JHS(E)

The Journal of Hand Surgery
(European Volume)
40E(Supplement 1) S1–S197

DOI: 10.1177/1753193415579771
jhs.sagepub.com
SAGE

A-0002 DIP fusion in Stage IV chondropathies: a comparative study with versus without joint preparation

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Introduction: The main complications in distal interphalangeal (DIP) arthrodeses are nonunion and hardware related. The main aim of this study was to show that joint preparation for DIP fusion is useless in Stage IV chondropathies. The secondary aim was to show that the use of buried compression screws decreases the complication rate.
Methods: Our continuous retrospective study included two groups of DIP percutaneous arthrodeses with self-breaking 1.8 mm compression screws: Group 1 with a joint preparation through a dorsal approach and Group 2 with no joint preparation. Group 1 included 15 patients (18 fingers) with a mean age of 65.3 years, representing nine cases of osteoarthritis, four cases of open trauma, one gout and one rheumatoid arthritis. Group 2 included 18 patients (21 fingers), with a mean age of 58.9 years, representing 16 cases of osteoarthritis, one rheumatoid arthritis and one swan-neck deformity.
Results: Tourniquet time was longer in Group 1 (61 min) than in Group 2 (24 min). The amount of emitted ionizing radiation was not different between groups. Pain and quick-DASH scores were not improved in Group 1, but were in Group 2. There was no difference in terms of consolidation time. One nonunion was observed in Group 1.
Conclusion: Our results showed that joint preparation for DIP arthrodesis is useless in Stage IV chondropathies and that there were no hardware-related complications.

A-0005 Are fluoroscopic anteroposterior and lateral views sufficient for distal radius volar plating? About 75 cases with fluoroscopic 'skyline'

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Introduction: Distal radius fractures volar plating can be responsible for tendon injuries, due to too long screws. The main objective of this work was to demonstrate that perioperative and intraoperative lateral fluoroscopy should be associated to 'skyline' fluoroscopy, in order to detect the screws that cross the dorsal cortical bone. The secondary objective was to demonstrate that anteroposterior fluoroscopy must be associated with 'skyline' fluoroscopy, in order to detect screws crossing the distal radio-ulnar joint (DRUJ).
Methods: Our series included 75 patients with an average age of 59 years. It was mostly women who underwent surgery for a distal radius fracture with locked volar plate. Three fluoroscopies were performed perioperatively and intraoperatively: anteroposterior, lateral and 'skyline'. We noted the differences of cortical screws crossing the dorsal cortical bone and/or the DRUJ.
Results: No screws seemed to cross the dorsal cortical bone on lateral views. The 'skyline' detected 5% screws crossing the dorsal cortical bone. Screw protrusion averaged 0.8 mm (0.5 - 2). Among 14.66% patients, the skyline view changed intraoperative management.
The 'skyline' could detect 24.68 times more often a cortical screw protruding from the dorsal cortical bone, than did lateral fluoroscopy. No screws crossing the DRUJ were detected.
Conclusion: Our results demonstrated that lateral fluoroscopy is insufficient to detect the screws crossing the dorsal cortex; and therefore, should be

associated with the 'skyline'. Our results did not show a superiority of the 'skyline' over the anteroposterior fluoroscopy to detect screws that cross the DRUJ.

A-0006 Percutaneous fixation of first metacarpal base fractures using locked K-Wires: a series of 14 cases

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Introduction: The treatment of choice for first metacarpal base fractures is surgery. Open fixation is stable, but causes tendinous adhesions. Percutaneous fixation is minimally invasive, but is often followed by secondary displacement. Here we describe an alternative approach that combines the advantages of both techniques through increasing stability of the Iselin technique, by externally connecting the K-wires.
Methods: Our series included 13 men of mean age 28 years. There were 13 fractures, six of which were extra-articular; and there were seven Bennett's fractures, five of which had a large fracture fragment. After reduction, two 18 mm K-wires were driven medially, crossing the three cortices of the 1st and 2nd metacarpals. After bending them at 90° angles, the K-wires were connected externally in a construction that allowed adaptation of the gap between the K-wires. Gentle immediate mobilization was allowed and the K-wires were removed 6 weeks later, in the clinic.
Results: At the 16-month follow-up, the mean pain score was 0.2 out of 10 and Quick DASH was 2.9 out of 100. Pinch grip was 81.8% of the contralateral side and grip strength, 91.2%. The first web space opening was 79.1%. There was one secondary displacement, with a good final result, and two malunions. No arthritis was noted, but the follow-up was short.
Conclusion: Our results showed that the Iselin technique using locked K-wires was minimally invasive, stable, and allowed immediate mobilization and K-wire removal in the office. Its indications may be extended to all fractures of the base of the first metacarpal, whether articular or extra-articular.

A-0014 Painful carpal instability due to scapholunate disassociation

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Objective: The scapholunate disassociation is a frequent and disabling disease, the pathogenesis of which is generally misunderstood. The name 'disassociation' of the two bones makes many hand surgeons think that it depends on the breakage of the scapholunate ligament, but this ligament does not exist. In fact, it is only a lax capsule that must allow dissociate flexion movements of the two bones. The reason of the disassociation is the breakage of the scaphotrapezoid ligament, which is the only ligament keeping the scaphoid in its place. It is the breakage of this ligament that allows the scaphoid to flex and to dislocate its proximal pole out of its articular facet of the radius, so moving away from the lunate. On the basis of this misunderstanding, many hand surgeons, even famous ones, have for years tried several reconstructions of the hypothetical scapholunate ligament, by means of various difficult and intricate techniques. If these techniques succeed, either the physiologically dissociated movements of the scaphoid and the lunate are blocked, or the new ligament will be destroyed.
Methods: Having carefully checked the anatomy of the hand by many cadaver dissections, I was able to see that only by cutting the scaphotrapezoid ligament could the scapholunate disassociation occur. Hence, I decided to reconstruct that ligament and I did that, by longitudinally dividing the tendon of the flexor carpi radialis and by passing a slip of it through a 3 mm tunnel that was pierced in the distal pole of the scaphoid, pulling the tendon slip dorsally and suturing it on the dorsal edge of the radius. By pulling the slip dorsally, the flexion of the scaphoid and thus, the scapholunate disassociation, disappear.
Results: I have operated on 45 cases. The follow-up is 20 - 180 months. No recurrences occurred. The return to work is on average, in 3 and 1/2 months. Flexion and extension of the scaphoid in adduction-abduction was completely re-established, as well as the height of the carpus.
Conclusion: In conclusion, the reconstruction of the scapho-trapezoid ligament is an effective surgery that is able to eliminate the disassociation and restore a normal, free and painless function to the wrist.

A-0017 CMC I osteoarthritis: comparison of clinical outcome with subluxation of the first metacarpal base

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Objective: It was discussed whether subluxation of the base of the first metacarpal in the thumb

carpometacarpal joint (CMC I) osteoarthritis has an influence on functionality and strength in the thumb saddle joint, before and after operative treatment. The aim of this study was to investigate if the pre- and post-operative radiographic subluxation correlates with subjective and clinical outcome.

Methods: In a prospective cohort study, 105 patients undergoing trapeziectomy with ligament reconstruction and tendon interposition for CMC I osteoarthritis were assessed subjectively, by the Michigan Hand Outcomes Questionnaire (MHQ), clinically and radiographically, at baseline and 1 year postoperative. Subluxation of the base of the first metacarpal in radiographs was measured by the distance from the scaphoid axis and the capitate head to the tangent through the first metacarpal bone. This distance at baseline was normally distributed. The lowest 10% of this distribution was declared as being no subluxation, patients within 11 - 40% as slight, patients in the 41 - 70% as medium, and patients in the 71 - 100% as having a severe subluxation.

Results: Subluxation decreased significantly from 8.2 mm (± 3.2) preoperatively, to 5.2 mm (± 2.5) at the 1 year postoperative assessment ($p \leqslant 0.001$). Patients subjectively improved in MHQ score, with 47 (±15) at baseline to 79 (±16) at 1 year ($p \leqslant 0.001$). We found that neither at baseline nor at 1 year postoperatively was there a correlation between the radiographic parameters and the MHQ or the key pinch strength (all correlations $r \leqslant 0.1$). Furthermore, no difference was found between the patients with different stages of subluxation regarding the MHQ ($p > 0.4$).

Conclusions: Subluxation of the base of the first metacarpal decreased significantly in all patients, 1 year postoperation. But there was no correlation between the stage of subluxation and the MHQ nor the key pinch strength, pre- and post-operatively. These results suggested that neither the preoperative nor postoperative residual subluxation of the metacarpal base of the thumb were associated with clinical outcome after resection-interposition arthroplasty of the CMC I joint.

A-0020 Predictors of Unstable Distal Radius Fractures: a meta-analysis

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Objective: Preferably, patients with a distal radius fracture with risk of dislocation are selected for preemptive surgical treatment. The purpose of this systematic review was to provide a comprehensive overview of all significant predictors of secondary displacement.

Methods: We conducted a prognostic meta-analysis and systematic search of literature in *Medline* and *EMBASE* to identify all studies on patients with distal radius fractures that reported displacement or fracture secondary displacement. Additionally, we pooled odds ratios (ORs) of predictors of secondary displacement.

Results: The initial search yielded a total of 2701 studies, of which 21 studies were included. Age, osteoporosis, shortening, loss of radial inclination and AO Type 3 fractures (A2, B3, C3) were found to be significant predictors of secondary displacement in multiple studies. We were able to pool the ORs of five predictors, and found there was a significantly increased risk of secondary displacement in fractures with dorsal comminution, in female patients and patients aged > 60. Distal radius fractures with an associated ulna fracture or intra-articular fractures did not have an increased risk of secondary displacement.

Conclusions: The pooled data in this meta-analysis showed an increased risk of secondary displacement for female patients, patients older than 60 years and fractures with the presence of dorsal comminution.

A-0021 Midterm results of Scheker arthroplasty for the distal radioulnar joint

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Objective: The range of motion and stability of the distal radioulnar joint (DRUJ) are important outcomes to preserve function, especially the pronation and supination, and weight-bearing ability. The aim of the study was to investigate the subjective, clinical and radiographic results after primary implantation of the Scheker total DRUJ prosthesis.

Methods: Between July 2010 and December 2013, we surgically treated 10 patients with osteoarthritis and/or instability of the DRUJ with the Scheker total DRUJ prosthesis. Eight patients had already had multiple surgical procedures at the same wrist. We only enrolled patients in the study who had had a minimum follow-up of 12 months. In a prospective case series, patients were assessed subjectively, clinically and radiographically.

Results: Included in the study were five male and five female patients ranging in age from 21 – 64 years (mean 49.6) at the time of surgery. Three of the prostheses had complications: bone resorption with stem loosening (n = 1) and nerve irritation, because of a screw tip of the radial component (n = 2). All

complications were resolved surgically, with good clinical course. No infections occurred.
Conclusions: Our study aimed to present results 1 - 5 years after primary implantation of the Scheker total DRUJ prosthesis. We hypothesized that the subjective, clinical and radiographic results improve in range of motion, pain and stability, compared to the preoperative findings.

A-0023 Cost-effectiveness analysis of the treatment of unstable extra-articular metacarpal fractures with mini-plates and screws, versus Kirschner wires

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Objective: Metacarpal fractures occur in young men with intense activity, and account for 18% for all hand fractures. Due to the complex structures and special function of the hand, the treatment of unstable metacarpal fractures that require surgical intervention has always been one of the intricate problems in orthopaedic surgical procedures. The purpose of this study was to compare the cost-effectiveness of operative treatments of metacarpal fractures, with mini-plates and screws versus Kirschner wires (KW).
Materials and methods: Between 2006 - 2013, we had 89 patients present with closed, unstable metacarpal fractures, at an average age of 28.6 years (19 - 45 years). The fracture was in the second metacarpal in 22 cases, at the third in 14 cases, at the fourth in 15 cases and at the fifth in 38 cases. In four cases, fractures of the third and fourth metacarpal coexisted; and in 5 cases, of the fourth and fifth metacarpal. In two patients, there were bilateral fractures of fifth metacarpal. The indications for operative fixation were: angulation more than 20º- 40º (dependent on the digit), rotatory malalignment, multiples fractures, shortening and failure to maintain reduction. The patients were divided in two groups: in Group A (46 cases), the fracture was treated by open reduction and internal fixation with mini-plates and screws, or by only screws (PS); and in Group B (43 cases), with two KW. Postoperatively, patients in both groups were placed in a palmar splint, leaving the proximal interphalangeal join free, for early motion. After sutures were removed, patients were allowed to perform daily living as tolerated.
Results: The average follow-up was 14 months (range, 12 - 18 months). The Disabilities of the Arm, Shoulder and Hand (DASH) score, Total Active Motion (TAM) of the digit, radiographic parameters (pre- and post-operative shortening and angulation, and time to healing), cost of implants, operative time and complication rates were then measured, to evaluate the outcomes. The mean DASH score was 9.38 in the KW group and 7.9 in the PS group. The median TAM score was 228º for the KW group and 239º for the PS group. Time to radiographic healing for the KW group was 5.6 (4 - 8) weeks and for the PS group, 4.6 (4 - 6) weeks. Operative time was significantly shorter with use of the KW, at 15 min (10 - 22 min), than with the PS group, at 38 min (22 – 46 min). The average cost for the PS group amounted to 80 euro (average 50 – 120 euro), while the average cost for the KW group was 6 euro. Among the complications in the KW group were the loss of reduction, in seven cases; extension tendon irritation, in nine cases; neuroma of the dorsal cutaneous branch of the ulnar nerve in one case and complex regional pain syndrome in one case. In the PS group, two patients had hardware removal and two had superficial infections.
Conclusions: Unstable or multiple metacarpal fractures are the indications for surgical treatment. Although the operative time was shorter and the cost of KW is lower than the PS group, the high percentage of complications and re-operations of the KW group led to the conclusion that the internal fixation of metacarpal fractures with plates and screws is more suitable, when indicated.

A-0024 Percutaneous versus open release for the treatment of trigger finger in patients with diabetes mellitus

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Objective: For the Department of Orthopaedics and Trauma, University Hospital, Heraklion, Crete, Greece, trigger finger is a common finger disease, caused by inflammation and hypertrophy of the retinacular sheath that progressively restricts the motion of the flexor tendon. At the initial stage of the disorder, a conservative treatment (splinting and corticosteroid injection) is the choice; but in recurrence, the treatment goal is gained by operative methods. The purpose of this study is to compare the outcomes and complications of conventional open vs. percutaneous release, for recurrent trigger finger in patients with diabetes mellitus.
Materials and methods: We treated 69 patients with diabetes mellitus (38 insulin-dependent and 31 non-insulin-dependent), with an average age of 48 years (range, 28 - 64 years) of age, for recurrent trigger

finger between 2008 - 2013. The mean duration of symptoms before treatment was 11.4 months (range, 4 - 21 months). All patients had failed conservative treatment (splinting, corticosteroid injections and anti-inflammatory medication). Their digits were graded according to the severity of symptoms: we classified 23 digits (33.33%) as Grade 2; 28 digits (40.57%) as Grade 3; and 18 (26.1%) as Grade 4 (with 8 locked in flexion and 10 in extension). The trigger was at the thumb in 23 cases, at the index finger in 12 cases, at the middle finger in 15 cases and at the ring finger in 19 cases. The patients were divided in two groups: Group A (37 patients) were treated by open release of the A1 pulley and Group B (32 patients) with percutaneous release, using the tip of an 18-gauge needle. Postoperative patients in both groups were placed in bulky soft dressing, leaving the interphalangeal joints completely free for early motion.
Results: The median follow-up period was 8 months (range, 6 - 14 months). The groups were statistically similar regarding their age, sex and the dominant side involved. The results were based upon recurrence, patients' satisfaction and complications. In Group A were five complications (two cases with infections and three with persistent pain) and patient satisfaction was 91.89%. In Group B, there were complications: three cases with pain, three cases with incomplete release (two cases in the thumb and 1 case in the middle finger), four had digital nerve injury (three cases at the thumb and one at the index finger), and the patients' satisfaction was 84.37%.
Conclusions: Trigger finger is a common disease among patients with diabetes mellitus. The goal of treatment is restoration of digit function. Both surgical methods (open or percutaneous release) resulted in similar therapeutic efficacy. The exception is trigger thumb, where the iatrogenic digital nerve injury is composed of severe complications, where we recommend open surgical release.

A-0025 Intentional distraction volar plate fixation for distal radius fractures with positive ulnar variance

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Introduction: Although volar locking plate fixation has been successful for treating distal radius fractures, minimal collapse can cause ulnar side wrist pain for patients with positive ulnar variance. This study aimed to analyse the effect of intentional distraction with volar locking plate for distal radius fractures with positive ulnar variance.
Materials and methods: We retrospectively reviewed 102 patients whom had distal radius fracture treated with volar locking plate fixation from 2011 - 2013. All patients had positive ulnar variance on the uninjured wrist. During the operation, ulnar variance was corrected to neutral, regardless of the contact of volar cortices. Radiologic parameters and their changes; range of motion; Disabilities of the Arm, Shoulder and Hand (DASH) score were evaluated at the final follow-up session.
Results: Union was achieved in all patients without bone graft. Average distraction was 1.6 mm. Mean ulnar variance was positive 1.1 mm at the final follow-up. Mean quick DASH score was 13. No patient received additional procedure for ulnar-sided wrist pain.
Conclusion: The intentional distraction volar plating technique for distal radius fractures was an effective method to obtain proper alignment in patients with positive ulnar variance, to prevent secondary ulnar impaction syndrome.

A-0026 Corrective volar plate fixation for refracture of malunited distal radius

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Introduction: Management for refracture of the malunited distal radius has not been established. The aim of this retrospective study was to evaluate the clinical results of corrective volar plate fixation for refracture of the malunited distal radius.
Materials and methods: We retrospectively reviewed 14 patients whom underwent corrective volar plate fixation for refracture of the malunited distal radius, from 2005 - 2013. With reference to the contralateral wrist radiograph, correction of the alignment was performed through the fracture site without bone grafting. There were 10 female and 4 male patients, of mean age 71 years (62 - 80 years). Radiologic and clinical results were evaluated at the final follow-up.
Results: Radiological union was achieved in all cases, at a mean of 11 weeks after operation. All radiologic parameter were acceptable and the changes were not statistically significant during follow-up. Mean quick Disabilities of the Arm, Shoulder and Hand (DASH) score was 16 at the final follow-up. Complications such as flexor tendon rupture did not occur in this cohort.
Conclusion: In-situ volar plate fixation for refracture of the malunited distal radius can cause flexor tendon irritation. Corrective volar plate fixation for refracture of the malunited distal radius is a safe and reliable procedure, and may prevent complications such as flexor tendon ruptures.

A-0028 Swing traction versus no traction for complex intra-articular proximal interphalangeal fractures: a multi-centre cohort study

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Objective: To compare swing traction versus no-traction management of complex fractures of proximal interphalangeal (PIP) finger joints. We hypothesised that there is no long-term (i.e. > 12 month) difference between swing traction and no-traction (with or without surgical fixation), in terms of motion, pain, function, patient satisfaction or treatment cost.
Methods: This multi-centre cohort study recruited adults with a history of complex PIP fractures affecting > 30% of the articular surface injury, from database searches at three public hospitals and a private clinic. Two blinded surgical registrars graded the X-rays taken at the time of injury and participants attended a clinic at least 1 year post-injury, for measurement of range of motion (ROM), self-reported function as measured by the Disabilities of Arm, Shoulder and Hand (DASH), pain and satisfaction. Participant data were then were grouped by treatment provided. One group (*n* = 17) was treated with swing traction and the other group (n = 14) had no traction. The primary outcome was combined motion of the PIP and distal interphalangeal (DIP) joints, expressed as both total active motion and Strickland score. Secondary outcomes were DASH scores, patient satisfaction, pain, complication rates and cost of treatment based on mean resource consumption per group.
Results: Patients treated with swing traction had greater combined PIP and DIP motion (141.9° compared to 100.8°; p = 0.008). There were no differences in patient ratings of function, pain or satisfaction. Complications, such as swan-neck deformity, cold sensitivity, malunion, infection or adhesions occurred in over one-half of both groups of participants. Average costs for swing traction were less than for surgical fixation with no traction.
Conclusions: Patients treated with the swing traction protocol had greater ROM in the finger; however, this did not translate to improved patient ratings of function, pain or satisfaction. A basic cost comparison indicated swing traction may be less expensive than other forms of surgical repair.

A-0033 Effect of anxiety and catastrophic pain ideation on early recovery after surgery for distal radius fractures

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This study evaluated the effects of preoperative anxiety and catastrophic pain ideation on perceived disability and objective measures after distal radius fracture surgery. We enrolled a total of 121 patients with distal radius fractures treated with volar plate fixation. The wrist range of motion (ROM), grip strength and perceived disability as measured by the Michigan Hand Questionnaire (MHQ) score were assessed at 4, 12 and 24 weeks after surgery. To evaluate psychological factors related to pain, catastrophic pain ideation was measured using the Pain Catastrophizing Scale (PCS); and pain anxiety, using the Pain Anxiety Symptom Scale (PASS). We assessed the relative contributions of pain anxiety and catastrophic pain ideation and other clinical parameters to functional recovery, in terms of grip strength, ROM and MHQ score. An increase in the PCS score was associated with the wrist ROM and grip strength only at week 4; whereas an increase in the PASS score was associated with the wrist ROM at week 4, and grip strength at week 4 and week 12. According to a multivariate regression analysis, an increase in PCS score was associated with a decrease in grip strength, ROM and MHQ score at week 4; and an increase in the PASS score was associated with a decrease in grip strength, ROM and MHQ score at week 4, and grip strength and MHQ score at week 12. At week 24, only age and fracture severity were associated with the MHQ score. In addition, age was associated with grip strength; and fracture type, with ROM. Preoperative PCS and PASS were significantly associated with delayed recovery, as evidenced by scores on both objective and subjective measures of function. Given these relationships, it becomes important to assess preoperative PCS and PASS, addressing issues for patients at risk with a brief psychosocial intervention early in the recovery process.

A-0034 A prospective, randomized comparison of volar plate and external fixation for intra-articular distal radius fractures

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This study compares surgical outcomes of volar locking plates (VP) and external fixation (EF) (with or without intrafocal fixation) for AO-Type C2 and C3 fractures of the distal radius. From an initial group of 92 patients with AO-Type C2 and C3 distal radius fractures who were enrolled in a prospective, randomized study comparing volar plate fixation with external fixation with or without intrafocal fixation, 74 patients were studied. Functional assessments (wrist range of motion (ROM), grip strength and Michigan Hand Questionnaire (MHQ)) were evaluated at each patient visit and radiographic assessment (radial inclination, volar tilt, ulnar variance and articular congruity) were measured at 12 months. The grip strength of the VP group was significantly greater than that of the EF group, at 3 and 6 months. ROM was significantly greater in the VP group than in the EF group, at 3 months. There were no significant differences in ROM and grip strength between the two groups, at 12 months. The MHQ score was higher in the VP group than in the EF group at 3 months, but were the same at 12 months. There was no significant difference between the two groups, with respect to volar tilt nor radial inclination. The VP group showed superior radiologic outcomes in terms of ulnar variance. One patient in the VP group and three in the EF group had an intra-articular step-off deformity $\geqslant$ 2 mm. This difference did not reach statistical significance. These results for functional recovery after distal radius surgery offer insights into treatment decisions and interpretation of treatment outcomes, for patients with comminuted intra-articular distal radius fractures.

A-0036 Arthroscopic management of chronic unstable scaphoid nonunions: effects on restoration of carpal alignment and recovery of wrist function

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Purpose: The purpose of this study was to assess the effects of arthroscopically-assisted reduction and osteosynthesis on restoration of carpal alignment and recovery of clinical wrist function, in patients with unstable scaphoid nonunion.

Methods: We enrolled 36 patients whom underwent arthroscopically-assisted osteosynthesis, with or without bone grafting for unstable scaphoid nonunion, between July 2006 and January 2012. The average time from injury to surgery was 51 ± 78.3 months. Radiographic and clinical evaluations were assessed on preoperative and postoperative days, and follow-up evaluation took place at a minimum of 24 months.
Results: Union was achieved in 86% (31/36) of patients at a mean of 11 ± 2.7 weeks. Scaphoid axial length (SAL), lateral intrascaphoid angle (ISA), scapholunate angle (SLA) and reversed carpal height ratio (CHR) were significantly improved after surgery, and those correction ratios averaged 66% ± 46.8%, 74% ± 58.2%, 81% ± 59.8%% and 94% ± 46%, respectively. The range of wrist motion was unchanged after surgery, but the grip strength improved from 74% ± 22.1% preoperatively to 89% ± 13.7% postoperatively, compared with the contralateral side ($p < .042$). Mean Disabilities of the Arm, Shoulder and Hand (DASH) and Patient-Related Wrist Evaluation (PRWE) scores improved significantly ($p < .001$) from 44 and 51 preoperatively, to 13 and 23 postoperatively, respectively. The radiological parameters of the scaphoid and carpal alignment in patients whom achieved bony union did not correlate with clinical wrist function.
Conclusions: Arthroscopic reduction and osteosynthesis of chronic unstable scaphoid nonunion is limited for restoration of normal carpal alignment, but has positive effects on the recovery of clinical wrist function. Level of Evidence: Level IV, therapeutic case series.

A-0037 Arthroscopic peripheral reconstruction with ulnar shortening osteotomy for chronically unstable triangular fibrocartilage complex tears in patients with ulnar plus variance

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Purpose: The aim of this study was to compare the effectiveness of combined arthroscopic peripheral reconstruction and ulnar shortening osteotomy (USO) for chronic unstable triangular fibrocartilage complex (TFCC) tears in the ulnar positive patients, to combine arthroscopic debridement and ulnar shortening osteotomy.
Methods: Between January 2007 and July 2012, we enrolled a total of 31 ulnar positive patients whom underwent arthroscopic treatment combined with

USO for chronic peripheral TFCC tears with foveal avulsion and were followed up at a minimum of 24 months: 15 were treated with arthroscopic peripheral reconstruction and 16 were treated with an arthroscopic debridement after USO. We evaluated the wrist range of motion (ROM); grip strength; Disabilities of the Arm, Shoulder and Hand (DASH) score; Patient-Related Wrist Evaluation (PRWE) score; and overall outcomes according to the modified Mayo wrist scoring system and stress test, to evaluate distal radioulnar joint (DRUJ) stability, to compare outcome measures between the two cohorts.
Results: At the final follow-up session, there were no statistically significant differences between the two cohorts, with regard to wrist ROM, and DASH and PRWE scores ($p > 0.05$). Otherwise, there was a greater improvement in grip strength in the reconstruction group, compared to the debridement group ($p = 0.017$). In response to the DRUJ stress test, 10 out of 12 (83%) patients in the repair group with a preoperative positive test improved, while only 4 out of 11 (36%) patients in the debridement group improved ($p = 0.027$).
Conclusions: Our study results suggested that chronic peripheral TFCC tears in ulnar positive patients can be effectively managed with either arthroscopic debridement or arthroscopic peripheral reconstruction combined with ulnar shortening osteotomy, but that the latter is preferable if DRUJ stability is concomitantly compromised. Level of evidence: Therapeutic case series, III.

A-0044 Factors influencing motion after re-motion total wrist arthroplasty

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Objective: Our purpose was to analyse to which extent patient-related factors, and patient-unrelated factors as well, had impact on motion after total wrist arthroplasty (TWA).
Methods: In a prospective cohort study of 165 cases, retrieved from the International Re-motion Registry, we performed a 2-way analysis of variance (ANOVA), with six variables and a supplementary regression factor analysis, comparing range of motion (ROM) before TWA and at the 1-year follow-up.
Results: The preoperative ROM was the outstanding most important factor that determined ROM in any direction, at follow-up ($p < 0.0001$). Age and sex had a minor influence on ROM in some directions ($p < 0.05$). Diagnosis and duration of immobilization had no impact ($p \geqslant 0.05$). The differences across the operating clinics were generally small, but statistically significant. At follow-up, motion tended to improve to a small extent for patients with very poor preoperative motion, but to decrease in patients with very good motion.
Conclusions: The ROM obtained in this material compares well to the ROM after other implants reported in the literature. Some papers report significantly improved ROM and others do not. The series are all very small. Our study showed that the most important factor for motion after re-motion TWA is the preoperative ROM. Preoperative information on the patients considering a re-motion TWA should include a statement that no marked change of motion can be expected.

A-0045 Surgical technique for distal radial fracture fixation with intramedullary nailing: avoiding complications of the superficial branch of the radial nerve

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Objective: Intramedullary nail fixation for distal radial fractures is reported to be a successful procedure, free of irritation around the implant. Case series of distal radial fracture fixation with intramedullary nails show that 13 - 20% of patients suffer from sensory disturbance of the superficial branch of the radial nerve (SBRN). To prevent this neurological complication of the intramedullary fracture fixation technique, we developed a safe method for handling SBRN and compared it with the conventional method.
Patients and methods: From July 2009 to October 2010, SBRN was dissected from subcutaneous tissue and retracted from the nail insertion point, before inserting the intramedullary nail (Micronail), to fix the distal radial fracture (Group A; conventional method). From November 2010 to June 2014, the SBRN was palpated after skin incision and left in the subcutaneous tissue, surgical dissection was performed volar to the SBRN, the subcutaneous tissue containing the SBRN was retracted dorsally from the nail insertion point, and the intramedullary nail was inserted to fix the distal radial fracture (Group B). The AO classification was used to evaluate fracture type. Group A comprised 20 patients (18 women, 2 men; mean age 75.3 years) with 11 A-type fractures and nine C-type

fractures. Group B comprised 39 patients (34 women and five men; mean age 69.3 years) with 31 A-type fractures and eight C-type fractures. The two groups were compared in relation to operating time, radiographic outcome, neurological complications and clinical outcome (Mayo Modified Wrist (MMW) score). To evaluate SBRN disorder, we defined subjective sensory distress of the SBRN area as neuritis and hypoesthesia without subjective symptoms, which resolved within 2 weeks, as a minor SBRN disorder. The Mann-Whitney U-test was used to evaluate differences in operating time, radiographic outcome and wrist score; and the chi-square test was used to evaluate differences in the number of patients with SBRN disorder between the two groups.

Results: Operating time was significantly longer in Group A (mean, 70.1 min; 72.0 min for the A-type fractures and 67.7 min for the C-type fractures) than in Group B (44.4 min; 46.3 min and 37.5 min, respectively; $p < 0.05$). No significant differences were seen in radiographic outcome (radial inclination/volar tilt/ulnar variance) between groups A and B: preoperative value was 18°/- 17.3°/2.6 mm versus 19.7°/- 18.6°/2 mm; and those immediately postoperative, 24°/7.8°/0.6 mm versus 27°/10.1°/0 mm; and the final follow-up measures, 25°/8.2°/1.3 mm versus 26°/12°/0.1 mm, respectively. The MMW score was 89.5 points for Group A (mean follow-up duration, 325.2 days) and 93.5 points for Group B (mean follow up duration, 280.9 days). Group A had significantly more patients with SBRN disorder (two patients had SBRN neuritis, which resolved several months after the operation, four patients had minor SBRN disorder) than Group B (one patient had minor SBRN disorder; $p < 0.05$).

Conclusion: The results of this study suggested that our method of handling SBRN was simple and safe for use in distal radius fracture fixation, with intramedullary implants inserted from the radial styloid process.

A-0046 Thumb carpometacarpal joint total arthroplasty: a systematic review

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Objective: Since the development of the first ball and socket prosthesis by JY De la Caffinière in 1971, many other types of total trapeziometacarpal joint arthroplasties were designed. The aim of this paper is to provide a systematic review of different kinds of total joint arthroplasties used to treat degenerative carpometacarpal osteoarthritis of the thumb.

Methods: *PubMed/Medline* and *EMBASE* databases were searched up to 31 May 2014. Articles reporting results of total joint arthroplasties for primary osteoarthritis with a mean follow-up of at least 12 months were included in the review. We assessed outcomes, survivorship, level of evidence and the methodology of the papers.

Results: We included 32 papers about 14 different prostheses. Five types of prosthesis did not fit the inclusion criteria. There were 31 Level VI studies, one Level IV study and one Level III study. There were only two prospective controlled studies, five prospective cohort studies, but 26 retrospective studies. In 18 studies, the grip strength and/or key pinch was measured and in 28 studies, pain was assessed. The criteria for radiographic evaluation were not consistent in all studies. The two main long-term complications were implant loosening and dislocation. The majority of the reports were not high quality and the measurement standards were different among them, which made the pooling of data impossible. Survivorship was reported for nine different prostheses, in 13 of the studies. A cumulative survivorship analysis was performed only in nine studies. Because of differences in methodology in determining survival rates and the short follow-up, the implant with the best survival rate could not be identified.

Conclusion: There are sufficient data to conclude that total joint replacement of symptomatic thumb carpometacarpal joint osteoarthritis does not reliably give better results than trapezectomy and it has some very high rates of failure. More randomized controlled prospective studies are needed, to prove that total joint replacement is better than trapezectomy.

A-0047 Corrective osteotomy of malunited distal radius fractures using bone allografts and internal fixation with locking plates

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Objective: Symptomatic extra-articular malunion of a distal radius fracture can be treated with a corrective osteotomy. Usually autogenous iliac bone grafts or synthetic bone substitutes are used to fill the gap. Other options are bone allografts or leaving the gap empty. The purpose of the present study was to investigate whether correction can be maintained with allografts and internal fixation with locking plates.

Methods: Between March 2006 and February 2014, we performed 26 corrective osteotomies of the distal radius, using frozen bone allografts. There were 21 women and five men, mean age 50 years (range, 18 - 78). Palmar locking plates were used in 17 patients and dorsal plates with locking screws were used in nine. Palmar tilt and ulnar variance were measured on wrist radiographs preoperatively, 1 day postoperatively, and after bone healing.
Results: The osteotomy healed, with integration of the bone allograft, in all patients. Mean preoperative ulnar variance measured 5 mm (range, 0 to 10) and mean palmar tilt was 4° (range, - 28 to 39). On the first postoperative radiographs, the mean ulnar variance measured + 1 mm (range, - 2 to 4) and the mean palmar tilt was 9° (range, -11 to 25). After bone healing, mean ulnar variance measured 2 mm (range, - 1 to 5) and mean palmar tilt 11° (range, - 6 to 25). When the first postoperative radiographs were compared with those after bone healing, we found an increase in ulnar variance of > 1 mm in one-third of the patients. In one case, palmar tilt change was > 10°.
Conclusion: A stable fixation can be obtained with locking plates and bone allografts, but a small increase in ulnar variance can be expected.

A-0050 Usefulness of the individual elevation of the free vascularized iliac bone graft, based on deep circumflex iliac artery and superficial circumflex iliac artery perforator flap from the same field

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Objective: When it is necessary to reconstruct skin and bone simultaneously, flexibility of the placement and direction of the skin and bone is required. Moreover, their free movement can improve their cosmetic appearance. The vascularized iliac bone graft supplied by the deep circumflex iliac artery (DCIA) and the groin flap supplied by the perforator of the superficial circumflex iliac artery (SCIA) were individually elevated from the ipsilateral side, and then were applied as the chimeric flap for the skin defect and the bone defect with osteomyelitis. The purpose of the current study was to examine the usefulness of this method.
Materials and methods: Case 1. A 34-year-old female patient suffered third-degree burn wounds on her right dorsal wrist by an electric heater, while asleep. These wounds were associated with the exposure of the ulnar head and the carpal bones, with infection. After surgical debridement and curettage, the skin defect was covered by the groin flap, and the osteomyelitis of the carpal bones was curetted. Wrist fusion was then performed using the vascularized iliac bone graft. Case 2. A 41-year-old male patient had a degloving injury on his right hand, due to a press machine. The carpal dislocation and the phalangeal fracture of his hand were reduced and fixed by C-wires; and the terminal branch of the radial artery was reconstructed using the vein graft between the snuff box and the princeps pollicis artery. The two dorsal veins were anastomosed using vein grafts and the digital nerves were sutured. Engraftment of the thumb fingertip was successful, but phalangeal lesion damage to the thumb was severe. Moreover, the blood supply in the proximal phalanx was absent and associated with infection. We reconstructed the skin defect with the groin flap, and removed the proximal phalanx of the thumb and reconstructed it using a vascularized iliac bone graft.
Results: The flaps of skin and bone in both cases survived. Subsequently, the extensor digitorum communis (EDC) was reconstructed by tendon transfer, for Case 1. Reconstruction of the wrist extensor tendon and the finger extensor tendon are scheduled for Case 2.
Conclusions: The vascularized iliac bone and the skin supplied by the pedicled DCIA can be elevated *en bloc*, but when the perforator blood flow from the bone to skin is insufficient, the skin flap gets necrosis, although the iliac bone survives. Therefore, it was reported that the vascularized iliac bone graft supplied by DCIA and the groin flap supplied by the perforator of SCIA were elevated separately, and then SCIA was supercharged by the ascending branch of DCIA. In our cases, we could elevate two different flaps as one pedicle artery safely, through the anastomosis of the ascending branch of DCIA to SCIA. In addition, the individual elevation of the vascularized iliac bone and the groin flap expands the versatility and the flexibility of the placement and direction of skin and bone. Moreover, the donor-site morbidity remains minimal, because of harvesting from the same site.

A-0051 Randomized comparison of volar locked plating vs. intramedullary nail, for unstable distal radius fractures

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Introduction: Minimally-invasive intramedullary nails (IMN) and volar locking plates (VLP) are available for the treatment of unstable distal radius fractures. The purpose of this study was to compare VLPs and IMNs,

by evaluating postoperative subjective and functional outcomes. Our hypothesis was that patients with IMN had less pain and required less pain medication in the early postoperative period, and returned to work earlier, compared to patients with VLP.
Methods: We randomized 60 patients whom had sustained a closed, displaced, unstable, metaphyseal fracture of the distal radius; to receive either a VLP or an IMN for internal fracture fixation. Functional outcome scores (Quick Disabilities of the Arm, Shoulder and Hand (QuickDASH) and Michigan Hand Questionnaire (MHQ)) and range of motion (ROM) were assessed; and the patients were followed for 2 years after surgery. Narcotic pain medication usage was documented for 5 weeks following surgery.
Results: There were two groups of 30 patients who received an IMN (mean age, 54.7 ± 14.1 years) or VLP (mean age, 54.6 ± 16.4 years, p = 0.980). Patients in both groups had similar demographics and comorbidities. Patients with an IMN regained extension earlier, but had similar ROM at the final follow-up. There was similar wrist improvement by MHQ and QuickDASH scores, and strength in both groups. At 5 weeks post-surgery, fewer patients with IMN required narcotic pain medication (13%), compared with the VLP patients (33%, p = 0.033). There were three failures in the IMN group (10%) versus one failure (3%) in the VLP group (p = 0.612).
Conclusion: Both IMN and VLP are viable options for unstable distal radius fracture fixation. Compared to VLP, IMN provided similar improvement in functional and radiographic outcomes, between a comparable cohort of patients. The IMN technique required less tissue disruption, leading to decreased amounts of narcotic pain medication needed by patients after surgery.

A-0058 Induced membrane technique (masquelet technique) to treat bone defect in the hand: prospective multicentre evaluation

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Introduction: There have been 26 cases of bone defect treated by the induced membrane technique, avoiding allograft, microsurgery and amputation.
Methods: We included 23 patients (mean age 51.7; 85% male patients, 65% work accidents) with 26 cases of bone defect of the hand, into this multicentric prospective evaluation (three centres): 19 cases were traumatic and 7 cases were septic. Bone defect size reached at least 'one phalanx' with an average of 2 cm (0.5 - 7 cm). We found that 38% of injuries were extra-articular. All cases were treated by the induced membrane technique, which consists in stable fixation, use of flap if necessary and in filling of the void created by the bone defect with a cement (polymethyl methacrylate) spacer. This technique needs a second stage procedure at 3 to 7 months (range, 1 - 14) after the first stage, where the cement is removed and the void is filled by cancellous bone (from the distal radius in 22/26 cases). The key point of this induced membrane technique is to respect the foreign body membrane, which appeared around the cement spacer and which created a biologic chamber after the second time. Evaluation of bone union was done prospectively in each case by a surgeon not involved in the treatment, by X-ray and computed tomography (CT) scan, if necessary. Failure was defined as a nonunion at 1 year or uncontrolled sepsis at 1 month.
Results: Two cases of bone defect failed to achieve bone union. No septic complications occurred and all septic cases were stopped. Bone union was achieved after a delay of 5 months (1 - 14) in 92% of the cases. Two biopsies allowed us to prove us that osteoid tissue was created by the technique. Total active motion (TAM) of the injured fingers reached 114 (20 - 250), Quick Disabilities of the Arm, Shoulder and Hand (QuickDASH) was 19 (4 - 40), and return to work was effective in 6 months (1 - 24), all fingers included.
Conclusion: Masquelet first reported 35 cases of large bone defect of tibia nonunion, treated by the induced membrane technique that allows to fill in bone defects with cancellous bone alone. The cement spacer allowed to induction of a foreign body membrane (neoperiosteum), which constituted a biological chamber. Work on an animal model reported by Pellissier and Viatteau showed the properties of the membrane: secretion of the growth factors VEGF, TGFbéta1 and BMP2; and osteoinductive activity of the cells. Use of this technique is possible in emergency or in septic conditions where the bone defect cannot been solved by shortening. This technique avoids use of microsurgical techniques and its limit is the quantity of available cancellous bone. Use of the induced membrane technique is possible in an emergency or in a septic condition, where the bone defect cannot be solved by shortening. This technique allows for early mobilization, depending on the associated injuries, and avoids use of microsurgical techniques to achieve bone union.

A-0059 Anatomical and radiological study applied to distal radius surgery

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Objective: The purpose of this study was to determine, during anterior plating of the distal radius, the length of a screw above which there is a risk for the extensor tendons and the optimal shape of an anterior plate. It was also to determine the projection of the axis of the distal one-third of the radius on the distal articular surface, in case of wrist arthroplasty, in order to simplify the procedure.
Methods: We studied 74 dry radii from adult cadavers. Each one underwent a computed tomography scan. We measured the thickness of each radius at the level of the dorsal tubercle, the second compartment and the third compartment. We calculated the metaphyseal-epiphyseal angles of the lateral column and of the intermediate column. We also calculated the projection of the longitudinal axis of the most distal 7 cm of the radius, on the distal carpal surface of the radius.
Results: Mean thickness at the dorsal tubercle level was 22.1 mm (18 - 26.1 mm). The mean slope of the lateral column was 155° (143 - 167°), while that of the intermediate column was 145° (134 - 153°). We found a statistically significant difference (p = 0.0001) between these two slopes. The axis of the distal radius was projected on the posterior-lateral quadrant of the distal articular surface.
Conclusions: The emergence of new implants needs a precise evaluation of a fractured, arthritic or reconstructed distal radius. The double slope of the distal radius complicated the manufacturing of an 'anatomical' plate. The optimal shape is between these two slopes. Moreover, ancillaries for wrist replacement were still approximations, which means that it is important to know the projection of the radial axis on the articular surface of the distal radius.

A-0064 Allotransplantation in the reconstructive surgery of the hand

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As part of the expanding field of composite tissue allotransplantation (CTA), hand allotransplantation combines the technical rigors of hand microsurgery with the complex multidisciplinary care that defines modern solid organ transplantation. The surgical technique, adapted from hand re-implantation, is well known. The central issue follows the fact that this is not a lifesaving procedure and is associated with lifelong immunosuppression, which could put patients at the risk of developing potentially fatal conditions. Nonetheless, the IRHCTT reported initial encouraging results, and the immunotherapy protocols were proved to be effective in preventing rejection in patients with hand transplants, without associated life-threatening complications. Hand allotransplantation is, therefore, a controversial treatment concept in which careful consideration is required. This article is a review of the available literature, through bibliographic research in *PUBMED*, in order to inform on the most relevant and actualized aspects of hand transplantation, namely the ones concerning ethics, patient selection, immunosuppressive treatment and the results of the procedure.

A-0067 Collagenase: new information from a series of 297 patients

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Hypothesis: So far, data published for Xiapex refer to single joints only. We extended the indication to contractures spanning more than one joint, in a single digit and to natatory (web space) cords. We present new insights into the outcome of Xiapex treatment.
Methods: The study's 297 patients were injected by a single surgeon. A comprehensive dataset was entered prospectively onto a bespoke database.
Results: Effective in standard indications: MCPJ (n = 98) gave 97% angular improvement; 94% had a full correction. Proximal interphalangeal joint (PIPJ) (n = 46) gave 91% angular improvement and 72% had a full correction. It was effective in natatory and combined cords, but had a higher failure rate: Combined cords (n = 98) had an 85% angular improvement and 48% of patients had a full correction. Natatory cords (n = 47) had an 86% angular improvement; 50% had a full correction. There was spontaneous rupture 16% of the time. The learning curve: we found that 7 of the first 20 (35%) needed a second injection, to get a satisfactory correction; and then only 7 in 277 needed one (2.5%). Deformity correlated with the risk of skin split: 21% had skin splits. Pre-injection deformity correlated with skin splitting: metacarpophalangeal contractures $< 30^{\circ}$ = 8% chance of split; $> 60^{\circ}$ = 55% chance of split; and combined cords of 0 - 60° had a 0% chance of skin split, while $> 91^{\circ}$ had a 65% chance of skin split. Pre-operative deformity tended to correlate with a lower chance of a full correction.

Summary:
- Collagenase is effective at reducing contractures.
- The chance of a full correction is better the lesser the contracture.
- The chance of a full correction is less, with natatory cords and combined MCPJ-PIPJ cords.
- Skin splits are common.
- Spontaneous rupture is common.
- There is a demonstrable learning curve.
- The chance of skin splitting increases with the severity of the contracture.

A-0069 In vivo carpal kinematics using four-dimensional computed tomography in healthy volunteers

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Objective: Recently, 4-dimensional computed tomography (4D-CT) was introduced for the acquisition of dynamic 3-dimensional (3D) images of a moving wrist joint. The aim of this study was to establish its reliability and evaluate the effect of gender and handedness on the in vivo kinematics of the scaphoid, lunate and capitate.
Methods: We clinically assessed both wrists of 20 healthy volunteers (11 men and nine women) between 20 - 40 years of age. All volunteers performed flexion-extension and radial-ulnar deviation with both wrists. To test for reliability, one motion cycle was rescanned for both wrists, approximately 15 minutes after the first scan. We used the coefficient of multiple correlation (CMC) to analyse reliability; and we used a linear mixed model (LMM) to compare carpal motion patterns.
Results: Overall, the mean or median CMCs were higher than 0.87. No significant differences were found when comparing men's carpal motion variables with those of women; however, in the male volunteers, the lunate, scaphoid and capitate of the non-dominant hand showed more radio-ulnar deviation during flexion-extension of the wrist, compared to the dominant hand. During radial-ulnar deviation, motion patterns of the lunate and scaphoid of the non-dominant hand were significantly different, compared to the dominant hand in male volunteers.
Conclusion: This innovative, non-invasive technique can precisely describe and determine in vivo carpal kinematics. It provided us with a better understanding and the normal values of carpal motion in uninjured wrists.

A-0071 A large European genome-wide association study reveals multiple genetic susceptibility variants for Dupuytren's disease

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Introduction and aims: Dupuytren's disease (DD) is a common condition, which predominantly affects people of Northern European origin. In addition to their genetic predisposition, risk factors include diabetes, hypercholesterolemia and smoking; making DD a typical complex disease. Our aim was to acquire a better understanding of the genetic predisposition to the disease, and the dysregulation of the underlying molecular mechanisms, by discovering novel predisposing genetic variants, in order to develop novel therapeutic strategies.
Materials and methods: As part of the 'BSSH Genetics of Dupuytren's Disease' collaboration, we performed a genome-wide association study (GWAS), utilising a UK case-control cohort consisting of 9115 individuals. Replication analysis was undertaken using samples from both Germany (German Dupuytren Study Group) and Holland (Dutch Dupuytren Study Group). The UK discovery cohort was genotyped on the Illumina CoreExome DNA microarray, to assess the variants at 538,448 positions across the whole human genome. Replication analysis was conducted on other platforms, including the Sequenom MassArray and Taqman. For immunocytochemistry and gene expression assays, we used myofibroblast cells derived from patients whom underwent fasciectomy.
Results: We replicated the association at eight of nine previously described variants. In addition, we discovered four new regions, on chromosome 6 (near SUMO4), on chromosome 8 (near EBF2), and two on

chromosome 14 (in MMP14, near ATL1) with associated genome-wide significance ($p < 5.0 \times 10 - 8$). Preliminary expression experiments suggested that the genotype at the most highly associated variant (rs16879765, $p = 5.18 \times 10 - 41$) alters the expression of SFRP4 in myofibroblasts, identifying a potential therapeutic target.

Conclusions: Our results have provided further insight into the molecular mechanisms crucial for the development of DD. This information will be used in the future, to develop novel therapeutic strategies aimed at preventing primary disease or recurrence after intervention. Further imputation and functional analyses are ongoing.

A-0074 Clinical and radiologic factors affecting functional outcomes after volar locking plate fixation of distal radius fractures

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Objective: To identify the clinical and radiologic factors affecting functional outcomes, including wrist motion, grip power and subjective score from Disabilities of the Arm, Shoulder and Hand (DASH) in patients with a distal radius fracture treated by volar locking plate fixation.

Methods: We conducted a prospective cohort study of a case series, to evaluate the outcome of unstable distal radius fractures after volar locking plate fixation. Patients returned for outcome evaluation at 3, 6 and 12 months after surgery. At each visit, we evaluated wrist motion and grip strength, which were recorded as a percentage of the value obtained by the uninjured side. The potential factors affecting functional outcomes were as follows: age, gender, whether the dominant hand was fractured, fracture mechanism, fracture classification, diabetes mellitus (DM) status, workers' compensation status, associated ulnar fracture, radiographic parameters (volar tilt angle, radial height, radial inclination and ulnar variance) at initial injury with plain radiographs before manual reduction, and postoperatively, plain radiographs taken within 1 week after surgery. A univariate linear regression analysis was conducted, to determine the relationships between potential factors (independent variables) and outcomes (dependent variables, the wrist range of motion, grip strength and the DASH score). Independent variables significant at $p < .2$ were included in the multivariate regression analysis. A multivariate linear regression analysis, using backward variable selection, was conducted to determine the independent variables at each postoperative stage. A p value of $< .05$ was considered significant.

Results: A total of 109 patients were included in this study; however, 89 of these wrists (81%) were recruited 1 year after surgery. In the multivariate linear regression analysis, only age was revealed to be associated with total wrist motion at 3, 6 and 12 months. (p = .006, .001 and .001, respectively). There were no independent variables affecting the grip power at 3 and 6 months. Age (p = .027) and postoperative ulnar variance (p = .04) were revealed to be associated with patient grip power at 12 months. Age (p = .033), worker's compensation (p = .000) and postoperative ulnar variance (p = .003) were revealed to be associated with the DASH score at 3 months. Age (p = .049) and worker's compensation (p = .000) were associated with the DASH score at 6 months. Worker's compensation (p = .000), DM (p = .017) and postoperative absolute displacement of the ulnar variance (p = .049) were reveal to be associated with the DASH score by 12 months.

Conclusions: The factor/s affecting long-term outcomes, 1 year after volar locking plate fixation of wrist motion, was age; and affecting grip power, were age and postoperative ulnar variance; and of the DASH score, were: worker's compensation, DM and postoperative ulnar variance. Precise anatomic restoration of ulnar variance enhanced the short-term and long-term functional outcomes, including grip strength and the subjective functional score.

A-0075 Biomechanical study of the distal radioulnar joint's ballottement test

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Introduction: The distal radioulnar joint (DRUJ) relies heavily on soft tissue support for stability, and dorsal and volar radioulnar ligaments are a primary stabilizer of the joint. DRUJ instability is assessed by manual stress test in clinical hand surgery practice, but interpretation of the test is merely subjective. There is

a lack of information regarding reliability and accuracy of the DRUJ ballottement test. The purpose of this study was to investigate the intra- and inter-rater reliability and accuracy of the manual stress test with different techniques in intact and the triangular fibrocartilage complex's (TFCC) sectioned wrists, using cadaver specimens.

Materials and methods: We used six fresh-frozen cadaveric upper extremities. The humerus and proximal ulna were fixed to a testing apparatus, with the elbow at 90° flexion by K-wire. The ulna was allowed to translate to palmar and dorsal directions, and the radius was allowed to move freely. Two sensors of a magnetic tracking system (3SPACE FASTRAK; Polhemus, Colchester, VT, USA) were attached directly into the distal aspect of the radius and ulna. The other two sensors were attached on the nail of the examiner's thumbs, by which each examiner will perceive a sense of instability. Five examiners conducted DRUJ ballottement test before and after sectioning of the ulnar insertion of the TFCC. We used two different techniques with and without holding the carpal bones to the radius during the testing (holding technique and non-holding technique). Each testing was repeated three times, and we measured magnitude of DRUJ movement between the radius and ulna and that between the examiner's nails. We determined the intra- and inter-rater reliability of the DRUJ ballottement test, by calculating the intraclass correlation coefficient (ICC) for dorsopalmar movement of the DRUJ. We compared the magnitude of DRUJ (bone to bone) movement with that of the examiner's nail movement, in order to determine how the nail movement approximates the joint's instability. The magnitudes of DRUJ movement were compared, between before and after the TFCC sectioning, and between the two different techniques of a manual stress test.

Results: Intra-rater ICC of the DRUJ movement in holding and non-holding technique was 0.92 and 0.94. Inter-rater ICC was 0.84 and 0.75, respectively. Inter-rater reliability of manual stress testing in the holding technique had a trend toward being higher than that in the non-holding technique.

The magnitudes of the DRUJ (bone to bone) movement, and of the examiner's nail movement, averaged 11.5 mm and 11.8 mm, respectively, so there was a statistically significant difference ($p < 0.05$) between the two movements. The DRUJ movement significantly increased after the TFCC sectioning ($p < 0.01$). The increase in DRUJ movement, following the triangular fibrocartilage complex (TFCC) sectioning in the holding technique (average 2.3 mm), was larger than that in the non-holding technique (average 1.6 mm).

Conclusion: Despite the possibility that the DRUJ ballottement test may overestimate instability, the test was relatively reliable and accurate enough to detect DRUJ instability. Using a holding technique is recommended, in which the examiner will hold the carpal bones to the radius during testing, because the holding technique showed a higher reliability and accuracy to detect DRUJ instability.

A-0076 Perforator-based propeller flaps in hand reconstruction

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Objective: Perforator flaps increasingly find acceptance and use in hand reconstructive surgery, but they are more prone to vascular compromise, when they are twisted more than a 90˚ angle. It is now possible to design propeller flaps based on a single perforator, the so-called 'perforator-based propeller flaps'. These flaps permit flap rotation up to 180°. We present the results of complex tissue reconstruction of the hand using perforator-based propeller flaps. We constructed a treatment strategy (predicting skin flap necrosis with indocyanine green angiography) and other some tricks, based on the location of the soft tissue defect and the perforator anatomy, to increase flap survival.

Methods: We did a computer simulation of the vascular pedicle rotation (one artery and two veins), using the commercially available Abaqus standard finite element software package (Dassault Systemes). All perforator-based propeller flaps used for hand reconstruction were analysed. The parameters studied included the size and location of the defect, the size and shape of the flap, the perforator (length and location by computed tomography (CT) angiography; flow velocity by unidirectional Doppler flowmetry), the degree of twisting of the perforator, the degree of perforator dissection, the management of the donor site and the flap survival area (using indocyanine green angiography).

Results: In this study, we investigated the circulatory compromise induced by twisting of the pedicle on a true perforator flap. All flaps survived completely, with the exception of partial skin necrosis in four cases. Some of these cases required debridement and skin grafting. The donor site was primarily closed, in the majority of cases.

Conclusions: Perforator-based propeller flaps provide a reliable option for covering small-to-medium-sized complex tissue defects of the hand. They have the advantages of use of similar tissues in reconstruction,

not damaging another area, not requiring main vessel sacrifice and that the donor site can generally be directly closed. Risk of venous insufficiency increases with: each degree of rotation beyond 90°, increasing the flap surface (> 40 cm²), reducing perforator size (length and/or diameter), increasing the flap and pedicle tension, and increasing pressure from neighbouring tissues on the vessel (producing hematomas).

A-0078 Arthroscopic palpation of the extrinsic ligaments of the wrist: what do we really palpate?

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Untreated wrist sprains can lead to a degenerative articulation within some years, an irreversible scapholunate advanced collapse (SLAC) lesion and severe disability. Thus, early diagnosis of those lesions is necessary. Arthroscopy is proposed by some authors as a reference examination, allowing palpation of the tension of the different extrinsic capsular ligaments of the carpus, in addition with the palpation of the intrinsic scapholunate and lunotriquetral ligaments. Palpation of the extrinsic ligaments has been described, and seems realistic after a reasonable learning curve; however, no study has been published to confirm, by an anatomical extra-capsular open approach, the correspondence of the different ligaments that are checked arthroscopically.
The authors used three fresh cadaveric wrists, prepared by ablation of the periarticular skin, muscles, tendons and carpal tunnel contents, to compare arthroscopic testing of the carpal extrinsic ligaments to direct extra-articular view of the capsule, and to pursue from outside the movements of the probe. The internal arthroscopic, and external dorsal and volar views, show the portals and the hook with transparency, giving a clear idea of what is traced during arthroscopy.
The findings showed that arthroscopic testing allows doctors to palpate the real radioscaphocapitate ligament, long and short radiolunate, ulnolunate and ulnotriquetral dorsal radiocarpal ligaments within the radiocarpal space; and the radioscaphocapitate, scaphotrapezial, triquetrocapitate and dorsal intercarpal ligaments, within the midcarpal space. Finally, arthroscopy is a useful technique to confirm the ligaments' status. It provides a precise spectrum of the lesions.

A-0079 Early results of anterior elbow release, with and without biceps lengthening, in patients with cerebral palsy

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Objective: To investigate the effect of partial biceps lengthening on elbow flexion posture, and active elbow flexion and extension, in patients with cerebral palsy.
Methods: We retrospectively reviewed 29 patients with cerebral palsy whom underwent anterior elbow release as part of multi-level upper extremity surgery. The early series of the patients (n = 14, Group 1) had lacertus fibrosus division, brachialis fractional lengthening, and denuding of the pretendinous adventitia off the biceps tendon. The later series of patients (n = 15, Group 2) had partial biceps tendon lengthening, in addition to the aforementioned procedures. We compared the two sets of patients for elbow flexion posture, active elbow flexion and extension, forearm rotation, and House scores with the mean follow-up values at 72 months, for Group 1, and at 31 months for Group 2.
Results: The two groups were comparable, in terms of the mean age, number of procedures and preoperative House scores. Group 2 patients had greater improvement in flexion posture (53° vs. 44°) and active extension (23° vs. 15°) than Group 1, postoperatively; however, Group 2 had a mean decrease of 7° in active elbow flexion, while Group 1 had no changes. There was no difference in forearm supination or in the improvement of House scores, between the groups.
Conclusions: The early results of partial lengthening of the biceps tendon showed that it may improve elbow flexion posture and active elbow extension in cerebral palsy patients with flexion deformities.

A-0081 Radial collateral ligament injury of the small finger proximal interphalangeal joint in young pianists

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Objective: To report the features of radial collateral ligament injury of the small finger proximal interphalangeal joint in young piano players.
Methods: Between 2005 and 2012, we treated six cases of radial collateral ligament injury of the small

finger proximal interphalangeal joint in young piano players, at a single referral center. We conducted a retrospective review of charts and radiographs and performed telephone interviews with all patients at a mean follow-up time of 33 months (range, 12 - 66), to evaluate the features of this injury.
Results: All patients were girls with a mean age of 10 years (range, 8 - 12), and all had injuries in their right hands. Patients had been playing piano for a mean of 3.8 years (range, 3 - 5), and practicing for a mean of 1.8 hours per day (range, 1 - 3). Pain was commonly aggravated when they played octaves or advanced pieces requiring extensive finger movements. All patients were playing on standard-size piano keyboards and had generalized hypermobility, with a mean Beighton and Horan score of 6.3 (range, 5 - 9). Two patients had an ulnar deviation deformity of 10° and 15° each, at the proximal interphalangeal joint, while the others had no fixed joint deformity. Five patients showed improvement with conservative treatment, but one patient underwent surgery.
Conclusions: In our practice, all piano-related injuries were in female pre-adolescents with evidence of generalized hypermobility; and these patients had been playing piano extensively, suggesting that the injury could have resulted from stress on the joint during piano playing. Future studies should further evaluate the efficacy of modifying keyboard size, techniques and repertoires for piano lessons; and of patient education regarding this type of injury.

A-0082 Reconstruction of the deep transverse metacarpal ligament with A1 pulley turnover flaps: a case report

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The functional integrity of the hand depends on the transverse metacarpal arch. This is maintained by the deep transverse metacarpal ligament (DTML); and disruption of this ligament is an unusual injury, caused mostly by forceful blunt injury. There are symptoms of reduced grip strength, painful instability, deviation and subluxation in flexion, and pain on the affected site of the hand. We tried to study the efficiency of DTML reconstruction with an A1 pulley turnover flap. We present the case of a healthy 26 year-old woman whom suffered an accidental left hand crush injury, leading to persistent spontaneous dislocation between the left hand long and ring finger metacarpophalangeal (MCP) joint, despite a 1-month splint fixation done at another hospital. The patient came to our hospital for further treatment. Although the radiograph showed no obvious fracture nor bony destruction, magnetic resonance imaging (MRI) disclosed a suspicious ligament injury between the long and ring finger MCP joint. Surgical exploration was carried out through a palmar approach, 4 months after injury. The DTML was reconstructed using turnover flaps from the half A1 pulleys of the long and ring fingers. We also fixed the small, ring and long finger metacarpal bone with two 1.2 mm Kirschner-wires, which were removed 4 weeks after surgery. A volar splint was applied to keep the wrist and MCP joint in a functional position for 4 weeks, followed by rehabilitation for another 4 weeks and then full activity. Functional recovery was evaluated during follow-up assessments in the clinic. Regular follow-up until 6 months post-surgery revealed improving grip strength, no abnormal metacarpal mobility, no dislocation and normal ranges of motion for all the MCP joints. The patient reported normal use of her hand for most daily tasks. The DTML is important in maintaining functional integrity of the hand's transverse metacarpal arch. Reconstruction of a ruptured DTML with A1 pulley turnover flaps could achieve a good functional recovery.

A-0084 TFCC status after volar plate fixation in distal radius fractures

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Objective: Distal radius fracture is associated with a high incidence of triangular fibrocartilage complex (TFCC) tears. As the current practice of performing anatomic reduction and stable volar plate fixation can achieve osteo-articular congruence of the distal radial ulnar joint (DRUJ), it is postulated that the well-vascularized peripheral tears may heal in a short period of time, rendering the joint stable with or without postoperative immobilization. This study aims to evaluate the status of TFCC after the healing of distal radius fractures treated by volar plate fixation.
Methods: Patients who were elected for the removal of volar plate fixation after the healing of their distal radius were recruited for the study, from Aug 2013 to Sept 2014. We performed concomitant wrist arthroscopy in the same operative setting, to assess the status of the TFCC.
Results: We recruited 30 patients with an average age of 53 years, for this study. The average period from injury to wrist arthroscopy was 8 months. Of these, 11 patients had extra-articular distal radius fractures, 10 patients had pre-operative symptoms that included

ulnar wrist pain, and 20 patients were noted as having DRUJ instability on examination. The findings of wrist arthroscopies revealed 20 complete and five incomplete (with signs of healing) TFCC tears. All patients with symptoms and signs had TFCC tears, while the five patients with intact TFCC tear had neither symptoms nor signs. Nearly 50% of the TFCC tears arose from the sigmoid notch and 12% had fovea tears, plus 12% of the TFCC tears were combined tears. There was no correlation between ulnar wrist pain and the location of the TFCC tears; and there was no correlation between TFCC tear and the presence of ulnar styloid fractures. We noted no complications with the additional procedure of wrist arthroscopy.

Conclusion: This study confirmed that a high incidence of TFCC tears is associated with distal radius fractures. Only 20% of the tears showed some healing after the healing of a fracture, after volar plate fixation. Not all TFCC tears were symptomatic, as only 40% of the tears presented with ulnar wrist pain and 80% of the tears were associated with DRUJ instability.

A-0085 Biomechanical study of bioabsorbable plates following finger fracture fixation

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Objectives: Metal plates and screws are one of the common treatment modalities in finger fracture management, as the strength of the construct is adequate for immediate postoperative mobilization; however, the method is relatively high in profile and may result in both adjacent tendons and soft tissue irritation. While bioabsorbable plates and screws that are more conforming and low in profile may be a potential alternative, there are concerns about the biomechanical strength of these implants.

Methods: We used 54 simulated bone models of the hand with a transverse osteotomy in our study. A control group of 18 bone models (Group 0) were fixed with standard 4-hole 1.5 mm titanium straight plates. A second set of 18 bone models (Group 1) were fixed by a 1.5-mm bioabsorbable mesh plate, which was fashioned to cover one-half of the circumference of the bone. For the remaining set of 18 bone models, similar fixation was employed by the bioabsorbable plates, except that they covered two-thirds instead of one-half of the circumference of the bone. All bone models were mounted to a Servo-hydraulic MTS 858 Bionix testing machine, for biomechanical testing. From each group, six bone models were tested for maximum bending force, maximum torsional force and fatigue property. The fatigue property was to simulate the load that the fixation construct would encounter over a 6-week period, i.e. a period that allowed the bone to heal with a callous. It was set at 100,000 cycles, at a displacement rate of 1 mm/sec. It was postulated that the number of finger movements was < 100,000 in those 6 weeks.

Results: The average maximum bending force for Group 0, Group 1 and Group 2 were 67.0 +/- 10.2 N, 40.8 +/- 15.0 N and 43.3 +/- 15.0 N, respectively. There was a significant difference between Group 0 and both groups of bioabsorbable plates, of $p < 0.001$.

For the average maximum torsional force, Group 0 was 0.66 (0.06) Nm, Group 1 was 0.27 (0.06) Nm and Group 2 was 0.32 (0.07) Nm. There was significant difference between Group 0 and both groups of bioabsorbable plates: $p < 0.001$. For the fatigue tests, all constructs except two in Group 1 were able to withstand 1,000,000 cycles. The subsequent force to failure of both the bioabsorbable constructs were only 10% that of titanium constructs (6.8 N vs. 67.6 N), $p < 0.001$. No significant difference was noted in maximum bending strength, maximum torsion force and fatigue stress between the two groups of bioabsorbable constructs.

Conclusions: The biomechanical strength of the bioabsorbable plates was inferior to titanium plates. Yet, as studies show that the requirement of finger fracture fixation is mainly to provide a stable environment for finger mobilization without stress, the fatigue property of a construct appears to be more important than the bending and torsional properties, in the early postoperative period. Thus, the bioabsorbable construct may still be strong enough to allow the fracture to heal.

A-0086 The use of scapholunate temporary screw fixation for the treatment of chronic scapholunate instability

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Objective: Loss of reduction after treatments for chronic scapholunate (SL) ligament instabilities is frequently seen. Due to the chronicity of the condition, we propose the use of SL temporary screw fixation to maintain the reduction of scapholunate interval after ligament debridement, repair or reconstruction.

Method: Patients with chronic SL instability were recruited for the period from 1991 to 2012. Arthroscopic debridement was performed for dynamic instability, while either primary repair or ligament reconstruction of the SL ligament was performed for static instability. SL screw fixation was then used for the protection of the repair or reconstruction. Screws were removed when loosening was noted on X-ray, which usually occurred at 4 - 7 months.
Results: We included 36 patients with an average age of 43 years. There were 11 SL with dynamic instability and 25 static SL with instability. The average time from the onset of symptoms to surgery was 12 months. The Watson test was positive for all patients. The average follow-up period was 7.9 years. Nearly 95% of the patients had no to mild pain. The range of movement (ROM) of the wrist was 55° of wrist extension, 51° of wrist flexion, 26° of ulnar deviation and 15° of radial deviation. Postoperative X-ray revealed a satisfactory SL angle, with an average of 56°. The average SL gap was 2.5 mm. Both of these radiographic parameters were maintained at the final follow-up. Postoperatively, dorsal intercalated segmental instability (DISI) deformity was not corrected in two patients, so they subsequently underwent scaphocapitolunate fusion, as a salvage procedure. One patient had avascular changes in the proximal scaphoid and lunate, but remained asymptomatic 7 years after the operation. Six patients showed mild degenerative changes at the radial styloid; one patient had mild narrowing of the capitolunate joint. None progressed to a more advanced degenerative pattern, i.e. scapholunate advanced collapse (SLAC) Stage II or above, at the last follow-up assessment. No screw breakage nor infection were noted.
Conclusions: Temporary SL screw fixation, together with arthroscopic debridement, ligament repair or reconstruction could provide a stable closure of the SL interval. Satisfactory clinical and functional results, together with a low complication rate, could be achieved.

A-0090 Neurodynamic approach in conservative treatment of cubital tunnel syndrome

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Objective: The aim of the study is to evaluate the effectiveness of the neurodynamic approach in the conservative treatment of cubital tunnel syndrome, which is the second most common entrapment neuropathy after carpal tunnel syndrome. The study compares and evaluates the use of neurodynamic technique vs. the classic conservative approach with resting position splint overnight and occupational therapy.
Methods: From January 2014 to May 2014, we selected 20 patients, whom met the study's inclusion criteria. The patients were randomly divided into Group A (experimental) and Group B (control), each one consisting of 10 units. For both groups, we provided a static splint for the night and an occupational therapy session, and in Group A we added the neurodynamic treatment. All patients were evaluated at T0, T1 and T2 (only Questionnaire Ulnar Elbow QUGO) by the VNS scale, Pinch, Jamar, ULNT3 and QUGO.
Results: From the obtained data, we demonstrated that the study was statistically significant for the variables observed in Group A, compared to Group B, at T1. The data collected from VNS scales showed $p = 0.034$; the results recorded by the dynamometers gave $p = 0.037$ (Jamar) and $p = 0.034$ (Pinch); and the ULNT3 showed a $p = 0.006$. The outcomes measured with QUGO were not significant at T1, but could be of some significance in T2, with $p = 0.052$.
Conclusion: Following statistical analysis of the results, we can say that the neurodynamic techniques gave a swifter decrease in pain symptoms. In addition, it led to increased strength and range of motion, compared to classic conservative treatment.

A-0092 Flexor and extensor tendon repair with modified pull-out technique

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Objective: Traditional pull-out technique for reinsertion of hand tendons and ligaments is a well-known concept, almost because of its simplicity, versatility and effectiveness. Afterwards, it was partially replaced by the use of small anchors, with related advantages and disadvantages. Both techniques have some limits. The aim of this paper was to expose our new technique of tendon repair, which is an evolution of the traditional pull-out, in order to improve efficiency and avoid some complications.
Methods: The method consists in fastening a pull-out suture on a K-wire, instead of on a traditional button, in order to make good use of the intrinsic elasticity of the K-wire. It can be employed both in extensor and in flexor tendon repair. We had 11 patients undergo a reinsertion of the extensor tendon to the distal phalanx; and five

patients underwent a reinsertion or repair of a deep flexor tendon. Our follow-up was done at 6 weeks, 3 months and 6 months after the operation.
Results: Treatment was very well tolerated by almost all patients. In the extensor lesion group, all patients except one recovered a good, active extension of the distal phalanx. One patient developed a pin tract infection. In the flexor tendon group, all patients recovered an active flexion of the distal phalanx, with no complications.
Conclusions: Traditional pull-out, as well as anchor sutures, provide just static fixation, because of the absence of system elasticity. This limitation often causes partial loss of tension at the time of knot fastening, with a consequent loss of tension of the tissue that has to be fixed. The two methods also present some complications, such as skin suffering or breakage of the suture. The modification of the pull-out technique that we are proposing improves the traditional technique by adding on the advantage of a dynamic fastening of the suture, making use of the 'spring' effect of the K-wire and giving continuous tension on the tendon that has to be reinserted. At the same time, it completely avoids skin suffering and allows for further attempts, in case of suture rupture. Of course our technique preserves the disadvantages of the common percutaneous pinning, such as the need of a long-lasting dressing and the risk of infections. Nevertheless, our first experience confirmed that the modified technique we propose offers several advantages, with no added costs, and it may be effectively employed in both extensor and flexor tendon repair, with excellent results.

A-0093 High revision rates with a metal-on-metal trapeziometacarpal prosthesis

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Background: The result after trapeziometacarpal (TMC) total joint prosthesis is diverse, and recently, there have been many concerns regarding metal on metal articulations. The aim of this study was, therefore, to evaluate the short-term results after receipt of the Basal Thumb Joint Prosthesis (Motec) with metal-on-metal articulation.
Materials and methods: We retrospectively evaluated a consecutive series of 42 Motec metal-on-metal prostheses (40 patients, 33 women), performed between 2009 and 2012. The primary endpoint was revision with implant removal and trapeziectomy. Secondary endpoints were the Disability of the Arm Shoulder and Hand (DASH) score, pain on a numerical rating scale (NRS) in rest and during activity, and serum chrome and cobalt concentrations. Revision rates were calculated. At follow-up, secondary outcomes were collected for both patients with the prosthesis in situ and for patients whom had undergone revision, and the results were compared. Finally, we compared secondary outcomes between patients with elevated serum chrome and cobalt levels, and patients with levels below the detection level.
Results: Mean overall follow-up was 26 month (range, 15 - 46). The 2-year accumulated revision rate was 42% (95% CI: 28 - 60%). Revisions were performed due to aseptic loosening of the cup (n = 9), pain (n = 4), dislocation (n = 3) and deep infection (n = 1). The DASH score was a mean of 28.4 for the unrevised group and a mean of 25.8 for the revision group (p = 0.65). Pain at rest and in activity was comparable, between groups. The frequency of patients with serum chrome and cobalt levels > 10 nmol/L was comparable between the two groups (p = 0.76). Pain and DASH scores were significantly higher in patients with elevated serum chrome and cobalt ($p < 0.05$), but was not associated with revision.
Conclusion: The revision rate after TMC prosthesis in this study is unacceptably high; however, the pain and DASH scores after revision are acceptable and comparable to patients with non-revised implants. In this short-term study, release of metal particles was associated with higher pain and DASH scores, but not associated with revision. The long-term effects of local metal particles in metal-on-metal prostheses are unknown, and further long-term follow-up on the TMC metal-on-metal prosthesis is warranted. We recommend caution in implanting a TMC joint prosthesis and that surgeons performing TMC prosthesis surgery should carefully monitor their results.

A-0094 Treatment algorithm of congenital or post-traumatic ulnar impaction syndrome

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Objective: We report on a series of 30 patients with ulnar impaction syndrome (15 congenital and 15 post-traumatic) treated with ulnar shortening osteotomy and wrist arthroscopy, between 2010 and 2012. We describe our surgical technique and present a treatment algorithm, following review of the literature and our own results.

Methods: Our retrospective analysis of 30 consecutive patients whom underwent ulnar shortening osteotomy with the ITS ulnar shortening system and wrist arthroscopy had a minimum follow-up time of 24 months. We used the Disability of the Arm Shoulder and Hand (DASH) score, Mayo-wrist score and the VAS. We performed objective measurement of wrist and forearm motion, and grip strength, and analysed the X-rays and computed tomography (CT) scans taken.
Results: All osteotomies healed within 3 months. Mean pain scores were reduced postoperatively, from 4.1 to 1.6. The mean postoperative DASH score was 34.3. The range of motion (ROM) increased up to 30% and the patient satisfaction was around 85%, excellent or good.
Conclusions: Ulnar shortening osteotomy is a safe method, with a high percentage of patient satisfaction. Up to 2 mm of ulnar variance isolated arthroscopy, arthroscopic wafer procedure or ulnar shortening osteotomy are adequate treatment options. For 2 - 4 mm of ulnar variance, the arthroscopic wafer procedure is an alternative to ulnar shortening osteotomy. In cases with > 4 mm ulnar variance, ulnar shortening should be considered the gold standard.

A-0095 New possibilities of radial forearm flap use in the elimination of hand deformities

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Introduction: The Federal State Institution Saint Petersburg Scientific and Practical Centre of Medical and Social Expertise, Prosthetics and Rehabilitation was named after GA Albrecht of the Ministry of Labour and Social Protection of the Russian Federation. Here we present the results of radial forearm flap on a distal vascular pedicle used in hand deformities correction, in situations of arterial palmar arches preservation and loss.
Materials and methods: An analysis of treatment results in 65 cases of patients aged 4 - 55 years with congenital anomalies and post-traumatic hand deformities: 68 cases of radial forearm flap on a distal vascular pedicle transplantation were performed (in 3 cases, patients had both hands operated).
Results: All deformities were divided into two groups, based on vascular disturbances. Group 1 had hand deformities with palmar arterial arches lesions (33 patients); Group 2 had hand deformities without palmar arterial arches lesions (32 patients). Surgical treatment was divided, due to the following principles:

- Due to surgery type: Plasty with radial forearm flap on a distal vascular pedicle was the main part of reconstruction; plasty with radial forearm flap on a distal vascular pedicle was the final reconstruction stage.
- Due to the vascular bundle separation variant: When considering to preserve palmar arterial arches and when planning the blood supply by means of the distal forearm third anastomoses.
- Due to tissue composition: skin-fascial flap or skin-fascial-osseal flap.

Discussion: In 32 operations, we used a shortened variant of mobilization on a vascular pedicle; in 32 operations, the standard variant; in the rest of the cases, transplantation was used as a final stage.
There were some complications after three surgeries and during standard graft releasing. In all cases, there were severe venous disturbances: all patients were operated on because of their previous freezing injury and followed finger amputations.
Conclusions: Radial forearm flap transplantation can be used in broadened indications, independently of conditions with superficial or deep palmar arches.

A-0097 Risk factors for nonunion and other complications after surgical treatment of both bones in forearm fractures

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Introduction: The incidence of both-bone forearm fractures is low (4 in 10,000 persons), according to Singer et al. Although postoperative complications are common, little is known about the risk factors for the main one, i.e. nonunion. This study aimed to identify the factors playing a part in the occurrence of nonunion. It also detailed other complications that occurred and their management.
Materials and methods: These retrospective studies were conducted between January 2008 and March 2014, in three French university trauma centres (Toulouse, Limoges and Strasbourg); and included 131 patients, all treated for both bone forearm fractures

with two 3.5 mm plates. The inclusion criterion was the presence of shaft fractures, with Monteggia and Galeazzi fractures excluded. Fractures were graded according to the AO classification system and the data were collected in an Excel file.
Results: The mean age at time of surgery was 35 years and 35% of the cases affected the dominant side. We found that 89% of patients had suffered high-kinetic trauma. Nonunion was observed during the postoperative course in nine patients. Several factors were associated with a higher risk of nonunion: age at the time of surgery (35 years old for the consolidated group vs. 46 years old for the nonunion group), AO classification (notably grade A32 was connected with less risk of nonunion). Factors such as comminution, smoking or faulty fixation (less than three screws used on each side of the fracture) were not found to be predictive of nonunion. Among the nine cases with nonunion, eight patients benefited from a decortication and graft that enabled successful consolidation. We found that 17 out of 131 patients (13%) presented with postoperative neurological disorders, 11 of which were still present at the last follow-up assessment; notably, there were four nerve palsies (three radial and one ulnar). These were treated using physiotherapy and specific orthoses. By the last follow-up appointment, no neurolysis had been performed. Five out of 131 patients (3.8%) presented with radio-ulnar synostosis. Only one was operated: resection of the synostosis and flap harvested on the fascia lata. One patient presented with preoperative compartment syndrome, which required an emergency decompression fasciotomy. No patient presented with a postoperative compartment syndrome, but 17 patients complained of discomfort attributed to the fixation material. On the whole, the postoperative course included 35 procedures for the retrieval of material and one iterative fracture.
Conclusions: The complication rate after fixation of fracture of both bones in forearm fractures is not uncommon, and is at nearly one in five patients. Neurological disorders were the most frequent, with nearly 8.4% of complications directly related to the surgery, including 3% composed of palsies that were still evident at the last follow-up assessment. The second most frequent complication was nonunion (7% of patients). Our statistical study revealed that age and AO type of fracture were both factors that influenced the occurrence of nonunions.

A-0099 Distraction pinning for comminuted fractures of the MCP joints

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Objectives: Unstable, severely comminuted fractures of the metacarpophalangeal (MCP) joint after gunshot or crush injuries are challenging. Closed treatment and casting often inadequately maintain proper alignment and impede wound care. Conventional pinning or plate fixations are not feasible, due to extensive bone loss and fracture comminution. The purpose of this study was to evaluate the effectiveness of distraction pinning for comminuted fractures involving MCP joints, after gunshot or crush injuries.
Methods: A retrospective chart review indentified 10 patients with comminuted fractures involving the MCP joint being treated with wire distraction fixation. Nine were male patients. The average age was 39.5 (18 - 57) years. Nine of the injuries were to the left hand. There were three long fingers, two ring, two small, one index finger and two thumbs involved. The mean follow-up time was 15 months (1 mo - 4.5 yrs). Distraction fixation frames were removed 3.5 - 6 weeks after surgery, with fracture consolidation confirmed upon X-ray.
Results: All fractures were healed, with stable MCP joints. Eight patients reported having no pain or minimal pain in their injured hand. The finger and thumb MCP arc of motion were 84 ± 23.9° and 30°, respectively. The mean Quick Disability of the Arm Shoulder and Hand (DASH) score was 18.6 (range 2 - 41). Six patients returned to their original job. One died, due to an unrelated medical condition. The other three patients' working status were unavailable. One patient required a second surgery, including bone graft and soft tissue coverage. Three patients developed pin site irritation and were treated with oral antibiotics.
Conclusions: The distraction pinning technique was effective in managing comminuted pilon-type fractures of the base of the proximal phalanx or metacarpal head, especially with associated open wounds. It had the advantages of being easily reproducible, inexpensive, facilitating wound care and having no need of special instruments.

A-0100 Surgical treatment for distal radius fractures using titanium versus stainless steel plates

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Objective: Plates are commonly used for operative fixation of distal radius fractures (DRF). To date, there is limited data regarding postoperative complications

and their subsequent removal, specific to plate material. The purpose of this study was to compare titanium and stainless steel plating of DRF. We hypothesized that there is no difference in postoperative hardware removal between plate types.
Methods: Our study had 54 patients (2009 - 2012) undergoing DRF repair randomly assigned treatment with 2.4 mm titanium and stainless steel locking plates (Synthes). The two cohorts were analysed for differences in complications leading to hardware removal.
Results: Titanium was used in 21 patients and stainless-steel, in 33 patients. Plates were volar (n = 44), dorsal (n = 2), or combined (n = 8). There was no significant difference in age, gender, plate location and length of follow-up between the two groups. Follow-up was at 48 ± 5.6 months. Four titanium plates and one stainless steel plate were removed during the follow-up period (9%). Mean time to plate removal was 18.4 ± 4.6 months. Reasons for hardware removal included chronic regional pain syndrome, tenosynovitis, carpal tunnel syndrome or decreased tendon excursion. There was no significant difference in removal rates between the two groups ($p > 0.186$).
Conclusions: Preliminary analysis revealed no significant difference in removal, despite titanium plates requiring removal more often (19% versus 3%). These data supported literature suggesting that soft tissue inflammatory response is not dependent on the plating material. Longer follow-up and more subjects may allow identification of significant differences. Future studies should include evaluation of radiographic plate prominence.

A-0101 Combined intraradial and intramedian nerve transfer for hand reanimation after C8T1 injuries

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Objectives: Lower brachial plexus injury (LBPI) remains a clinical challenge. We have been using a double distal intraneural transfer for hand reanimation after LBPI, for the past 4 years. The procedure includes transferring a pronator branch of the median nerve (PBMN) to the anterior interosseous nerve (AIN) and a supinator branch of the radial nerve (SBRN) to the posterior interosseous nerve (PIN). We hypothesized that early double distal nerve transfer may support thumb and finger functional recovery.
Methods: Four patients were treated with distal double nerve transfer for LBPI. There were three male and one female patient, with three of them involving the right side. The mean age at surgery was 22 years (17 - 26). The mean time of delay for surgery was 7.5 (5 - 13) months; the mean time of follow-up was 20 months.
Results: The first two patients achieve M4 of thumb and finger extension (EPL, EDC); and M4 of thumb and finger flexion (FPL and FDP) on their 26- and 30-month postoperative visits, respectively. The two more recent patients showed signs of motor recovery at their 6- to 12-month follow-up visit. There was no functional loss of forearm pronation or supination after surgery.
Conclusions: Simultaneous double distal transfer of PBMN to AIN and SBRN to PIN is a useful technique for patients with LBPI. The advantages of this procedure include:

- Transfers can be performed through one incision with minimal intraneural dissection;
- The transferred nerves are very close to the targeting muscles;
- There is no need for a nerve graft; and
- Both transfers are in-phase, with ease in cortical adaptation.

A-0104 The relationship between the bony morphology of the first metacarpal base and the stability of the thumb carpometacarpal joint in normal female populations

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Objective: Instability of the thumb carpometacarpal joint (CMCJ) is considered as a major cause or an early stage of CMCJ osteoarthritis. We evaluated the effect of the bony morphology of the first metacarpal base on the stability of thumb CMCJ in normal female populations.
Methods: We evaluated 108 female hands without generalized ligament laxity or CMCJ osteoarthritis. We evaluated the bony morphology of the first metacarpal base, using the first metacarpal slope of true lateral radiograph of the first metacarpal, and then evaluated radiologic instability of the thumb CMCJ, using the subluxation ratio of the CMCJ stress view radiograph. We evaluated the relationship among age, metacarpal slope and subluxation ratio.

Results: The mean participant age was 57 years. The mean MS was 82.3° (SD 4.2°; range 71.2 - 89.8°), and the mean SR was 0.27 (SD 0.13°; range 0 - 0.57°). There was no statistically significant relationship between each variable, such as age, metacarpal slope and subluxation ratio in Pearson's correlation test. And there was no statistically significant relationship in the multivariate regression analysis.
Conclusions: There was no relationship between the bony morphology of the first metacarpal base and the radiologic stability of thumb CMCJ, in the normal female population. And both the bony morphology and the stability of thumb CMCJ were not affected by increasing age. There were some studies about the relationship between the bony morphology and the thumb CMCJ stability in arthritic patients. This suggested that there could be some changes in stability and bony morphology of the first metacarpal base, with development and progression of thumb CMCJ osteoarthritis.

A-0108 Findings in patients with hemodialysis-associated carpal tunnel syndrome admitted for surgical decompression: comparison with patients with idiopathic carpal tunnel syndrome

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Objective: Our hypothesis is that the clinical symptoms and surgical results of patients with chronic hemodialysis-associated carpal tunnel syndrome (CTS-HD) are different from those of patients with idiopathic carpal tunnel syndrome (CTS-I). To determine the features of CTS-HD, we examined preoperative psychological factors and the progression of clinical symptoms in patients with either CTS-I or CTS-HD.
Methods: We enrolled 17 patients in the CTS-I Group and 14 patients in the CTS-HD Group. Their mean age was 69.4 and 64.1 years, respectively. The psychological status of the patients was evaluated before CTS surgery, using the Self-Rating Depression Scale (SDS) and the State-Trait Anxiety Inventory (STAI). Clinical symptoms were evaluated three times (before surgery, and 1 and 12 months after surgery) using the JSSH version of the CTS instrument (CTSI-JSSH), visual analogue scale of numbness (VAS), and the Quick Disabilities of the Arm, Shoulder and Hand (Q-DASH) scores. We compared the scores of the CTS-I and CTS-HD groups.
Results: The CTS-HD group contained significantly more patients who suffered from anxiety, compared with the CTS-I group; however, there was no significant difference in SDS between the two groups. In both groups, the CTSI-JSSH, VAS and Q-DASH scores improved significantly 12 months after surgery, compared with preoperative values. Preoperative CTSI-JSSH and VAS at 12 months were significantly different between the CTS-HD and CTS-I groups.
Conclusions: Compared with the idiopathic patients, hemodialysis patients with carpal tunnel syndrome have a tendency for anxiety, but not depression. Both groups of patients showed an improvement in CTSI-JSSH, VAS, and Q-DASH scores within 12 months of surgery, although numbness tended to remain in the CTS-HD group. Surgery for carpal tunnel release is an effective treatment for idiopathic and chronic haemodialysis patients with carpal tunnel syndrome.

A-0109 Conservative rehabilitative treatment in carpal tunnel syndrome: a comparison between night splints and neurodynamic treatments

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Introduction: Carpal tunnel syndrome is a very common pathological disorder caused by the compression of the median nerve that descends from the forearm to the hand through a channel called the carpal tunnel. This study focuses on conservative treatments. The aim is to compare two different methods: to evaluate whether a combination of neurodynamic exercises supported by use of a night splint determine better or worse results than a treatment based exclusively on the use of the night splint. The question remains which treatment will give the fastest and most effective cure.
Materials and methods: Patients were divided into two groups randomly, Group A and Group B.
Patients are selected in respect of inclusion criteria. The outcomes to be recorded were: Visual Analogue Scale (VAS) and Boston Carpal Tunnel Questionnaire (BCTQ).
Group A (20 patients) was asked to wear a night splint for at least 6 - 8 hours, for a period of 3 months. Group A procedure:

- T0: prepare personalized splint, administer VAS and BCTQ and execute upper limb tension test number 1 (ULNTT1);

- T1 and T2: splint control and administer VAS;
- T3: splint control, repetition of ULNTT1, and administer VAS and BCTQ

The Group B (20 patients) was asked to wear a night splint for at least 6 - 8 hours, plus undergo neurodynamic treatments and exercises (performed under the supervision of the therapist, once a month), for a period of 3 months. Group B patients were also assigned exercises at home (neurodynamic gliding exercises and functional hand exercises). Group B procedure:

- T0: Prepare personalized splint, administer VAS and BCTQ, execute ULNTT1, do home exercises sheet and treat mechanical interfaces: cervical spine and cervical muscles, mobilization of the gleno humeral joint, massage the forearm muscles, and aponerosis through soft tissue massage and stretching of the transverse carpal ligament;
- T1: splint control, administer VAS, home exercise sheet and neurodynamic treatment in slider (gliding);
- T2: splint control, administer VAS, home exercise sheet and treatment of mechanical interfaces in preneural tension position; and
- T3: splint control, administer VAS and BCTQ, neurodynamic treatment in neural tension (by tensioner) and repetition of ULNTT 1.

Results: The current analysis of data showed that there are statistically significant differences. In particular, VAS decreased for both groups, but especially if we consider Group B, and that the percentage of variation of the mean between T0 and T1 is better for Group B (3 points better in Group B vs. 2.1 in Group A). The symptom severity scale (SSS) of BCTQ also showed a better result for Group B: the mean percentage between T0 and T3 of Group B decreased 51.48%, instead of 38.76% for Group A.
Conclusions: The statistical analysis of data showed that patients in Group B had a better performance results concerning pain decreases, while both groups showed statistically significant improvements in BCTQ values. Patients in Group B achieved statistically significant results in relation with pain decreases, between their second and third treatment session (T1 - T2) and between the third and fourth treatment session (T2 - T3). This study is currently in progress.

A-0112 Useful plain radiographic findings in diagnosis of paediatric olecranon greenstick fracture complicated with proximal radial fracture

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Objective: With careful scrutiny of the initial plain radiographs, we found that olecranon fractures in children can be detected easily only with plain radiographs, by checking if a longitudinal crack on the olecranon exists. The aim of this study was to verify the utility of this easy sign to diagnose an olecranon occult fracture.
Methods: We retrospectively reviewed all patients below 16 years of age diagnosed with proximal radial fractures, treated at our hospital between 1 April 2006 and 31 September 2014. We identified 22 cases, 9 boys and 13 girls at the mean age of 8.5 years, for inclusion. Injuries resulted from a fall from standing height (n = 7), a fall from high site (n = 14) and a direct blow (n = 1). All fractures were designated according to the Chambers classification (17 Group I and 5 Group II fractures).
Three hand surgeons blinded to each other's results examined all the initial radiographs of the injured elbow, included the lateral and anteroposterior views. To diagnose the occurrence of the fracture and review fracture patterns, we evaluated computed tomography (CT) scan images in nine cases. Follow-up radiographs for sclerosis or periosteal reaction indicated a healing fracture in the other 13 cases. Finally, we classified the fractured olecranon into three types; medial crack, posterior flat and posterior crack type.
Results: We detected 12 associated olecranon fractures (54.5%). In five cases, the olecranon fractures were not pointed out by the primary doctors. All associated olecranon fractures were green stick fractures. Other complicated fractures were humeral lateral condyle and humeral medial condyle in one case each. According to the fracture type of the olecranon, three cases were medial crack type, five cases were the posterior flat type and three cases were the posterior crack type. Each type of fracture had characteristic findings in the plain radiographs. The mean value of the sensitivity was 97.2% (91.7% - 100%), specificity was 90.0% (90.0%), positive predictive value was 92.1% (91.7% - 92.3%), and the negative predictive value was 96.7% (90.0% - 100%).
Conclusions: The diagnosis of elbow fracture may be difficult, because the physical examination of an uncooperative child with a grossly swollen elbow is problematic, and also difficult to obtain true anteroposterior and lateral views of the radiographs. In addition, the additional procedures to establish the

correct diagnosis, such as arthrography or CT or magnetic resonance imaging (MRI) are either invasive or expensive, often needing sedation or general anaesthesia. Our data indicated that this easy, noninvasive additional check of the sign provided a quantity of benefits to the patients, so as not to miss a paediatric olecranon fracture.

A-0114 Ipsilateral cortical changes in response to median nerve injury: a fMRI study

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Objective: Recovery from peripheral nerve injury in adults results in profound abnormalities in sensory perception, despite improved microsurgical technique. It is of great importance to increase the understanding of cortical changes in response to peripheral nerve injury, to improve the rehabilitation of these patients. We previously described a transient increase in the contralateral primary somatosensory cortical activation area using functional magnetic resonance imaging (fMRI), following nerve damage and repair (Hansson and Brismar, 2003). In addition, there is growing evidence of interhemispheric plasticity. Studies of rats with a denervated paw show a transfer of activity from the contralateral to the ipsilateral hemisphere. Our objective was to study the ipsilateral cortical activation pattern in patients with median nerve injury.
Methods: We included in the study 11healthy volunteers (mean age 24) and four patients (mean age 39) with median nerve injury at the wrist, repaired with epineural suture at least 2 years prior to the examination We used 3T fMRI to measure brain activity while the median and ulnar nerve-innervated fingers of both hands, respectively, were given tactile stimulation by an air-driven brush. The static 2-point discrimination (2pd) test was used to evaluate sensory function. Data analysis was performed using SPM12 and the laterality index (LI) was calculated to evaluate redistribution of hemispheric dominance.
Results: All patients showed abnormal 2pd in the injured median nerve innervation area (8 to > 15 mm). The patients had normal 2pd (< 5 mm) in the healthy hand and in the ulnar fingers of the injured hand. All healthy volunteers had normal 2pd. The fMRI showed a higher degree of ipsilateral activity in the parietal lobe of the patients than in the healthy volunteers; and there was a significant difference in LI between the two groups (mean for patients: 0.21; healthy volunteers 0.60; $p < 0.05$).
Conclusions: Our study showed that patients with median nerve injury have lower LI, meaning a more bilateral activation pattern in the somatosensory cortex, compared to a group of healthy individuals. Healthy individuals display a greater degree of contralateral dominance to unilateral median nerve stimulation. The relative increase in the ipsilateral contribution may compensate for the disorganised contralateral somatosensory cortex, i.e. it may be a part of the interhemispheric plasticity in response to peripheral nerve injury.

A-0115 Pyrocarbon metacarpophalangeal joint replacement: a service evaluation and 2-year minimum follow-up assessment

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Objective: Arthritis of the metacarpophalangeal (MCP) joint can cause significant pain, deformity and loss of finger function. Traditionally, this joint was replaced with a silastic spacer. Stability and durability, particularly in higher-demand patients, may compromise the implant. Pyrocarbon implants were developed with anatomic accuracy and promising material properties, which should provide greater stability and durability. There are few studies on the outcome of these procedures. This study aimed to evaluate the pyrocarbon MCP joint replacements carried out in our unit, over a 12-year period.
Method: We carried out a retrospective review on 18 patients whom had undergone 29 pyrocarbon MCP joint replacements, over a 12-year period. Patients were recalled by telephone and then satisfaction, pain and Quick Disabilities of the Arm, Shoulder and Hand (QuickDASH) scores were calculated. The notes were reviewed for any mention of complications and range of movement (ROM) issues.
Results: The patients' average age was 68 years (26 - 91). Mean follow-up time was 5 years (2 - 12).
At follow-up, 50% of patients reported a pain score of 0 out of 3 (no pain) in the finger. For those patients where full data was available, the arc of movement had improved from 34° pre-operatively, to 57° post-operatively. The mean postoperative QuickDASH score was 16 (0 - 45). There were three complications:

one was a superficial wound infection, one was a revision for pain and one was a revision for fracture. Patient satisfaction was high, with 68% of patients completely satisfied and 21% satisfied, and 95% of patients reported that they would have the procedure done again.
Conclusions: Our results suggested that pyrocarbon MCP joint implants are a safe and effective implant to use in MCP joint arthritis, with high rates of patient satisfaction and low complication rates. Longer-term review and larger studies are required to confirm whether these promising results are reliable and durable.

A-0118 Stabilizing effect of ulnar shortening procedure for DRUJ instability

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Introduction: Ulnar shortening is widely indicated for ulnocarpal abutment syndrome with positive variance wrist. It also stabilizes the distal radioulnar joint (DRUJ), because of the tightening effect on the triangular fibrocartilage complex (TFCC), as long as either the dorsal or palmar portion of the radioulnar ligament (RUL) was attached to the ulnar fovea. In clinical practice, it is very important to check the condition of the RUL through DRUJ arthroscopy, when the ulnar shortening was indicated for DRUJ instability cases. We retrospectively analysed our case series.
Methods: There were 663 wrists (of 624 cases) that underwent the ulnar shortening procedure, done by a single surgeon. Among them, 70 wrists of 68 patients indicated mild to severe DRUJ instability. There were 34 male and 34 female patients. The right wrist was affected in 36 cases, the left in 20 cases, and two were bilateral. The age range was 19 – 63 years, with an average of 34 years. The preoperative ulnar variance indicated 1.98 mm (range 0 - 6.5). All wrists indicated pain, while there was no limitation of the pronosupination range. Mild DRUJ instability, which indicated there was more instability, compared to the intact contralateral side, was noted in 11 wrists; there was moderate instability indicated by no endpoint either in the dorsal or palmar direction in 41 patients; while severe DRUJ instability was demonstrated by instability without endpoints both in the dorsal or palmar direction, in 18 patients. Arthroscopic examination, including DRUJ exploration, was done before shortening of the ulna. If there was still DRUJ instability, we performed additional open repair or reconstruction of the DRUJ using the ECU half-slip tendon. The ulna was shortened by an average of 2.4 mm (range 2 - 6.5). We evaluated the arthroscopic findings and clinical results using our original DRUJ evaluation system, including: pain, range of pronosupination and DRUJ instability. We also examined the difference in clinical results with the severity of DRUJ instability.
Results: Palmer 2A tear was in 43 wrists, Palmer 2C tear was in three and Palmer 1B tear in eight wrists, as seen through radiocarpal arthroscopy. DRUJ arthroscopy re-evaluated the partial dorsal tear of the RUL in nine wrists and complete avulsion of the RUL at the fovea in 10 wrists. We added open TFCC repair in seven wrists of complete avulsion of the RUL and three wrists needed reconstruction of the TFCC. Overall clinical results obtained were: 59 excellent, nine good, one fair and one poor; and 11 wrists with mild DRUJ instability all obtained excellent clinical results only with ulnar shortening. In 41 wrists with moderate DRUJ instability, ulnar shortening obtained 40 excellent and one poor clinical result; however, in the severe DRUJ instability wrists, we only obtained eight excellent, nine good and one fair clinical result, even with an additional procedure, such as open repair or reconstruction.
Conclusions: Ulnar shortening obtained excellent clinical results in the wrists having mild to moderate DRUJ instability. When the RUL was avulsed from the ulnar fovea completely, ulnar shortening could no longer restabilize the DRUJ. In such cases, repair or reconstruction of the RUL is necessary.

A-0119 Secondary prevention of osteoporosis after distal radius fragility fractures

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Objective: Fragility fractures are common and their treatment constitutes a medical, social and financial burden. Recent studies emphasize prevention for osteoporotic fractures, but the systematic approach to these patients in many health systems remains inadequate. The purpose of this study was to evaluate the existing treatment of patients following surgery for fragility fractures of the distal radius in a Health Maintenance Organization (HMO)-type medical system in the north of Israel.
Methods: We performed a retrospective review of distal radius fragility fractures in a HMO hand service

between 2012 - 1013. Fragility fracture was defined by radiographs and the mechanism-of- injury. Demographic data, previous and subsequent fractures, and the quality of secondary prevention were documented. Chi-square was used for analysis.
Results: We evaluated 82 patients (67 female and 15 male patients). Their age was 64 years (SD 10.2); 64 years (SD 10.9) for female and 61 (SD 6.15) for male patients. Follow-up after the index fracture was 25.2 months (SD 4.6): 28% of the patients had a second fracture. Seven patients had subsequent fracture within the follow-up period (8.5%) and 16 had a fragility fracture prior to the index fracture. The mean time from primary to index fracture was 50 months (SD 42). Patients who had additional fragility fractures were significantly older and carried a diagnosis of osteopenia or osteoporosis; plus 37% of smokers suffered an additional fracture. Hypercholesterolemia, hypertension and diabetes did not seem to predispose to additional fractures. No patients were referred for prevention or an endocrinologist at discharge, but 45% of patients were treated following fracture, most by the family physician, with vitamin D and calcium. We found 16 patients with previous or additional fracture (76%) who did not see an endocrinologist ($p = 0.05$), and nine patients with a second fracture received no preventive medication ($p = 0.08$).
Conclusion: In our population, although treated and followed by a closed and organized medical system, patients with a first fracture were unlikely to receive appropriate evaluation and treatment for prevention of fragility fractures. Secondary prevention is most important for patients with known osteopenia or osteoporosis, smokers and patients above 50 years of age. In order to improve care for our population, a systems-based treatment plan for the prevention of osteoporosis should be implemented, such as a multidisciplinary osteoporosis clinic designed to treat and follow patients with prior fragility fractures.

A-0122 'Regressive' patho-mechanics of Kienböck's disease and salvage by coxa manus surgery

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Objective: In this study, the author explains the patho-mechanics of Kienböck's disease (in Lichtman, Stage IIIab - IV) by the perspective of mechanics of biarticular concentric carpal mechanism and wrist ontogenesis; exposing the ratio of surgical treatment in this: the reconstruction of the coxa manus (RCM), which illustrates the technique and shows the results in casuistry.
Methods: Kienböck's pathogenesis is compared to Rx-staging, in which the symptoms of stages I - II are organic and pertinent to the suffering lunate; while the IIIab - IV stages depend on a dissociative carpal instability that does not fall in the classic scheme of DISI-VISI, but can be typed in two configurations: Kienböck dissociative scaphoid extension, rarely seen; and Kienböck dissociative scaphoid flexion, the typical plan and more often in terminal stages, structured carpal arthroscopic collapse. However, this instability sometimes (paradoxically) allows an acceptable function when it passes in the so called adaptive carpus (AC), characterized by the emergence of an ancestral function, for which the movement tends to focus on the capitate's head, that articulates on the collapsed lunate. The symptoms fall (and AC derails) when the latter is shattered. Specifically, the AC concept was reproduced in the RCM, consisting of a radiocarpic arthrodesis with distal scaphoid resection. In a special variant, the missing lunar coxa manus component is obtained by lifting osteotomy of the distal radius lunate facet. The surgical procedure optimizes the adaptation of bi-articular to uni-articular mechanics, implicit in AC.
Results: In support we present seven operated cases (2002 - 2012 with three illustrated, for example). The results (assessed according to the parameters of the Mayo Wrist Score Chart, with a 5.85 years average follow-up period) were satisfactory in all patients.
Conclusions: The results confirm the validity of this approach to knowledge and surgical treatment of terminal Kienböck's disease, supporting the RCM as advantageous saving procedure.

A-0125 Dimensions of the trapezium bone: a cadaver and CT study

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Purpose: The primary purpose of this study was to define the size of the trapezium bone through measurements on cadaver specimens and computed tomography (CT) scans of living subjects. The

secondary purpose of this study was to determine if any correlation existed between the size of the trapezium and local anatomical parameters.
Methods: The radio-ulnar length (L), dorsopalmar width (l) and height (h) of the distal surface of the trapezium were measured by two independent observers on 20 cadaveric specimens. The same measurements were carried out by two other observers, on anonymized CT scans from 18 patients. The inter- and intra-observer agreement was determined using the intraclass correlation coefficient.
Results: In the cadavers, the mean length, width and height of the trapezium were 22.8 mm, 15.5 mm and 15.2 mm, respectively. On the CT scans, these same dimensions were 19.2, 11.4 and 11.6 mm. Inter-observer agreement was statistically significant in both parts of the study.
Discussion: The dimensions of the trapezium bone were about 3.33 mm larger in cadavers than on CT scans. These differences can be explained partially by a systematic under-sizing error on the CT scans and the fact that the cartilage layer cannot be directly visualized.
Conclusions: This study was able to define the dimensions of the trapezium bone. It may be possible to predict the trapezium height from the length of the forearm or the width of the radial epiphysis. Our data can be used to adjust the size of trapezium implants to the dimensions of the patient's bone.

A-0126 Bone peg scaphoid osteosynthesis: economic, not demanding, works

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Objective: The bone peg graft technique of scaphoid osteosynthesis (G Murray, 1976) consists of a dorsal approach, harvesting free nonvascular cortical-spongy bone graft from the dorsal side of the distal radius and inserting it through a longitudinally-drilled scaphoid bone. The technique is used for fractures and nonunions of the scaphoid bone, without intervention to the pseudarthrosis zone. Despite the archaic nature of this technique and some disadvantages, it also has some clear benefits, and in some cases is irreplaceable. Effectiveness of this method requires an objective revision.
Methods: In a retrospective study of the 2006 - 2012 period, we used the 'bone peg graft' method and operated on 11 patients with fractures and 43 with pseudoarthrosis. In the patient control group, surgery was performed by conventional methods: the palmar approach, headless screws, and in the case of pseudarthrosis with resection of the nonunion zone, correction of the form and length of the scaphoid, and interposition of the bone autoplasty. In this group, 11 patients with fractures and 36 with nonunion (scaphoid nonunion advanced collapse (SNAC) 0/1/2/3 degree in 17/8/11/0, accordingly). Evaluation of the results was based in part on the consolidation of scaphoid pseudoarthrosis and repeated operations, the dynamics of the carpal height index, radiolunate angle, relative scaphoid length and the Disabilities of the Arm, Shoulder and Hand (DASH)-score.
Results: The 'bone peg graft' technique achieve 90.9% of fracture union (11:1 patients); however, consolidation of uncomplicated pseudarthrosis reached 94.7%. Despite this, union of SNAC in 5/24 (20.1%) patients was not achieved, and two of them (8.3%) underwent reoperation. Functional results were 16.5 (6.9) by DASH-score, the carpal height index was 0.490 (0.020), radiolunate angle (- 17.2 (9.9)) and relative scaphoid length (88.7 (3.8%) had negative dynamics in these indicators for the SNAC patients. In the control group, all fractures 11:11 (100%) were consolidated. In uncomplicated nonunions, success reached 17:1 (94.1%) patients. Patients with SNAC had nonunions in 6/19 (31.6%) cases, mostly with SNAC II, and five of them (26.3%) underwent reoperation. Functional results were 14.2 (8.3) by DASH-score, the carpal height index was 0.509 (0.010), radiolunate angle (- 12.5 (5.2)), and relative scaphoid length 95.5 (4.9)%, with positive dynamics of these indicators in all cases of consolidation.
Conclusions: The bone peg graft technique of scaphoid osteosynthesis has a number of benefits: it does not require metal fixators, so there are no complications associated with them. Minimally invasive for the wrist joint (1cm arthrotomy), it does not require a highly-qualified surgeon and intraoperative X-ray control. It is applicable for small fragments of the scaphoid proximal pole and selective denervation is also available from the dorsal approach. Disadvantages noted: the technique does not eliminate scaphoid fragment dislocation, not correct the shape and length of the scaphoid bone and wrist instability. The method has moderate cosmetic defects (as is a dorsal wrist approach), and gives nominal damage to articular cartilage of the proximal pole. Nevertheless, the bone peg graft scaphoid osteosynthesis provides good results in the scaphoid fractures and uncomplicated nonunions; however, in patients with SNAC the outcomes are worst.

A-0129 An anatomical study of the dorsal branches of the digital nerves

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Objective: A particular challenge when operating on Dupuytren's disease is the presence of spiral cords. Their close relationship with the neurovascular bundle, at the base of the finger, can distort the usual anatomy and displace the bundle medially. The dorsal branches (DBs) which arise from the digital nerves (DNs) in this area may, if large in diameter, can be mistaken for DNs, leaving DNs at risk of inadvertent injury. Descriptions of the anatomical consistency, origin and diameter of the DBs relative to the DNs vary in the available literature; however, a clear understanding of this anatomy is critical to minimising the risk of nerve injury during surgery.
Materials and methods: Dissection was performed on 10 (five paired) fresh-frozen cadaveric hands. The flexor retinaculum and Guyon's canal were incised, and dissection of the neurovascular structures was performed in a proximal to distal direction, under 3.0 loupe magnification. On each side of the digits, the origin of the DB was measured relative to the proximal A1 pulley and to the common digital nerve (CDN) bifurcation. The DN and DB diameters were measured immediately distal to the DB origin with an eyepiece graticule. We calculated the mean of three measurements.
Results: We found DBs on both sides, in the majority of digits (89 ± 3.1% of 100 digits) and they were most commonly absent on the radial side of the thumb. The DB originated at or proximal to the A1 pulley, in the majority of digits (58%); while 11% arose proximal to the pulley, usually in the thumb. The DB was distal to the A1 pulley in 34% of cases, most commonly in the third web space. Relative to CDN bifurcation, the DBs originated closer on the radial sides of the middle and ring fingers (24.4 ± 2.6 and 22.4 ± 1.9 mm, respectively), compared to the ulnar sides of these digits (40.3 ± 2.5 and 39.7 ± 4.05 mm, respectively), and arose most proximally on the ulnar side of the little finger (19.8 ± 2.3 mm). Similarities between the size of DN and DB were obvious during dissection and width measurements demonstrated that DBs were consistently more than one-half the diameter of the corresponding DNs. This was particularly the case for the radial side of the middle finger (1:0.98) and the ulnar side of the little finger (1:0.93). The ratios on the two sides of the finger were least comparable for the middle finger (radial 1:0.98 and ulnar 1:0.67), but most similar for the border digits.
Conclusions: Our study provides an anatomical description and comparison of DBs and DNs across all digits of the hand. We hope that this will help guide safe dissection at the base of the fingers, and highlight the use of DBs as suitable nerve donors for repair of damaged DNs.

A-0130 Predictors of recurrence for joints successfully treated with CCH injections

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Objective: To identify subject-level or joint-level characteristics that predict the recurrence of a Dupuytren's disease (DD) contracture, up to 5 years after successful treatment with collagenase *Clostridium histolyticum* (CCH) injections.
Methods: Joints affected with DD (a fixed-flexion contracture (FFC) > 20° with a palpable cord) were treated with CCH injections. Joints included in this study reached clinical success (FFC < 5° within 30 days post-injection). We evaluated these joints for recurrence over a 5-year period after successful treatment. Recurrence was defined as a > 20° worsening of the contracture, with a palpable cord, or if the joint underwent further treatment. Baseline severity of the joint and 24 subject-level variables were analysed to see which predicted recurrence. Variables included: total contracture index (TCI) equal to the sum of FFC of 16 finger joints, prior to CCH treatment), body mass index (BMI), demographics, alcohol consumption and comorbidities. All predictor variables were dichotomized. A Fisher's exact test was used to determine which variables were related to recurrence. A stepwise logistic regression analysis was done, including the 25 predictor variables.
Results: A total of 644 subjects had 1081 joints treated with up to three injections of CCH (mean 1.6 injections), of which 623 joints (451 MP, 172 proximal interphalangeal (PIP)) reached the primary endpoint of clinical success. At 5 years after successful treatment, 47% of these joints had had a recurrence (39% of MP joints and 66% of PIP joints). The following variables were associated with greater recurrence of DD after successful treatment with CCH: baseline TCI > 110° ($p = 0.001$), bilateral disease ($p = 0.02$), alcohol consumption ($p = 0.009$), low weight (median split based on gender, $p = 0.04$), and low BMI (< 26 kg/m^2, $p = 0.04$). For MP and PIP separately, a baseline TCI > 110° ($p = 0.009$), alcohol consumption ($p = 0.01$), bilateral disease ($p = 0.01$), and prior surgery for DD ($p = 0.04$) predicted recurrence in MP joints, whereas only gender was marginally related ($p = 0.06$) to recurrence in PIP joints, with male patients having more

recurrence than female patients. In the stepwise regression analysis, only baseline TCI > 110° and alcohol use predicted recurrence for all joints and for MP joints, and only gender predicted recurrence for PIP joints.
Conclusions: Certain subject characteristics were associated with an increased rate of recurrence of Dupuytren's contracture, following successful treatment with CCH. In this analysis, predictors associated with recurrence included higher baseline TCI, bilateral disease and prior surgery. All of these could be considered surrogates for disease severity. Alcohol use and lower weight/BMI were also predictive of recurrence. For PIP joints, our analysis suggested that male patients may be at a higher risk for recurrence than female patients. This information about subject- and joint-level characteristics may be helpful in guiding patients and physicians, in determining the prognosis and treatment of Dupuytren's contracture.

A-0132 Surgical management of upper limb vascular malformations

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Objective: Vascular malformations are a heterogeneous group of developmental anomalies. The Birmingham Peripheral Vascular Anomalies Service is a supra-regional multidisciplinary team that manages non-head and neck vascular malformations in adults. We reviewed all patients whom underwent surgical management of upper limb vascular malformations between 2009 and 2014. The primary aim of this study was to review the outcome of surgery. The secondary aims were to review surgical approaches and complication rates.
Methods: Patients who underwent surgery for vascular malformations of the upper limb, including shoulder girdle, were identified from our database. The notes were reviewed, to identify the type of vascular malformation, preoperative imaging, pre- and postoperative interventional radiology, indications for surgery and surgical access incisions. We recorded the outcome of surgery and any complications.
Results: We identified 17 patients (eight were male and nine female). The affected areas were: shoulder girdle muscles (n = 5), upper arm (n = 1), forearm (n = 6) and hand (n = 5). Nine patients had low-flow venous malformations; eight patients had high-flow arteriovenous malformations. The high-flow malformations were classified as Schobinger 2 (n = 7) and 3 (n = 1). Indications for surgery included: increasing swelling (n = 10), pain (n = 6) and cosmesis (n = 1). Three patients with high-flow arteriovenous malformations underwent preoperative liquid embolization with Onyx (suspended tantalum power in an ethyl vinyl alcohol copolymer dissolved in DMSO). All vascular malformations were excised by identification of tissue planes, while protecting neurovascular structures, with the incorporation of pre-existing scars where appropriate. A total of 13 patients underwent marginal surgical excision and three underwent debulking procedures. At surgery, one patient was found to have a vascular malformation within the median nerve and that planned excision was aborted. Outcomes were recorded as improved in all 16 patients who had debulking or excision, and as unchanged in the one patient whose excision was abandoned. There was one complication, a digital nerve neuropraxia, which completely resolved. There were no cases of wound breakdown or symptomatic persistent malformation.
Conclusions: Surgical resection of vascular malformations can be achieved in appropriately selected patients, with low recurrence and low complication rates. It is not always possible to perform complete excision; however, in complex or diffuse malformations, carefully planned debulking procedures can usefully reduce patient symptoms. Preoperative interventional radiology is useful in selected cases.

A-0134 Are Mason II radial head fractures really displacements during active flexion-extension of the elbow? A cadaver study with Cone-Bean computer tomography

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Objective: Management of uncomplicated Mason Type II fractures remains controversial. We analysed, in a cadaveric model, if Mason II were really a displacement during elbow flexion-extension. The purpose of our study was to quantify the exact fracture dislocation after simulated physiological load, using Cone-Bean computer tomography (CBCT).
Methods: Mason II fracture was practiced in the non-articular quadrant (36.2% of the articular surface) in five cadaveric elbows. We performed a modified Kaufman's close reduction and simulated the biceps brachii active action with a series of different flexor-extension ranges (0 - 30° and 30 - 110°) with 5 cycles of load each (10 N, 20 N and 40 N). We evaluated the

fracture displacement after each load (at three reference points: P1, P2 and P3) for the axial, coronal and sagittal planes, comparing the dislocation before motion and after motion at 0 - 30° and 30 - 110°, and checked the articular surface depression. The data was evaluated with Kolmogorov-Smirnov, unpaired *t*-test, unpaired *t*-test with Welch's correction, and Mann-Whitney tests.
Results: Mason II fractures:

- Were effectively reduced by the Kaufman modified method (significant decrease of fracture dislocation on all three planes ($p < 0.01$);
- Had the 0 - 30° motion arc contribute to reducing the fragment dislocation on coronal ($p < 0.05$) and sagittal planes ($p < 0.001$); and
- Had the 30 - 110° range further decrease the dislocation's fragment on axial and coronal planes ($p < 0.05$).

Articular surface depression was significantly reduced (< 1 mm) after a Kaufman's modified manoeuvre and after 0 - 30° mobilization.
Conclusions: The simulated elbow flexion-extension didn't dislocate Mason II fractures. In particular: First, a fracture displacement doesn't occur in the 0 - 30° range; the fracture improved the reduction on coronal and sagittal planes, while with > 30 - 110° and the movement contributed to the further reduction of fragments on all planes. Second, the articular surface depression improved at certain landmarks (dx and dy coronal, and dy sagittal), got worse in the dy coronal and sagittal planes, but remained depressed with < 1 mm.

A-0138 A review of 300 cases of wide-awake surgery of the hand

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Objective: Wide-awake surgery (WAS) may bring a lot of progress to hand surgery, both in terms of clinical outcome and in terms of patient comfort.
Methods: First, we defined WAS as a surgery performed with a small dosage of local anesthetic for a minimal time (< 15 minutes), or just the addition of epinephrine, or using any intra-operative ischemia (tourniquet); and the patient was wide awake and able to cooperate in functional tests, during surgery.
Results: A review of 300 WAS operations, performed after 2009, showed the following results: all patients were comfortable with the requirement of being wide awake. Those who had experienced previous regional anaesthesia and/or the use of the tourniquet, judged the procedure far more comfortable. Nerve surgery and tendon surgery benefit from less invasiveness, granted by the absence of intra-operative ischemia. Tendon transfer accuracy was enhanced by performing it in WAS.
Conclusions: We found WAS more accurate and less invasive, particularly in nerve and tendon surgery. The short (or absent) rehabilitation period required should probably be associated with avoiding tourniquet use. Careful positioning of the limb and higher surgical skill are required to perform WAS.

A-0139 Clinical implications of a refined structural model of peripheral nerve that explains the 'bands of Fontana' phenomenon

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Objective: In 1779, Fontana identified transversal and oblique bands along peripheral nerves. Subsequent studies pointed alternatively at endoneural or perineural components as the cause. We wanted to sort out these conflicting findings.
Methods: Recoiling of the bands was video-recorded in the rat sciatic nerve. Computer-assisted design (CAD) was used to model the nerve by interference figures.
Results: In-vivo microdissection showed distinctive black and white, highly packed bands in the perineurium: this differentiated them from the widely spaced, translucent dark grey to pale grey, staggered bands in the endoneurium. Using CAD, we merged these two patterns, produced images that resemble the in-vivo bands.
Conclusions: Two repetitive structures with different characteristics, one in the perineurium and another in the endoneurium, were merged to give the appearance of the bands. The nerve structure proposed may contribute to an understanding of why an artificial nerve-guide can succeed in repairing a nerve-gap lesion.

A-0145 Comparison of arthroscopic resection arthroplasty versus ligament reconstruction and tendon interposition arthroplasty, for thumb basal joint osteoarthritis

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Purpose: According to the *Cochrane Review*, regarding 2009 surgery for thumb basal joint osteoarthritis, no procedure demonstrated any superiority over

another in terms of pain, physical function, patient global assessment nor range of motion (ROM). The review also showed that trapeziectomy with ligament reconstruction and tendon interposition arthroplasty (LRTI) was associated with 12% more adverse effects than simple trapeziectomy. So we started to perform arthroscopic trapezium resection arthroplasty (ARA) since 2010, as an alternative to LRTI from the viewpoint of being minimally invasive surgery. We compared it with the LRTI performed formerly.

Methods: We conducted a retrospective study that included 13 patients (five female and eight male; mean age 64 years (range 49 - 75 years)) in the ARA group, compared with 13 patients (eight female and five male; mean age 67 years (range 51 - 73 years)) in LRTI group: both groups were not significantly different. The grind test was positive in all patients before surgery. We categorized 11 patients as Stage 3 and two patients as Stage 4, according to the Eaton classification. The ARA procedure was performed to a depth of 3 - 4 mm, using a 2.9 mm abrader burr; and simultaneously, thermal shrinkage using radiofrequency device was added to the anterior capsular ligament through two dorsal trapeziometacarpal portals; and the temporary fixation between 1st and 2nd metacarpal bones was performed. The details of LRTI procedure were: total trapeziectomy, ligament reconstruction using the entire FCR tendon, interpositional arthroplasty by remnant FCR tendon and temporary fixation in the same manner as the ARA. Postoperative immobilization periods lasted 4 weeks in the ARA and 6 weeks in the LRTI. We collected postoperative subjective data by grind test; Quick Disabilities of the Arm, Shoulder and Hand questionnaire (Quick DASH); pinch strength; adverse effects; and the trapezial height on radiographs.

Results: After the procedure, none of the patients except one exhibited grind test positivity within 6 months, in the ARA group; but two patients exhibited it in the LRTI group, at 1 year. For the percentage of pinch strength of the contralateral side, the preoperative average of 76% improved to a postoperative average of 85% at 9 months and 92% at 1 year in the LRTI; and the preoperative average of 83% improved to a postoperative average of 95% at 6 months and 113% at 1 year, in the ARA group. For the Quick DASH score, both groups improved significantly at 1 year, namely, there was a postoperative average of 11.5 points in the LRTI and 9.5 points in the ARA. For the trapezial height, the preoperative average of 27% in both groups decreased to 16% at 1 year in the LRTI group; however, the 25% obtained at 3 months was preserved until 1 year in the ARA group. There were no adverse effects in the ARA group, but a volar branch of median nerve injury occurred in the LRTI group.

Conclusions: Our observations revealed that the patients having the ARA procedure experienced significantly better improvement in pain relief, pinch strength, less sinking of the first metacarpal bone and fewer adverse effects than those with LRTI. Considering that the outcomes were excellent, our ARA procedure is recommended for patients with thumb basal joint osteoarthritis.

A-0146 Evaluation of surgical treatment for neuropathic pain after peripheral nerve injury

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Objective: Chronic neuropathic pain after peripheral nerve injury is a major clinical problem. Its management is difficult and therapeutic approaches are often multiple, including oral medication, local or regional infiltrations, neurostimulation and surgery. The aim of this study is to assess the adequacy of surgical nerve revision in a large series of patients, with a long-term follow-up assessment.

Methods: We reviewed the charts of 231 patients whom had suffered from neuropathic pain after peripheral nerve injury and had been operated for nerve revision in our institution, between 1997 and 2012. The following parameters were recorded for each patient: history, location, duration and severity of the pain, and nerve revision surgery details. In addition, patients were invited to participate in a follow-up consultation and were asked to score their pain at that time. Current medication and examination findings were also documented.

Results: Elective surgery was the source of nerve injury for 55% of patients. The lower leg was the most commonly involved anatomical region (30%), before the lower abdomen (19%) and the upper extremity (15%). The mean time between the onset of injury and revision surgery was 48 months. Patients had an average of 1.3 injured nerves explored and were operated 1.2 times. Each nerve was revised 1.1 times, on average. Neuromas, incontinuity or scar-tethered nerves were observed 205 times (61%), while terminal neuromas were observed 130 times (39%). We performed 186 (56%) neurolyses and 149 (44%) neuroma resections and translocations. The mean follow-up of the 127 (55%) patients who accepted to come back for a consultation was 68 months. They indicated an average pain decrease of 4 points on the visual-analogue scale (VAS) score. A pain relief $>30\%$ or a 2-point decrease on the VAS score, which are the criteria for a successful treatment according to the

European Federation of Neurological Societies guidelines, was encountered in 71% and 80% of patients, respectively. It did not vary in a statistically significant way depending on the surgical technique, age and gender of the patient, affected nerve, nor the time between trauma and surgery. Before surgery, 76% of patients were taking paracetamol and/or non-steroidal anti-inflammatory drugs (NSAIDs) and 44% were taking opiates; while after the nerve revision, only 37% of them were still needing simple analgesia and 14%, opiates. Postoperatively, 48 patients (38%) still presented local allodynia, versus 118 patients (93%) having it before surgery.
Conclusions: Remembering that medication achieves satisfying pain relief in only 30 - 40% of patients with neuropathic pain, surgery has to be considered as an effective alternative therapy. No objective criteria could be proven as factors of poor prognosis. Systematic preoperative clinical mapping of the injured nerves and diagnostic nerve blocks could improve the primary success rate of this surgery.

A-0147 Treatment of hyperextension deformity of the metacarpophalangeal joint associated to carpometacarpal arthritis of the thumb

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Objective: Secondary hyperextension deformity of the metacarpophalangeal (MCP) joint is an important complication in advanced carpo-metacarpal arthritis of the thumb. If this deformity is not corrected during trapeziometacarpal (TM) arthroplasty, the first metacarpal returns to a longitudinal intercalated collapse deformity in the flexed and adducted position, causing increased stress at the basal joint arthroplasty. The purpose of our study was to compare different treatment options for this complication of basal joint arthritis, on the basis of preoperative and postoperative functional assessment, and possibly to determine the best treatment of choice.
Methods: From 2004 to 2013, we treated 44 thumbs in 39 patients with a mean age of 60.9 years (range 47 - 86 years) whom were affected by basal joint arthritis, with hyperextension deformity of the MCP joint. All candidates for basal joint arthroplasty had radiographic evidence of Stage 3 or 4 arthritis (as per Eaton-Littler classification). All were treated with Pellegrini-Burton or Ceruso arthroplasty. Associated hyperextension of the MCP joint was treated on the basis of the degree of deformity: if hyperextension was < 30°, no treatment or percutaneous pinning was performed (14 cases); if hyperextension was > 30°, extensor pollicis brevis (EPB) transfer, as described by Blank and Feldon (13 cases), or MCP volar capsulodesis (11 cases) was performed; and if the MCP joint was arthritic, an arthrodesis was performed (3 cases). In three patients with a severe, fixed zigzag deformity of the thumb (average hyperextension of MCP joint, 70°), we performed a TM arthrodesis.
At an average follow-up time of 25 months (range 12 - 68 months), a clinical subjective assessment with the Disabilities of the Arm, Shoulder and Hand (DASH) questionnaire was evaluated and global functional assessment was performed with the De La Caffinière scoring system. Objective assessments included pain, range of motion (ROM), grip strength and complications.
Results: The average DASH score was 9.4 and the De La Caffinière scoring system had 84.1% either excellent or good results. At the MCP hyperextension assessment, we had different results: after no treatment or percutaneous pinning, there was a slight progression of hyperextension deformity, on average 25 - 28°; after the EPB transfer, the average hyperextension went from 45.7° to 28.4°; after capsulodesis, the average hyperextension went from 49° to 12°; and after TM arthrodesis, the average hyperextension went from 70° to 15°. There were three complications (one each): reflex sympathetic dystrophy, superficial pin-track infection and transient superficial radial nerve dysesthesia.
Conclusions: On the basis of our results, no treatment or percutaneous pinning are not recommended for slight MCP hyperextension deformity; the EPB transfer corrected, but not sufficiently, the deformity and did not stabilize the first ray during active grip and pinch; yet the MCP volar capsulodesis resulted in the best treatment option. We also propose a treatment algorithm.

A-0148 External fixation versus volar locking plate fixation in the treatment of AO Type A3, C2 and C3 distal radial fractures

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Objective: Both external fixation with adjuvant pins and volar locking plate fixation have been recommended for the treatment of complex distal radial fractures, but the problem in trying to compare previous study results is that most used dorsal plates or volar non-locking plates. Our purpose was to determine the best treatment modality between the two surgical techniques, for AO Type A3, C2 and C3 distal radial fractures; on the

basis of our radiographic outcomes, functional outcomes and rates of complications.
Methods: We retrospectively reviewed 44 patients treated for complex distal radial fractures fractures (AO Type A3, C2 and C3 fractures): 21 patients were treated with external fixation (Group I) and were followed up for an average of 108 months (range 19 - 159 months); and 23 patients were treated with volar locking plate fixation (Group II) and followed up for an average of 20 months (range 13 - 37 months). Radiological assessment was performed, measuring at the last follow-up visit the radial angle, dorsal angle, radio-ulnar index and articular step. Clinical subjective assessment was performed with the Disabilities of the Arm, Shoulder and Hand (DASH) questionnaire. Objective assessment included both the Garland-Werley system and the Mayo Wrist Score. Mean outcome measures of pain (visual analogic scale (VAS)), range of motion (ROM by standard goniometer) and grip strength (using Jamar dynamometer) were expressed as a percentage of the uninjured side. We also documented complications.
Results: The mean radial angle was 22.8° in Group I and 22.4° in Group II; mean dorsal angle was 3.2° in Group I and 4.1° in Group II; mean ulnar variance was 0.9 mm in Group I and – 0.7 mm in Group II. An articular step exceeding 1 mm was present in five cases in Group I and one case in Group II. The mean DASH score was 15 in Group I and 11 in Group II. The Garland and Werley scoring system showed no significant differences between the two groups. The Mayo Wrist Score gave 67% excellent and good results in Group I and 82% in Group II. Mean VAS score was one in Group I and 0.6 in Group II. Mean flexion was 88.2% of the uninjured side in Group I and 91.2% in Group II. Mean extension was 89.6% of the uninjured side in Group I and 93.6% in Group II. Mean grip strength was 84.9% of the uninjured side in Group I and 94.6% in Group II. Further surgery was necessary in four cases: all were related to surgical errors. A nascent malunion in Group I required further fixation with a volar plate. Three patients in Group II had removal of hardware: two for an intra-articular screw and one for a symptomatic prominence of the plate.
Conclusions: Both surgical systems are effective methods for the treatment of complex distal radial fractures, but we believe our results support the use of the volar locking plate for the treatment of AO Type A3, C2 and C3 distal radial fractures.

A-0150 A new smart dynamic external fixator in the treatment of complex fractures of the proximal interphalangeal joint of the long fingers

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Objective: Treatment of articular fractures of the proximal interphalangeal (PIP) joint of the hand can be a hard challenge. Ideal treatment should include an anatomic reduction, stable fixation and the possibility of early finger mobilization, to prevent joint stiffness. We proposed treatment of these fractures with a new smart dynamic external fixator (SDEF), derived from the device described by Suzuki and based on the concept of the capsuloligamentotaxis described by Vidal.
Methods: From 2003 to 2012, we used a SDEF to treat 21 patients with a mean age of 44 years (range 19 - 61 years) whom were affected by articular fracture of the PIP joint. This device eliminates any assembling difficulty. The entire surgical procedure was performed percutaneously. The mean operative time was 11 minutes (4 - 21 minutes). Patients were encouraged to move the PIP and the distal interphalangeal (DIP) joints immediately after the procedure. The device was removed after a mean time of 54 days (42 - 64 days). We retrospectively assessed 15 cases, after a mean follow-up period of 15 months (11 - 21 months). Radiological assessment was performed to evaluate fracture reduction and bone healing. The clinical subjective assessment was performed with the Quick Disabilities of the Arm, Shoulder and Hand (quick-DASH) questionnaire. Pain was also evaluated with a visual analogical scale (VAS). Objective assessment included range of motion (ROM), grip strength and incidence of complications.
Results: At the radiological evaluation, good reduction was achieved in 13 cases; and in two cases, a residual articular step was present. Bone healing was achieved in all cases. The average quick-DASH score was 8.4 (0 - 18). The average VAS score was 1.5 (0 - 3). The mean ROM of the PIP joint was 80° (84% of the uninjured side). The mean ROM of the DIP joint was 56°. A mean DIP extensor lag of 10° (5° - 15°) was present. The average grip strength was 94% (78 - 115%) of the contralateral hand. No cases of septic arthritis and/or osteomyelitis were present. Superficial pin-track infection, treated with oral antibiotics and temporary rest, developed in three cases.
Conclusions: On the basis of our results, we believe that SDEF is a good, minimally-invasive surgical option for the treatment of articular fractures of the PIP joint. The procedure is very easy and fast to realize; and does not require particular skill by the surgeons.

A-0156 Pain management with continuous in situ diffusion of ropivacaine following mini-invasive locking plate fixation for distal radius fracture

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Objective: The aim of this comparative and prospective study is to evaluate the results of pain management with the association of two techniques for the treatment of radius distal fracture with volar locking plate: a mini-invasive pronator-sparing technique, which can avoid hematomas and then necessity to drain; and in situ, continuous diffusion of Ropivacaine.
Methods: In Group 1 (11 patients) there was no catheter, but a suction drain for three of them. In Group 2 (23 patients operated by another surgeon), an in situ catheter was placed in the surgical site, for continuous diffusion (flow 5 mL/h) of 270 mL of Ropivacaine 2%, with an elastomeric pump. The catheter was removed by a nurse at home, 48 hours after surgery. Pain was evaluated with the Visual Analogue Scale (VAS) at days 1, 2, 3, 7 and 30; with a comparative *t* student test ($p < 0.05$). We performed a radiological examination at Day 30. The type of hospitalization was noted.
Results: In Group 2, VAS at Day 1 and Day 2 was significantly lower than in Group 1 (4.8/3.5 vs. 6.6/5.6; $p < 0.05$). There were no differences in the results of VAS at Day 3, Day 7 and Day 30. No radiological signs of chondrotoxicity were observed at Day 30. There were six patients operated in one day surgery in Group 1 (55%) and 20 patients in one day of surgery, in Group 2 (87%).
Conclusion: The association of the mini-invasive technique with an in situ diffusion of ropivacaine is an effective procedure to control postoperative pain after treatment of distal radius fracture; and this could authorize 1-day surgery.

A-0158 Clinical comparison of hook plate fixation versus extension block pinning for bony mallet finger: a retrospective comparison study

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This retrospective study aimed to determine whether traumatic mallet fractures treated by hook plate fixation (22 patients) have improved functional outcome scores, range of motion (ROM), the complication rate and pain relief, as compared with extension block pinning (25 patients). Evaluation included Crawford's criteria; the distal interphalangeal joint ROM; the Disabilities of the Arm, Shoulder and Hand (DASH) score; and the visual analogue scale (VAS) score. Intraoperative and postoperative parameters, along with procedure-related complications, were considered. No significant differences were observed in the functional and clinical outcomes, nor in complications. Whereas operative time was longer in the hook plate group, the intraoperative fluoroscopy use, the time to union and time to return to work were greater in the extension block group. Although the hook plate method is more technically demanding, it provides good stable reduction and it affords less intraoperative X-ray exposure, earlier mobilisation and an earlier return to work. The extension block pinning technique is easy, safe and effective to apply, but it requires greater X-ray use.

A-0159 Percutaneous release of the first dorsal extensor compartment: a cadaveric study

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Purpose: To evaluate the efficiency of the percutaneous 18-gauge needle technique in releasing the fibro-osseous sheath over the first dorsal extensor compartment of the hand.
Methods: Using anatomical landmarks, we performed percutaneous release with an 18-gauge needle on 48 wrists of 24 cadavers. The specimens were then dissected and examined for the completeness of the 1st dorsal extensor compartment release, and any tendon or neurovascular injuries. We evaluated the tunnel length, number of abductor pollicis longus and extensor pollicis brevis tendons, presence of an intertendinous septum, and the effects of these parameters on percutaneous release.
Results: Percutaneous release was performed on all of the wrists, and the evaluation of the adequacy of release revealed 25 complete releases, 21 partial releases and two missed releases. There were 19 cases of tendon complications. No neurovascular injuries were noted. The mean tunnel length was 2.66 ± 30 cm and the mean number of tendons was 2.75 ± 0.86. A septum was present in 33.3% of cases. Tunnel length and tendon number had no statistically significant effect on release, while the presence of a septum was significantly associated with inadequate tunnel release and the development of tendon complications.

Conclusions: Percutaneous release of the first dorsal extensor compartment using an 18-gauge needle was associated with high rates of incomplete release; and tendon damage in the presence of an inter-tendinous septum. Further study is required under ultrasound guidance, to determine the usefulness of percutaneous release in the first dorsal extensor compartment.

A-0160 Diagnostic accuracy performance of MRI and clinical tests for wrist ligament injuries: a systematic review

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Objective: The optimal diagnostic strategy for wrist ligament injuries is not known. In 2001, Hobby et al. published a systematic review of the diagnostic performance of wrist magnetic resonance imaging (MRI) for tears of the triangular fibrocartilage complex (TFCC) and the intrinsic carpal ligaments, as well as osteonecrosis of the carpal bones. Concerning wrist ligament injuries, they report that high-resolution MRI is an accurate means of diagnosing TFCC tears, but although MRI is highly specific for tears of scapholunate ligament (SL) and luno-triquetral ligament (LT) injuries, its sensitivity is low. Arthroscopy was then judged to be the gold standard in diagnosing wrist ligament injuries. In 1995, LaStayo and Howell reported that wrist provocative tests are efficient for identifying patients whom need further investigation and of those patients needing arthroscopic diagnostic operation, the provocative tests proved to be more efficient at predicting the absence of injury than at predicting its presence. The purpose of this study was to perform an updated systematic review and meta-analysis of the current literature on diagnostic techniques in wrist ligament injuries (TFCC, SL and LT). MRI and clinical provocative tests were compared with arthroscopy.
Methods: A systematic literature search in *Medline*, *EMBASE* and the Cochrane Library was carried out in February 2014. English-language papers, with studies of skeletally mature participants, published between January 2000 to February 2014, were eligible for inclusion. Only studies that investigated MRI and clinical provocative tests were included. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist guided the extraction and reporting of data. The methodological quality of the included articles was carefully assessed. We considered wrist arthroscopy as the diagnostic gold standard. The primary outcome measure was the negative predictive value (NPV) of MRI and provocative tests. Secondary outcome measures were positive predictive value (PPV), sensitivity, specificity and diagnostic accuracy.
Results: A total of seven articles (327 patients with MRI, 105 patients with clinical tests) were included in this systematic review. The included papers display marked heterogeneity with significant differences in study design, participants, sample size and diagnostic methods. Six papers investigated the diagnostic properties of MRI, and only one paper investigated clinical testing. Six of the articles investigated TFCC, four papers investigated SL and three investigated LT. All studies had a level of evidence IV. The distribution and range in sensitivity was wide, concerning MRI (TFCC: 44 - 93%, SL: 11 - 89% and LT: 0 - 82%), specificity (TFCC: 54 - 100%, SL: 55 - 100% and LT: 76 - 100%) and PPV (TFCC: 71 - 100%, SL: 25 - 100% and LT: 0 - 100%). Only one study concerning MRI reported a NPV of > 90% (TFCC: 37 - 90%, SL: 72 - 94% and LT: 74 - 95%). In the study dealing with clinical tests, the NPV was 55% for TFCC, 74% for SL and 94% for LT.
Conclusions: A negative MRI cannot rule out the possibility of an injury of the TFCC, SL or LT. Clinical provocative wrist tests are of limited diagnostic value. In conclusion, the current gold standard, arthroscopy, is still the preferred diagnostic technique, with adequate conclusive properties when it comes to wrist ligament injuries.

A-0161 Correlation between decreased torque strength and arthroscopically diagnosed TFCC injuries

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Objective: Distal radio-ulnar joint (DRUJ) instability is common after distal radial fractures, but the importance of the instability is not well understood. Lindau et al. (2000) show that instability of the DRUJ is a worsening factor after distal radial fractures in young patients independently of radiography. More than 40% of dislocated distal radius fractures are in fact associated with injury of the triangular fibrocartilage complex (TFCC). Isolated injuries of the TFCC do also exist, for example, after a twisting injury. Several anatomic structures stabilize the DRUJ, of which the TFCC is the most important, especially its foveal insertion. To improve the possibility of objective evaluation of wrist

and forearm function, we developed and reliability tested two methods of measuring strength for torque and lifting. The hypothesis for this study was that patients with DRUJ instability and arthroscopically certified TFCC injury have reduced torque strength during pronation and supination.
Methods: We tested 20 patients waiting for operation with clinical signs of TFCC rupture (positive foveal sign) and distinct DRUJ instability preoperatively, with the specific measuring equipment for torque strength. Torque strength was added to the common preoperative evaluation. During the operation, we documented intra-articular injuries such as TFCC rupture and other pathology. The measurement of torque strength was performed by an independent observer, nurse or physiotherapist blinded to the patients' expected diagnosis. The photos taken at the operation were also individually scrutinized and assessed by an independent, blinded second hand-surgeon, for interpersonal reliability. Full agreement was reached in all 20 cases concerning the existence of a TFCC injury and its classification. There were eight men and 12 women, of mean age 31.5 years: 85% (17/20) had had a prior significant trauma, 40% had had a concomitant distal radial fracture, but only two patients had a minor remaining malunion. The right wrist was affected in six cases, the left side in 14 cases. We performed eight arthroscopic reinsertions of TFCC, five open reinsertions, one arthroscopy and radial corrective osteotomy, one arthroscopy and Adams ligament reconstruction, and five arthroscopies with shaving.
Results: Among these 20 patients with DRUJ instability and clinically suspected TFCC injury, we arthroscopically confirmed (among other injuries) TFCC injury Type 1 B, according to Palmers' classification, in 18 cases. The preoperative torque strength was on average 73.7% (range 37.0 – 98.8), compared to the non-injured contralateral side in pronation; and 69.4 % (32.8 – 89.5) in supination. Paired *t*-testing showed a statistically significant difference between the injured and non- injured side, with a decrease in torque strength of approximately 30% ($p < 0.0001$), or 2.4 kg in pronation and 3.8 kg in supination.
Conclusions: In conclusion, we found that DRUJ instability with arthroscopically certified TFCC injury was associated with a significant loss of preoperative torque force in pronation and supination.

A-0162 Percutaneous pinning arthroscopically assisted in acute scapholunate ligament lesions: medium-term results

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Objective: During the first few days after trauma, scapolunate (SL) ligament lesions have an intrinsic potential of healing, due to their bleeding. Thanks to this biological aspect, percutaneous pinning with Kirschner wires may be a viable option for surgical treatment. The purpose of our study was to evaluate clinical and radiological results in patients treated with this technique, in the acute phase after trauma.
Methods: From 2006 to 2010, we treated 12 patients with a mean age of 43 years (range 22 - 58 years) affected by acute SL ligament lesions (Geissler 2 or 3 lesions), within the first 10 days after trauma. Arthroscopy was necessary for a correct diagnosis. The surgical procedure included reduction of the SL dissociation and temporary percutaneous K-wire stabilization, preferably under arthroscopic assistance. K-wires were removed after 4 weeks, postoperatively. Eight of 12 cases were retrospectively assessed after a mean follow-up of 56 months (30 - 91 months). Clinical subjective assessment was performed with the Disabilities of the Arm, Shoulder and Hand (DASH) questionnaire. Objective assessment was performed with the Mayo Wrist Score. Mean outcomes measures of pain (visual analogical scale (VAS)), range of motion (ROM) and grip strength were evaluated. Complications were also evaluated. We performed radiological assessments, measuring at the last follow-up visit the SL angle, radiolunate angle and presence of osteoarthritis.
Results: The mean DASH score was 4. With the Mayo Wrist Score, excellent and good results were obtained in 87.5% of cases. Mean VAS score was 1. Loss of movement, compared to the uninjured side, was insignificant: mean flexion was 74° (98% of the uninjured side), mean extension was 60° (100% of the uninjured side), mean radial inclination was 20° (90% of uninjured side), mean ulnar inclination was 46° (102% of uninjured side), mean pronation was 76° and mean supination was 87° (both 98% of the uninjured side). Mean grip strength was 98% of the uninjured side. There were no perioperative complications. At the radiological evaluation, the mean SL angle was 61° (33° - 97°), the mean radio-lunate angle was 11° (0°- 20°). There were signs of arthritis in only two cases: one scapholunate advanced collapse (SLAC) grade I and one SLAC grade III. We found no correlation between the DASH score and radiographic parameters analysed.
Conclusions: The possibility to perform a carpal pinning is linked to the need to arrive at an accurate diagnosis in the first week. Closed reduction and percutaneous pinning of the SL dissociation showed there were good clinical and radiographic results; however,

maintenance of the reduction and functional quality will require assessment, even with long-term studies.

A-0163 What is the 'normal' strength of pronation and supination? The correlation between dominant and non-dominant right-handed healthy adults: preliminary results

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Objective: To evaluate the link between the strength of pronation and supination of the dominant forearm, and those of the non-dominant one.
Materials and methods: We tested 97 volunteers, in pronation and supination, with an analogue dynamometer. Gender, age, dominance, height and weight were recorded. The measurement position was: 90° of elbow flexion, 0° of shoulder abduction, wrist slightly extended and neutral pronation and supination. We took four measurements per patient: the strength in pronation and supination, in both the dominant and non-dominant sides. We evaluated 15 subjects, twice. The left-handed (four) patients were removed from the statistical analysis. There were 38 men (37 years, 18 - 66) and 55 women (45 years, 21 - 71).
Results: Torques were higher ($p < 0.05$) in men than in women, higher in supination than in pronation and in the dominant side, compared to the non-dominant one (average ratio of non-dominant to dominant: 0.85; s = 0.16). There was a strong correlation between the non-dominant hand strength and the dominant hand strength (Pearson > 0.6). For the 15 subjects evaluated twice, the value of the forces varied during the day, but the ratio of non-dominant/dominant was constant. Left-handed people were excluded, as their values may be different from those of right-handers, as has been shown for grip strength.
Conclusions: There was strength variation during the day, but the ratio of non-dominant/dominant was constant, making a more relevant intra-individual comparison (non-dominant side versus dominant side), rather than an inter-individual comparison (based on charts of gender, age, weight and height). In right-handed people, the ratio of strength for non-dominant side/dominant is constant; defining easily, in consultation, the expected value of recovery of an injured forearm. The non-dominant hand has 80% of the strength in pronation or in supination, than the dominant hand has, in right-handers.

A-0165 Chondrosarcomas of the bones of the hand

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Objectives: Chondrosarcomas represent about 10% of all malignant tumours. They are very strange in the hand (0.5 - 3.2% of all chondrosarcomas). These tumours can be described as primary tumours or can appear as a result of a malignant transformation of other benign tumours, as solitary chondroma or in the context of enchondromatosis. Although this tumour requires aggressive surgical treatment to avoid the risk of recurrences and/or metastasis, several studies demonstrate that low-grade condrosarchomas in other locations can be treated more conservatively. The aim of our study was to describe the epidemiological data, treatment and oncologic outcome of our series of chondrosarcomas of the bones of the hand.
Methods: We retrospectively revised our database of chondrosarcomas of the bones of the hand, between April 1985 and April 2013. We analysed epidemiological data, characteristics of the tumour, surgical treatment and outcome.
Results: We followed four patients, two women and two men, with a mean age of 66 years (46 - 85) for 40 months (6 - 120). The main symptom was an increase of volume of years of evolution in three cases; and a pathological fracture in one case. The most common affected bone was the metacarpal, followed by the proximal phalanx. One patient, affected by Ollier syndrome, had the affectation in two metacarpals. Three patients were treated with curettage (two of them required bone grafting), and one underwent a metacarpal thumb amputation. Nobody received adjuvant therapy. The histopathology was positive for chondrosarcoma Grade I/III in three cases and grade II/III in one case. Two cases presented recurrence. The first one, the patient who underwent a thumb amputation, was reoperated (a middle forearm amputation). The other one had high comorbidity and decided not to operate.
Conclusions: Chondrosarcomas affecting hand bones are extremely rare and it is crucial that the differential diagnosis not confuse benign lesions with a chondroma. Prompt diagnosis and an aggressive surgical treatment are required, in order to avoid local recurrences; however, in low-grade chondrosarcomas a less aggressive treatment, like curettage with or without bone grafting, can be an option.

A-0168 Results of unusual indication in upper limb replantation

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Introduction: Over the years, upper limb replantation of small and large segments has experienced a progressive widening of indications, because of the improvements in reconstructive techniques both in emergency and in secondary surgery. While there are clear indications for replantation or amputation (general and local conditions of the patient and of the amputated segment, timing, etc.), there is on the other hand, a 'grey area' in which indications tend to depend on the 'skill', 'experience' and inventiveness of the surgeon. This is true both in emergency and for secondary reconstructive strategies.
Materials and methods: Over the past 10 years, we have put together 17 cases of borderline indications that probably in the past, would not have been considered for replantation: double level replantations, avulsion injuries, patients over 75 years of age, deglovements, and longer than suggested revascularization time. The minimum follow-up was 1 year, and each case had been analysed using Chen's criteria of assessment of residual function. All secondary procedures were pointed out. Failures were also reported.
Results: In all the cases presented, the replanted segment survived. There were no major complications in the segment that survived. Re-operation was necessary only in 20% of cases (tendon transfer and tenolysis). All patients said they were satisfied with the treatment.
Conclusions: The case series that will be presented could give the audience suggestions on how to deal with special cases and could stimulate the use of imagination in this kind of surgery, in extreme conditions. The goal of reconstruction should be restoration of function that is better than a prosthetic replacement. It is clear that this type of surgery can only be performed as long as the patient's life is not in danger.

A-0169 Nerve repair by fresh muscle-vein combined nerve guides: clinical results and actual indications

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Introduction: Although autogenous nerve grafting is still considered the best method for bridging nerve defects, several alternative types of conduits (biological and synthetic) have been studied. We demonstrated, in previous experimental research, that a graft made using a vein (providing a guide for nerve regeneration) filled with fresh skeletal muscle (to prevent vein collapse and support axon regeneration) gave similar results to traditional nerve grafts, in the rat. On this basis, we decided to use the muscle-vein combined grafts in clinical cases, not only for sensory nerves, but also for mixed nerves. Despite continuous research and surgical innovations, treatment of peripheral nerve injuries remains a complex problem, particularly in non-sharp lesions, where this kind of reconstruction is a good option for treatment. We report our case series and results.
Material and methods: Mixed nerves: we reviewed 23 patients operated on from 1993 to 2008 with this technique. The mean follow-up period was 26 months (14 - 58 months). The mean length of conduits was 2.5 cm (0.5 - 6 cm). Case series: Four radial nerves at the elbow level, nine median nerves at the distal one-third of the forearm, six ulnar nerves at the forearm, one ulnar nerve at the wrist, one ulnar nerve at the arm, and two proximal cords of the brachial plexus. Sensory nerves: we operated on 13 patients for sensory nerve reconstruction, at the hand and wrist level. These patients were operated on in emergency, for crush injuries of either sensory or mixed nerves. We evaluated our results by the criteria of the Nerve Injuries Committee of the BMRC, modified by Mackinnon-Dellon. We classified the results into three groups, with the grading system proposed by Sakellarides: Very Good: M4 / S3+; Good: M3 / S3-S2+; Poor: < M2 / < S2+.
Results: Mixed nerves: In 12 (52%) of the cases we had good and very good results. In six cases (26%), good sensory restoration was not accompanied by good motor recovery. In two cases (8.5%), we had a good motor recovery and a fair sensory recovery. In the last three cases (13%), in a gap longer than 3 cm, we had fair results, both for sensory and motor recovery. Sensory nerves: In the muscle-vein-combined group, 10 patients (76.9%) showed very good results, while only three patients (23.1%) showed good results.
Conclusions: The clinical employment of tubes as an alternative to autogenous nerve grafts is mainly justified by the limited availability of donor tissue for nerve autograft and its related morbidity. The indication, in this little series of patients operated over 10 years, had been very restricted: only if treatment is an emergency, there was not enough nerve graft, or no will of the patient to have harvesting of a healthy nerve. Our

retrospective study demonstrated that favourable results can be achieved, either for primary repair of crush-injured nerves when a short gap is present, or in secondary procedures mainly for sensory nerves. An attempted reconstruction in an emergency, with a muscle-vein combined graft or alternative conduits is justified, considering the possible advantages offered.

A-0170 Recurrent neuropathy treated by means of neurolysis surgery, associated with a gel-formulated co-polymer, based on carboxy-methyl-cellulose and poly-ethylene-oxide (Dynavisc ®): clinical outcome and experimental study

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Objective: Scar tissue formation around a nerve is the second most frequent reason of recurrence after nerve decompression, in compressive neuropathies. This event is responsible for pain and loss of function on the affected arm; and may generate, if not treated, irreversible injuries. The surgeon needs to perform neurolysis and to restore a correct gliding surface between the treated nerve and surrounding tissues. In this study, we tested (on a sciatic nerve mouse model), a gel composed by carboxy-methyl-cellulose (CMC) and polyethylene oxide (PEO), in order to describe its safety and efficacy. In the meantime, we assessed the outcome of eight human patients operated on with neurolysis, followed by an application of CMC and PEO, to address any recalcitrant neurological pain.
Methods: We had 26 adult mice undergo a surgical procedure in which we burned the muscular bed of the sciatic nerve bilaterally, and then in one of the nerves, we applied anti-adhesion gel. After three weeks, we measured the maximum force required to detach the nerve from the muscle by means of a suitable instrument, and by histological evaluation of scar tissue, with specific staining for collagen fibers. In the clinical study, we assessed eight patients operated on for recalcitrant pain, after previous surgical procedures were done on nerves (Pre-operative visual analogue scale (VAS), 6 - 8). The painful component of the syndrome was assessed by means of the VAS scale pre-operatively and post-operatively at 1 day, 1 month and 6 months.
Results: According to the results obtained by histological and bio-mechanical analyses, the CMC-PEO gel demonstrated its ability to reduce perineural scarring. The group of burnt muscle beds showed an adhesion force of 46 g, the CMC-PEO gel group of 37 g, and the control group, of 31 g. There was a statistically significant difference between the gel group and the burnt group. Even histological analysis showed reduction of the scar tissue after application of the gel. In the clinical cases, we did not observe adverse effects, due to surgery after the application of CMC and PEO. In seven out of eight cases, satisfactory results were achieved with reduction (difference > 4 VAS) of pain, in both the short and long term.
Conclusions: Our preclinical animal model study showed that the CMC-PEO gel can reduce perineural scar formation. In the clinical study, we assessed eight patients operated on for recalcitrant pain after having had previous surgical procedures on the nerves (seven female participants and one male; average age 47.5; pre-operative VAS = 6 - 8). In all eight patients, a neurolysis combined with the application of CMC and PO gel was performed.

A-0175 Bi-lobed perforator flap in finger reconstruction

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Introduction: The digital artery perforator flap (DAP) described by Koshima in 2006 is a very useful method in covering small skin defects over the distal phalanx. The drawback of these flaps is the necessity to sometimes close the donor site by free split-thickness grafts (FSTG), made us determined to try to find a method that could avoid this impediment. So we developed the bi-lobed perforator (BLP) flap, which respects the same principles and has the same blood supply as the DAP flap, but consists of two flaps, with the same pedicle. The BLP flap finds its indication in small and medium defects over both the palmar and dorsal aspect of the fingers.
Material and methods: Through dissection of six cadaveric hands, we identified the blood vessels' architecture, and after latex injections and transparentation, we identified the main perforator vessels emerging from the common and proper digital arteries. We found many perforators from the digital arteries perforating the thin fascia and subcutaneous tissue, and terminating in the subdermal layer, laterally and dorsally. These perforators are represented by one artery and one or two veins, and they are accompanied by very thin, sensitive nerves.
Based on our experience in performing the DAP flap and on our experimental findings, we developed the bi-lobed perforator flap. The flap consists of two

oval-shaped flaps with a common pedicle, and blood supplied by one perforator originating in the common or proper digital artery. The flap is harvested on the lateral or dorsal aspect of a finger. The angles between the two lobes of the flap could be 45 - 180°. First, one of the edges of the defect to be covered is prolonged, to be able to identify through a minute dissection, a perforator vessel. Once identified, the final design of the flap is done with its pedicle centred by the perforator. The first lobe of the flap has one edge in common with the defect and is generally oriented transversely. Both its length and width are 3 - 4 mm more than those of the defect to be covered. The second lobe is oriented according to skin pliability. Both its length and width are 1 – 2 mm less than the first lobe. The first lobe is transposed to the original defect, and the second one, to the remaining defect. The donor site of the second flap is closed by direct suture.
Results: In all 35 BLP flaps performed, we registered very good flap integration. The mobilization of the reconstructed finger/s was possible after 24 - 48 hours. We registered a transitory venous congestion of the first lobe in two cases, and of the second lobe in seven cases, but without affecting the final outcome. The return of the patients to work was possible after 14 - 21 days.
Conclusions: The use of the BLP flaps in finger reconstruction represents a good option for covering small and medium defects. They are harvested from the same operative field, with no donor site morbidity, and can be sensate and allow for early mobilization.

A-0176 Measurement properties of the brief Michigan Hand Outcomes Questionnaire in patients with Dupuytren's disease

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Background: The well-known Michigan Hand Outcomes Questionnaire (MHQ) shows good measurement properties for patients with different hand disorders; however, there exists an item redundancy in certain subscales, in the original version. Therefore, and in order to reduce responder burden, the brief MHQ (briefMHQ) was developed as a short version of the MHQ. The objective of this study was to investigate the measurement properties of the briefMHQ, in patients with Dupuytren's disease.
Methods: In this prospective cohort study, we included 57 patients diagnosed with Dupuytren's disease who received either a collagenase injection or a partial aponeurectomy. At baseline and at 6 weeks after the intervention, we measured grip strength and the extension lag of the affected finger. Patients filled out the briefMHQ, the MHQ, and the short version of the Disabilities of the Arm, Shoulder and Hand Questionnaire (QuickDASH). They also completed the briefMHQ, 2 - 14 days after the baseline. We calculated, for all patients, test-rest reliability (intraclass correlation coefficient (ICC)), internal consistency (Cronbach's alpha), and criterion and construct validity (Spearman's correlation coefficient (r)). As patients after surgery were still in the wound healing phase at the follow-up session, we calculated responsiveness by effect sizes (ES) and the minimal important change (MIC), only for patients after receipt of the collagenase injection (n = 44).
Results: For the briefMHQ, we found an ICC = 0.87 and Cronbach's alpha = 0.88. The briefMHQ was highly correlated with the full MHQ, with r = 0.88 (criterion validity). For construct validity, the correlation between the briefMHQ and the QuickDASH was r = - 0.82, with the extension lag r = -0.03, and with a grip strength of r = 0.37. Regarding responsiveness, we found an ES of 0.6 for the briefMHQ and a MIC of 14 points.
Conclusion: Based on our results, we can conclude that the briefMHQ showed excellent reliability and criterion validity, good construct validity and good responsiveness in patients with Dupuytren's disease. Therefore, we recommend this tool be used as an outcome measure, in this population.

A-0178 A novel preoperative planning technique for complicated toe-to-hand reconstruction

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Background: Microsurgical toe-to-hand transplantation is a reasonable salvage procedure after failed replantation, though no consensus exists on the proper donor toe length for restoration of hand function and the optimal donor flap needed for recipient site healing. The purpose of this study was to introduce a novel technique for preoperative planning in

complicated toe-to-hand reconstruction and to assess feasibility in four cases.
Methods: Computed tomography (CT) angiography was used to map the donor site vasculature, while CT data were used to create three-dimensional (3D) soft-tissue and skeletal models for the injured and uninjured hands. Based on the reformatted model (a mirror of the uninjured hand), soft-tissue and finger skeleton models were generated, using a 3D printer. An adhesive plaster model was placed on the donor side, to determine the osteotomy level and the incision markings. The skeletal model was used to determine the length of the donor foot resection. Four complex amputation cases are included, to illustrate clinical feasibility and the early functional and cosmetic outcomes.
Results: In all four cases, the thumb and fingers were reconstructed successfully; and all flaps survived. No arterial nor venous thromboses or major donor morbidity were observed. Functional and cosmetic outcomes were satisfactory, with similarly satisfactory static 2-point discrimination, key pinch and grip strength, and scores of the Michigan Hand Outcomes Questionnaire (MHQ).
Conclusions: This novel microsurgical toe-to-hand reconstruction methodology, as introduced in this study, showed promising functional and cosmetic outcomes. Application of this technique in complex hand injuries has the potential to increase surgical efficiency, minimize procedural morbidity and improve reproducibility.

A-0180 Brunelli pull-out technique in flexor tendon repair in Zones II and III: a study of 65 cases

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Background and aims: Reconstructing the continuity of the long fingers' flexor tendons in Zones II and III still raises problems from the operative point of view. One of the surgical methods with a great success rate for Zone II lesions is the pull-over technique, described by Brunelli. In this paper, we present the modifications proposed by us for this technique, as well as the indication's expansion for lesions in Zone III.
Material and methods: The study refers to 85 cases involving flexor tendon lesions in Zone II and III, operated in our service, since the year 2000 until now. From these, 77 were Zone II lesions and eight were Zone III lesions. Lacking the very long and highly curved needles used by Brunelli, we modified the initial technique by starting from the proximal towards the distal area, and used two straight needles with continuous threads. In addition and especially for the Zone III lesions, we incised the digital skin until reaching near the insertion area of the flexor digitorum profundus; and then the suture thread was passed through the tendon in one or more steps, to reach the distal end of the tendon. In 62 cases, we used non-absorbable sutures that were removed after 21 days, and in 23 cases, absorbable sutures that were only cut after 21 days. In 57 cases, the surgical procedure took place under regional anesthesia that allowed the reinforcement of the patient's psychological motivation, by seeing the favourable results during surgery. The recovery started from the first post-operative day, with passive finger mobilization; and 48 hours after the surgery, we initiated the active against-resistance mobilization.
Results: The patients were followed for 3 - 24 months after surgery. We obtained complete flexion in 43 patients; 16 patients had a flexion deficit of 5 - 10°; another 19 patients had a 10 - 20° flexion deficit; and in seven cases, they had a 20 - 30° flexion deficit (all had Zone III lesions). All of the patients were able to resume their social life and work in the same place, after a maximum of 45 days. We had one rupture, and tenolysis was necessary in only five cases (patients with complex traumas).
Conclusions: We consider that the Brunelli technique is a very good method for addressing Zone II lesions and that the modifications proposed by us allow a broadening of its indications in the field.

A-0183 A Prospective randomized trial comparing nonoperative treatment with volar locking plate fixation for displaced and unstable distal radial fractures, in patients 65 years of age and older

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Background: Despite the recent trend toward internal fixation of distal radial fractures in older patients, the currently available literature lacks adequate randomized trials examining whether open reduction and internal fixation (ORIF) with a volar locking plate is superior to nonoperative treatment, such as by a cast. The purpose of the present randomized clinical trial was to compare the outcomes of two methods that are used for the treatment of displaced and unstable distal radial fractures in patients 65 years of age, or older: the first is ORIF, with use of a volar locking

plate, and the second is closed reduction and plaster immobilization (casting).

Methods: We performed a prospective randomized study, with 73 patients with a displaced and unstable distal radial fracture, whom were randomized to ORIF with a volar locking plate (n = 36), or closed reduction and cast immobilization (n = 37). The outcomes were measured on the basis of the Patient-Rated Wrist Evaluation (PRWE) score; the Disabilities of the Arm, Shoulder and Hand (DASH) score; the pain level; the range of motion (ROM) of the wrist; the rate of complications; and radiographic measurements that included dorsal radial tilt, radial inclination and ulnar variance.

Results: There were no significant differences between the groups, in terms of the ROM or the level of pain during the entire follow-up period ($p > 0.05$). Patients in the operative treatment group had lower DASH and PRWE scores, indicating better wrist function, by the early postoperative time period ($p < 0.05$); but there were no significant differences between the groups, at 6 and 12 months. Grip strength was significantly better at all times in the operative treatment group ($p \leqslant 0.05$). Dorsal radial tilt, radial inclination, and radial shortening were significantly better in the operative treatment group than in the nonoperative treatment group, at the time of the latest follow-up ($p < 0.05$). The number of complications was significantly higher in the operative treatment group (13 compared with five, $p < 0.05$).

Conclusions: At the 12-month follow-up examination, the ROM, the level of pain, the PRWE and the DASH scores were not different between the operative and the nonoperative treatment groups. Patients in the operative treatment group had better grip strength through the entire time period. Achieving anatomical reconstruction did not convey any improvement, in terms of the ROM or the ability to perform daily living activities in our cohorts.

A-0184 Palmar subluxation after volar plating for distal radius fractures: importance of support of the ulnovolar fragment of the distal radius

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Introduction: In the treatment of distal radius fractures, palmar subluxation of the lunate and distal fragment after volar plate fixation is one of the most severe complications. Harness reports seven failure cases of AO Type B3-3 without support of the volar lunate facet fragment, and it was referred to as volar shearing fracture. The ulnovolar side of the distal radius is important for stability, because it is not only the maximum loading point of the wrist, but also the attachment point of the ligament and the joint capsule. We investigated 14 cases whom had dislocated after volar plating, due to insufficiency of supporting ulnovolar fragments, investigating the treatment methods and their results, and also examining the future surgical treatment.

Materials and methods: These 14 cases of dislocation after volar plating were the subjects of this study. Their mean age was 46 years old, and the male: female ratio was 8:6 cases. The fracture type at the time of injury was: three cases of dorsal displacement (Colles) type; 11 cases of volar displacement (Smith) type; seven cases of B3 and 7 cases of C3, by the AO classification.

Results: All initial surgeries were performed by volar plate fixation (non-locking plate: two cases; monoaxial locking plate: six cases; polyaxial locking plate: six cases; and additional K-wire: one case). Re-fixation with volar plating after palmar subluxiation was performed in four cases. For one case, although the operation of re-fixation (with addition of external fixation) was repeated three times in total, subluxation occurred. As the cause of palmar subluxation is insufficiency of buttress support of the ulnovolar fragment, improper screw insertion to fix the fracture fragments and insufficiency of preventing dislocation should be considered. Outcomes of all the cases were poor, except for six cases that were successfully re-operated (open reduction) or slightly displaced.

Conclusions: Harness reports seven cases of insufficiency of support in the ulnovolar fragment after volar plate fixation (they were all Smith (volar Barton) type). However, our 14 cases of subluxation were not only Smith type, but Colles type. In three of our cases that were Colles type, palmar subluxation occurred. For prevention of subluxation, it is important to reduce and support the ulnovolar fragment perfectly. In addition, temporary fixation of the radiolunate joint by K-wire could be done, if necessary.

A-0185 SPECT/CT: diagnostic accuracy and importance in hand and wrist pain

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Background: Hand and wrist pain is a diagnostic challenge for hand surgeons and radiologists. Magnetic resonance imaging (MRI) arthrography is still considered the study of choice, in chronic or unspecific wrist pain patients with negative radiographs. SPECT computed tomography (SPECT/CT) is a diagnostic alternative, and it combines the presentation of metabolic disorders and adequate anatomical resolution. We have published different series evaluating the diagnostic accuracy of SPECT/CT and now would like to present our experiences.
Materials and methods:

- First study: These 21 patients with nonspecific hand and wrist pain got SPECT/CT and MRI.
- Second study: These 51 patients with unspecific pain of the hand and wrist got X-ray, planar bone scan and SPECT/CT.
- Third study: These were 27 patients (28 wrists) with suspected ulnocarpal impaction, who were evaluated with SPECT/CT arthrography and MRI (arthrography).
- Fourth study: The 32 patients with nonspecific pain of the hand or wrist were imaged by plain X-rays, bone scan, SPECT/CT and MRI. Diagnostic accuracy and interobserver agreement were determined for readers and imaging modalities.

Results

- First study: SPECT/CT was shown to be more specific in evaluating causative pathologies, while MRI was more sensitive.
- Second study: SPECT/CT showed higher lesion detection rates, compared to standard X-rays and planar bone scans. A significant impact on patient management could be demonstrated.
- Third study: SPECT/CT arthrography was feasible. Regarding diagnosis of ulnar impaction, a high concordance with MRI arthrography was found.
- Fourth study: SPECT/CT proved to be the most helpful imaging modality in patients with non-specific wrist pain. MRI worked better only for typification of lesions.

Discussion: Especially in non-specific wrist pain, SPECT/CT is a very helpful diagnostic tool. MRI is often outperformed by the combination of imaging metabolic disorders and a very good anatomical resolution. According to MRI, diagnostic value can be augmented by intra-articular construct imaging (SPECT/CT arthrography). Even in patients with normal X-rays and normal MRI arthrography, SPECT/CT can be problem-solving, and can influence consecutive therapy significantly. Furthermore, SPECT/CT is an alternative, if MRI is not possible, or is contraindicated.
Conclusion: We suggest integration of SPECT/CT into diagnostic imaging algorithms of unspecific or chronic wrist pain.

A-0186 Computer aided custom-made ulnar head prosthesis

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Objective: Rheumatoid arthritis and osteoarthritis involving the ulnar head are considered to be the common cause of distal radioulnar joint (DRUJ) disorders. Because of the low incidence of those disorders and the unavailability of the commercial ulnar head prosthesis in our country, we invented a custom-made ulnar head prosthesis to solve this problem. The objective of this study was to present the development of this prosthesis and to evaluate the preliminary outcomes in patients with ulnar head arthritis.
Methods: Patients with pain or instability of the distal radioulnar joint from ulnar head arthritis were enrolled in the study. The three-dimensional (3-D) model of the affected wrist was created from the computed tomography (CT) scan of both wrists, using a reverse engineering technique. The ulnar head prosthesis model was designed from the morphometric study of the 3-D wrist model, using computer-aided design (CAD) software. The trial prosthesis and wrist model was made with photopolymer-resin, by the additive manufacturing technique, and was used for a pilot surgery to assure the prosthetic fit. The ulnar head prosthesis was then produced by a computer numerical machine, using cobalt-chromium, and the dimensions inspected by video measuring machine. We evaluated the outcomes of the treatment in patients whom presented with ulnar head arthritis by using custom-made ulnar head prosthesis. The pre- and post-operative visual analogue score for pain, Mayo wrist score, the Disabilities of the Arm,

Shoulder and Hand (DASH) score, and postoperative satisfaction score were analysed. The radiographic outcomes and complications were also reviewed.
Results: Three patients with ulnar head arthritis were treated with a custom-made ulnar head prosthesis. There were two men and one woman, with an average age of 59 years (range 49 - 69). The two men had post-traumatic arthritis and the one woman had rheumatoid arthritis. Two out of three affected hands were the dominant hand. The follow-up period was 26 months on average (range, 17 - 38). All three patients demonstrated improved wrist pain and function. VAS for pain was improved from a value of 8 to 1, in two patients, and from a value of 8 to 2, in another patient. The Mayo wrist score improved from 45%, 50% and 55% (which is fair), preoperatively, to scores at 95%, 85% and 80% (good to excellent) at follow-up, respectively. The DASH score improved from 60.8, 57 and 53.3, preoperatively; to 11.7, 13.3, and 13.3 at patient follow-up, respectively. The satisfaction scores for this surgery were 5, 4 and 5 (out of 5) in these patients. There were radiographic signs of prosthetic loosening in one patient, without clinical symptoms.
Conclusions: In the situation of cases with low incidence of ulnar head arthritis, and the lack of a prosthesis supply, a custom-made ulnar head prosthesis could be produced. This personalized prosthesis provided a good preliminary outcome in patients. This technology could also be applied in the production of various types of orthopaedic implants and prostheses.

A-0188 Experimental microsurgical application of a decellularized human small-calibre vessel

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Objective: To assess the potential clinical application for microsurgical purpose of a small-calibre vessel replacement or flap pedicle length augmentation, by studying decellularised human vessels in an animal model. At the same time, we have provided an innovative decellularisation method.
Methods: Samples of small-calibre human vessels (artery and vein with a diameter < 2 mm) were collected from anatomical parts not suitable for reconstruction or reimplantation. The vessels were then microsurgically prepared by adventitia tunica removal and submitted to an innovative decellularisation protocol. The quality of this procedure was assessed by histology, immunohistochemistry and DAPI for the presence of cell nuclei. Afterwards, four New Zealand male white rabbits were submitted to microsurgical replacement of a 3-cm tract of vein (n = 2 animals) or femoral artery (n = 2 animals) by the decellularised human vessel, using the graft technique, with double anastomoses with Prolene 10-0 sutures. They were sacrificed after 4 weeks and anastomosis patency was checked in the collected samples for histological and immunochemistry proof.
Results: All the animals survived the procedure until the sacrifice and there were no rejection phenomena nor complications. At the time of sacrifice, the vessels were patent, both to clinical examination before sacrifice and by control of the specimen by vein and artery histology and immunochemistry, which demonstrated patency, recellularisation by the host circulating and transendothelial cells, with reconstitution of functional endothelium. No inflammation nor host rejections were observed, and they had a similar structure to a native vessel.
Conclusions: Human small-calibre vessels submitted to a special decellularisation protocol could be integrated in a recipient host with preservation of structure, absence of inflammation and rejection, and with new endothelialsation of most of the usual 2 cm. Use of a decellularised artery graft could avoid the employment of a vein graft, offering at the same time the load response of a native artery vessel, according to the reconstructive principle of 'like with like'. At the same time, a large number of clinical applications in microsurgery, both elective and urgent, could be discovered for such bioengineered structures.

A-0189 Influence of forearm pronosupination on scapholunate stability

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Objective: The dynamic effects of the different wrist motor tendons in the stabilization of the scapholunate (SL) joint was recently demonstrated for the forearm in neutral axial rotation, but not in other forearm axial rotations. Whether or not those effects are maintained when the forearm is in pronation or supination remains unknown. Answering this question may have important implications in the postoperative treatment of SL ligament repairs or reconstructions.

Methods: Eight fresh-frozen arms with no pre-existing SL ligament injury were dissected and set in a specially designed jig that allowed for testing the effect of isometric loading of the carpus on specific carpal bones' alignment in different forearm axial rotations. Six wrist motor tendons (the APL, ECRL, ECRB, ECU, FCU and FCR) were transected at the mid-forearm level and loaded simultaneously, by hanging weights to their proximal end. The weights were proportional to each muscle's physiologic cross-sectional area. A motion-tracking device was used to monitor the effects of loading on the spatial position of three sensors that were attached to the scaphoid, triquetrum and capitate bones. The experiment was performed with all ligaments intact, and the forearm in neutral rotation, in 45º of supination and in 45º of pronation. We analysed the data by repeated-measures analysis of variance (ANOVA), followed by paired *t* statistics, comparing the unloaded versus the loaded conditions. Significance was set at $p < 0.05$.
Results: Significant positional changes of all sensors were detected as a result of simultaneously loading all six wrist motor tendons. Those changes were not significantly different if the forearm was tested in the neutral position or in 45º of pronation. By contrast, with the forearm in 45º of supination, there were larger amounts of pronation documented for both capitate ($p = 0.004$) and scaphoid ($p = 0.02$).
Conclusions: Forearm axial rotation may influence the way in which wrist muscles stabilize the carpus. Forearm supination, for instance, increases the intracarpal pronation capability of the ECU tendon, this represents an increased risk for any SL ligament repair to re-rupture, if the muscle contracts when the forearm is in supination. Patients with a SL ligament insufficiency or repair should avoid training their forearm muscles with the forearm in supination.

A-0190 Free vascularized medial femur condyle bone graft for recalcitrant Scaphoid nonunions with avascular proximal pole necrosis

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Background: In scaphoid fractures with a long-standing nonunion, and in those where previous surgery has failed, the results of conventional bone grafting are generally poor. Recently vascularised bone grafts have been recommended for persisting scaphoid nonunions, after failed earlier surgery, and for nonunions with evidence of avascular necrosis (AVN). We evaluated the use of a free vascularized medial femur condyle (MFC) bone graft and internal fixation with K-wire, to treat patients with recalcitrant scaphoid nonunions with evidence of AVN.
Methods: We treated 24 patients (19 men and five women) with an avascular nonunion of the scaphoid, in whom conventional bone grafting had previously failed, with MFC bone grafting. The mean age of the patients was 36 years (25 - 49); and in 18 of them, the dominant wrist was affected. The mean interval from fracture to the vascularized bone grafting was 41 months (11 - 62). Pre-operative magnetic resonance imaging (MRI) showed no contrast enhancement in the proximal fragment, in any patient. Fracture union was assessed radiologically or with computed tomography (CT) scans, if the radiological appearance was inconclusive.
Results: At a mean follow-up time of 2.6 years (1 - 4), union was obtained in 21 patients. In the 21 patients who achieved union, wrist extension, radial deviation of the wrist and grip strength increased after surgery; but they were accompanied by a reduction in active flexion and ulnar deviation. Only the difference in the pre- and post-operative grip strengths were statistically significant ($p = 0.03$). At final follow-up, a comparison with the uninjured wrist demonstrated that the mean flexion-to-extension arc, the mean ulnar radial deviation arc and the mean grip strength were restored to 65%, 71% and 83% of the uninjured side, respectively. There was no pre- or post-operative limitation of pronation or supination. The mean pain level measured by visual analogue scale (VAS) decreased from 21.0 points (6 - 42) before surgery, to 3.1 points (0 - 11) at the final follow-up session ($p = 0.03$). Three patients had to change their occupation, because of prolonged pain during attempts to return to their pre-injury employment. The mean Disabilities of the Arm, Shoulder and Hand (DASH) score at final follow-up was 18.4 points; the mean Patient-related Wrist Evaluation (PRWE) score was 20 points. The Green and O'Brien score showed 15 excellent, four good, three fair and two poor results.
Conclusions: Prevention of progressive carpal collapse, the absence of donor site morbidity, good subjective results and pain relief justifies use of this procedure in the treatment of recalcitrant nonunion of the scaphoid.

A-0191 Complications following internal fixation of unstable distal radius fracture with a volar locking plate

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Introduction: The increasing number of fixed-angle plate systems used to treat distal radius fracture (DRF) carries with it the problem of determining the optimal fixation for unstable fractures. Our goal was to analyse the clinical and radiological outcomes of patients with displaced, unstable DRFs treated with a volar locking plate.
Patients: Over a mean 15-month period (range, 12 - 27 months), 141 consecutive patients were treated for an unstable, dorsally displaced DRF. We assessed objective and subjective functional results (active range of motion (ROM); strength; Disabilities of the Arm, Shoulder, and Hand (DASH) score; visual analogue scale (VAS); and Green and O'Brien Score) and radiographic assessment (palmar tilt, radial inclination, ulnar variance and fracture union). Any potential for complications was given special attention.
Results: We treated 114 patients (21 men and 93 women) with a mean age of 57 years (17 - 79 years). Fractures were classified according to the AO/ASIF classification system, as Type A2 (n = 39), A3 (n = 16), C1 (n = 24), C2 (n = 30), or C3 (n = 5). The modified Green and O'Brien Score revealed 31 excellent, 54 good, 23 fair, and six poor results. Active wrist motion averaged 54° of extension (82% of the uninjured side), 46° of flexion (72% of the uninjured side), 81° of pronation (95% of the uninjured side), and 82° supination (95% of the uninjured side). Mean grip strength was 70% of the uninjured side. VAS demonstrated that 81 patients (71%) were pain free, 17 patients (15%) had mild pain, 10 patients (9%) had moderate pain, and six patients (5%) had severe pain. The DASH score average was 13 points (range, 0 - 39 points). Fracture union was achieved in all patients. We measured a mean loss of palmar tilt of 3.4°, radial inclination of 0.4° and ulnar variance of 1.2 mm. The overall complication rate was 27% (31 out of 114 patients). The most frequent problems were flexor and extensor tendon irritation (57% of the total number of complications), including two ruptures of the flexor pollicis longus tendon, two ruptures of the extensor pollicis longus tendon, four cases of extensor tendon tenosynovitis, and nine cases of flexor tendon tenosynovitis. Carpal tunnel syndrome was observed in three patients, and complex regional pain syndrome occurred in five patients. In two cases, loosening of a single screw was seen. Delayed fracture union occurred in three patients, and intraoperative intra-articular screw displacement was recognized in one patient. Neither the clinical outcome nor the complication rate were dependent on the fracture type (intra-articular versus extra-articular).
Conclusions: Very distal volar plate positioning can interfere with the flexor tendon system, too long screws can penetrate the extensor compartments, and distal screws in comminuted fracture patterns can cut through the subchondral bone and penetrate into the radiocarpal joint. Mindful of these problems, we consider that the complex fracture pattern of an unstable distal radius fracture cannot be treated by a single plate system and approach.

A-0192 Carpal four-corner fusion with memory shape staple or circular plate: comparison of techniques and results

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Objective: Advanced cases of scapholunate collapse, scaphoid nonunion and carpal instability could be treated with carpal 4-corner fusion, using this technique as a great surgical option for providing pain and discomfort resolution, and offering wrist motility and recovery of functionality. The aim of our study was to compare two different fixation techniques, using the memory shape staple and the circular plate.
Methods: In the period between October 2007 and July 2014, we performed a carpal 4-corner fusion in 34 patients; 26 of them were re-evaluated over time (average follow-up, 34 months). Patients were divided in two groups: the first group was composed by patients treated with memory shape staple (14 patients); the second group included patients treated with circular plate (12 patients). We performed a clinical evaluation using the Disability of the Arm, Shoulder and Hand (DASH) and Mayo Clinic Wrist scores. Grip strength and clamp strength, articular excursion and eventually pain persistence by visual analogue scale (VAS) were also evaluated.
Results: All carpal fusions were radiologically steady. Two patients treated with the plate and three patients treated with the staple methods have shown nonunion that was not clinically relevant. In the first group, in which all patients were treated with memory shape staple, the average DASH was 20.4; while the average Mayo Wrist Score was 63.3. In the group treated with circular plate, the average DASH was 20.8 and the average Mayo Wrist Score was 68.8. The average grip strength was 27 kg (59% of the other limb's strength) in the first group; and 24 kg in the second group (65% of the other limb's strength). The average range of motion (ROM) in flex-extension movements was 70% for the first group and 67.5% in the second one. Our results showed that patients treated with the staple had two cases of asymptomatic nonunions (15%), one wound decency (7%), one incorrect staple placement

and longer period of immobilization after surgery (3 weeks versus 2 weeks, for those patients treated with a plate). Carpal fusion with the plate is technically more complex, leading in our experience to one case of asymptomatic nonunion (5%), two cases with pain lingering after 3 months that required plate removal due to a dorsal impingement (17%), and one case of synovitis.

Conclusions: In conclusion, there is no statistically significant in difference between the two techniques. Our results are comparable to those reported in the literature. Carpal fusion with circular plate is technically more complex and can lead to more complications. The fusion rate was higher in those patients who were treated with the plate, thus they gained early mobilization. Crucial in this kind of carpal surgery is the correct surgical indication.

A-0195 Non-dissociative midcarpal instability: an uncommon wrist instability pattern

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Purpose: Midcarpal instability, described by Lichtman (1981), is defined as a loss of normal alignment between the proximal and the distal carpal rows of the wrist and it is included in the carpal instability non-dissociative (CIND) description of the Mayo classification. It is due to a partial or complete loss of extrinsic stabilizers: during ulnar deviation of the wrist, the proximal carpal row abruptly jumps from a palmar flexed position into extension, leading to an abnormal clunk of joint repositioning ('the catch-up clunk').

Methods: Since 1998, we had 84 patients present to our observation reporting a clunk with feeling or evidence of a shot in the wrist, sometimes audible, which manifested itself in the movements of radio-ulnar deviation in certain activities, in some cases associated with pain; that was diagnosed as a CIND. On examination, the patients had pain and decreased strength, associated with transient oedema of the dorsal side of the wrist and sag of the joint in the volar direction; and there was always a characteristic clunk, most often accompanied by pain and in nine of our cases, the patient could play it by himself, during an active movement in ulnar deviation.

Results: Non-operative treatment is always attempted in all of our cases, and includes protective 3-point dynamic splinting, rest, avoidance of provocative manoeuvres, daily muscle exercises of stabilization and strengthening (ECU, FCU, muscles of the hypothenar) and re-education of proprioceptive and neuromuscular control. When adequate clinical improvement is not shown by rehabilitative treatment, surgical options are recommended. To date, however, one cannot find an absolute indication of treatment. In our series, we treated by surgical procedure five patients with symptomatic CIND. In one case, we performed a dorsal ligament reconstruction, in the other cases we preferred a proximal row carpectomy (PRC) by a dorsal approach; furthermore, it did not seem to be even reported in the literature as a possible option to treat CIND. In the first case, we observed a recurrence of symptoms in a few months and the patient was very unsatisfied. The results of PRC were effective, both in terms of the resolution of pain and range of motion (ROM) of the wrist. The long-term follow-up sessions (at 2, 3, 7 and 9 years) showed a stable result, with excellent recovery of grip strength and ROM, which allowed patients to return to their activity, previous work and sports. All these patients were satisfied and would repeat the surgery.

Conclusions: Treatment of CIND always starts with a rehabilitation program. Surgical treatment of this type of instability is also discussed, but the limited experience reported did not allow a definitive indication of the most appropriate surgical repair. The results obtained in our cases of PRC appear to be satisfactory in the long term, and are in line with the trend reported in the literature of a preference to work on the bones, rather than on the wrist capsular ligaments.

A-0196 Proposal of a new classification for peripheral nerve lesions

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Nowadays, surgical resolution of a disability resulting from a peripheral nerve lesion is no longer an impossible task for the surgeon, even if a correct understanding of the lesion is essential to choose the appropriate surgical treatment, its timing and the rehabilitation program. Many papers presenting the outcome of nerve repairs start with an imprecise classification of the lesion; and the results may be different if the repair face is a crush or a neat lesion, a proximal or a distal one. It's so important in the scientific community to present similar things with clear, simple, understandable; but above all, shared language. So we propose a classification that may, in a simple way, help in the task of grouping similar lesions, thus facilitating the transmission of data and their collection for a final presentation. The lesion is

presented through a series of letters and numbers, which represent the involved nerve and its composition, the level and type of the lesion:

- The nerve is presented by initials: A = axillary, S = suprascapular, LT = long thoracic, TD = thoracodorsal, Mu = musculocutaneous, Me = median, R = radial, S = sciatic, P = peroneal, and T = tibial;
- The site of the lesion is then characterized by a number: 1 = shoulder/pelvis; 2 = arm/thigh; 3 = elbow/knee; 4 = forearm/leg; and 5 = wrist-hand or ankle-foot;
- The composition of the nerve at the level of the lesion is again expressed by a number: 1 = Motor, 2 = Sensory and 3 = Mixed;
- A simple letter describes if it is an open or closed injury (O or C); and
- The characteristics of the nerve lesion are then represented in the following way: P = partial/incontinuity; C = complete (with 1 = neat, 2 = crushed and 3 = loss of tissue).

Thus, the string U43OC.1 means a lesion of the ulnar nerve at wrist level, when it is still mixed, and the injury is an open one, complete and neat. We have used this system in 40 cases at two different centres, making easy the data transmission and the classification. Additional letters and numbers may be useful in the evaluation of the surgery and the factors influencing the final result:

- For age: A = aged (more than 60 years old); B = Young;
- For timing: 1 = immediate; 2 = delayed; 3 = secondary;
- For technique: 1 = suture; 2 = graft up to 10 cm; 3 = graft > 10 cm; and
- For comorbidity (smoking, diabetes, etc.): Y = Yes; N = No.

We aim to present the rationale and the technical details of this new classification, discussing its utility and limits that come from our experience.

A-0197 Four-corner arthrodesis: our experience with the circular HUB-CUP plate

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Introduction: Scapholunate advanced collapse (SLAC) or scaphoid nonunion advanced collapse (SNAC) wrist conditions are widely accepted as the most common mechanisms of wrist arthritis. Surgical options vary, based on the stage and progression of the disease. Two main procedures are generally accepted: the proximal row carpectomy and the 4-corner arthrodesis. The aim of our study was the evaluation of the mid- to long-term clinical and radiographic results of the 4-corner arthrodesis, by a specific circular plate in patients affected by level II and III SLAC/SNAC wrist.
Materials and methods: From 2006 to 2014, we had 68 patients undergo the index operation. Preoperative assessment consisted in a standard radiographic and computed tomography (CT) study and a clinical evaluation, focused on: range of motion (ROM), pain by visual analogue scale (VAS), Disabilities of the Arm, Shoulder and Hand (DASH), Patient-related Wrist Evaluation (PRWE) and the patients' consideration. Postoperative study consisted in a radiographic study and the same clinical parameters. Postoperative rehabilitation consisted in an early, active mobilization from postoperative Day 15.
Results: The mean follow-up period was 45.2 months (range 7 - 63). The outcomes were good, with a mean VAS of 1.4 and a mean improvement of the ROM of 48%, with respect to the contralateral wrist. All patients but one were satisfied. A single complication was registered, related to a technical mistake in the plate positioning in a patient with a dorsal impingement of the plate on the wrist, and a consequent reduction of ROM: the plate was removed, providing a substantial functional recovery.
Conclusions: The outcomes of our study correspond to those reported in literature. The use of a circular plate with respect to other devices used in the last years seems to achieve a better fixation, allowing an earlier rehabilitative protocol, with consequent patient satisfaction. An adequate and precise surgical technique may prevent minor complications related to the use of these devices.

A-0198 Fracture of the hamate hook treated by dorsal percutaneous screw with a volar pinning insertion

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Introduction: Percutaneous fixation from a dorsal approach for hamate hook fractures is reported as a successful procedure. Resection of the hamate hook has also been reported, with fair results.
Materials and methods: We present a series of six cases of percutaneous fixation, using a volar pinning insertion and a retrograde dorsal screw, in six-male patients with an average age of 30 years.

The mechanism of injury was FOOSH in all cases. Diagnosis was made with magnetic resonance imaging (MRI) in three cases and computed tomography (CT) in three cases. All X-rays were negative for the hook of the hamate fracture, but in one patient, a scaphoid fracture was found. The average time for surgery following the injury was 49 days (6 - 177 days). Union was obtained in all patients and all returned to their pre-injury sports activity level. The right screw positioning and union was confirmed with CT. The Patient-related Wrist Evaluation (PRWE) scores were comparable to the uninjured wrist.
Conclusions: Acute and delayed fractures of the hamate hook can be treated successfully with percutaneous fixation, using a volar pinning insertion and a retrograde dorsal screw.

A-0201 Good outcomes for surgical correction of malunited fractures of the distal radius

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Objective: Malunion of the distal radius may result in functional limitation and pain that demands treatment. Common symptoms include ulnar sided wrist pain and loss of supination. We hypothesised that surgical correction of the radial malunion produces good symptomatic relief.
Methods: We corrected 58 patients with symptomatic malunion of the distal radius using radial osteotomy and fixation with a volar locking plate (Trimed) with variable angle screws, bone graft and early mobilisation. We assessed range of motion (ROM), grip strength, functional scores, functional testing, complications and radiological outcomes. We performed an ongoing review, currently at a mean follow-up time of 2.6 years.
Results: A high degree of satisfaction was achieved. Pain improved by a mean of 4 of 10 on a visual analogue scale (VAS). Subjective wrist function improved by 5 out of 10 (VAS). Grip strength improved by 14.4 kg. Mean post-operative Quick Disabilities of the Arm, Shoulder and Hand (QuickDASH) score was 14.4 and the Patient-rated Wrist Evaluation (PRWE) score was 16.9.
The post-op active flexion and extension arc improved by 29° to 124°, compared to a mean of 135° on the contralateral side. The post-op pronation/supination arc was 133°, compared to 152° on the contralateral side. Supination improved by 15° to 69°, compared to 84° on the unaffected side.
All osteotomies united. The dorsal sagittal tilt improved from - 7.2 to + 7.4˚. Ulnar variance shortening osteotomies, one triangular fibrocartilage complex (TFCC) debridement and eight wrists needed plate removal. Complications were noted in 7 out of 58 patients: two had transient nerve irritations, two had post-operative haematomas, two had extensor tendon ruptures and one patient developed complex regional pain syndrome (CRPS).
Conclusions: Our technique of radial osteotomy is simple, reproducible and produces near anatomic reduction and good functional results, with high satisfaction rates in carefully selected patients. Complications were uncommon, but secondary surgery to achieve an optimal result may be necessary.

A-0204 Outcomes of the Sauve-Kapandji procedure with an Acutrak screw for rheumatoid arthritis: results of 1-year prospective follow-up

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Background: The Sauve-Kapandji procedure (SK) has the following two purposes in patients with rheumatoid arthritis (RA): preventing carpal collapse indirectly and stabilizing the distal radioulnar joint (DRUJ) directly, by a shelf formed by the fixed ulnar head; however, in DRUJ fusion, the screw is fixed to the essentially osteoporotic bone in patients with RA, so the fixed force in a conventional screw is insufficient. For rigid DRUJ fixation, we have been using the Acutrak screw. In the present study, we report the results from a 1-year prospective study.
Materials and methods: A total of 31 wrists from 27 patients with RA were followed up prospectively for 1 year. The SK procedure alone was used in 24 wrists, and combination radiolunate fusion was used in seven. The mean age at time of operation was 66 years (range 42 - 84 years). All patients were fixed solely with an Acutrak 4/5 screw (screw length range, ** - ** mm). Tenodesis of the ulnar proximal stump was not performed in all wrists.
Results: Bone union was obtained in all wrists. At 1 year after surgery, the Quick Disabilities of the Arm, Shoulder and Hand (Quick-DASH) improved from as score of 46 before surgery to 28, and supination improved from 71° to 83°. On the other hand, volar flexion decreased from 46° to 35°. The dorsopalmar distance did not increase (2.2 mm to 0.27 mm) and the ulnar proximal stump was stable. The carpal translation index and the palmar carpal subluxation ratio were unchanged 1 year after surgery, and there was no association with use of combination radiolunate

fusion. In the 10 wrists in patients for whom the DAS28-ESR (indicating disease activity) was evaluated prior to surgery, DAS28-ESR showed a correlation with the amount of change in the palmar carpal subluxation ratio after surgery.
Discussion: Although single screw fixation was used alone, bone union was obtained in all cases, and strong fixation due to the Acutrak screw was confirmed. Since the progress of the palmar ulnar dislocation of the carpal bone was not related to the presence of radiolunate fusion, the SK procedure alone was able to control the carpal bones; however, since the DAS28-ESR showed a correlation with the palmar carpal subluxation ratio, this method alone might be insufficient for high disease activity cases.

A-0205 Hand-based swing traction splinting for intra-articular PIP joint fractures: a case series

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Objectives: Acute intra-articular fractures of the PIP joint have always presented as a difficult injury to manage, for both the treating surgeon and therapist. Traditional traction management involved large bulky splints or difficult to apply pins-and-rubber-band traction systems. This case series presents the design and results of a more streamlined hand-based swing traction splint, which is less cumbersome for patients than other forms of traction splinting. The main benefit of traction management is to enable ligamentotaxis and early motion. An advantage of this method is the simple K-wire insertion, compared to other more involved operative procedures with higher risks of morbidity.
Methods: Five patients presenting with intra-articular proximal interphalangeal (PIP) joint fractures underwent surgery whereby a transverse K-wire was inserted across the middle phalanx. The treating Occupational Therapist fabricated a hand-based swing traction splint, to provide a distraction force from the K-wire to the splint. Range of motion (ROM) and patient satisfaction were the primary outcome measures.
Results: All five patients reported satisfaction with their hand function, following therapy involving swing traction splinting. Furthermore, ROM was comparable to other forms of traction management reported in the literature, with an 88° mean arc of motion at the PIP joint.
Conclusions: This case series demonstrated that hand-based swing traction splinting is a viable treatment option for the management of intra-articular PIP joint fractures. With similar outcomes to other forms of distraction that enable early movement, such as the 'Pins and Rubber Traction System', this design is an alternative. The less cumbersome splint design is the main advantage over other splinting methods that apply distraction, whilst also enabling early motion.

A-0207 Thumb carpo-metacarpal arthritis: preliminary results of the use of a new biodegradable joint scaffold

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RegJoint is a biodegradable joint scaffold that reconstructs damaged joints. The implant stimulates new tissue growth and creates a flexible and durable new joint. It consists of a porous, biodegradable polylactide copolymer implant (BPI) that is round and disc-like in shape, with a diameter that varies from 8.0 mm to 18 mm, and a thickness that ranges from 3.6 mm to 4.5 mm. We used a RegJoint scaffold in 15 patients affected by thumb carpo-metacarpal arthritis (Eaton-Littler Stage 2° - 3°): 13 were women and two men, all aged 45 – 75 years with an average of 61 years. Our innovation is the use of RegJoint with the Pirodisk surgery technique, with reconstruction of oblique palmar and dorsoradial thumb carpo-metacarpal joint ligaments, joint alignment and first ray high reconstruction.
Preliminary results show that all patients reached the full range of motion (ROM) of Kapandji 9 - 10, when 7-10 was the Kapandji value before surgery. Pain: the visual analogue scale (VAS) had an average score of 1.5 (range 1 - 4), and was 5.5 before surgery. The pinch was 4.6 (3.4 before surgery because of pain), similar to the other hand. Grip: average 22 kg (20 before surgery), while 22 kg was the value of the other hand. All patients completed the Disability of Arm, Shoulder and Hand (DASH) questionnaire: the value was 29 points (range 18 - 65). Only two cases had extra-joint pain on the scar, persisting after 10 and 6 months: they also suffered from different allergies, so this may be the lactose of the scaffold (?). All patients reached their best ROM and were able to restart their normal work-related activities in 2 - 3 months (average 2.4 months).
In addition, 10 patients had a follow-up at 12 - 18 months: The clinical follow-up was done at 1, 4, 8, 12 and 18 months, with no sign of instability. The radiological follow-up was done at 4, 8 and 12 months (not all patients), without any ray changing. RMN was done at 4, 8, 12 and 18 months (all different patients). The preliminary results are highly encouraging, despite

the low number of patients treated. There is some doubt: what is going to happen, once that scaffold is completely resorbed?

A-0211 McCash open palm technique versus reverse hypothenar flap for the treatment of Stage III-IV Dupuytren's disease

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Objective: This study intended to analyse the optimal surgical approach and to compare the results in the treatment of Dupuytren's disease, between an open palm technique (McCash) and a reverse hypothenar flap in III - IV Tubiana stages retractions of the fourth and fifth digital rays.
Methods: Between 1988 and 2014, we performed the McCash technique in 56 cases and hipothenar flaps in 49 cases, with III - IV Tubiana stages retractions of the fourth and fifth digital rays. In the McCash technique using transverse incisions in the palm, we performed a limited fasciectomy and the palmar gap was left for secondary cicatrisation. The hypothenar flap (RHF), based on a branch of the ulnar palmar digital artery of the little finger, could be rotated 90˚ to cover the palm gap. RHF, containing durable fasciocutaneous structures, had good texture, matching the normal palmar skin. Postoperative hand therapy included splinting, exercises, oedema and scar control; and the main objective was to maintain the range of motion (ROM) gained intraoperatively.
Results: In the McCash opening technique, the late onset of functional re-education determined a period of incapacity more than 6 - 8 weeks; and an extension deficit of 20 - 45° in the end of this period. For the patients on whom we performed RHF, the physiotherapy program was more intensive and they had an average of 4 - 6 weeks of work disability and an overall deficit of extension of 25° (25 cases 20°, 22 cases 25° and two cases of 30°). From the 49 cases with RHF, we found that only in two cases (4%), in postoperative evolution of the tip flap necrosis. The mean Quick Disabilities of the Arm, Shoulder and Hand (Quick DASH) score was 23.1 preoperatively, improving by a mean of 8.1 points to 15.0 after surgery. Testing the grip force at 8 weeks after surgery, we found a mean of 32.4 kg for the McCash group and 36.6 kg for the RHF group. We indicated the RHF for advanced stages (III - IV) of Dupuytren's disease for ulnar digital rays, to assure better results for early functional re-education and socio-professional reintegration. In the McCash technique we found two disadvantages: first, digital dissection ends at the proximal interphalangeal joints; and second, if primary closure of the digital incisions cannot be achieved without tension, little full-thickness skin grafts are required, because of the exposed flexor tendons. One the other way, the open palm method technique needed an extra 2 - 3 weeks for complete healing.
Conclusions: RHF for skin closure, for the treatment of Stages III - IV of Dupuytren's disease is a safe and feasible technique, shortening the healing time, improving finger motion much quicker than the McCash technique. The more intensive physical therapy program for the RHF improved the final results, when we tested postoperatively, at 8 weeks. Advantages to the McCash technique were no cutaneous necrosis, hematoma or seroma. Each technique doesn't exclude the other, each has its own advantages and disadvantages, but patient selection will determine the technique chosen.

A-0212 Motor nerve regeneration using an optimized nerve allograft in a rat sciatic nerve model: an in vitro and in vivo analysis

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Objective: In previous animal studies, commercially available processed nerve allografts have been inferior to autograft nerve, for motor recovery. The goal of this study was to create an optimised nerve allograft (in vitro) and subsequently challenge it to the nerve autograft, regarding motor nerve regeneration (in vivo).
Methods: For the in vitro experiment, 50 rat nerves were processed. Based on previous research, standard decellularisation protocols were used with different modifications and the addition of a highly potent enzymatic step with elastase. Subsequently, the nerve segments were stored at either 4˚C or - 80°C, for the duration of 2 weeks. Both processed and fresh control nerves were analysed with confocal microscopy, using immunohistochemical staining on the basal lamina (laminin γ-1), Schwann cells (S100 protein) and immunogenicity (major histocompatibility complex (MHC) Class I). The morphology of the ultrastructure and

amount of cellular debris was analysed on cross-sections of the nerves, stained with toluidine blue and analysed under electron microscopy (EM). The superior method of this in vitro project was used for implementation in vivo, to test the motor functional outcome of the nerve allograft in a rat. In the in vivo project, 60 rats sustained a 1 cm sciatic nerve reconstruction with either the autograft (I), non-frozen allograft (II), or frozen allograft (III). At 12 and 16 weeks postoperatively, motor functional outcome was determined with ankle angle, electrophysiology, isometric tetanic force, muscle mass and histology.

Results: Nerve ultrastructure was preserved with all decellularisation protocols. Storage at - 80°C severely altered nerve ultrastructure, after any decellularisation method. Elastase was found to significantly reduce the immunogenicity (of MHC-I) and the amount of Schwann cells (S100), while maintaining good structural properties. When tested in vivo, no significant difference was found between the three groups, with regard to motor function at both 12 and 16 weeks. The two experimental groups were not different from the nerve autograft.

Conclusions: Elastase, when added to nerve processing, reduced immunogenicity, diminished cellular debris and removed Schwann cells better, while maintaining ultrastructure. Storage at - 80°C after the decellularization process heavily damaged nerve ultrastructure, compared to cold storage. This in vivo study demonstrated no significant difference in functional outcome between the two storage techniques; however, the optimized processed nerve allograft showed it was comparable to the gold standard, the nerve autograft, at both 12 and 16 weeks, postoperatively.

A-0213 The clinical results of radial head prosthesis

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Objective: Radial head replacement is the preferred surgical procedure for comminuted fracture of radial head and nonunion of radial head fracture. The purpose of this study is to analyse clinical and radiologic outcomes after radial head replacement with prosthesis.

Methods: Seven patients with severe comminuted radial head fracture, four patients with nonunion of radial head fracture and one patient with a radial head resected state were taken and were treated with radial head replacement with prosthesis. For clinical evaluation, elbow range of motion (ROM), satisfaction, Mayo Elbow Performance Score (MEPS) and Disabilities of the Arm, Shoulder and Hand (DASH) scores were measured at the last follow-up. For radiographic evaluation, medial and lateral ulnohumeral space, osteolysis, capitella erosion and loosening were measured at last follow-up. The average follow-up period was 17 months (range, 12 - 60 months).

Results: At the last follow-up, average further flexion, flexion contracture, supination and pronation were, respectively: 134°, 2.5°, 76° and 79°. Satisfaction was excellent or good. The average MEPS and DASH score were 89 and 8.4. On plain radiographs, medial and lateral ulnohumeral spaces were 2.7 mm and 3.3 mm. Osteolysis was observed in five patients, at 6 months. Ectopic ossification was observed in one patient. There was no loosening of any prosthesis.

Conclusions: Radial head replacement with prosthesis provided good clinical outcomes and functional improvement in comminuted fracture of the radial head and nonunion of the radial head fracture, at the short-term and mid-term follow-up sessions. Radial head replacement with prosthesis was a recommendable procedure.

A-0214 Distal phalanx reconstruction after finger bone tumor resection

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Objective: To assess the long-term outcome of distal phalanx tumours after resection and reconstruction of the bone and nail bed.

Methods: Between 2000 and 2014, we operated on 21 patients with P3 tumours. These tumours of the distal phalanx were: five enchondroma, two giant cells tumours, one osteoid osteoma, three aneurysmal cysts, four epidermoid cysts and six glomic tumours with osteolysis; which required bone graft after excision or curettage. Surgical treatment of tumours of the distal phalanx must respect the following principles:

Complete excision of tumour tissue, preventing relapse; Reconstruction of the phalanx length, preserving joint biomechanics; Preserving the functional and/or reconstruction of the flexor profundus tendons and distal insertion of the extensor apparatus; Avoid digital nerve damage and scar pulp; and Preserving the aesthetics of the nail and pulp.

The amount of bone graft was determined preoperatively (dimension and geometry) by imagistic examination (radiologically, CT, MRI with three-dimensional

(3D) reconstruction) and it was harvested from the distal epiphysis of the radius and iliac crest.
Results: In 15 patients with P3 tumors, the pulp and nail aspect and size were perfectly preserved. In six patients with P3 tumors, it was necessary to resect three-fourths distal of the phalanx and a longitudinal strip (3 mm in width) from the nail bed. We used in addition, a tinfoil nail splint for recovery of the nail bed, but the aesthetic results were unsatisfactory.
Conclusions: We consider that the final result quality depends on preserving the nail bed, dorsal cortical portion and the base phalanx joint, followed by an anatomic (geometric) reconstruction with a bone graft.

A-0216 Reconstruction of the hypoplastic thumb: comparison of two different techniques

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The hypoplastic thumb is a rare congenital radial dysplasia with an incidence of 1 in 100,000 births. It may occur bilaterally, sometimes associated with more complex radial dysplasia or congenital conditions. The bony hypoplasia is associated with an inconstant, partial or total absence of intrinsic and extrinsic muscles; the first MPJ instability is often associated with the first web retraction for metacarpal adduction and a smaller thumb. The child is not able to pinch with the thumb. In the period from 2006 – 2009, eight patients (age varied between two and four years, but mean age was about 32 months) with a hypoplastic thumb (classified as 2 and 3A, following the Manske classification) were treated, employing the two different surgical techniques. Four patients were treated using the technique described by Huber-Littler (that is based on the abductor digiti minimi (ADM) teno-muscular transfer to the radial side of the first MPJ; and four patients by using the technique proposed by Ezaki (based on the ring finger flexor digitorum superficialis tendon transfer to the first MPJ, in order to oppose the first ray to the others; and using the final tendon extremity to create a stable ulnar collateral ligament, passing it through a well-made oblique drill hole from the radial to ulnar side, in order to give stability to the joint and the thumb at all).
Analysing our preliminary experience, we consider the surgical procedures, weak points and tricks, the associated surgical steps and the postoperative protocols. The surgical treatment is indicated when the child is 2 - 4 years old. We suggest prudence in treating patients with associated syndromes.

A-0217 Successful conversion of failed contemporary wrist prostheses to arthrodesis: Prospective results in 11 patients

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Introduction: Wrist arthrodesis has been the treatment of choice for painful degenerative wrist disorders for more than 100 years. Many patients with fused wrists complain over residual pain and functional limitations (1,2). Wrist arthroplasty implantation is increasing worldwide, after promising results with contemporary arthroplasties (3,4) in non-rheumatoid and rheumatoid patients. Conversion of failed wrist arthroplasties to arthrodesis was complicated with older designs, because of extensive bone removal during insertion and further bone loss due to loosening.
Materials and methods: All wrist arthroplasties implanted in our department since 2001 (110 wrists) were followed up prospectively: 11 patients (mean 49 (24 - 75) years, seven were women) were converted to arthrodesis due to infection (n = 4 or 3 with positive bacterial cultures), muscular imbalance/pain (n = 4) or aseptic loosening (n = 3), after a mean of 2.8 (0.8 - 6.4) years. The failed arthroplasty was a developmental prototype in five cases and the Motec® wrist arthroplasty in six cases. One patient had rheumatoid arthritis, the remaining 10 had non-rheumatoid osteoarthritis (six SNAC or SLAC, three sequele radius fracture, one Kienbock's disease). Eight patients were operated with a bone transplantation and arthrodesis plate. In three patients with well-fixed components, bone transplantation and a custom-made peg were used for fixation between the osseointegrated components. We measured range of motion (AROM); pain by Visual Analogue Scale (VAS) for the radial and ulnar, at rest and with activity (rr, ra, ur, ua); Quick Disabilities of the Arm, Shoulder and Hand (QDASH); Patient-rated Wrist and Hand Evaluation (PRWHE); grip-strength; and key-pinch. Radiographs and computed tomography (CT) were taken pre-operatively and at follow-up.
Results: One patient died 1 year after surgery, of an unrelated cause; but the remainder were followed-up for 5.6 (3.8 - 7.1) years. Perioperatively, one patient sustained a metacarpal '3' fracture, with healing uncomplicated. Postoperatively, the same patient developed a nonunion between the graft and carpus, and was reoperated with bone transplantation and fixation. Another patient developed postoperative carpal tunnel syndrome (CTS). All arthrodeses healed.

The arthrodesis plate was removed in five out of eight patients. Preop and postop measures: VAS mean rr 4.2 (0 - 8.0) to 0.8 (0 - 3.0), ra 7.0 (2.0 - 10.0) to 2.3 (0 - 7.5), ur 4.2 (0 - 8.0) to 0.2 (0 - 2.0), ua 6.7 (2 - 10) to 1.0 (0 - 4.0). The QDASH went from 54 (27 - 75) to 32 (2 - 75); the grip strength, 11.3 (0 - 31.7) to 23.4 (6 - 56) kgs. At follow-up, the PRWHE was 25.2 (4.0 - 75.0) and the Key pinch, 6.6 (2.8 - 9.0) versus 8.4 (1.4 - 14) kgs on the opposite side.
Discussion: Failure of total wrist arthroplasties may necessitate extra surgery. The Motec® prosthesis and its developmental prototype can be converted to arthrodesis successfully, with a clinical outcome comparable to primary arthrodesis.

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A-0218 New surgical therapeutic approach for neurogenic thoracic outlet syndrome: 'Saving the first rib', a homogeneous continuous series of 104 cases

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Objective: Resection of the first rib is the common denominator for the treatment of thoracic outlet syndromes. Although they long shared this viewpoint, the authors have completely changed their opinion for neurogenic forms and now advocate a simplified technique that saves the first rib.
Methods: The technique consists of exploring and liberating the brachial plexus at different levels of possible compression, through a double supraclavicular l and subclavicular deltopectoral approach:

- The ligamento-muscular structures are resected whenever present;
- The scalenus anterior is not detached, while the scalenus medius is always disinserted and sometimes partially resected.

Since July 2010, we have never encountered a costoclavicular clamp and the first rib could be maintained.

- The clavipectoral outlet is always examined and the plexus is liberated in 40% of cases by section of the subclavius muscle aponeurosis or of the coracoclavicular or coracocostal ligament; the control ends at the brachial canal.

Results: With a mean follow-up of 20 months (6 - 42 months), we found that 73 cases (70%) saw their pain disappear completely; 26 cases (25%) said they had improved; two cases failed, but one improved after a follow-up intervention (insufficient resection of the middle scalene); and three cases had a partial reappearance of clinical symptoms, but this did not warrant a follow-up intervention.
Conclusions: This technique is minimally invasive for the plexus and preserves the scalenus anterior and the first rib. It is satisfactory for 95% of patients. We had never previously achieved this level of results with the Roos or Cormier protocols.

A-0219 Clinical and radiological results of total elbow prosthesis in the treatment of inflammatory arthritis: 10-year mean follow-up

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Objective: The main indication of Total Elbow Arthroplasty (TEA) in inflammatory arthritis is advanced elbow joint involvement ranked Stage 3 or more, in Larsen's radiological scale. The objective of this study was to assess clinical and radiological results of the GSB III prosthesis (Allopro®, Sulzer Medica®) in the treatment of inflammatory arthropathy of the elbow, with a mean follow-up of 10 years.
Methods: Every patients with advanced rheumatoid arthritis (RA) or juvenile idiopathic arthritis (JIA) of the elbow ranked Stage III or more in the Larsen classification, and treated in our department by TEA between June 1990 and April 2008, were clinically and radiologically reviewed with a mean follow-up time of 10.6 years (2.25 - 20.2). All patients gave their informed consent before being recruited into the study. We collected the following: etiology of the inflammatory disorder, clinical and radiological preoperative features and preoperative pain assessment that relied on the visual analogue scale (VAS), medical history,

pre-operative functional statement using the Steinbrocker classification and Morrey score, and symptoms related to ulnar nerve impairment. Radiographic damage of operated elbows were ranked pre-operatively using the Larsen and Morrey classifications. The elbow prosthesis was always the GSB III (Allopro®, Sulzer Medica®) and was performed under general anaesthesia, using the Gschwend approach by a single senior surgeon. The ulnar nerve was always transposed and a synovectomy was systematically performed.

Results: There were 19 patients (21 prosthesis, 2 bilateral) consecutively operated on (16 female patients and three male). No postoperative complication was noticed. At the final follow-up, no patient was lost, but four patients (and four prostheses) were deceased from unrelated causes. The 15 remaining patients (17 prostheses) were assessed. The etiologic arthritis was rheumatoid arthritis for 14 cases and juvenile idiopathic arthritis for the other three cases. According to Larsen's classification, there were five at Stage 3, 10 at Stage 4 and two at Stage 5. According to Morrey's classification,16 cases were Stage 3 and two were Stage 4. The overall survivorship was 100% with explantation as the endpoint; and 89% (16 out of 18) with a radiological loosening as the endpoint. Fifteen patients (93%) had stable outcomes.

Conclusion: The present study reported good clinical and radiographic results that justify continuing to use TEA in inflammatory arthropathies of the elbow, from the Stage 3 of Larsen or Morrey classifications. This series is similar to those in the literature. Our results are interesting because they emerged from a study without loss to follow-up, homogeneous causal pathologies without postoperative complication and sufficient follow-up time for evaluating mechanical complications. The TEA GSB III provides good long-term clinical and radiological results in advanced inflammatory arthritis of the elbow.

A-0220 Free phalanx transfer in congenital absence of digits: considering hand and foot results, is there still a place for this indication?

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Purpose: Free, non-vascularised toe phalangeal transfer is an established surgical option for the reconstruction of hypoplastic digits in symbrachydactyly, transverse congenital absence and other severe congenital conditions, when parental advice does not accept (or local conditions contraindicate) single or multiple free toe transfer. This study aimed to estimate the value of the procedure, considering the results on the hand and on the donor site.

Methods: In our hand surgery service (since 1997) we have treated several cases of simbrachydactyly, from mild to a really severe form. Regarding the most severe cases, seven children among them were treated by free toe transfer (with single or multiple digits transferred) for a total of 10 transferred toes; and 23 children were treated by free, non-vascularized toe phalangeal transfer. We reviewed all 23 children treated by free non-vascularized toe phalangeal transfer (1997 - 2012). The diagnosis was digital hypoplasia resulting from symbrachydactyly in 20 cases and constriction ring syndrome in three cases. The patients were followed up after surgery for a mean of 6.5 years (range 3 - 12). Due to well-known problems at the donor site since 2007, we changed the technique of donor site closure. To fill the gap, we used a free partial bone graft harvested from the head of the metatarsal, to substitute part of the picked phalanx. Then the graft was fixed together with the distal phalanx and the residual metatarsal with a Kirshner wire for 6 weeks. The hand has been evaluated, comparing the transferred phalanx growth with the other foot phalanx and the contralateral hand phalanx. The Oxford Ankle Foot Questionnaire was used to outline patient symptoms, and patient and parental satisfaction on the donor site. We assessed toe length ratio, the presence of visible deformity and distal hypoplasia of the donor toes.

Results: Despite the modified techniques, some (but not all) donor site results were disappointing, in different degrees (independent of the standard or modified technique used) and some (about four) required secondary surgery. Emotional problems related to the foot appearance were common. We did not find functional problems with footwear (none of the patients). When presenting foot deformity, this increased with growth, particularly where multiple donor phalanxes had been harvested. Hand function was in all cases significantly improved, and even upgraded in cases where lengthening of the transferred phalanx was performed.

Conclusions: Donor site morbidity for free toe phalangeal transfer is greater than previously documented. This should be considered during the surgical decision for making for reconstruction of hypoplastic digits. In any case, considering the good and stable results in the hand, this procedure must be contemplated in the congenital absence of digits when parents (or local conditions) advise against free toe transfer.

A-0221 Outcome of surgical treatment of upper limb spasticity in 26 patients

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Objective: The aim of this study was to evaluate the outcome of the surgical treatment of upper limb spasticity in patients affected by sequelae of a stroke or a cerebral trauma.
Methods: We treated 26 patients (15 women and 11 men, mean age 55) by a number of surgical procedures to improve posture, hygiene and function. Tenotomies, myotendineous fractional lengthening, Z lengthening of tendons, tendon transfers, neurotomies, arthrodeses were the most frequently used surgical procedures to release spastic contractures of the shoulder, elbow, wrist and hand. The European Quality of Life Questionnaire (Euroqol) and Visual Analogue Scale (VAS) about the current state of health-related quality of life were the outcome measures used. We evaluated 18 patients at a mean follow-up time of 3 years, 4 months.
Results: All patients and caregivers expressed satisfaction with the clinical results and reduction of their disability. The Euroqol score (complete range 0.1 - 1) of our patients ranged from 0.14 to 0.85 (mean 0.7). The mean VAS score (range 0 - 100) was 64.
Conclusions: Surgical treatment of upper limb spasticity can improve a patient's quality of life and reduce disability, as suggested by both subjective evaluation of patients and family, and by the outcome measures used in this study.

A-0222 *Clostridium histolyticum* collagenase: 1-year follow-up of treatment of patients with recurrent Dupuytren's contracture

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Background: Dupuytren's contracture (DC) is a disorder that affects the palmar fascia, where a pretendinous cord with time causes the finger to flex, resulting in impaired hand function. The aim of this study was to evaluate the efficacy of *Clostridium histolyticum* collagenase (Xiapex®) treatment of recurrent DC, at least 12 month after Xiapex® injection.
Materials and methods: This study was a prospective study on a consecutive series of patients with recurrent DC and flexion deformities of the metacarpophalangeal and/or proximal inter-phalangeal joint of > 20° and a palpable cord. Our end points were: reduction in contracture, improving hand function and patient satisfaction.
Results: We enrolled 81 patients with treatment, 69 men and 12 women, mean age 67 years (36 - 85); 91% of the treated fingers were numbers 4 and 5. Treatment distribution to MP/PIP joints were 45/55%. In this evaluation group, 51% had a skin rupture after manipulation and 95% of these patients had a need for an additional visit in our out-patient clinic. Mean follow-up time was 15 months (12 – 23). At follow-up, there was a mean reduction in contracture of 44/40% for the MP/PIP joint. The mean Disabilities of the Arm, Shoulder and Hand (DASH) at pre-injection was 15 (0 - 61) and at the 12-month follow-up, it was 9 (0 - 39). In five cases (6%), there had been a need for further treatment of the Xiapex®-treated finger at 12 months (unacceptable recurrences). At the 12-month follow-up, 65% of the patients were satisfied or very satisfied.
Conclusions: Our results are acceptable and we find Xiapex® a possible treatment option for recurrent DC patients with a palpable cord. The treatment is not as effective, has a higher recurrence-rate and lower patient satisfaction, compared to Xiapex® treatment of primary DC.

A-0223 Reconstructive surgery of radial head fractures and consequences

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Objective: To improve the surgical treatment results of fragmented radial head fractures and decrease the indications for the prosthetics.
Methods: Analysis of surgical treatment of 73 patients with radial head fractures and their consequences was made. The average age was 36.2 ± 3.9 years; there were 35 men and 38 women. The term of the admission after an injury was from 3 - 4 days to 5 - 6 months. Distribution of patient trauma terms were: before 4 weeks, 35 patients (48%); over 4 weeks, 38 (52%). We used Mason's classification of radial head fractures: Type II, 19 (26%); Type III, 44 (60%); Type IV, 10 (14%).
Results: In Type II cases, miniscrews were used; for Type III and IV, we applied miniplates and screws. In cases of multifragmented fractures, we did repositioning and fixation of the head fragments outside of the body, and then performed the final osteosynthesis. In concomitant fractures, we performed their reposition and osteosynthesis. For the multifragmented fractures with small fragments, we performed substitution of part of head premodeling autograft from the iliac crest. It is very important to perform a synthesis

of the coronoid for prevention of the elbow's dislocation. In small and multifragmented fractures of the coronoid process, we used transossal suture of the capsule. We restored injured medial and lateral ulnohumeral ligaments for the prevention of an elbow instability. In five cases, when the removal of the radial head was in a previous stage of treatment and the patient developed subluxation in the elbow or in the wrist, as one of element of reconstruction, we performed a radial head replacement. The same patient needed not only fixators removal, but also the arthrolysis of the elbow in long-term follow-up. We used the extension splinting of the elbow, but, starting with the first day after operation, flexed of the elbow for 1 - 2 hours and more, using the collar and cuff sling. This type of arm slings is useful for changing of the elbow angle flexion. In all patients from the first days, we used the active-controlled rehabilitation program that included three periods of increasing movements in the elbow joint. Treatment results were assessed by the Mayo Elbow Performance Score. Results were excellent and good in 95% and 84% of cases, in patients with Type II and III fractures. In the group of fractures of Type IV, excellent results were achieved in 31% of cases and good, in 43%. We observed the consolidation of 94% of the multifragmented fractures, including cases using bone plasty of the radius head. It wasn't so in cases of heterotopic ossification. The obtained results are improved, due to using of the active-controlled rehabilitation program.

Conclusions: The use of osteosynthesis in multiple fragmentary fractures in most cases makes it possible to obtain good and excellent results. Bone grafting of the radial head by the premodeling transplants show effectiveness. Active-controlled rehabilitation is an important component for achieving good results.

A-0224 Effect of nerve damage to the structural changes in limb muscles

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Introduction: Traumatic injuries of the peripheral nerves are still an issue in reconstructive surgery. Restoring of the limbs' function with denervation and muscle atrophy is always problematic, because of long-term time to have restoring and structural changes that occur in muscular tissue. We sought to identify the structural changes in the muscles, depending on the level of nerve damage, in the current study.

Materials and methods: All rats were 8 - 12 week old males (230.1 ± 5.6 g). Unilateral forelimb denervation was performed by peripheral nerve neurotomy (n.medianus; n.ulnaris), with formation of the defect (diastase) of the nerve by 1 cm. The muscles and nerves of the extremities were examined using histological and biochemical methods in the first month after injury.

Results: Research showed the denervation muscle atrophy and inability of spontaneous recovery of the large nerve defects after neurotomy at different localisations. There are degenerative changes of nerve fibres and the reorganization of the stromal elements in the proximal nerve segments; and the distal nerve fragments were usually totally necrotized. The rats' forearm muscles atrophy was characterized by varying degrees of development, depending on the level of nerve damage. The muscle proteins were decreased by 9.6% in the group with a proximal nerve injury and by 11.8% in the group with the distal nerve injury ($p < 0.05$). The levels of free aminoacids in the distal neurotomy group reduced to 4 times, and in the proximal neurotomy group it was essentially unchanged, indicating the rapid rate of changes in the case of closely-localized nerve trauma.

In both groups, there was the same type of damage in the muscle enzyme systems: reducing of the activity of lactate dehydrogenase by 7 times and the creatine kinase to 13.5% ($p < 0.05$), while the content of polyunsaturated fatty acids that are necessary for recovery processes was left without changes. The content of the new short fatty acids in the distal neurotomy group increased by 10.6% and in the group with proximal neurotomy, decreased by 27.6% ($p < 0.05$), this means that the higher nerve injury triggers more active lipolysis and the development of scar tissue in the muscles that had denervation atrophy.

Conclusions: Our experimental data showed the correlation between degenerative changes of the muscle and the level of nerve injury. In the case of a high level of nerve injury, the muscles of the forearm's tolerance to the denervation is reduced.

A-0225 One-step reconstruction of first webspace and thumb in Apert syndrome, using a bilobed flap design

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In the Apert syndrome, the reconstruction of the best possible function in as few operations as possible is the aim of all surgeons. Often the first operation is to deepen the first webspace and separate the fifth finger. The correction of the axis and length of

the thumb will be done in another operation. With small changes of flap design (bilobed) the reconstruction of the first web space and the thumb in length and by axis can be done at the same time. Since some years ago in Innsbruck, we have done the simultaneous reconstruction of the first web space with a dorsal extending flap, and the reconstruction/correction of the thumb, with a dorsal extending flap, an inverse u-shaped osteotomy of the thumb and reduction of the nail bed, if necessary. Most cases were children with Apert-Syndrome Grades I or II. We got good functional results and a good and early grip function with the better positioning of the tip of the thumb, in an overview of 10 hands. We had no problems with the blood supply of the two flaps and no problems with wound healing. We can recommend this flap design, at least for children with Apert-Syndrom Grade I or II.

A-0226 Botulinum toxin for the management of digital ischemia

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Objective: Botulinum toxin A (BoNT-A) is shown to improve digital ischemia by increasing blood flow. We describe the variability in response with BoNT-A injection for ischaemic fingers, when treating Raynaud's disease.
Methods: In our series, we included 11 treatment episodes on 6 patients (5 female patients and one male) over a 29-month period (June 2012 - November 2014). The mean age of the patients treated was 46.5 years (range 22 - 61 years). Four patients had bilateral symptoms. The majority (5/6) had a history of Raynaud's disease (hands: 4; feet: 1). One patient presented with Raynaud's phenomenon associated with scleroderma and mixed connective tissue disease (MCTD). All patients were managed jointly with rheumatologists and had been with medical management prior to the BoNT injections. BoNT-A was injected into the palm around the neurovascular bundle. The total mean dose was 60 units in each hand. (range 50 - 75 units). The toxin was injected around the dorsal pedis, posterior tibial and digital arteries to the toes of both feet (total 150 units/foot).
Results: All patients had digital rest pain relief, healed digital ulceration and improved function. Three patients had complete resolution of symptoms with just one treatment. One patient needed two treatments nearly a year apart, to achieve complete symptom relief. Digital ulceration in the patient with scleroderma and the MCTD has been well controlled with 6 monthly BoNT- A injections. She required a reduction of the dose of toxin, to have the same effect. There was no reported hand weakness, post-injection.
Conclusions: BoNT-A is effective in treating digital ischemia in patients with Raynaud's syndrome. The number of treatments required to achieve symptom relief is variable. The toxin dose used in our study is lower than in previous studies. Patients with scleroderma have been shown to have a poor response to BoNT injection. This may be attributable to increased sensitivity to alpha-2 adrenergic agonists in these patients. The patient in our study showed a good response, but required regular treatments to maintain symptom relief. This study demonstrated the variability in longevity of symptom relief in patients with Raynaud's disease. This information is useful in counselling patients.

A-0227 Anatomy of the direct small branches of the proper digital nerve of the fingers: a cadaveric study

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Background: The purpose of this study was to evaluate the anatomical constancy of the direct small branches of the proper digital nerve.
Methods: A total of 208 digital nerves of the index, long, ring and little fingers from 13 cadavers were studied. For each digital nerve, the number of direct small branches was counted at the proximal and middle phalanx levels. In addition, the diameter of these branches was measured at the level of the branch bifurcation. We also measured the diameter of the proper digital nerve at the level of the distal interphalangeal (DIP) joint.
Results: The direct small branches of the proper digital nerve were anatomically constant among the index, long, and ring fingers. The average number of direct small branches was 2.7 at the proximal phalanx level and 2.3 at the middle phalanx level. The average

diameter of the small branches at the level of the proximal phalanx was 0.80 mm in the index finger, 0.76 mm in the long finger, 0.66 mm in the ring finger and 0.48 mm in the little finger. The average diameter of the small branches at the level of the middle phalanx was 0.61 mm in the index finger, 0.57 mm in the long finger, 0.49 mm in the ring finger, and 0.36 mm in the little finger. At the level of the DIP joint, the average thickness of the proper digital nerve was 0.85 mm in the index finger, 0.84 mm in the long finger, 0.72 mm in the ring finger and 0.49 mm in the little finger.
Conclusion: In this study, we verified the anatomical constancy of the direct small branches of the proper digital nerve. The size of these branches at the proximal phalanx level was similar to that of the corresponding proper digital nerve at the level of the DIP joint. Therefore, these nerve branches at the proximal phalanx could be applied to the creation of various sensate flaps in reconstruction of fingertip injuries.

A-0230 Advancement towards non-invasive naturally-controlled robotic hand prostheses

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Objective: Nowadays, prosthetic hands with advanced mechanical features do exist; however, the control systems allow controlling only a few movements, with unnatural sequential strategies. The application of machine learning techniques to analyse the sEMG signals seems promising, but it is far from practice, due to the heterogeneity of the studies and the lack of data. In this work, we describe the results and the clinical applications obtained from the analysis of Ninapro, the largest sEMG database of hand movements. We show that relationships between several clinical parameters and robotic hand control capabilities by sEMG do exist, thus laying the foundations for innovations in neuroscience, phantom limb pain treatment, amputation surgery procedures and, of course, hand prosthetics.
Methods: We had 11 transradial amputated subjects participate in this study. All subjects except one were originally right-handed. The amputated arm is the right one in seven cases and the left one in three cases, while one subject underwent a bilateral amputation. All subjects underwent amputation due to traumatic injury, except for one who was amputated due to a tumour. Data were acquired under the final version of the NinaPro acquisition protocol (1). For all the subjects, we recorded age, weight, height, percentage of the remaining forearm, time elapsed since the amputation, intensity of phantom limb sensation (0 - 5, subjective scale), prosthesis use and Disabilities of the Arm, Shoulder and Hand (DASH) score (2). During data acquisition, the subjects were asked to mimic, with the missing hand, 50 movements shown on the screen of a laptop. Muscle activity was recorded with 12 double differential sEMG electrodes located on the forearm. The sEMG signals of the movements were classified with machine learning techniques and the results were statistically analysed, to reveal the relationship with clinical parameters.
Results: The accuracy of the classification of 40 movements is in some cases higher than 60% and it is possible to select up to 11 movements that are classified with an accuracy higher than 90%. The capability of the subjects to reproduce the movements is significantly related to several clinical parameters (including, for example, the intensity of the sensation of phantom limb), introducing new questions about the relationship between these parameters and amputation. Finally, several subjects reported an increased feeling of muscle control during the acquisition.
Conclusions: The described results could improve the prognosis for the subjects, by reducing the discomfort related to the amputation and improving the rehabilitative capabilities offered by modern prostheses. The relationship between classification accuracy and clinical parameters added new information regarding the nature of phantom limb sensation, introduced questions about the evolution of the nervous system in the amputated arms, and suggested that future surgery procedures could improve the natural control of robotic hand prostheses, in many different movements.

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A-0232 Total wrist fusion in the treatment of Kienböck's disease: functional assessment

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Objective: Kienböck's disease (KD) or lunatomalacia is defined as idiopathic avascular necrosis of the lunate. It is agreed to provide a conservative treatment before Stage 3B of Lichtmann's scale. Moreover, except for the shortening of the radius when the distal radioulnar variance is negative, there is no therapeutic consensus. The objective of this work was to evaluate subjective outcomes of total wrist fusion (TWF) in the treatment of Kienböck's disease.
Method: From June 1994 to December 2009, 33 patients had been treated for lunatomalacia in our department. Among them, 15 patients were rated 3B or 4 by the Lichtmann classification. They all had been consecutively treated, by the same senior surgeon and with TWF, and were retrospectively included in this study. Preoperative data were: pain assessed by visual analogue scale (VAS) and radiological stage of the disease, according to Lichtmann. The preoperative mean pain score was 7.4 (4 - 10) and the cases were divided into six with Stage IIIB and nine with Stage IV. After obtaining informed consent, a functional assessment was retrospectively performed, with a mean follow-up of 71.6 months (18 - 180). A short postoperative follow-up confirmed the fusion in all cases. The final assessment relied on a phone questionnaire and Quick Disabilities of the Arm, Shoulder and Hand DASH (QuickDASH) self-assessment, sent by mail. There was no loss to follow-up. The phone assessment focused on pain, loss of strength ratio compared to the contralateral side and overall satisfaction with the procedure.
Results: At the final follow-up, one patient was disappointed and 14 were either satisfied (7 cases) or very satisfied (7 cases). The mean pain score with VAS was 2/10 (0 - 6.5), and the mean strength was 82 % (50 - 100%) of the contralateral side. The mean QuickDASH score was 22 (12 - 35). All patients resumed the same work, except one. He was a manual worker, of 58 years and very satisfied without pain.
Conclusions: TWF is a reliable and efficient therapeutic option for advanced KD. As highlighted by several authors, in self-assessment, pain is of higher importance than the wrist motion, and an arc of motion is not absolutely necessary for normal upper extremity function. We believe that TWF should be proposed as an alternative option to partial wrist fusion in advanced KD.

A-0233 Accuracy of preoperative triplanar measures for cubitus varus deformities in adults: comparison with 3-D analyses

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Cubitus varus deformity consists of varus, internal rotation and extension components. When corrective osteotomy is indicated, three components of the deformity should be measured preoperatively; however, it is unclear whether the clinical and conventional radiological measures correctly refer the triplanar deformities in adults. This study aimed to evaluate the accuracy of clinical and radiological measures of assessing the deformities in adults. Three-dimensional (3D) bilateral humerus models were developed, using customized software from the bilateral humerus computed tomography (CT) images of 20 adult patients (⩾ 19 years) with cubitus varus from previous humeral supracondylar fractures in children. We assessed the true varus, internal rotation and extension components of the deformity by superimposing the 3D bone model onto a mirror-image model of the contralateral normal humerus. Values obtained from physical measurements (carrying angle, internal rotation angle (IRA) of the shoulder and extension of elbow), and radiographic measurements (humerus-elbow-wrist angle (HEW-A) and tilting angle (TA)), were compared with those from the 3D modeling method.
Mean varus deformity angle was 29.4 ± 5.6° measured by carrying angle difference, 28.7 ± 6.1° measured by HEW-A difference, and 25.1 ± 7.8° as measured by the 3D modelling method. Mean internal rotation deformity angle was 8.5 ± 12.8° as measured by IRA and 12.5 ± 11.7° by the 3D modelling method. Mean extension deformity was 1.6 ± 3.6° as measured by difference in extension, 10.2 ± 12.1° measured by difference in TA and 8.2 ± 12.0° by 3D modelling. When the 3D measurement was considered accurate, only the varus component of cubitus varus was measured accurately by physical and radiological evaluation. The extension component was measured accurately only by radiologic evaluation. However, the internal rotation component of the deformity could not be measured accurately, preoperatively. So, if correction of the rotational component of the deformity is considered, then CT images should be taken to quantify the rotational component of the deformity, preoperatively.

A-0235 Assessment of immunologic, proangiogenic and neurogenic properties of the human peripheral nerve epineurium for potential application in prevention of neuroma formation

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Objective: Transplantation of the epineural sheath may support nerve regeneration after traumatic nerve injuries; however, one of the unsolved problems following nerve injury is the development of painful neuromas. New technologies supporting nerve regeneration in poly-trauma patients suffering from painful neuromas at their surgical, hand or lower limb amputation sites are needed. Natural biologic material, most immunologically neutral, would be appropriate as a protective barrier following nerve injury. We assessed the immunologic, neurogenic and proangiogenic properties of the human epineurium for potential application in prevention of neuroma formation.
Materials and methods: We examined 28 nerve samples, obtained from 10 deceased donors from the ilioinguinal nerves (n = 19), and nine samples taken from five sciatic nerves from limbs that were amputated due to critical limb ischemia. Cross-sectioned samples and empty epineural sheath created after nerve fascicles' removal using the pull-out technique, were prepared. The assessment included hematoxylin and eosin (H&E) for histology, and immunohistochemistry for: neurogenic (S-100, GFAP), proangiogenic (VEGF, CD31) and immunogenic (human leukocyte antigen HLA-class-I, HLA-class-II, CD3, CD4, CD8, CD68) markers.
Results: Normal architecture of nerves containing nerve fascicles surrounded by perineurium and epineurium was confirmed by H&E staining and by S-100 expression in all axons. Expression of HLA-Class I on vessel endothelium and HLA-Class II antigens on infiltrated cells was stronger in the epineurium from amputated limbs, compared to deceased donors. Single T-lymphocytes were present in the epineurium from the deceased donor, whereas in the epineurium from amputated limbs they were more abundant, often forming clusters ($\geqslant$ 50 cells). Cytotoxic CD8+ lymphocytes prevailed over the T-helper CD4+ lymphocytes. Macrophages CD68+ distributed in the epineurium and endoneurium were more numerous in sciatic nerves from the amputated limb. The vessel density of CD31+ and VEGF+ was greater in the epineurium from deceased donors, compared to these from amputated limb (3.42 ± 1.5 versus 2.57 ± 1.39; and 2.00 ± 0.99 vs 0.67 ± 0.53; p = 0.0002, respectively).
Conclusions: Immunohistochemical analysis confirmed a reduced expression of HLA Class II antigens on infiltrating cells and reduced number of T lymphocytes, and greater vessel density in epineurium from deceased donors, demonstrating less immunogenic and higher proangiogenic properties of the epineurium from deceased donors over an amputated limb, which may serve as a potentially biologic material for prevention of neuroma formation for allogenic recipients.

A-0236 Vascularized pedicle bone graft for treatment of humerus supracondylar nonunion

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Introduction: Treatment of humerus supracondylar nonunion is open reduction and internal fixation with bone graft. In cases of a history of infection in the short distal segment, and several previous surgery and sclerotic soft or bone tissues, a viable bone graft is superior to a traditional graft. Radial forearm bone flap (RFBF) and posterior interosseous bone flap (PIBF) are two of vascularised pedicled bone grafts that had been used for forearm nonunions. We reviewed our patients, who underwent forearm vascularized bone graft for treatment of a humerus supracondylar nonunion.
Material and methods: We found 12 patients in our archives that were treated for humerus supracondylar nonunion with radial forearm or posterior interosseous bone flaps. The patient's files were reviewed for the indication of the vascularized bone flap, the final result for union, the elbow range of motion (ROM), and elbow Mayo score.
Results: There were 12 patients with humerus nonunion, with previous 0 - 6 (mean 2.8 surgery), from 28 - 67 (mean 52.3) years old whom were found with at least 7 months follow-up in our archives. The indication of this operation was current or previous infection in four cases, small or comminuted distal segment in five cases and sclerotic nonunion in three cases. In six cases we used RBBF and in 6 cases, PIBF. All of our cases united. Total elbow range of motion (ROM) was 45 - 120° (mean 98°). There was not any complication of the donor site. Elbow Mayo score was 65 - 95, in the last follow-up session.
Conclusion: Forearm vascularized bone flap is a reliable bone graft source for difficult elbow nonunions.

A-0237 Rhizoarthritis treatment with pyrocarbon spacer

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Objective: The goal of rhizoarthritis treatment is a functional reconstruction of the thumb column, sparing

the tissues and the normal anatomy. By keeping the length and preserving articular motion, it is possible to eliminate pain and restore good hand function.

Methods: We surgically treated by TM arthroplasty with a pyrocarbon spacer (Pyrocardan) 92 patients (71 women and 21 men). Their mean age was 57 years. Preoperative examination showed a mean for pain of 7.2 on the analogue scale (EVA\10), and a mean Disabilities of the Arm, Shoulder and Hand (DASH) score of 55.6. X-rays showed there was limited TM arthritis, at Stage 1 and 2 of the Dell classification, in 86 patients. Six patients showed a Grade 3 arthritis, but we decided to proceed with the Pyrocardan, due to age (⩽ 55 years) and functional needs. Pyrocardan was positioned preferring the linear dorsal approach and sparing the capsule as much as possible. The procedure was on average, 50 minutes long. Patients were all treated in 1-day surgery, with no post-operative complications. All patients wore a personalized splint for 3 weeks. First X-ray follow-up was 21 days after the surgery. When the splint was removed, patients were given a rehabilitation schedule with exercises that they could practice by themselves. We re-evaluated patients at 3 and 6 months after surgery, with another follow-up 12 and 24 months after the implant was installed.

Results: The average follow-up period was 18 months (min 6, max 30). We evaluated 72 patients, whom we followed with clinical, radiographical and subjective evaluation. The DASH mean score to 18 months was 20, and mean pain on EVA/10 scale was 1,5

At each follow-up session, we observed a constant reduction of the pain, which was mildly persistent in the first 3 months (mean score 4.2). Complications were transitory and without clinical impact.

Upon observing the X-rays, we noticed three volar subluxations of the spacer at 12 months, all in patients with grade 3 osteoarthritis. The clinic was good. We observed that the length of the thumb was maintained, similar to its contralateral. No rotation flaw nor articular misalignment was visible.

Subjectively, 41 patients were very satisfied, 24 were satisfied, five partially dissatisfied and two very dissatisfied.

Conclusions: Our post-operative work let us affirm that the above treatment allows the anatomical sparing of the thumb, with length keeping and important tissue sparing, due to the minimally invasive procedure. The pinch strength was also almost recovered, and we also obtained a good grip strength. The pain had disappeared, mostly during sleep and rest. The procedure seemed to be indicated in symptomatic Dell Grade 1 and 2 arthritis, but could be applied also in Grade 3 for young and high demanding patients, thanks to the several options of salvage procedure, due to minimal bone loss and anatomical structure-sparing.

A-0239 Arthroscopic decompression of lunate for treatment of Kienbick disease: short-term results

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Introduction: There are several treatments for Kienbock's disease. Lunate decompression has been introduced for treatment of Grade 1 and 2, with acceptable results. Lunate decompression can be done arthroscopically. We reviewed our patients with Kienbock's disease whom were treated by arthroscopic decompression of the lunate, with at least 1 year of follow-up.

Materials and methods: From March 2011 till September 2014, we had treated 23 patients with Kienbock's disease and they had at least 12 months of follow-up. The patients underwent arthroscopic decompression from the transfour portal, followed by 6 weeks of immobilization. Radiographic stage of the disease, pain by the Visual Analogue Score (VAS Score), grip force, wrist range of motion (ROM) and Disabilities of the Arm, Shoulder and Hand (DASH) score were measured before and at the last follow-up session.

Results: There were 8 women and 15 men with Stage 1 - 3A, from 16 - 43 years (mean 31.6) of age included in this study. The VAS score decreased from 5.3 (1 - 8) to 2.1 (0 - 4). Grip force increased from 43% of the contralateral hand to 76%. Total range of flexion-extension increased from 47° to 62°. The DASH score decreased from 78 to 23. There was no patient in this group with an increasing radiographic stage of the disease.

Conclusion: arthroscopic decompression of the lunate can improve the clinical manifestations of Kienbock's disease. This technique can be offered to the patient as an alternative treatment.

A-0240 Total wrist arthroplasty versus Amandys

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Total wrist arthroplasty is performed for painful radio and/or mediocarpal arthritis. In this study, we have assessed the patients with total implants (RE-Motion, 26 cases) versus Amandys (10 cases). The average follow-up was 6.5 years for the RE-Motion and 3.5yrs for Amandys models. Significant improvements were

seen in both groups, in the Quick Disabilities of the Arm, Shoulder and Hand (Quick-DASH) and the pain score with the Visual Analogue Score (VAS). This was a little less for RE-Motion). Survivorship was 95% and 100%, respectively; and the post-operative VAS were 3 and 1.5, respectively. One RE-Motion was removed for infection and another one revised, for synovitis.
Four RE-Motion had some lucency around the radio or carpal components (but not much was symptomatic). Grip strength decreased in both, but more in RE-Motion, and the range of motion (ROM) was better in Amandys. At present, we prefer to implant Amandys in a stable wrist with effective bone stock, because it is less invasive than a total implant.

A-0242 Acellular dermal substitutes or skin flaps: How to choose the best reconstructive solution?

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Objective: In the last decade, regenerative surgery has progressively increased its interest in the hand surgery field. The possibility to build a dermal thickness through the use of biological scaffolding directly applied over traumatic or oncologic loss of tissue gives the hand surgeon a new, seductive instrument that allows simplifying and reducing the reconstructive time and minimizing donor site morbidity.
Methods: In the Clinic of Plastic Surgery of Padova University, a prospective registry (175 patients) was kept during the past 5 years that catalogues patients whom presented deep wounds with complex soft-tissue loss and were treated with Integra™ grafts. Comparative analysis between upper limbs' complex injuries at different anatomical sites treated with any surgical flaps and Integra grafts was carried out, recording the functional recovery and the quality of donor site scars.
Results: In 39 patients (mean age 38.3 years) who presented post-traumatic defects, localized on upper limb, multiple layers of Integra™ were serially applied (mean surface of Integra™ grafts: 20.9 cm^2). Final skin grafts were applied between the third and fourth week (mean 23 days), and long-term follow-up (mean, 36 months) showed good restoration of tissue contour and satisfactory functional recovery. All full-thickness pulpar wounds showed a reconstructive indication with neurovascular digital flaps and presented satisfactory sensitive recovery at long-term follow-up.
Conclusions: The regenerative dermal layer, obtained progressively in 3 weeks, was effectively able to cover poor vascular surfaces such as tendon or bone exposures. Secondary split-thickness skin grafts obtained a definite cover, even in large loss of tissues. The clinical experience with Integra grafts demonstrated effective salvage of several complex injuries, by protecting the exposed tendons, bones and joints; and gave unexpected morphologic restoration in critical anatomical areas such as pulpar or articular regions. On the contrary, the use of homo- and hetero-digital neurovascular flaps, composite pedicled or microsurgical flaps showed their benefits in the treatment of multiple tissues' lesions and full-thickness pulpar defects. These observations, along with further investigations, may contribute to the development of knowledge of the healing process of wounds treated with acellular dermal substitutes, giving to the modern hand surgeon the capacity of adapting the best surgical solution to any clinical condition.

A-0246 Surgical treatment of thumb duplication: evaluation of results and complications

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Introduction: Thumb duplication is classified as a pre-axial polydactyly and represents one of the most common congenital malformations of the hand. The aim of our study is to analyse results and complications that occurred in a 5-year period after operative treatment of congenital bifid thumb.
Materials and methods: From June 2008 to June 2013 in our hospital, we treated 22 thumb duplications in 20 patients (13 male patients and 7 female) with a mean age of 14 months at surgery (range 11 - 17). According to the Wassel classification, 11 patients had Type IV duplication, seven patients had Type III and four had Type II. All patients were treated by two senior surgeons, with removal of the radial thumb and reconstruction of the dominant one. Every patient was clinically and radiologically evaluated using the Tada scoring system and plain X-ray, with a mean follow-up of 38 months (range 12 - 60).
Results: The average Tada score was 4.1, after a mean 38 months of follow-up. Nine patients (41%) developed minor complications: Two had clinodactyly for MP or IP instability, one had nail dystrophy, four had scar hypertrophy, one had Z deformity and three had EPL deficits. A second operation was necessary in seven patients (32%): three excisions of the scar with Z plasty, one RCL reconstruction at MP, three EPL retensions, and one corrective osteotomy for Z deformity.

Conclusions: The percentage of reoperated patients (32%), although high, is comparable with the literature (11 - 37%). In most cases, complications are minor and affect soft tissues. This is due to the difficulty in studying soft tissues before surgery, and their treatment is closely related to the intra-operative assessment and surgeon's experience. EPL lag is difficult to treat and in our experience, tends to return after retension.

A-0247 Surgical treatment for malunited intra-articular fractures of the distal radius

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Objective: Post-traumatic intra-articular incongruity of the distal radius may cause an arthrosis and dysfunction of the wrist. The purpose of this study was to evaluate the results of surgical treatment of patients with malunited intra-articular fractures of the distal radius.
Methods: We evaluated 12 patients (5 men and 7 women, average age 40) with 12 malunited intraarticular fractures of the distal radius (2006 - 2014) in approximately 16 months after corrective osteotomy. The average interval between the injury and surgery was 4.9 months. According to the AO classification, there were two B1, five B3, three C2 and two C3 fractures. According to the classification system of Frykman, there were four Type III, three IV, one VII and four Type VIII fractures. The maximum step-off or gap of the articular surface prior to the operation was 6.5 mm. Two patients had dorsal and four patients had volar subluxations of the radiocarpal joint. In nine patients, an intra-articular corrective osteotomy was performed, in three there were combined intra-articular and extra-articular ones performed. An osteosynthesis of the distal radius using locking plates was performed in all patients.
Results: In 1 year after the operation, 11 patients showed excellent and good outcomes: 91.7% (Cooney-Krimmer score), nine patients, 75% (Martini score). The rates of Disabilities of the Arm, Shoulder and Hand (DASH) questionnaire were prior to the operation, with an average of 57.43 ± 3.90 points; and after surgery 14.21 ± 2.43 points ($p \leqslant 0.001$). Radio-ulnar inclination increased from 11.50 ± 3.03° preoperatively, to 21.88 ± 1.0° ($p = 0.005$) postoperatively. Palmar inclination improved from 22.40 ± 3.90° and – 37.00 ± 2.00, prior to the operation, to 11.50 ± 0.87° ($p = 0.020$) and 9.00 ± 1.00° ($p = 0.014$), postoperatively. Preoperative ulnar variance of 4.17 ± 0.77 mm was decreased to 0.17 ± 0.46 mm ($p = 0.001$), postoperatively. Intra-articular step-off was corrected from 4.08 ± 0.31 mm to 1.07 ± 0.19 mm ($p \leqslant 0.001$). Preoperative active range of motion (ROM) of the wrist and forearm was 53.69 ± 3.62% of the other side, postoperative was 83.75 ± 1.96% ($p \leqslant 0.001$). Pre-operative grasping power was 32.44 ± 7.31%; postoperative was 79.25 ± 3.28% ($p \leqslant 0.001$) of the contralateral hand. Complications included: one postoperative carpal tunnel syndrome (CTS), one complex regional pain syndrome (CRPS), and one superficial median nerve irritation. Three patients had radiographic signs of radiocarpal arthrosis. Fixators were removed from three patients.
Conclusions: The corrective osteotomy for intra-articular malunion of the distal radius enables the surgeon to restore the radiographic parameters, improve the functionality of the wrist and decrease the amount of complications.

A-0249 Combined muscle-in-vein graft for microsurgical nerve reconstruction in the distal one-third forearm, hand and fingers

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Objective: The purpose of this study is to compare the results between muscle-in-vein graft and the classical techniques: the Jabaley epineurial splint or nerve grafts.
Methods: Between 2001 and 2014, we applied the muscle-vein technique in 21 cases for sensitive branches of nine median, eight ulnar and four sensory radial nerves. The forearm offers a generous venous bank in the same operative area. A vein of the same length of the nerve gap and the appropriate diameter with the recipient nerve is harvested; it is then filled with a piece of muscle with its fibres longitudinally oriented.
For the nerve defects (1.5 - 2.5 cm), sometimes it is difficult to choose the microsurgical technique between direct neuropathy in tension, and defect reconstruction by a nerve graft. The tension on the suture line is avoided by the Jabaley epineurial splint technique. The epineurial splint is created on the profound side of the nerve connected to the mezonerve, restoring the epineurial vascular support. The two flaps (proximal and distal) of the epineurial splint are tailored to be unequal. Thus the FG's suture line will be performed at a different level. Sometimes the

structure of the epinerve and post-traumatic modification make impossible to use the Jabaley technique. In these cases, harvesting a cutaneous nerve to be used as a nerve graft for reconstruction of the sensitive nerve defect has several drawbacks (new incision in other sites, skin scar, sensory loss in the donor area, risk of neuroma formation). This is why the combined muscle-in-vein graft represent a better solution, like Battiston demonstrated in 2002.
Results: The late results of the classical techniques: the Jabaley epineurial splint technique (46 cases), nerve grafts using the sural nerve (63 cases) and the muscle-vein graft (21 cases) were similar, with a S3 - S4 recovery of 86%.
Conclusions: We recommend the muscle-in-vein technique for short defects in sensory nerves in the fingers, hand and the distal forearm, due to comparable results with the standard techniques and the absence of any donor site morbidity.

A-0252 Modified Sennwald-Della Santa shortening osteotomy of the distal ulna: surgical technique and results of 10-patient retrospective study

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Introduction: Ulnocarpal abutment is a common condition. There are different surgical methods of treatment for this pathology: open and arthroscopic Wafer procedure and ulnar shortening osteotomy. This article describes a modified fixation technique with two cannulated headless compression screws of the distal metaphyseal oblique osteotomy of the ulna. We report the results of 10 patients treated with this method.
Materials and methods: Patient-rated outcomes were measured using Visual Analogue Scale (VAS) for pain, Patient-Rated Wrist and Hand Evaluation (PRWHE) survey and Quick Disability of Arm, Shoulder and Hand (Quick-DASH) survey for functional outcomes. At the time of final follow-up, we measured the range of motion ((ROM) like extension and flexion, ulnar and radial deviation, pronation and supination). Grip strength, pronation and supination strength were measured using a hydraulic dynamometer. ROM and strength of the affected wrist were compared to ROM and strength of the unaffected wrist. Surgical procedure: Oblique metaphyseal osteotomy of the distal ulna, fixed with two cannulated headless compression screws.
Results: The average postoperative VAS for pain was 23.71 (SD of 30.41). The average postoperative PRWHE score was 32.55 (SD of 26.28). The average postoperative QuickDASH score was 28.65 (SD of 27.21). By most patients, the ROM and grip strength of the operated side were comparable with the unaffected side.
Conclusions: The potential advantages of our surgical technique are the lesser amount of osteosynthesis material and the smaller incision. The oblique direction and the metaphyseal location of the osteotomy potentially allow shorter time for union.

A-0255 A new ulnar bridge plate as a new device for ulnar shortening with guided bone osteotomy: techniques and results

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Introduction: Ulnar-sided wrist pain is a common reason for attending hand surgery centres. Pain is mainly experienced in the dorsal and ulnar aspect of the wrist, and is exacerbated on pronation, extension and ulnar deviation. A common feature of such pain is positive ulnar variance, which may be idiopathic or may occur secondarily, due to malunion after distal radius fractures or premature closure of the radial physis in the immature skeleton.
This condition increases force from the ulnar caput to the triangular fibrocartilage complex (TFCC), triquetrum, lunate and lunotriquetral intraosseous ligament, which is typically seen on radiographs as cortical sclerosis and subchondral changes. In a later stage, the patient may experience carpal chondromalacia.
Surgery for ulnar shortening has been transformed in the last few years. A number of technical options are available: the Darrach procedure, the Bowers procedure, matched ulnar arthroplasty, the Feldon procedure and the Sauvé-Kapandji procedure. A common feature of all methods is correction of radioulnar length discrepancy and consequent reduction of pain. The main aim of this study was to present on one hand, the ulnar shortening technique with the new RECOS® bridge plate, and to analyse, on the other hand, the outcome after ulnar shortening.
Material and methods: All patients who underwent guided ulnar-shortening osteotomy between 2009 and 2011 were analysed retrospectively. Data concerning

age, gender, range of motion (ROM), grip strength, pain, follow-up interval, the reason for the ulnar impaction syndrome, and the length of ulnar shortening were collected for statistical analysis. The *t*-test for paired samples was used to determine significance in pre- to post-surgery improvement of the ROM.
Results: Overall, 16 ulnar shortening osteotomies were performed from 2009 - 2011. The patients' mean age was 50 ± 14 years. Fourteen operations (87 %) had been performed, because of a post-traumatic ulnar impaction syndrome and two, because of a degenerative ulnar impaction syndrome. There were 62% of the patients who were men and 38%, women. The mean duration of follow-up was 350 days. At follow-up, the ROM improved in all planes; improvements in the sagittal plane ($p \leqslant 0.01$) and in forearm rotation ($p \leqslant 0.05$) were significant. On average, the patients had a pre-operative ulnar variance of 4.25 ± 2 mm. Mean ulnar shortening was 5.12 ± 1 mm. We found that 75% of the patients had no symptoms at the follow-up. The remaining three patients experienced a significant reduction in pain after the operation. Plate removal was required in three patients. All osteotomies had healed at the last follow-up investigation. No complications were encountered.
Conclusion: Guided ulnar shortening osteotomy improves the patients' ROM to a significant extent and also reduces symptoms. In the present study, the patients' ROM in the sagittal plane and forearm rotation were significantly improved. The new method of ulnar shortening osteotomy is an easy and safe procedure for the treatment of ulnar-sided wrist pain.

A-0256 Long-term outcome after volar radioscapholunate arthrodesis with resection of the distal scaphoid pole in malunited distal radius fractures

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Introduction: Distal radius fractures are increasing in their incidence, especially in women, with age. These fractures are the most common upper-extremity fractures. Current standard therapy is open reduction and internal fixation with a palmar locking plate; however, if internal fixation fails, the fracture progresses to malunion and leads to bad clinical results and finally, results in a degenerative joint disease. Different operative treatment options are available, like wrist denervation, total wrist arthroplasty, total wrist arthrodesis, and limited or total wrist arthrodesis. Radioscapholunate (RSL) arthrodesis is performed if the post-traumatic joint arthritis involves the radiolunate and radioscaphoid joints, with normal midcarpal joints. Both RSL arthrodesis with resection of the distal scaphoid pole as without, are described in the literature; however, additional distal scaphoid pole resection leads to better clinical and a higher fusion rates of RSL arthrodesis.
Materials and methods: We had 16 patients undergo a volar RSL arthrodesis, in the years 2006 – 2009: these were retrospective analysed. For statistical analysis, age, gender, range of motion (ROM), grip strength measurement, pain according to the visual analogue scale (VAS) and follow-up interval were collected. Hand function was analysed according the Patient-Rated Wrist Evaluation (PRWE); Quick Disabilities of the Arm, Shoulder and Hand (Quick-DASH); and Mayo Score. We performed radiological examinations to document union. The surgical technique contains a volar approach, previously placed hardware removal if necessary, distal scaphoidectomy, cancellous bone graft and radioscapholunate arthrodesis with a locking frame plate, placing each of two screws in the lunate and the scaphoid.
Results: The average age of the patients was 50.6 years (range, 41 - 66). In the computed tomography (CT) scan at follow-up, there was no pseudarthrosis. One case of midcarpal arthrosis occurred and was related to the surgical procedures. The clinical results showed pain relief in all cases. Residual function covers a 51° flexion-extension arc, 21° radial-ulnar deviation arc and 60% of grip strength, compared to the contralateral side.
Conclusions: The palmare radioscapholunate arthrodesis showed, in cases of malunion and hardware irritation after volar plating of the distal radius, a good option to reduce pain and achieve good residual wrist motion and grip strength.

A-0257 Early functional aftercare of operatively stabilized distal radius fractures: a prospective randomised pilot trial

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Introduction: In the last decades, operative treatment of distal radius fractures became the standard therapy.

The main reason for open reduction and stabilisation with a palmar locking plate is the possibility for early postoperative mobilisation. There are only a few studies that compare early postoperative mobilisation after radius fractures against cast immobilisation. The main aim of this study was to investigate if early postoperative mobilization leads to a better clinical outcome than cast immobilisation.

Materials and methods: We included 30 patients with operatively-treated distal radius fractures in the years 2010 and 2011 in this study, and randomised them into two groups. One group ('early mobilisation') received a removable plastic cast for 1 week and was allowed to move the wrist directly, postoperatively. The other group (control group) received a non-removable cast for 5 weeks. Both groups underwent physiotherapy two times a week. The control group was only allowed to move the close-by joints. In postoperative Week 6, 9 and 12, one half year and 1 year after the operation, the patients underwent a range of motion (ROM), grip strength measurement and pain test, according to the visual analogue scale (VAS). Hand function was analysed according to the Patient-Rated Wrist Evaluation (PRWE); Quick Disabilities of the Arm, Shoulder and Hand (Quick-DASH); and Mayo Scores.

Results: Early functional postoperative treatment leads to significantly better results in grip strength ($p \leqslant 0.01$) and active ROM in the dorsal extension ($p \leqslant 0.05$) as well as palmar flexion ($p \leqslant 0.01$). Up to the Week 6 after surgery, early functional treatment showed significantly better results in hand function tests. There had been no differences in pain intensity between both groups.

Conclusions: Early postoperative mobilisation after distal radius fractures leads to better functional outcomes than cast immobilisation, with no significant increase of the pain intensity.

A-0258 Economic consequences of distal radius fractures in the elderly and strategies for prevention

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Introduction: Distal radius fractures are increasing in their incidence, especially in women, with age. These fractures are the most common upper-extremity fractures in individuals over the age of 60 years. There are different therapeutic options and they are discussed as controversial in the literature, especially in elderly patients. Stable fractures can be treated by closed reduction and cast immobilisation, but for unstable fracture, additional fixation is needed.

Falls are the leading cause of injuries in adults over 60 years of age. Fall-related injuries are a major cause of morbidity and mortality. It's well known that two-thirds of those who fall, will fall in the next 6 months again. The most serious effect of falling is the loss of independence. About 50% of those who sustain a fall-related injury will be discharged to nursing homes.

Materials and methods: All patients over 60 years of age, who suffered a distal radius fracture and were treated at the L Böhler Trauma Hospital in Vienna, Austria, in 2006 - 2009 were analysed retrospectively. Treatment costs were calculated and analysed. The literature was reviewed for risk factors leading to falls in the elderly and possible strategies to prevent falls in the elderly, as well.

Results: There are several risk factors like intrinsic, extrinsic and precipitating causes, which lead to a fall in the elderly. The most common causes are accident/environment-related, balance disorders, dizziness, drop attack and confusion. In the literature, some interventions for preventing falls in the elderly are described like an improvement of physical functioning, operative intervention, home modification, assessment and correction of visual disorders and stabilising footwear. The most effective intervention in 37 randomised controlled trails was exercises to improve physical function, which reduces the risk of a fall by 12% and the mean numbers of fall by 19%.

In the L Böhler Trauma Hospital, a total of 1727 patients over 60 years old with distal radius fractures were treated: 65% were treated conservatively and 35%, by surgery. The age of the patients had a significant impact on the choice of therapy. Only 9% of patients over 90 years of age were treated by surgery.

Calculating the costs of distal radius fractures in the L Böhler Trauma Hospital, each conservatively-treated distal radius fracture caused costs (by 1.202 € and operative treatment, 3.405 €) per case. So the calculated costs per year (432 distal radius fractures in those over 60 years of age) had been 851.917 €. So a reduction of 12 % would probably save 102.230 € per year.

Conclusions: Distal radius fractures are very common in people over 60 years of age, and till 2030, an increase about 50% is expected, because of a rising life expectancy. So an escalation of costs to health care is expected. There are several strategies available for reducing the risk of falls in the elderly and predicting a reduction in the risk of fall, up to 12%.

A-0259 Economical effects of complex hand injuries and their prevention

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Introduction: Complex hand injuries occur with an incidence of 5.74 in 100 inhabitants per year. They cause costs in the US of about $38,000 per patient. Complex hand injuries lead to a reduction of hand function and post-traumatic psychological restriction, and 5% of these patients have to change their occupation and another 5% retire.
Materials and methods: All complex hand injuries in the years 2010 and 2011 that had been treated in hospitals of the Austrian Workers' Compensation Board (AUVA) were analysed with respect to the time of the accident, age, profession and object causing the injury. A complex hand injury was defined as an injury with a combination of at least two injuries: fracture or dislocation fracture, vascular injury, nerve injury, tendon injury, gunshot injury or amputation.
Results: All 174,855 hand injuries were treated in hospitals of the AUVA. From these, 814 (0.5%) had been classified as complex hand injuries; 71% of these accidents occurred during leisure time activities and 19% had been accidents at work. We found that 58% of all work-related complex hand injuries happened between 26 and 50 years of age, and 42% of the patients had been in the construction and metal-working industries. Complex hand injuries most frequently happened from Monday to Thursday, at 08:00 AM. The average calculated costs per complex hand injury were 110,846 € per case. The calculated costs for the years 2010 and 2011 for complex hand injuries during work were 25,716,239 € (12,858,119 € per year). The average sick leave taken was 3.2 months per case.
Conclusions: Complex hand injuries are very rare, only 0.5% of all hand injuries, but lead to a reduction of hand function and post-traumatic psychological restriction. All hand injuries lead to a cost of 309 million € per year for AUVA, so this 0.5% of all hand injuries leads to 4.2% of all work-related lifetime costs.

A-0262 Surface coating small metal-on-metal joint replacements with chromium nitride reduces production of metal wear products

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Objectives: Metal-on-metal (MoM) articulations are still in use in the small joints of the hand and wrist. Concerns of raised metal ion concentrations locally and systemically have been raised, particularly for larger joints. Methods of reducing the amount of wear would be of interest, but have not been the subject of much study for these small articulations. Chromium nitride (CrN) coating is one means of achieving this goal, so our aim was to study a small CrN-coated MoM articulation and compare it to the standard uncoated articulation, in vitro.
Materials and methods: We tested six standard and six CrN-coated 6-mm ball and socket articulations (Motec®, Swemac Orthopaedics) in a unidirectional simulator, for 512,000 cycles (frequency 1 Hz, amplitude 45° each way from the central axis). The applied load was 5 kg. The components were tested in sealed rubber bellows containing Ringers' lactate solution; the wear products were subsequently filtered off and examined.
Results: Mean weight loss for the six standard articulations was 8.04 mg (SD 1.75), but 0.76 mg (SD 0.36) for the coated components. After filtration, 11.84 (3.08) mg and 1.17 (0.43) mg of wear products were recovered from the filter paper from the normal and coated articulations, respectively. This also included potential contaminants, like rubber particles from the bellows. Spectroscopy was done to analyse this further: we found the total sum of cobalt, chrome and molybdenum to be 5.43 (1.50) and 0.28 (0.15) mg, respectively, for the standard and coated articulations.
Conclusions: Coating the articulating components with CrN led to a marked reduction in metal wear products in a ball and socket articulation. Whilst metallosis does not seem to be as big a problem for smaller joint replacements, based on lessons learned from the use of MoM joint replacements in the hip, we believe that keeping the production of metal wear products to a minimum is important.

A-0265 Clinical results of arthroscopic repair of TFCC injury (1B) using the outside-to-inside technique

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Introduction: This is a retrospective analysis of the clinical results of arthroscopic repair using the outside-to-inside technique in triangular fibrocartilage complex (TFCC) damage (1B).
Materials and methods: Our results were derived from 43 patients whom had surgeries using outside-to-inside technique, due to palmar 1B Type TFCC damage, which was detected under the manifestation of wrist arthroscopy of patients whom do not have a history of carpal fracture, but a history of trauma, and

whom could be observed for ⩾ 6 months, from January 2010 to December 2013. At 6 weeks, 3 months and 6 months before or after the surgery, the correlations between the pain scale examination by visual analogue scale (VAS), measurement of carpal range of motion (ROM), measure of grip strength, and Mayo wrist score examination were analysed.
Results: there were 24 cases of male patients and 19 of female patients, with an average age of 39.7. The average term between the manifestation of symptoms and the hospital visit was 8.6 (4 - 16) weeks, and the average term between the hospital visit and the surgery was 4.4 (2 - 6) weeks. There was no statistical difference in carpal ROM in the physical examination before and after the surgery, but the average VAS pain score was 6.4 points before the surgery and 2.7 points, 25 weeks after the surgery. The results of the Mayo and Disabilities of the Arm, Shoulder and Hand (DASH) scores were better with a shorter period between the injury and surgery, younger age, or wider ROM before surgery ($p = 0.012$, $p = 0.014$, $p = 0.035$, respectively). There were 14 patients with fibrillation, under surgical findings. This fibrillation was observed more frequently with a shorter term between the injury and surgery ($p = 0.041$), but the Mayo and DASH scores showed no statistical difference ($p = 0.193$).
Conclusions: The result of outside-to-inside repair in palmar 1B Type TFCC damage is favourable, and it appears that faster time to operation after the injury produces good results.

A-0267 Evaluation of paediatric displaced supracondylar humeral fractures treated by transarticular external fixation

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We report on a long-term (mean 7 years; range 3 - 21 years) evaluation of 13 paediatric supracondylar displaced fractures (Lagrange-Rigault Types III and IV), treated by closed reduction and humero-ulnar external fixation. We found that 11 patients had no sequel of the fracture, a full recovery of elbow joint amplitudes and a normal carrying angle. The neurological examination was normal in all patients. There was no case of late osteoarthrosis. One patient presented a cubitus varus deformity, another a cubitus valgus. This latter patient suffered an extension lag of 30°. The overall Flynn's score was therefore excellent in 11 patients, fair in one patient and poor in one patient. The average MEPI score was 95 (SD 14), excellent. The Disabilities of the Arm, Shoulder and Hand (DASH)/mDASH score was 4.6 (SD 9.5). Humero-ulnar external fixation is an excellent treatment option for markedly displaced supracondylar fractures in children.

A-0268 Prospective randomised controlled study on the outcome of traction tenolysis in open trigger finger release

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Introduction: Surgical release of trigger finger has excellent results, with 97% complete resolution of triggering. Release is done by dividing the A1 pulley; however, after division of the A1 pulley, some surgeons perform traction tenolysis, where they lyse the adhesions between the flexor digitorum superficialis and flexor digitorum profundus tendons by pulling the tendons. A previous retrospective study by Choudhury and Tay showed that patients who had traction tenolysis done during open trigger release appeared to fare worse, in terms of total active motion (TAM) and postoperative pain, than those without and it was suggested that traction tenolysis should only be performed during routine trigger finger release when there is a specific indication, e.g. residual clicking after pulley release.
Objective: The objective of this study is to validate a previous study by performing a prospective randomized controlled trial to compare the outcome, in terms of TAM and pain, in patients who had traction tenolysis (A group) performed, versus those who did not have traction tenolysis (B group) during open trigger release.
Methods: Our randomization of patients for traction tenolysis, or not, was based on the last digit of their National Registration identity card number. TAM and pain score was recorded. Statistical analysis was done using 95% CIs and Fisher's exact test.
Results: There were 92 patients: 31 male and 61 female patients. The 114 digits were operated upon with the middle finger involvement being the highest and the most common grade of trigger, grade 3.47%, being of the digits that had traction tenolysis. The TAM of the group of patients who underwent traction tenolysis, Group A, had a higher increase in the TAM compared to Group B. It was also noted that both groups had a fairly similar incidence of postoperative pain.
Conclusions: Our preliminary results indicated that patients whom had traction tenolysis done during open trigger release appeared to fare better than those without (Currently ongoing study results based

on preliminary data obtained from the patients who had completed their series of follow-up appointments in the clinic. Target end date of study: February 2015).

A-0270 Ultrasound assessment of paediatric peripheral nerve palsies associated with close fractures in the upper limb

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Objective: To determine the usefulness of ultrasound assessment (USS) of paediatric peripheral nerve palsies associated with close fractures in the upper limb.
Methods: Retrospective analysis was performed on 53 patients seen at our children's hospital over a period of 7 years (2008 - 2014), whom had ultrasound assessment of peripheral nerve palsies associated with close fractures of the upper limb. The data was retrieved using the database from the radiology department. In the group of patients, which USS suggested had intact nerves, final outcome of nerve recovery was correlated to the ultrasound findings. In the other group of patients with peripheral nerve injuries, as indicated by USS (requiring surgical exploration), the intraoperative findings correlated to the ultrasound findings.
Results: There were a total of 46 patients included in the final analysis. Based on the ultrasound findings, 41 out of 46 (89%) patients had non-surgical management of their nerve palsies, and 5 out of 46 (11%) patients had surgical intervention of their nerve injuries. All 41 patients with non-surgical management of their nerve injuries, based on USS, had a complete recovery. Five patients underwent surgical exploration: two patients with Gartland Grade III supracondylar fractures, one patient with humerus fracture, one patient with radial head fracture and one patient with radius-ulna fracture. Intraoperative findings correlated well with USS findings. Three patients required neurolysis, one patient required nerve graft repair and one patient required direct repair of nerve laceration. All five patients had good recovery of their nerve function in their long-term follow-up.
Conclusions: Ultrasound examination of peripheral nerves provides pathomorphologic information that can aid our clinical decision-making process and identify those patients whom would benefit from surgical intervention. In our case series, ultrasound findings correlated with intraoperative findings and clinical recovery.

A-0273 Flexor tendon injuries after volar plate fixation for distal radius fractures

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Purpose: Tendon injuries are a major complication in treating fractures of the distal radius. The risk factors of injury to the flexor tendons following volar plating are: the plate being located more distal to the watershed line; and the plate moving away from the cortical bone and protruding at the volar side. We experienced 17 cases of flexor tendon injuries after treating a distal radius fracture using volar plate fixation. The radiologic locations of the volar plates in these 17 cases were analysed, and the correlation between the location of the plate and the degree of risk were also analysed through a case control study.
Methods: From March 2005 to March 2013, 17 cases in which there was damage to the flexor tendons were identified: 13 were female and the mean age of all was 64.6. The mean time of tendon ruptures was postoperatively, at 26.6 months. Of the 17 cases, four were complete ruptures and 13 were attrition injuries. In order to perform a case-control study, we had a control group, two times the pool of the subject group that were matched by gender, age range and implant. Three board-certified orthopaedic surgeons analysed the location of the volar plates using X-ray lateral imaging. As for the factors of the study, the relationship between the extent of plate protrusion and the volar critical line, as reported by Soong et al., was determined (Grade 0, 1 or 2). The distance between the plate and the volar critical line (PCL), and the distance between the plate and the volar rim of the distal radius (PVR), as reported by Kitay et al., were measured. Finally, the volar tilt angle of the distal radius was likewise measured.
Results: Of the 17 cases of flexor tendon injury, 15 cases were G1 according to the Soong grade, and two cases were G2. The mean PCL was 4.67 mm, the mean PVR was 1.89 mm, and the mean volar tilt was 1.35°. The control group showed seven cases of G0, 25 of G1, and two of G2. Their mean PCL was 1.21 mm, the mean PVR was 3.41 mm and the mean volar tilt was 9.32°. The subject group showed a higher PCL ($p \leqslant 0.001$), lower PVR ($p = 0.003$) and lower volar tilt ($p = 0.021$).
Conclusion: The authors confirmed that the risk of flexor tendon injury increases when the PCL was greater than 2.11 mm; however, the PVR, which shows how distal the plate is located, did not show any significant differences. This study had critical limitations. The mean time of plate removal in the

control group was postoperatively at 8.0 months, while the mean time of tendon ruptures was 26.6 months. This indicated that the effects of early plate removal cannot be overlooked. In conclusion, if the protrusion of the plate is ⩾ 2.11 mm and bone union is judged to have taken place, it is recommended that the plates be removed as early as possible.

A-0274 Electrical stimulation prevents axon degeneration induced by cytosine arabinoside

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Objective: Axon degeneration is induced directly by nerve injury in a process known as Wallerian degeneration. In this study, we induced axon degeneration in the dorsal root ganglion (DRG) explant culture by ara-C and verified the axon degeneration prevention effect of electrical stimulation (ES).
Methods:

1. DRG explant culture experiments were performed on neonatal 2-day old mice. DRGs were separated from the spinal cord and plated on a poly-D-lysine and laminin pre-coated multi-electrode array (MEA). The culture medium consisted of neurobasal medium, B-27 supplement, penicillin-streptomycin and L-glutamine solution. Culture medium was changed every 2 days.
2. Ara-C induced DRG axon degeneration, where the treatment in the culture medium was with 10 μM, 30 μM, 50 μM of Ara-C. Axon degeneration was observed day after day, with a Nikon eclipse TS 100 optical microscope.
3. Electrical stimulation: Explanted DRGs were stimulated continuously for 1hr at 100 μsec, 2 μA and 20 Hz, electrically, on MEA.

Results: Seven days from electrical stimulation, the electrical stimulation group was observed for morphological signs of intact axons, compared with the control group.
Conclusions: The effect of ES to primary DRG cultures prevents axon degeneration induced by ara-C, in a dose-dependent manner. In a future study, we can clarify the molecular mechanisms underlying the axon degeneration that was prevented by ES.

A-0275 Radiologic characteristics of distal radioulnar joint osteoarthritis after ulnar shortening osteotomy in idiopathic ulnar impaction syndrome

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Objective: Ulnar shortening osteotomy (USO) can result in osteoarthritis in the distal radioulnar joint (DRUJ), even though it is a key procedure for treating ulnar impaction syndrome (UIS). The purpose of our retrospective study was to investigate the radiologic characteristics of DRUJ osteoarthritis after ulnar shortening osteotomy for treating idiopathic UIS.
Methods: We retrospectively reviewed 25 patients (28 wrists) whom had DRUJ osteoarthritis after USO for idiopathic UIS, for a mean follow-up time of 45.2 months (range 12.1 - 100.4). There were 10 men and 15 women, with an average age of 41.3 years (range 21 - 53). The plane radiography of the wrist was checked up on, at regular intervals after surgery. Osteoarthritis of the DRUJ was assessed, based on the presence of any osteophyte or joint space narrowing in the DRUJ. We observed the radiologic pattern of DRUJ osteoarthritis progression; and the radiologic differences of DRUJ osteoarthritis, according to Tolat's DRUJ typing.
Results: The time of occurrence of DRUJ osteoarthritis was a mean of 5.8 months (range 2.0 - 15.3). The radiologic pattern of DRUJ osteoarthritis progression was constant in all patients, regardless of DRUJ type, and could be staged as follow:

Stage 1. Osteophyte formation on proximal ulnar head; Stage 2. Subchondral sclerosis between ulnar head and radial sigmoid notch; Stage 3. DRUJ remodeling and joint space narrowing; and Stage 4. Osteophyte formation on proximal sigmoid notch.

The direction of osteophyte and DRUJ configuration, after DRUJ remodelling, was different according to the DRUJ type. In the parallel type, the direction of osteophyte was parallel to the longitudinal axis of the forearm and the DRUJ configuration was preserved. In the oblique type, the direction of osteophyte was radial and the proximal direction and the DRUJ configuration was also preserved. In the reverse oblique type, the direction of osteophyte was radial and the DRUJ configuration was changed to a figure-S configuration.
Conclusions: The radiologic pattern of DRUJ osteoarthritis progression was constant, regardless of DRUJ type; however, the direction of osteophyte and DRUJ

configuration after DRUJ remodelling was different, according to the DRUJ type.

A-0282 Kienböck disease: 10-year and 25-year follow-ups of intra-carpal and extra-carpal unloading procedures

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Objective: Between 1986 and 1991, STT fusion was our unloading procedure for the surgical treatment of Kienböck's disease. The procedure was then dismissed in favour of radial shortening (RS), due to the risk of secondary radio-scaphoid arthrosis. The aim of this study was to evaluate the long-term clinical results of both STT fusion and RS in patients affected by Kienböck's disease, and to assess the long-term radiographic changes.
Methods: Between 1986 and 1991, nine patients underwent STT fusion for Kienböck's disease at Stage II, IIIa and IIIb. Between 1992 and 2005, there were 14 patients with the same indications who underwent RS. We reviewed six STT patients at the 18 - 24 year follow-up; and nine RS patients at the 10 - 14 year follow-up.
Results: All patients but one were satisfied and returned to work 4 - 5 months after the surgery. The Disabilities of the Arm, Shoulder and Hand (DASH) score was equal in both groups (mean was 16.5 for the STT and 16 for the RS patients). Grip strengths were 84%, as compared to the unaffected hand, in both groups. Wrist flexion-extension range of motion (ROM) was 100° (opposite wrist: 154°) for the STT and 134° (opposite wrist: 178°) for the RS patients. The Mayo Wrist Score was good in three and fair in three STT patients; and in the RS patients, it was excellent in two, good in five and fair in two patients. Radiographic assessment showed there were minimal degenerative changes in the radio-scaphoid joint of only one patient, 24 years after a STT fusion (Mayo wrist score: good).
Conclusions: Both unloading procedures, the STT fusion and RS, were assessed at a longterm follow-up date: this gave satisfactory results in the treatment of Kienböck's disease. RS interferes much less with wrist biomechanics, gives a better flexion-extension ROM and should be preferred; however, it does not seem that STT fusion produces any long-term degenerative changes at the radio-scaphoid joint, as it was feared, and so it could be considered as a second-choice unloading procedure, in case of failure of other surgical treatments.

A-0290 Efficacy and safety of collagenase treatment for Dupuytren's contracture: 1-year follow-up results

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Objectives: Dupuytren's contracture is a common hand problem that affects the palmar fascia. Fibrogenic cytokines stimulate the fibroblast to differentiate into a myofibroblast. The latter is responsible for the formation of collagen Type III, with pathologic cord formation. Contracture of the fibrous cords lead to an extension deficit of the fingers. Several treatment options exist, but none are curative and recurrence is common. Injecting the pathologic cords with an enzyme, collagenase (Xiapex™), is new treatment option that has shown promising results. The enzyme clostridial collagenase (AUX I, II) cleaves the collagen fibres at different sites, with weakening and eventual rupture of the fibrous cord after manipulation. The main goal of treatment is long-term improved extension of the fingers. We report on our 1-year follow-up results with this treatment option.
Methods: An independent, prospective follow-up study was organized with 97 patients with symptomatic Dupuytren's contracture, whom were treated with one or more collagenase injections. Inclusion criteria were a contracture of at least 20° at the metacarpophalangeal (MCP) or the proximal interphalangeal (PIP) joint. The most affected joint was taken into consideration for the follow-up evaluation. The resulting extension deficit was measured at 1 month and 1 year after treatment, by an independent observer, and was graded as a clinical success (reduction of contracture to within 0° - 5° of normal), a clinical improvement (a 50% or more reduction from the baseline contracture) or a clinical failure after 1 year.
Results: There were 74 patients available for the final follow-up evaluation and 75 joints (42 MCP and 33 PIP joints) were included in this study. The mean baseline contracture at the start of therapy was 41° for the MCP joint and 50° for the PIP joint. One month after the injection, a mean flexion contracture of 3.3° and 11.1° was seen, respectively, for the MCP and PIP joint. At 1 year after treatment, the mean flexion contracture was 10° and 27° for MCP and PIP, respectively. Clinical success was accomplished in 67% of

the MCP joints and in 24% of the PIP joints; clinical improvement was present in 21% of the MCP joints and 24% of the PIP joints. A clinical failure appeared in 12% of the MCP joints and 52% of the PIP joints. No major complications occurred and at the final follow-up assessment, 86% of the patients were satisfied and would have the treatment again, under similar conditions.

Conclusions: Collagenase injection is a safe treatment option for Dupuytren's contracture, resulting in significant improvement of joint contracture and high patient satisfaction at the 1-year follow-up; however, it is clear that it is not a permanent cure for Dupuytren's disease and that recurrent contracture following treatment is high. Results worsen with time, and the initial results immediately following treatment are not maintained after 1 year. Longer follow-up studies are necessary to evaluate the treatment and define its precise indications in the treatment of Dupuytren's contracture.

A-0295 AVM advanced strategy of treatment: 20 years of development of a combined approach

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The author shows experience in the diagnosis of arterovenous malformations (AVM), pointing out the relevance of their correct haemodynamic evaluation. This evaluation is the starting point to define the most indicated treatment of the case: the experience in reaching this objective is demonstrated, together with the classification criteria and their algorithm for treatment; therefore, the author shows 20 years of experience in treatment, demonstrating that the combined approach, which includes an initial end arterial embolisation or direct sclerotisation of the AVM, eventually followed by secondary surgery, is the most efficient treatment; in some cases, intraoperatory injection of embolising drugs help to complete the procedure. As this series has reached 107 cases, divided into the different patterns of AVM, the author's conclusion is that it is also infrequent to definitively resolve the pathology, so this kind of approach is useful to maintain the AVM under control for a long period, limiting the surgical procedures.

A-0297 Change of compression force of headless screw according to drill depth

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Purpose: A headless compression screw is useful for intra-articular fracture, because its head is made to enter the bone. Although there are many contrast studies about mechanical properties of various types of headless compression screws, compression force of headless compression screws according to drilling depth has seldom been reviewed. The purpose of this study was to evaluate the change of compression force of Acutrak® mini and Synthes HCS 3.0, which are commonly used headless compression screws, according to drilling depth.

Methods: The load cell was inserted between a 12 mm and 20 mm sawbone (grade 15 pcf (0.24 g/cm^3)) blocks, maintaining the blocks at intervals of 1mm. Following placement of the guide pin into the centre of the block, compression force was measured both immediately and 30 minutes after inserting the headless compression screw, by drilling to a predetermined depth. Drilling depths of Acutrak® mini and Synthes 3.0 HCS screw ranged from 16 mm to 28 mm; and from 22 mm to 28 mm in 2 mm increments, respectively. Compression force was measured twice at each depth, and then the average value was calculated.

Results: In the case of Acutrak® mini, compression force reached the peak at the drilling depth of 16 mm, 65.66 N/m^2 immediately after insertion and 62.92 N/m^2 after 30 minutes following insertion; whereas the compressive value was of 17.35 N/m^2 and 15.48 N/m^2, respectively, at a depth of 28 mm. Therefore, we showed a strong inverse correlation between the compression force and the drilling depth (coefficient of determination: immediately after insertion 0.9959 and 30 min after insertion 0.9977; coefficient of regression: immediately after insertion - 3.8814 and 30 min after insertion, - 3.8329). On the other hand, the peak compression force of the Synthes 3.0 HCS was 42.04 N/m^2 immediately after insertion and 33.03 N/m^2 after 30 minutes following insertion at a drilling depth of 26 mm, whereas it had a compressive value of 41.16 N/m^2 and 31.56 N/m^2, respectively, at a drilling depth of 28 mm, creating a weak inverse correlation (coefficient of determination: immediately after insertion 0.2827, 30 min after insertion 0.1342; and coefficient of regression: immediately after insertion - 0.0765, 30 min after insertion, - 0.097).

Conclusion: The Acutrak® mini provided greater compressive force when drilled to a lesser depth, while we found that there was not much change of compressive force, according to drilling depth, with the Synthes 3.0 HCS.

A-0302 A novel artificial nerve conduit: vascular vessel-containing tube with implantation of bone marrow stromal cells and decellularised allogenic basal lamina

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Objective: Although autologous nerve grafting is considered the criterion standard in treating segmental nerve defects, it has several drawbacks, including limited sources of donor nerves and donor-site morbidity. Here, we investigated the efficacy of a novel artificial nerve conduit, which contained vascular vessels, bone marrow stromal cells (BMSCs), and decellularized allogeneic basal lamina (DABL); in comparison with autografts.
Methods: We used 21 Lewis rats and five Dark Agouti rats. BMSCs were prepared from the femoral bones of a Lewis rat and expanded in vitro. DABL was prepared from the bilateral sciatic nerves of a Dark Agouti rat and were decellularized by three cycles of freezing (in liquid nitrogen) and thawing (in phosphate-buffered saline (PBS) at room temperature). We repaired 20-mm sciatic nerve defects in the Lewis rat right hind limbs with either our conduits (conduit group, n = 10) or autografts (autograft group, n = 10). In the conduit group, the gap was bridged with 20 mm DABL. The DABL and the adjacent nerve stumps were subsequently inserted into a 23 mm silicon tube, through a longitudinal slit. Then, the sural vessels were elevated in a retrograde fashion with a monitoring flap and introduced into the tube. Finally, BMSCs in medium were injected into the tube. In the autograft group, a 20 mm nerve segment was excised, inverted 180°, and resutured in situ (for a reversed autograft). At 24 weeks, we performed a walking track analysis (using a CatWalk XT); and electrophysiological, morphometric and wet muscle weight measurements. The data, except for the morphometric measurements, were expressed as a percentage of the values obtained for the intact left hind limbs. The ratios of the values in the conduit group to those in the autograft group (C/A ratios) were calculated.
Results: The walking track analysis revealed a significantly larger contact area (37.7 ± 7.3% vs. 17.8 ± 6.9%; $p \leqslant 0.05$; C/A ratio = 2.12) and higher intensity (79.6 ± 12.1% vs. 53.1 ± 19.0%; p = 0.06; C/A ratio = 1.50) of footprints in the conduit group, when compared with the autograft group. In electrophysiological measurements, the compound muscle action potentials (CMAPs) were recorded in the pedal adductor muscles in all rats, in both groups. The conduit group had greater CMAP amplitudes (64.3 ± 19.6% vs. 49.0 ± 21.3%; p = 0.11; C/A ratio = 1.31) and faster motor nerve conduction velocities (59.2 ± 12.8% vs. 57.9 ± 14.0%; p = 0.83; C/A ratio = 1.02) than the autograft group. Morphometric measurements, using transverse sections of the regenerated nerves 5 mm proximal to the distal sutures, found a smaller number (5133 ± 899 vs. 6556 ± 1991; p = 0.07; C/A ratio = 0.78) and m, p = 0.28; C/A ratio = 1.08) μm vs. 3.67 ± 0.52 μl larger diameter (3.96 ± 0.56 of myelinated axons in the conduit group. The wet weight of the tibialis anterior muscles was significantly less in the conduit group (70.4 ± 5.8% vs. 81.6 ± 3.1%; $p \leqslant 0.05$, C/A ratio = 0.86).
Conclusions: In the conduit group, the variables measured in the regenerated nerve were ⩾ 75% of the values found in the autograft group. Critical long segmental nerve defects in rats were successfully repaired with our new conduit, which contained vascularity, cells and scaffolds, although the wet muscle weight measurements indicated a slower axonal regeneration in the conduit group than in the autograft group.

A-0303 Pre-operative use of *C. botulinum* toxin to prepare patients with upper limb spasticity for tendon transfer/lengthening: a case series

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Objective: *Clostridium botulinum* toxin (BTNx) is used in upper limb spasticity to interrupt nerve stimulation by preventing the release of acetylcholine. This case series involves the pre-operative use of BTNx before definitive tendon transfer or lengthening, in order to optimize movement in patients with severe head injury (SHI) and cerebral palsy (CP).
Methods: Patients were administered BTNx into affected flexors before definitive tendon transfer/lengthening procedures. Following surgery, aggressive hand therapy input was initiated and patients were followed up in OPC.
Results: One senior surgeon performed the BTNx administration and tendon transfer/lengthening procedures at the Burns and Plastic Surgery Unit at Whiston Hospital. Five patients were treated with preconditioning BTNx before definitive surgery. Reduced painful spasticity was noted on waking from the general anaesthesia after the surgical procedure, thus reduced forces across the tendon coaptation. BTNx is reported to reduce painful spasticity in hips and erector spinae and our case series supports its use in upper limbs.

- Case 1: A 17 year old male with CP was managed with BTNx in July 2013, to manage right upper arm spasticity. Pre-conditioning was performed to FCR, FCU, PT, FDP, FDS and FPL. Definitive surgery was in October 2014, with right FCU and FPL lengthening, with FCR transfer with good outcome.
- Case 2: A 16 year old female with SHI in 2002, resulting in left hemiplegia managed with BTNx. She underwent BTNx to left FCR, PT, FDS, FDP, thenars, adductors and interossei in September 2013. Left wrist FCR transfer to ECRB and lengthening of FDP, FDFS, FPL and FCU uncovered spasticity in the intrinsic muscles, which responded to BTNx to the left APL and lumbricals.
- Case 3: A 20 year old female with SHI, resulting in right sided hemiparesis. Managed with BTNx to biceps, FCR and FDS. She underwent right FDS and FPL lengthening, right FCR transfer to ECRL and right first carpometacarpal joint fusion with K-wires. Unfortunately, the K-wires needed removal, due to discomfort, and BTNx addressed the overactive thenar muscles. A right thumb osteotomy, release of abductors and volar plate tightening was followed by BTNx to the right FPL and thenar muscles in October 2014.
- Case 4: An 18 year old female with CP, with flexed left wrist. BTNx was administered to the left FCR, FDS, FDP and FPL in September 2013; followed by FCR tendon transfer to the ECRB and lengthening of FDS and FPL. Good range of movement was noted at the wrist and the patient was able to perform bilateral tasks.
- Case 5: A 24 year old male with SHI in 2006, resulting in upper right limb spasticity, underwent BTNx to the right forearm flexors and intrinsics. He underwent tendon transfer to the right forearm, release of intrinsics, right ECU tenodesis and tendon rebalancing. BTNx was injected to the right FCR before the right FCR lengthening was performed in February 2013. Post-operative BTNx has improved the right wrist position.

Conclusion: Our case series supported the use of BTNx to pre-condition patients with upper limb spasticity before definitive surgical management. The implications for clinical practice are that a reduction in post-operative pain results in improved splint compliance and earlier instigation of aggressive therapy.

A-0306 Three-dimensional analysis of acute scaphoid fracture displacement

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Introduction: Scaphoid fractures are common, and internal fixation is the preferred treatment for displaced fractures. Quantification of the mode of displacement of the scaphoid fragments may aid in correct surgical management. Previous studies have described the relative movement between the scaphoid fragments in fractures with nonunion. The goal of this study was to analyse the movement of acute scaphoid fracture fragments and adjacent bones relative to a common coordinate system.
Methods: All computed tomography (CT) scans diagnosing an acute scaphoid waist fracture during the study period were evaluated, using the developed three-dimensional (3D) model (Amira Dev 5.3, Mercury Computer Systems, Chelmsford, MA, USA). The fractures were divided into displaced and nondisplaced fracture groups; and they were compared to a control group with no injury. Three anatomical landmarks were labelled on each of the distal and proximal fragments of the scaphoid, as well as the lunate and trapezium. Four landmarks were marked on the distal radius articular surface. Each set of labels formed a triangle, representing the bone or fragment. Virtual reduction of the fracture was conducted in the displaced fractures. A coordinate system based on the radius distal articular surface was used as a reference. The position of each bone or fragment was calculated, using six variables, representing: lateral, volar and distal motion; pronation; flexion/radial deviation; and rotation of the bone or fragment.
Results: In the displaced group, compared with nondisplaced and control groups, the proximal scaphoid fragment showed significant extension (25.1° and 25.2°; $p \leqslant 0.001$), supination (7.1° and 7.5°; $p = 0.006$) and volar motion (0.9 and 0.6 mm; $p = 0.037$). The lunate showed supination (4.6° and 5.2°; $p = 0.058$), similar to that of the proximal scaphoid fragment. The distal fragment and the trapezium showed no movement.
Conclusion: Measuring the displacement of the acute scaphoid fracture fragments and the adjacent bones relative to a common coordinate system revealed that the proximal scaphoid fragment is the one displaced, along with supination of the lunate. According to this data, concurrent reduction of the proximal scaphoid and lunate may be the more effective reduction manoeuvre. The developed 3D method can be a tool in the evaluation of the quality of reduction of the

scaphoid fracture, as well as other aspects of wrist biomechanics.

A-0310 Hypnotherapy for the treatment of complex regional pain syndrome: is it a valuable therapeutic option? A prospective evaluation

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Introduction: Complex regional pain syndrome of Type 1 (CRPS1) is related to sympathetic nervous system disorders, body image disturbances and the participation of psychological factors. The association of physiotherapy, hypnosis and MEOPA (PHM) was evaluated previously in our department to treat this syndrome, on 69 patients with satisfactory results, concerning reduction of analgesic consumption, decrease of sympathetic symptoms, and wrist and hand range of motion (ROM) recovery. The objective of this new study was to evaluate prospectively and more accurately the clinical results. Our hypothesis was that hypnotherapy would reduce the central retrocontrol stimulated during painful mobilization of the involved joints, and improve early ROM recovery.
Materials and methods: Between May 2014 and May 2015, all patients with typical hand or wrist CRPS1 were included prospectively in this study, whatever the evolution phase. A single operator performed a complete clinical and radiographic evaluation at the beginning of the protocol, and after the last session. The main evaluation criteria were: pain level (visual analogue score (VAS) and analgesic consumption), ROM (wrist and fingers), and strength with the JAMAR dynamometer (wrist strength and pinch). Secondary assessment was performed with: the Quick Disabilities of the Arm, Shoulder and Hand (Quick-DASH) score, Patient-Rated Wrist Evaluation (PWRE) score, patient satisfaction level, and details about work resumption.
Results: For the moment, 10 patients were included, seven women and three men of on average 59 years (49 - 75) of age. Eight patients were in the inflammatory phase, and two in the atrophic phase. The average duration of the sessions was 1 hour; the rhythm of the sessions was weekly or twice weekly. All patients obtained good results, after a mean of four sessions: the average VAS decrease was 4 points; the consumption of analgesic was limited to paracetamol upon request; and stiffness decreased totally for eight patients. Quick-DASH decreased 20 points on average and the PWRE score, 42 points. Wrist strength was increased by 9.75 points and the pinch, by 4.5 points. All patients but one observed a total disappearance of their sympathetic symptoms. A slight oedema and some trophic disorders persisted on a single patient. All patients were able to go back to their previous work activity. No side effect was observed; and all patients were satisfied or very satisfied with this therapy.
Conclusions: Our hypothesis was validated: hypnotherapy + physiotherapy + MEOPA have given satisfactory results on patients with CRPS1: with pain relief, ROM recovery and disappearance of sympathetic symptoms. The evolution phase of the CRPS did not seem to influence the final results.

A-0312 A comparison of histological methods for evaluating axon density in peripheral nerve: a rat sciatic nerve model

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Background: A key method in the evaluation of nerve regeneration is the evaluation of axon density in nerve cross-sections. Formal quantification of axons is classically performed by toluidine blue (TB) staining, using manual counting techniques; even though this is considerably time-consuming and more expensive than immunohistochemical or immunofluorescent techniques that are used extensively in neuropathology. Immunofluorescence staining may have the additional advantage of fluorescent techniques, of automated axon counting and differential axon counts. Our hypothesis was that by using immunofluorescent stains, axon density evaluation is comparable to TB staining.
Methods: Seven wild-type rats underwent a unilateral crush injury of the sciatic nerve. The nerves were harvested at either 1 or 3 weeks post-insult, including segments proximal and distal to the injury site, and from the contralateral (uninjured) side, the designated control. Each segment was stained with TB staining or immunofluorescent staining with axon-specific antibodies (anti-neurofilament (NF) and anti-protein-gene-product 9.5 (PGP)), or a combination of NF with anti-choline acetyl-transferase (CAT), for differential counting of motor axons. Manual axon counting, using a grid technique, and automated counts of the entire nerve cross-sectional area, were performed and compared between the groups, using Pearson as well as Spearman's rho correlation measures.
Results: We found there was a high correlation between the immunofluorescent stains and the TB

manual counts for all segments, including those distal to the injury. Comparing NF with TB yielded a Pearson's coefficient of 0.992 ($p \leqslant 0.001$) for proximal, 0.857 ($p = 0.029$) for distal and 0.977 ($p = 0.001$) for control segments. Comparing PGP with TB yielded Pearson coefficients of 0.767 ($p = 0.044$), 0.915 ($p = 0.011$) and 0.968 ($p \leqslant 0.001$) for the proximal, distal and control segments, respectively. There was a lesser, yet significant, correlation between the TB stain and the automated count of NF (Spearmans' Rho 0.52; $p = 0.019$). The CAT staining of motor neurons did not yield significant results.

Conclusions: We found that immunofluorescent staining resulted in a comparable estimation of axon counts in the peripheral nerve, as did the TB stain, regardless of the injury. Although automated techniques correlated less with the TB stain and the differential counts were not successful, this technique requires a fraction of the time while counting the entire nerve section and not only estimates using grid techniques. Immunofluorescence techniques may be a more affordable tool for the analysis of peripheral nerve injury and regeneration.

A-0315 Reconstructing the upper extremity in arthrogryposis multiplex congenita: various methods in a rare anomaly

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Introduction: Arthrogryposis multiplex congenita is seen in 1 of 3000 live births. In the classic arthrogryposis, amyotrophia congenita, the bilateral shoulder, elbow, forearm, wrist and digits may be affected. In the distal arthrogryposis variant, the wrist and the digits may be affected. The treatment is individualised in each patient, and the main goal is to increase the active range of motion (ROM) of the involved joints, enabling a better bimanual function. Our aim is to present our main treatment strategies in both the classic and distal variants.

Materials and methods: We operated on 10 patients between December 2010 and December 2014. The mean age of the patients was 9.7 years (3 - 16 years). Six patients were female and four were male. Bilateral upper extremities were involved in all of the patients, and multiple joints of only one extremity was operated on, in each session. Five patients had amyotrophia congenita, and five of them had distal arthrogryposis. In one patient with amyotrophia congenita, the wrist extension was obtained with wedge osteotomy, and the elbow flexion was managed with a triceps muscle transfer to the biceps muscle. In two patients with amyotrophia congenita, the elbow flexion was managed with a triceps muscle transfer to the biceps muscle. In two patients with amyotrophia congenita, the elbow flexion was managed with a latissimus dorsi transfer to the biceps muscle. In three patients with distal arthrogryposis, the proximal and distal interphalangeal joint contractures were released with full-thickness skin grafts. On two patients with distal arthrogryposis, the first web contractures were released with myotomies, bilobed flaps and tendon transfers. The patients were followed with postoperative splinting for 4 weeks, and an individual therapy protocol was initiated in all patients. All patients were examined, both by the operator and same physiotherapy team. Patients and their families were questioned about their functional status and passive and active ROMs were measured.

Results: All but one of the patients, and their families, were satisfied with the results, expressing improved performance in daily tasks. The contracture recurred in only one patient with distal arthrogryposis. His contractures in four digits were released with full-thickness skin grafting, 6 years after the initial Z plasty surgery. The passive and active ROM of each joint (elbow, forearm, wrist and digit) increased by at least 10%, and at most 300%.

Conclusion: If the conservative treatment with splinting and physiotherapy failed, we operated on the patients, depending on the severity of the contractures and the type of arthrogryposis. In amyotrophia that is congenital, with proximal joint involvement, we performed tendon transfers to the shoulder, elbow and wrist. Also, we released extreme contractures with tendon lengthening, and wedge osteotomies on the radius. On the other hand, in patients with distal arthrogryposis, we released the contractures with full-thickness skin grafts, Z plasties, bilobed flaps and tendon transfers. The treatment must be individualised, according to the needs of the patient, and then a team approach, with experienced hand surgeons and physiotherapists, is vital.

A-0316 Outcomes for Mason Type III radial head fractures treated by osteosynthesis

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Objective: Mason Type III radial head fractures are generally considered an indication of the need for

surgical treatment, but the surgical method required is still a matter of debate. Radial head resection is no longer performed commonly and some recent papers have reported results favouring replacement over osteosynthesis; however, a prosthesis may have its inherent drawbacks, such as osteolysis or loosening, and thus it is preferable to preserve the normal articulation and bone stock, if we can get acceptable functional outcomes with low complication rates after osteosynthesis. We have been preferentially performing osteosynthesis for Type III fractures, and in this study, we retrospectively investigated the outcomes of surgically-treated radial head fractures with sufficient data.

Methods: After exclusion, 62 patients were reviewed. The fractures were Mason Type I in four patients (6%), Type II in 32 patients (52%), and Type III in 26 patients (42%). The surgery for Type I and Type II fractures was osteosynthesis, in all cases. The surgery for Mason Type III was osteosynthesis in 19 patients (73%), replacement in six patients (23%), and resection in one patient (4%). In osteosynthesis, the fragments were fixed either with mini-screws, mini-plates, Acutrak, or K-wires. We evaluated radiologic and functional outcomes and reviewed the complications.

Results: The mean follow-up period was 16 (6 - 53) months for Mason Type I and II fractures, 24 (6 - 77) months for Type III treated by osteosynthesis, and 31 months for Type III treated by replacement. The mean range of motion (ROM) of extension-flexion and pronation/supination at the final follow-up was 6° - 128° and 72°/78° for Type I and II fractures; and 6° - 129° and 67°/73° for Type III, treated by osteosynthesis; and 5°-122° and 69°/75° for Type III treated by replacement. The mean Quick Disabilities of the Arm, Shoulder and Hand (QuickDASH) score at the final follow-up was 17.5 (2.3 - 68.2) for Type I and II fractures, 27 (2.3 - 43.2) for Type III treated by osteosynthesis, and 44.7 (27.3 - 86.4) for Type III treated by replacement. No nonunion, osteonecrosis, or postoperative infection was encountered after osteosynthesis, in our series. Radiologic arthrosis developed in 12 (33%) of Type I and II fractures, and in seven (37%) of Type III treated by osteosynthesis. Among Type III fractures treated by replacement, osteolysis developed in two patients, loosening developed in two patients, and an implant dislocation developed in one patient.

Conclusions: Although the outcomes after osteosynthesis of Mason Type III fractures were not as good as those for Mason Type I and II, they were better than those after replacement, in our cases. The functional outcomes after osteosynthesis were comparable to those after replacement in previous reports, and the complications were not as frequent as those in previous reports. Osteosynthesis is a good treatment option for Mason Type III radial head fractures.

A-0317 Articular reconstruction with osteochondral autograft from the knee joint for hand and wrist disorder

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Objective: Although osteochondral autograft from the knee joint is widely used and is a useful therapy for chondral lesions of the knee, ankle, and elbow joints; there are few reports for use in hand or wrist joint problems. We report the results of 12 cases treated with osteochondral autograft, harvested from the knee joint for hand and wrist joint lesions.

Methods: We performed 12 cases of osteochondral autograft harvested from the knee joint for hand and wrist lesions. The autograft was harvested from the patellofemoral joint with the mosaicplasty technique. The average age of the patients was 34 years old (15 - 52 years old). The average follow-up period was 32 months (15 - 52 months). Three cases of total replacements for osteoarthritis (OA) of the proximal interphalangeal (PIP) joints, two cases of total replacements for OA of the metacarpophalangeal (MP) joints, two cases of hemi-replacement for OA of the MP joints and five cases of partial replacement for the wrist joints were included in this study. The causes of the PIP joint OA were post-trauma (two cases) and unknown (one case). The causes of the MP joint OA were post-trauma (two cases), Dieterich disease (one case) and unknown (one case). The causative diseases of the wrist cases were rheumatoid arthritis (one case), infection (one case), Kienbock's disease (one case), malunion after intra-articular fracture of the distal radius (one case) and unknown (one case). We evaluated graft survival, range of motion (ROM), pain and the Disabilities of the Arm, Shoulder and Hand (DASH) score.

Results: Graft survival was verified by radiography in all 12 cases, without bone absorption. OA progression was not shown radiologically in any case. Although ROM was improved in all cases, only a little improvement was shown in some wrist cases. Visual analogue scale (VAS) of pain was improved from 70 mm preoperatively, to 15 mm postoperatively. The DASH score improved from 32, preoperatively, to 13 postoperatively.

Conclusions: Although osteochondral autograft is an established treatment for articular cartilage disorder, it is not widely used for hand or wrist disorder. Commonly-used donors are the 2nd, 3rd carpometacarpal joints or the rib cartilage; however, graft size is limited from these sites. In contrast, more than one autograft can be

harvested from the patellofemoral joint. This would mean it is suitable even for relatively large-sized chondral lesion. We concluded that osteochondral autograft from the knee joint, for hand and wrist disorder, is an easy and useful procedure. Longer follow-up is needed.

A-0318 Distal nerve effectors protection in proximal nerve lesions: babysitting technique's clinical and biological perspectives

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Objective: When proximal nerve trunk lesions occur, time plays a negative role in maintaining lost function in distal effectors, as both Schwann cells and growth factors have been proven to progressively decrease, whilst axon regeneration from the proximal trunk is progressing. Among several techniques to maintain distal effector function, are: surgical 'baby sitting' or 'neural protection', that connects the damaged nerve to a healthy trunk through a 'bridge' graft, has been revealed as a promising tool to avoid degeneration of the sensate and motor terminations, through a minor donor nerve sacrifice.
Materials and methods: Eight cases have been reported in the whole literature, the first a series from Kayikcioglu et al., the second from the same authors, and the third from Sherif and Amr. Results of each group were analysed and compared. Surgical technique: At the distal one-third of the volar aspect of the forearm, about 5 cm proximal to the distal palmar wrist crease, 4 cm of both the median and the ulnar nerve were exposed, and on both trunks an epiperineural window was opened, on both the sides containing motor fascicles, the palmar ulnar side of the median nerve and the palmar radial side of the ulnar nerve, respectively (stimulation can be used to confirm). The two windows were connected through a graft (obtained either from a cutaneous nerve of the upper limb or from the sural nerve), which was sutured to the main trunks with two 11-0 nylon sutures. In one case of a median nerve lesion, the anastomosis was performed in the palm, between the thenar motor branch and deep ulnar motor branch. The Highet-Zachary scheme was applied for motor evaluation, and a modification of the Mackinnon and Dellon Sensory Recovery Scale was used, with a static and moving 2-point discrimination test.
Results: In two series, the former from Kayikcioglu et al. (two cases, 100%) and the latter our series (one case, 50%), cross nerve grafts above the wrist were proven ineffective or at least fair, in bringing the axons distally; whereas in the Sherif and Amr series, three cases treated by bridging above the wrist showed good results, in a paediatric median nerve and an ulnar nerve (M4), as well as mediocre results in another ulnar nerve (treated 6 months after the initial trauma); the other median nerve was treated successfully by bridging graft, performed in the palm.
Conclusions: The authors point out this technique as an interesting tool for distal effector protection; they believe care in technical details (epiperineurial window, one shot cable, and stimulation in the median and ulnar nerve trunks), as well as early intervention, made this technique successful. To date, some concerns about the negative role of sensitive axons from the donor nerve, as well as the origin of the axons in end-to-side nerve sutures, have been reopened and claim further studies will better understanding and management of distal effector protection, especially after proximal trunk lesions.

A-0319 Proximal pole scaphoid nonunion: choosing reconstruction with vascularised bone graft over replacement with hemiprosthesis

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Objective: Treatment of proximal pole scaphoid nonunion frequently has a poor outcome, which motivates multiple techniques to be tried to solve this problem. Our aim was to compare two of the most well-regarded treatments on the subject: proximal pole resection followed by scaphoid hemiarthroplasty with a pyrocarbon implant and open reduction with internal fixation (ORIF), following placement of vascularised bone graft.
Methods: We ran a 3-arm retrospective cohort study in our department, from 2006 to 2013. A total of 20 patients (21 procedures) were submitted to surgery with intention to treat proximal pole scaphoid nonunion. From these, we excluded two patients, because their surgery consisted solely of a proximal pole resection. The remaining ones were: proximal pole resection followed by scaphoid hemiarthroplasty (seven procedures, two of which were performed in the same patient, in different wrists), ORIF following placement of vascularized bone graft (three procedures), and ORIF following placement of non-vascularized bone graft (11 procedures), as our control group. All patients

were men, with a mean age of 29.55 ± 10.90 years and a mean follow-up of 2.81 ± 2.74 years. Patients submitted to scaphoid hemiarthroplasty were generally older (p = 0.034). We compared the groups, regarding postoperative range of motion (ROM), pinch and grasp strength, pain as measured by visual analogue scale (VAS), function as measured by the Quick Disabilities of the Arm, Shoulder and Hand (QuickDASH, but Portuguese translation) and the Mayo Wrist Score (MWS). Statistical analysis was performed using the Kruskal-Wallis analysis of variance and the Mann-Whitney U-test, and assuming that statistical significance for $p \leqslant 0.050$. Missing data was handled through multiple imputations.

Results: Groups differed with statistical significance only on the two optional enquiries of the QuickDASH survey (work module: p = 0.014; sports/performing arts module: p = 0.032); however, comparing directly the first two groups gave different results, regarding QuickDASH scores (p = 0.017), punishing scaphoid hemiarthroplasy (median 40.90; range 32.4) over ORIF, following placement of vascularized bone graft (median 32.06; range 3.9).

Conclusions: No major differences were found in outcomes, following scaphoid hemiarthroplasty and ORIF with vascularized bone graft. As such, the choice belongs both to the surgeon and the patient, as well as to the availability of required instruments and implants.

A-0320 The collagenase experience in Dupuytren's disease: results after the first 3 years and 74 patients

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Introduction: Dupuytren's disease remains one of the most challenging diseases for the hand surgeon nowadays. Classic treatment was mainly the surgical procedures, until the development of the *Clostridium* collagenase a few years ago. The aim of this study is to review the patients with Dupuytren's disease treated by collagenase injection at our centre, since 2011.

Materials and methods: We reviewed 74 patients with Dupuytren's disease whom underwent treatment with the collagenase injection , in a prospective study: 61 were male patients and 13 were female, mean age 66.8 years (range 40 - 89). The patients were classified according to the Toubiana classification into Grade I: 17 patients, Grade II: 41 patients, and Grade III: 10 patients. Six more patients were classified as recurrences after surgical treatment and thus, had no Toubiana grade. The distribution of the disease showed 43 patients with fifth ray disease, 34 patients with fourth ray, 11 patients with third ray involvement, and one patient with the thumb and first web impairment. The MCP joint was affected in 49 cases and the PIP joint, in 41 cases. Patients were reviewed after the treatment at 3, 6, 12, 24 and 36 months of follow-up.

Results: The finger extension after injection was successful in all patients but one, with a previous recurrence after surgery. No major complications were registered, but skin tears during extension were produced in 20 cases. Mean time of follow up was 16.6 months (range 6 - 36). There were 28 cases (37%) with recurrence (more than 20º of lack of extension), 21 cases at the PIP joint (51%) and seven cases at the MCP joint (14%). Of the 46 patients (57 joints) with a follow up of at least 24 months, there was a recurrence in 25 cases (43%).

Conclusions: The collagenase injection was a safe and effective procedure for the treatment of Dupuytren's disease in our series, with no major complications. The recurrence rate was 37% in this study (51% PIP and 14% MCP), similar to other previously-published rates. The high rate of recurrence at the PIP joint should lead to a change in the indication of this treatment, in that location.

A-0325 Can collagenase effectiveness be improved by using ultrasound-guided injection? A comparative study with standard injection

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Introduction: Collagenase injection into the cords of Dupuytren's disease is usually carried out after observation and palpation of the affected cords. Our aim is to test whether ultrasound-guided injection can improve the effectiveness of this treatment. Here we compare the standard injection with the ultrasound-guided injection.

Materials and methods: We designed a prospective comparative study between two consecutive groups of patients with Dupuytren's disease. Both groups were treated by injection of collagenase from *Clostridium histolyticum* (Xiapex®), by using different approaches. The first group (Group A) had 47 cases and they were standardly injected; the second group (Group B) had 36 cases and was treated by ultrasound-guided injections with a 18MHz probe. Inclusion criteria were the same in both groups: palpable cords, primary or recurrent, in any finger except the thumb, with a metacarpophalangeal (MP) and/or proximal interphalangeal (PIP) joint contracture above 20°. We collected the epidemiological data of each patient, the contracture degrees of the MP and PIP joints and the

characteristics of the affected cords. All patients were reviewed 1 week, 1 month and 3 months after the injection, repeating the same joint measurements every time. Statistical analysis was performed by using SPSS version 19.0. We compared the effectiveness in order to obtain full extension of each finger and each joint (⩽ 5° contracture), using the chi-square statistic. A student's *t*-test was used to compare the percentage of contracture improvement of each finger and each joint. P values ⩽ 0.05 were considered significant.

Results: We report the results after one single injection in each affected cord, in both groups. 43% of the cases within the Group A obtained full extension of the finger and, on the other hand, 53% of the cases within Group B (p = 0.355) obtained it. Full extension of the MP and PIP joints was achieved in 61% and 33% of the cases, respectively, within Group A; and in 74% and 50% within Group B (p = 0.326 and p = 0.198). The percentage of correction of the initial contracture was 70% in Group A and 81% in Group B (p = 0.095). In the MP joints, this percentage was 80% in Group A and 90% in Group B (p = 0.078). In the IFP joints, we obtained 54% in Group A and 76% in Group B (p = 0.020).

Conclusions: Ultrasound-guided injection of collagenase in Dupuytren's disease improved the results obtained for the standard injection, but not in a significant manner. Thus, the method cannot be recommended for routine use. Certain cases, such as those whose cords are difficult to palpate, could take advantage of this approach.

A-0326 The unsolved issue of painful neuromas of the upper limb: an update on use of the new regenerative approach of perineural fat grafting

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Objective: The treatment of painful neuromas is an open issue for hand surgeons, due to frequent pain relapse. We propose an up-to-date of the original technique of perineural fat grafting (PFG).

Methods: We performed a retrospective analysis of 19 patients affected by a secondary 20 painful end-neuromas, treated with PFG. After dissection, the previous scar was excised and proximal neurolysis was performed, to allow the nerve to physiologically glide during the movements of the limb. The nerve was sectioned after the neuroma and exteriorized through a 2-mm incision, proximal to the first. The nerve is kept under light tension, with an epineural stitch. Three cannulas are then introduced and fixed trans-cutaneously, in order to point their inner extremities around the nerve in the subcutaneous tissue. The main surgical access is sutured with intradermal stitch and the adipose tissue, processed according to Coleman, is injected through the previously-placed cannulas. In this way, an adipose wrap is created around the nerve. The exteriorised tract is slightly tractioned and sectioned proximally to the neuroma, thus burying the healthy nerve stump inside the adipose wrap.

Results: Reduction of paresthesias and pain was recorded after surgery, with significant improvement of limb functionality. In 18 patients, we observed a completely negative Tinel test and improving of sensibility. Neuroma recurrence was recorded in one case only.

Conclusions: The grafting of adipose tissue is an unexplored resource in the treatment of painful neuromas. It potentially acts on those mechanisms that produce the formation of a new neuroma. The satisfactory pain reduction and increase in limb functionality observed in our series confirmed the effectiveness of PFG.

A-0328 How safe is corrective osteotomy of malunited distal radius without bone or bone substitute graft?

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Introduction: Corrective osteotomy after healed fracture of the distal radius is needed in symptomatic cases when there is shortening of the radius, excessive angulations, distal radioulnar joint instability or joint surface incongruity. Classical technique of corrective osteotomy, which is at present 83 years old, includes transfer of cortico-cancelous bone from the iliac crest. As the donor site is painful, a lot of artificial bone substitutes were tried in last 2 decades. With the development of angular stable plates and screws, an idea raised up that none of the latter is needed, if osteosynthetic material provides sufficient stability, until the bone grows back. Peter Brink et al. (2005) published the first article on this technique.

Method: In a retrospective study, we included all corrective osteotomies for malunited distal radius fracture that were done in our hospital, from 2006 - 2012. We included just those cases where at least 2 months passed from fracture to osteotomy. We included all osteotomies that had some kind of elongation (open wedge, lengthening, intra articular osteotomy and combinations). Angulary stable material was used in

all cases (Aptus 2.5 mm VA and Synthes 2.4 mm FA). The senior author didn't use corticocancelous graft or artificial bone graft from 2006 on, in any case. Younger authors, until 2010 in most cases, performed the classical technique. Together in these 7 years, we did 127 corrective osteotomies for malunited distal radius fracture. The senior author made 111 corrective osteotomies without any graft on these. Younger authors made 11 osteotomies following the classical technique and five without any graft. So together, in this period, we did 116 osteotomies of malunited distal radius without any bone nor a bone substitute graft.
Results: All osteotomies, with the exception of one, healed solidly in 4 - 12 months (99.2%). The biggest bone defect that was done and healed was 16 mm. One case that didn't heal and its needed reoperation was analysed.
Conclusions: We conclude that cortico cancelous graft in distal radius osteotomy is not needed, if we use angulary stable osteosynthetic material, and if the patient has at least satisfactory osteogenic potential.

A-0330 Second-look arthroscopy for foveal avulsed TFCC treated by arthroscopic transosseous repair

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Introduction: Arthroscopic transosseous repair is an option for foveal avulsion of the triangular fibrocartilage complex (TFCC) at the fovea; however, there was no report on the second look findings of arthroscopic transosseous repair. The purpose of this study was to examine the second look findings on the repaired radioulnar ligament (RUL), by arthroscopic transosseous repair, and to evaluate the clinical results of the case series.
Methods: Since 2002, there were 36 foveal avulsions of the TFCC that had undergone arthroscopic transosseous repair. Among them, 13 wrists of 13 patients underwent second look arthroscopy. There were six male patients and seven female patients, and their right wrists were involved in 10 cases and their left in three cases. The average age at the time of the second look ranged from 22 - 54, with an average of 34.3 years. Causes of the TFCC injury were: fall (n = 7), sports activity (n = 3) and traffic accident (n = 3 wrists). A first look indicated complete foveal avulsion of the TFCC through DRUJ arthroscopy in all wrists, then the fovea was debrided by shaver and transosseous repair of the TFCC was done using Nakamura's technique. Second look arthroscopy was done on average 8.3 months after the first operation. We evaluated the second look findings on the repaired RUL through DRUJ arthroscopic findings and clinical results, using our original DRUJ evaluating system, checking for postoperative pain, range of forearm rotation and DRUJ instability, and the modified Mayo wrist score.
Results: Complete repair of the RUL was obtained in 12 wrists through second-look DRUJ arthroscopy. One wrist indicating partial rupture of the RUL underwent ulnar shortening. 'Excellent' clinical results were obtained in eight wrists, 'good' in three wrists, with the DRUJ evaluating system and modified Mayo wrist score, in which all wrists indicated complete repair of the RUL. One wrist indicated a poor clinical result, due to partial rupture of the RUL and CRPS.
Conclusions: This study demonstrates the excellent repair of the RUL with arthroscopic transosseous TFCC repair to the fovea, on second-look DRUJ arthroscopy. Excellent repair of the RUL can correlate with excellent clinical results.

A-0331 Early post-traumatic finger reconstruction with toe-to-hand transfer: results of 31 cases

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Introduction: Early free flap reconstruction is a well-established method in reconstructive surgery. Many authors stated the immediate restoration of all damaged structures is their goal, whenever possible. Absolute indications of emergency free flaps are represented by an exposed vital structure, high risk of infection, flow-through flaps and salvage flaps; relative indications are represented by finger reconstruction with toes. It is well known as in the mutilated hand, that microsurgical toe-to-hand transplantation provides thumb and finger reconstruction that is superior to conventional techniques in appearance and function. We report a retrospective series of 31 cases of early toe-to-hand transfer for the reconstruction of a mutilated hand.
Materials and methods: The overall results of 31 consecutive procedures performed as emergency reconstructions of mutilated hands with loss of thumb and/or fingers, over a 10-year period in our institutions. We

reviewed 20 thumb reconstructions and 11 reconstructions of the long fingers. The transfer was performed at a mean time from admission into the hospital to a surgery of 8 hours. We retrospectively evaluated the results, with regard to the kind of lesion and reconstruction, function, length of hospital stay, complications (e.g. infection, re-exploration or reoperation) and donor site morbidity. The mean follow-up time was 3 years (range, 18 months - 7 years). Tips, tricks and the rationale for these reconstructions are described.

Results: The success rate of these series was 100%. The rate of re-exploration was 10% (venous thrombosis). The recuperation of mobility was between 70 - 90% (bigger for the thumb) of the range of motion (ROM) of the transferred digit; and the sensibility was 60% of a normal finger (mean mTPD 12 mm). About the donor site morbidity: we did not report problems doing sports, nor normal activities, only morphological dysfunction. Regarding patient satisfaction, we report a rate of 70% for very satisfied patients, 24% for those satisfied and six percent, unsatisfied patients from an aesthetical point of view.

Conclusions: The data reported suggested that finger reconstructions using toes from the foot can be safely and reliably performed during the initial presentation in selected patients: cooperative and interested young patients are the ideal candidates for toe transplantation. Early toe transfer provides some advantages over elective procedures in acute hand injuries, such as: psychological benefit, single-stage reconstruction, short hospital stay; without any significant differences in the success rate, functional results or frequencies of complications, if compared to other elective case series.

A-0332 Microsurgical reconstruction of the Blauth III-IV hypoplastic thumb by second toe longitudinally split hemi-metatarsal or PIP joint

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Background: As an alternative to pollicisation, Chow et al. (2012) described a non-vascularised, longitudinal hemi-metatarsal second toe transfer to reconstruct the CMC joint of the Blauth Grade IIIb or IV hypoplastic thumb. Previously, others had described the whole second toe MTP joint transfer. We describe the microsurgical, vascularized, longitudinal hemi-metatarsal second toe transfer to reconstruct the CMC joint, based on the dorsal metatarsal artery system, and the vascularised transfer of the MTP and PIP joint of a single second toe, to reconstruct bilateral CMC joints in Blauth Grade III-IV thumbs.

Methods: Four hypoplastic thumbs of Blauth Grade III - IV were reconstructed with a microsurgical, vascularised, longitudinal hemi-metatarsal second-toe transfer, with the aim of providing improved growth and reduced risk of resorption. We present the technique of harvest and transfer, and the secondary surgery. The technique of second toe sharing to reconstruct both hypoplastic thumbs is also described with the MTP joint reconstructing one side and the PIP joint reconstructing the other side. We provide 2-year follow-up results.

Results: Successful transfer of portions of the second toes occurred in all patients. There was one malunion, requiring revision. Stable yet mobile CMC joint reconstruction occurred. Secondary surgery was required to improve functional mobility and use. Utilisation of the longitudinally-split metatarsal allowed preservation of a fully functional second toe.

Conclusion: For those patients whose parents refuse pollicisation, or who present later in life, we report for the first time that microsurgical reconstruction of the severely hypoplastic thumb is possible, using either a longitudinally split second toe metatarsal, or a whole second toe PIP joint reconstruction.

A-0337 Traumatic brain injury, heterotopic ossification and peripheral neuropathy

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Introduction: Patients with severe traumatic brain injury (TBI) may suffer from heterotopic ossification (HO), mainly of the elbow or hip joints. This is well described in adults, but less so in paediatric patients. Timing of surgical excision of the HO, as well as postoperative treatment with non-steroidal anti-inflammatory drugs (NSAIDs) or single-dose irradiation are questions debated in adults. There is very little data in children and no clear recommendations. The aim of this study was to examine the frequency of this problem in the paediatric population and examine possible risk factors for its occurrence.

Patients and methods: We reviewed the medical records of all patients with severe TBI between 0 - 16 years of age, hospitalised at our paediatric and adolescent rehabilitation centre during the years 2000 - 2013. Data regarding brain and additional injuries, diagnosis and care of HO were collected.

Results: There were 83 patients, including 60 boys and 23 girls. Eight were excluded, due to inadequate data. Of the remaining 75 patients, HO was diagnosed in six patients, at an average of 4 months from the injury, at the elbow (n = 4) and the lower limb (n = 2). The age at injury ranged between 7 and 14 years, and the Glasgow Coma Scale at admission was 5 - 8. Of the six patients, two had fractures in the same limb; two had botulinum toxin injections, followed by serial casting in the same limb; and in all, the involved side was the plegic limb, with increased muscle tone. Symptoms resolved in five patients given NSAIDS treatment and rest. One patient required surgical excision of the elbow HO, due to progressive ulnar neuropathy 6 months post-injury. Post-operative management included NSAIDs for 6 weeks. After 3 months, the clinical signs of the ulnar neuropathy had resolved, yet some of the elbow contracture recurred.
Conclusions: Severe TBI in children may be complicated by HO of the plegic limb, and increased muscle tone of the limb. When diagnosed, there is a need for monitoring of the limb's neurologic status, to detect early signs of nerve entrapment, in addition to the neurologic deficits of the brain injury. Peripheral neuropathy may be an indication for more aggressive treatment of the HO.

A-0338 Resection of the distal pole of the scaphoid in symptomatic scaphotrapeziotrapezoid osteoarthritis and symptomatic scaphoid nonunion

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Objective: Resection of the distal pole of the scaphoid is one of the surgical techniques applied for the treatment of painful scaphotrapeziotrapezoid osteoarthritis (STT-OA) and nonunion of fractures in the distal part of the scaphoid. Very few studies report on the outcome of this technique. The purpose of this study is to evaluate midterm outcomes, in a consecutive series of patients.
Methods: This is a retrospective study in which we evaluated eight patients (10 wrists) with a mean follow-up of 3.9 years. The indication for surgery was in one case a scaphoid nonunion and in the remaining nine cases, a STT-OA. We evaluated objective functional outcome measures (range of motion (ROM) and grip strength) and the patient-reported outcome measures (visual analogue scale (VAS) for pain and Quick Disabilities of the Arm, Shoulder and Hand questionnaire (Quick-DASH)). We also assessed the degree of dorsal intercalated segmental instability (DISI) and postoperative complications.
Results: Extension and flexion averaged 58.7° and 72.5°, while the radial and ulnar deviation averaged 16.1° and 27.2°, respectively. Grip strength at positions 1 – 5, respectively, averaged 16.9 kg, 25.6 kg, 23.3 kg, 19.6 kg and 15.1 kg. Reported pain averaged 2.0 out of 10 and the Quick-DASH, 23.6 out of 100. A mild postoperative DISI deformity was observed in nine wrists with an average lunocapitate angle of 22.8° (range 0 - 44) on radiographic evaluation, without a correlation with reported pain scores. None of the opposite wrists, whether with or without STT-OA, displayed a DISI deformity. The only observed complication was complex regional pain syndrome, in one case.
Conclusions: The mid-term results for distal pole resection of the scaphoid in the treatment of STT-OA and scaphoid nonunion are satisfactory. Almost all patients develop a mild degree of DISI deformity, but this does not affect the outcome. Five more patients will be included in this study during the upcoming months and will be included in the oral presentation.

A-0339 Timing of spontaneous recovery of infraspinatus in neonatal brachial plexus palsy

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Objective: There exists a subgroup of patients who regain elbow flexion early, who therefore do not meet the criteria for early nerve surgery, but who are slow to regain or who never regain shoulder external rotation, spontaneously. With the options of nerve transfer or tendon transfer available, it remains uncertain how long it is reasonable to wait in expectation of a spontaneous return of active external rotation. To help in making treatment decisions in these patients, we sought to study the timing of recovery of active external rotation, when it occurs spontaneously. We also sought a time-point after which return of spontaneous external rotation is unlikely.
Methods: We retrospectively reviewed the records of patients with neonatal brachial plexus palsy (NBPP). Patients were included only where there was adequate documentation regarding active external rotation. To be included, an initial observation of a lack of external rotation was required, by AMS < 3 or Mallet < 3, or by clear comment. We excluded patients whom had surgical intervention. The definition of return of active ER was an AMS score > 3 or Mallet score > 3.
Results: We identified 139 patients whom had clear documentation of absent external rotation; we then extracted 48 patients whom had then recovered

external rotation without intervention. The average time to recovery was 14.1 months, the median was 9.5 months (SD 11.9). We found that 12 of the 48 patients had spontaneous recovery later than 20 months.
Conclusions: There is no threshold age in the first 2 years of life. Beyond that, spontaneous recovery of active shoulder external rotation is rare. The timing of nerve transfer surgery for reanimation of the infraspinatus will depend on the time to recovery after this procedure, and the proportion of patients in whom it is successful.

A-0341 Breaking the spiral: reconstructive approach for multi-operated humeral nonunions

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Introduction: Inveterate pseudarthrosis of the humerus is a highly disabling condition that precludes the use of the otherwise normal hand and forearm of the affected extremity: despite normal circulation and preserved neuromuscular function, the hand cannot reach objects.
Patients and methods: We present our series of 26 patients (14 adults and 12 children) with inveterate pseudarthrosis of the humerus resulting from trauma (64%) or oncologic treatment (36%), between 1999 and 2013. All patients had previously been operated on various occasions (between 4 - 14 surgeries). Our surgical approach was the same in all cases: wide resection of all pathologic tissue, followed by reconstruction with a free vascularised fibular bone transfer and fixation with lateral plate and screws. The patients were instructed to wear a sling postoperative ly for 2 weeks, and began with mild active mobilisation of the extremity after this period. We evaluated: bone healing on serial postoperative X-rays; presence of pain; preoperative and postoperative Quick Disabilities of the Arm, Shoulder and Hand (QuickDASH) scores; return to previous activity; and patient satisfaction.
Results: All patients achieved consolidation postoperatively, within the first 3 months, were pain free and returned to their previous daily activities. There was a dramatic improvement in QuickDASH scores (mean preoperative QuickDASH score was 88 and mean postoperative score was 11). Two patients developed postoperative transient radial nerve palsy that resolved without further surgical treatment. All patients were satisfied with their treatment, rating the results as excellent.
Discussion: The surgical treatment of previously operated pseudarthrosis of the humerus poses a challenge for the reconstructive surgeon. We obtained excellent results with our current approach, which is based on complete debridement of the pathologic tissue (up to healthy bone), inlay of the fibula within the medullary channel of the humeral stumps, careful fixation with a long plate to secure length and rotation, and achievement of an undisturbed blood flow (through microvascular anastomosis to carefully-selected recipient vessels) and preservation of the continuity of the medullary cavities of the humerus and fibular graft.

A-0342 Photogrammic scanner as a promising tool in volume measurement of the upper extremity

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Objective: Volumetry is an important tool in hand surgery, to determine swelling, document postoperative volume changes, etc. We used photogrammetry to capture a 360° surface contour; and thus, the volume of the human wrist.
Methods: We recorded 10 patients' wrists by a photogrammic scanner and a virtual three-dimensional (3-D) model was created. The obtained volume was compared to the volume generated by computed tomography (CT) scans of each wrist. In each case model, volume and six planes were compared in both measurement methods.
Results: There was no significant difference between the data gathered by CT-scan or the 3-D photogrammic system. Particularly the volume, as the determining parameter, showed only a slight deviation of 0.25% ± 0.13%.
Conclusions: This study showed for the first time, that the 3-D assessment of extremities is technically applicable and highly accurate. The high precision and accuracy of the scanner makes it a promising tool in volumetry of the upper extremity.

A-0345 Acceleration of peripheral nerve regeneration using nerve conduits in combination with induced pluripotent stem cell technology and a basic fibroblast growth factor drug delivery system

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Objective: For peripheral nerve repair, various modifications, including addition of Schwann cells or incorporation of growth factors with bioabsorbable nerve conduits, have been explored; however, no reports about nerve conduits containing both supportive cells and growth factors have been published as being regenerative medicine for peripheral nerves. The purpose of this study was to repair sciatic nerve gaps in mice using tissue-engineered bioabsorbable nerve conduits coated with basic fibroblast growth factors (bFGF), in combination with induced pluripotent stem cell (iPSC) -derived neurospheres, as a way to deliver both supportive cells and growth factors.
Methods: The bioabsorbable nerve conduit (external diameter 2 mm, internal diameter 1 mm and length, 7 mm) was composed of an outer layer of a poly L-lactide mesh and an inner layer of a porous sponge, composed of 50% L-lactide and 50% ε-caprolactone. Mouse iPSCs were neurally induced in vitro, using a published protocol. The secondary neurospheres (4,000,000 cells per conduit) derived from iPSCs were suspended in each conduit. The bFGF (100 μg)-incorporated gelatine microspheres of 5 mg, which creates a slow-release drug delivery system, were suspended in the nerve conduits coated with neurospheres derived from iPSC, just before transplantation into mice. The 5-mm sciatic nerve gaps in mice were reconstructed in the following groups: nerve conduit alone (control group, 18 mice), nerve conduit coated with iPSC-derived neurospheres (iPSC group, 18 mice), nerve conduit coated with iPSC-derived neurospheres and bFGF-incorporated gelatine microspheres (iPSC + bFGF group, 8 mice) and autograft (autograft group, 12 mice). The recovery of motor and sensory function of each mouse's hind limb was assessed at 4, 8 and 12 weeks after repair of the peripheral nerve gaps. At 12 weeks, the nerve conduits and grafted nerve were harvested, and the nerve regeneration was evaluated by histological analysis.
Results: The fastest functional recovery and the greatest axon regeneration occurred in the autograft group, followed in order by the iPSC + bFGF group, iPSC group, and control group until 12 weeks after reconstruction.
Conclusions: Peripheral nerve regeneration using nerve conduits and functional recovery in mice were accelerated by a combination of iPSC-derived neurospheres and a bFGF drug delivery system. The combination of all three fundamental methodologies, with bioabsorbable nerve conduits for scaffolds, iPSC technology for supportive cells and a bFGF drug delivery system for growth factors, was essential and useful for peripheral nerve regenerative medicine.

A-0346 Coonrad-Morrey total elbow arthroplasty for patients with rheumatoid arthritis: 54 prostheses reviewed at 7 years average follow-up, maximum 16 years

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Introduction: Total elbow arthroplasty was used for many years to treat rheumatoid arthritis. The Coonrad Morrey total elbow prosthesis is a semi-constrained device. Theoretically, potential complications are related to the weakness of the link system with follow-up. We hypothesised that semi-constrained characteristics of the prosthesis did not compromise the survival rate of the implant in the rheumatoid elbow.
Materials and methods: Between 1997 and 2012, there were 54 Coonrad Morrey total elbow prostheses for rheumatoid arthritis operations performed in 46 patients. Minimum follow-up was 2 years. There were 35 women and 11 men with a mean age, at the time of surgery, of 60 years (range, 29 - 83 years). There were 30 Type 3A, 21 Type 3B and three Type 4; according to the Mayo Clinic classification. The surgical procedure was the same for all patients. An anterior splint kept the elbow in extension for 2 days. Patients were then allowed to start moving the elbow according to pain level. No physiotherapy was prescribed. Clinical assessment was performed preoperatively and at the latest follow-up, with a range of motion (ROM) evaluation, Mayo Elbow Performance Score (MEPS), and Quick Disabilities of the Arm, Shoulder and Hand (Quick-DASH) score. The presence of lucent lines, implant loosening and bushing wear were evaluated on standard radiographs. Survivorship was assessed with use of the Kaplan-Meier method, with revision surgery as the endpoint.
Results: At an average of 7 years of follow-up (range, 2 - 16 years), the mean MEPS was 91 points (range, 55 - 100 points) and the quick-DASH score was 34 points (range, 0 - 75 points); there were 40 elbows that were not painful and 10 that were slightly painful. The average ROM was 23 - 135° in flexion-extension, and from 69° of pronation to 70° of supination. A normal function was observed for 45 elbows. Radiolucency was observed in six cases around the humeral component and in six cases around the ulnar component. Bushing

wear was observed in 16 cases: it was partial in 11 cases and severe in five cases. There were 14 complications (26%): four triceps weakness, three transient ulnar neuropathies, three deep infections, one ulnar component fracture, one ulnar fracture distal to the prosthesis and two aseptic loosening. Revisions were performed in six of them (11%). The survival rate was 97% (95% CI 83.6 - 99.6) at 5 years and 85% (95%CI 68.3 - 93.7) at 10 years.
Conclusions: The Coonrad-Morrey prosthesis provided satisfactory results with follow-up, with a 97% survival rate at 5 years and 85% at 10 years. The rate of complications remains high, even if the rate of implant revision stayed low; however, the increased incidence of radiolucency around the ulnar component and bushing wear with follow-up remain of concern.

A-0348 Arthroscopic-assisted reduction and fixation of trans-scaphoid perilunate fracture dislocations: a minimum 2-year follow-up study

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Diminished wrist function is a common consequence, although open anatomic repair and fixation of perilunate fracture dislocations are appropriate. Arthroscopic-assisted fixation of these injuries could be an alternative option, as a minimally-invasive approach. The purpose of this study was to evaluate the clinical outcomes of arthroscopic-assisted reduction and fixation in patients with trans-scaphoid perilunate fracture dislocations.
We retrospectively reviewed 10 patients whom underwent arthroscopic-assisted reduction and fixation for trans-scaphoid perilunate fracture dislocations, between May 2009 and March 2012. All scaphoid fractures were stabilised with headless compression screws; and lunotriquetral injuries were fixed with two K-wires. The two K-wires were removed at 6 weeks postoperatively; and then active wrist movement exercise was encouraged. Clinical outcomes with a minimum follow-up of 24 months were assessed via range of motion (ROM), grip strength, Mayo Wrist Scores (MWS) and the Disabilities of Arm, Shoulder and Hand (DASH) scores. Mean follow-up was 38.4 months (range, 28 - 60 months). All scaphoid fractures united uneventfully, without any deformities. At the last follow-up, the average grip strength was 82.3% of that of the contra-lateral side and the average flexion-extension arc was 108.3°. The average MWS and DASH scores were 77.8 and 9.6, respectively. According to the plain radiographs taken at the last follow-up, the average scapholunate angle and radiolunate angle were 47.3° and 3.9°, respectively. There was no definite evidence of radiocarpal and midcarpal arthritis. The results of our study suggested that trans-scaphoid perilunate fracture dislocations can be managed successfully with arthroscopically-assisted reduction and fixation.

A-0351 Open injuries of the extensor mechanism on the dorsum of the metacarpophalangeal joint of the fingers and thumb treated with primary tendon grafts

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Introduction: This study was performed to evaluate the clinical outcome and the degree of impairment of injuries to the extensor mechanism of the thumb and fingers over the dorsum of the metacarpophalangeal joint.
Methods: We evaluated 30 consecutive repairs in 20 patients. Surgery comprised wound excision and debridement, and reconstruction of the damaged segmental loss of the extensor tendons with a primary tendon graft; and when required, revascularisation with a local advancement or pedicle flap.
Results: Of the 30 injuries, donor tendon grafts were harvested from the palmaris longus (n = 19), semitendinosis (n = 7), flexor carpi radialis (n = 3) and brachioradialis (n = 1). We closed 10 cases using a neurovascular island pedicle flap, in eight cases we utilised a V to Y advancement flap, two with a rotation flap and 10 with primary approximation. K-wires were used for internal fixation in three cases. We found that 21 of the injured joints regained a full range of flexion and extension. Three patients (two with multiple repairs) had a slight loss of flexion. One patient developed ulnar instability of the extensor tendon, requiring further surgery which resolved the problem. One patient had complications with repetitive bleeding and required multiple procedures, including a 2-stage silastic rod tendon reconstruction and a radial forearm flap.
Discussion: Primary tendon grafting of Zone 5 of the fingers and on the dorsum of the metacarpophalangeal joint of the thumb for open injuries with a loss of the extensor mechanism is a reliable technique with a high success rate.

A-0361 An alternative salvage option before staged tendon prosthesis operations in flexor tendon Zone II ruptures due to the adhesions: tendon dressing method

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Objective: Flexor tendon ruptures in the Zone-2 level are usually managed by staged tendon reconstruction operations. This requires the removal of tendinous structures from the tendon bed and to harvest a tendon graft for the reconstruction of the tendon in the other stage, even if the secondary suturation is available. The authors used an alternative intermediate stage before a staged tendon reconstruction, as a salvage procedure that allows secondary repair of the ruptured tendon, called the tendon dressing method, to produce a pseudosheath around a repaired tendon and reduce the formation of adhesion.
Methods: A retrospective analysis of 27 patients who were operated on for flexor tendon ruptures between the years 2011 - 2014 was performed. The most common cause was industrial accident (n = 16), followed by sharp injury caused by glass or kitchen instruments (n = 11), respectively. The mean follow-up period was 16.4 months (7 - 21 months). Mean patient age was 22.6 years (range 16 - 44 years) and 21 patients were male, while the remaining six were female. The distribution of fingers were: middle finger (n = 9); index finger (n = 7); ring finger (n = 5); thumb (n = 4) and little finger (n = 2), respectively. The tendon dressing method was performed after the re-repair of the ruptured flexor tendon, by using the double-stranded modified Kessler method. A medical grade silicone tube was prepared by the removal of a longitudinal segment excepting the radiopaque line in it, and inserted over the repaired flexor tendon, from one joint inferior to one joint superior to the laceration zone. If any intact pulley was observed, the catheter was passed under it, to prevent a possible bowstringing. In 11 of the cases, slips of flexor digitorum superficialis tendon were used to form a pulley around the tube. The distal end of the catheter was then sutured to the subcutaneous layer and skin, to prevent mobilisation at the level of finger pulp via another 5 mm incision. The proximal end of the silicone tunnel was left free. Passive flexion and extension exercises were performed by the patients during the splinting period. After 1 month, magnetic resonance (MRI) views of the hands were obtained for pesudosheath thickness; and a second session, for the removal of the silicone tube was performed under local anaesthesia. Direct active motion was started after the second session.
Results: All of the patients healed successfully without any complications secondary to the medical grade silicone catheter; and 97.2% of patients gained full active flexion at the MP joint level, while 93.4% did so at the PIP joint level and 96.3% at the DIP joint level. Full IP joint was gained in four patients with thumb injury. The mean capsule thickness at the level of tendon repair was 1.7 mm (range 0.9 - 2.3 mm). There were seroma formations in all patients, between day 7 and day 20 after the operation, which resolved gradually.
Conclusion: The tendon dressing method was used as a salvage procedure before any tendon reconstruction method, in patients whom had enough tendon excursions.

A-0365 Anterior release operation for obstetrical palsy: indications and results

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Objective: Muscle imbalance in a growing child can lead to bone and joint deformities. Obstetric palsy patients with incomplete recovery have glenohumeral (Gh) joint problems, because of the imbalance between the shoulder adductors and the internal rotators, and the shoulder abductors and external rotators (ER). Shoulder internal rotation contracture, preventing the shoulder abduction and external rotation, is a common problem in obstetric palsy patients. Shoulder joint problems can occur as early as 3 months of age, and they require early diagnosis and treatment. We routinely examined the obstetric palsy patients weekly, beginning recently after birth and during the nerve recovery period. If passive shoulder external rotation was limited, glenohumeral joint magnetic resonance imaging (MRI) was performed. In our routine practice, patients with glenohumeral joint dislocation or dysplasia go through the anterior release operation, whereas patients with normal joint structure receive *C. botulinum* toxin injections. In this study, we present the results of the 'shoulder anterior release' operation.
Methods: In 22 patients (12 female and 10 male) we performed an anterior release operation between the ages of 8 - 42 months. All children had passive and active ER limitation and Gh joint deformity upon MRI. During the operation, the pectoralis major, the

coracobrachialis and the short head of the biceps muscles, and also the coracohumeral ligament, were released and lengthened through a deltopectoral incision. The subscapularis tendon and the anterior joint capsule were released in some patients, and the elongated coracoid process was diminished as well. The patients were given casts for 3 weeks in 90° abduction and full external rotation. Between the 3rd and the 6th weeks, exercises for the shoulder above 90° of abduction were allowed. In the 6th week, full ROM exercises were initiated, without a sponge support. The results were compared with the Active Movement Scale (AMS), before and after the operation.

Results: The overall average age of the children was 19.70 months, and the mean average follow-up period of the cases was 9.5 months. Preoperatively, the AMS scores were as follows: the shoulder abduction was 3.2 (over 7), the shoulder external rotation was 0.45 (over 7), and the shoulder internal rotation was 6 (over 7). Postoperatively, the AMS scores were 5.6, 4.5 and 6.2, respectively.

Conclusions: Muscle and tendon releases and transfers to restore the ER function and to improve the abduction are standard procedures in patients with incomplete recovery; however, the glenohumeral joint deformity could begin at very early ages. Teams dealing with obstetrical palsy must be aware of this condition, and take appropriate measures that are not only aggressive physiotherapy and *botulinum* toxin injections, but also early joint contracture and muscle releases, as well. Our results with the anterior release procedure in appropriately selected patients showed significant improvement in the upper extremity functions. They are encouraging, in terms of upper extremity utilization during daily activities, in patients with glenohumeral joint deformity caused by obstetrical brachial plexus injury.

A-0367 Management of shoulder internal rotation limitation in obstetrical palsy

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Objective: Muscle imbalance in a growing child can lead to bone and joint deformities. Obstetric palsy patients with incomplete recovery have glenohumeral joint problems, because of imbalance between shoulder adductor and internal rotator (IR) muscles and abductor external rotator (ER) muscles. Although shoulder internal rotation contracture, preventing shoulder abduction and external rotation is the most common problem in obstetric palsy patients with partial recovery, shoulder internal rotation limitation or external rotational contracture is a worse condition, preventing hand-to-belly and back functions, hence limiting daily activities. An obstetric palsy child could have both shoulder external and internal rotation limitations and contractures at the same time. It is hard to explain this condition with muscle imbalance theory, in which adductor and internal rotatory muscles are often out of balance with the abductor and external rotator muscle forces. Maybe, at incomplete recovery with C5, 6 or 7 involvement in every muscle unit, the stem cells are differentiating into sarcomeres, which are short and less functional, causing contractures. To improve shoulder abduction and ER, tendon transfers are commonly used, and postoperative transient loss in internal rotation is expected. But some patients cannot get their preoperative IR functions, long after the operations. Also, there were some nonoperated patients whose main problem was internal rotation limitations. We operated on these two groups of patients, to achieve better internal rotation function.

Method: Four patients had an operation to improve shoulder ER and abduction, 3 years ago. Although their Abd and ER degrees improved dramatically; 2 years after the operation, they had internal rotation limitation, despite vigorous physiotheraphy. Two patients did not have either nerve nor palliative operations before, but had IR limitations preoperatively. During the operation, a posterior incision above the spine of the scapula was performed; we encountered supraspinatus, infraspinatus and teres minor muscles and acromion bone. The observed not only heavily scarred muscle fasciae needed relaxation, but also the shortened external rotator muscles needed release and lateralization with V-Y fashioning, so that passive shoulder internal rotation movements were possible. The patients were put in a cast for 3 weeks in adduction and in full internal rotation. At the 3-week postoperative rehabilitation program, the active range of motion (ROM) exercises were initiated. All cases were evaluated by using ROM measurement and the Mallet scale.

Results: The average age of the children was 6.3 years and the average follow-up period was 11 months. The preoperative values, in terms of IR, were 2° and postoperatively, 20°. The degree of abduction was a mean of 136˚ before the surgery. After surgery, it decreased to 105°, but with therapy it caught up to preoperative values. The degree of external rotation value was a mean of 85°, preoperatively; and after the treatment, the external rotation value was measured at 66.2°. The mean Mallet score improved from 18 preoperatively, to 20 postoperatively.

Conclusion: Although shoulder abduction ER problems are far more common in obstetrical palsy patients, there is a group of patients that had internal rotation limitations, that either occurred spontaneously or surgically. Faced with this reality, we operated on these patients to achieve better hand-to-midline and back functions.

A-0368 Skin re-innervation by a targeted re-innvervation technique: animal model of skin as nerve-machine interface

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Objective: This is a preliminary study which addresses the question of how to best utilize the rat model, in order to study skin as a nerve-machine interface.
Methods: In a rat model (n = 8), the closest cutaneous nerve to sciatic nerve was identified and transected. The distal part was then coapted end-to-end without tension, with a sural nerve. The contralateral limb was used as a control. Skin area with a radius of 1 cm from the innervating point of the cutaneous nerve was harvested 12 weeks later. We performed a histology study and immunohistochemistry study, using s100 and antinestin to detect nerve components and mechanoreceptor stem cells, respectively.
Results: In all models, there was a consistent branch of the sciatic nerve 5 mm proximal from the point where the sciatic nerve divides into the peroneal, tibial and sural nerves. This nerve pierces a point located in the one-third distal part of the biceps femoris muscle and innervates a skin area over the muscle. It can be coapted without significant difficulty with the sural nerve, due to its proximity. Histology and immunohistochemistry studies revealed the absence of mechanoreceptors with a morphology commonly found in human skin; however, nerve endings could be identified in the subcutaneous area, with the experimental group exhibiting a mix of nerves with pathological and normal appearance.
Conclusions: Our study is the first study that described a rat model for studying reinnervated skin. One of the applications is to use skin as an interface between the nerve and limb prosthesis.

A-0369 Muscle as nerve machine interface in animal amputee model

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Objective: Nowadays, there is a trend of using muscle as the interface between nerve and machine, with the advantages of being less invasive and reliable. Our study is a preliminary study for creating an animal amputee model with a body-integrated robotic mechanism, using muscle as the interface.
Methods: Amputations of Sprague Dawley rat's left hind limb (n = 3) were performed, while carefully preserving the three main branches of sciatic nerve: peroneal, tibial and sural nerve. Main motor innervations to the biceps femoris were identified and transected. Distal stumps were connected to the peroneal and tibial nerve. At 12 weeks after surgery, the EMG signal was recorded from the biceps femoris muscle of the amputated and normal limb, as the control group. Muscle specimens were also subjected for histology and immunohistochemistry studies.
Results: During anatomical exploration, constant innervation of the biceps femoris area was identified as a branch of the sciatic nerve in the proximal area, which directly branches again into three nerves. In the normal limb, stimulation of the sciatic nerve at the point where it branches into the peroneal, tibial and sural nerve resulted in ankle joint movement and no EMG signal from the biceps femoris. Stimulation in the suspected motor nerve to the biceps femoris muscle resulted in an EMG signal with a mean amplitude of 9.2 mV (range; 9 - 9.7 mV). In the amputated limb, stimulation of the coapted peroneal and tibial nerves resulted in a mean amplitude of 0.52 mV (range; 0.3 - 0.7 mV) and visible movement of the biceps femoris muscle. Histology and immunohistochemistry studies showed minimal atrophy of the biceps femoris muscle.
Conclusions: This animal model is reproducible and also reliable, to be utilized in future studies of body-integrated robotic mechanisms.

A-0370 Indications and causes of failure for botulin toxin treatment at shoulder problems in obstetrical palsy

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Introduction: Muscle imbalance in a growing child can lead to bone and joint deformities. Obstetric palsy patients with incomplete recovery may have glenohumeral problems, due to the imbalance between the

shoulder adductors and internal rotators, and the abductors and external rotators (ER). The shoulder internal rotation contracture preventing the shoulder abduction and external rotation is a common problem in obstetric palsy patients. The shoulder problems can occur as early as 3 months of age, requiring early diagnosis and treatment. We routinely examine these patients weekly, during the nerve recovery period. If passive shoulder external rotation is limited, glenohumeral joint (Gh) magnetic resonance imaging (MRI) is performed. Patients with glenohumeral dislocation or dysplasia go through an anterior release operation, whereas patients with normal joints receive botulin toxin injections to the internal rotators. Although we achieved good results in terms of shoulder abduction and ER in most patients, we couldn't achieve satisfactory improvement in four patients, necessitating operation. We aim to share our findings.

Methods: Four patients (two female patients and two male) between 1 - 2 years of age had normal glenohumeral MRI and therefore, were not considered for anterior release operation. They had 1 - 2 botulinum toxin injections to the subscapularis, latissimus dorsi, teres major and pectoralis major muscles; in order to solve the muscle imbalance between the shoulders' external and internal rotators. The outcome was disappointing, so we changed the algorithm to operation. Both the anterior deltopectoral and posterior axillary incisions were performed, and the pectoralis major was released at its tendinous portion. We observed an aberrant muscle branch from the latissimus dorsi, preventing passive abduction and ER. Also, we observed heavily thickened latissimus dorsi and teres major fascia. Both conditions could not be treated with the *C. botulinum* toxin, justifying our indication. Both aberrant muscle strips and fascial thickenings were excised, to improve passive abduction and external rotation. The patients were placed in a cast for 3 weeks, in 90° of abduction and full external rotation. Between Weeks 3 and 6, exercises for the shoulder above 90° of abduction were allowed. In Week 6, full range of motion (ROM) exercises were initiated, without the sponge support. All cases were evaluated by using ROM measurement and the Mallet scale.

Results: The average age of the children was 18 months and the average follow-up period was 12 months. The mean abduction was 75° before, and after surgery, it increased to 140°. The external rotation mean was 20° before; and after treatment, the external rotation was 78°. The mean aggregate Mallet score improved from 14 to 18.

Conclusions: We used MRI for obstetric palsy patients, to plan the treatment, and if the Gh was congruent, we preferred botulin injections, to improve the abduction, and the ER had good results, without any need of tendon transfers. This algorithm can fail, if the injected muscles have aberrant muscle strips or fascial thickening. Then, a release operation is inevitable for a satisfactory result.

A-0371 Decellularized nerve for upper limb nerve reconstruction: a systematic review of functional outcome

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Objective: A decellularised nerve is an allograft that is already washed of antigenic components; and thus, leaves only a scaffold for the axon to fully regenerate. It promotes axonal growth, yet diminishes the need of immunomodulatory drugs; and also, the morbidity of the donor site. The purpose of this systematic review is to evaluate the evidence of functional outcomes after utilization of decellularised nerve in the clinical setting.

Methods: Literature research was primarily done using the *PubMed/Medline* database (1990 - Feb 2014) for English-language studies with the keywords 'decellularized nerve' and 'processed nerve allograft'. Inclusion criteria were prospective and used retrospective case reviews of decellularised nerve usage for peripheral nerve repair in the clinical settings.

Results: We retrieved six studies of level VIII and one study of level VI (based on the Jovell and Narvarro-Rubio classification), with a total of 131 reconstructions. Basic data for each of the studies are as following: patient age (range: 18 - 86 years), duration between initial injury and nerve reconstruction procedure (range: 8 hours - 1460 days) and follow-up period (range: 40 - 717 days). One study applied this graft for brachial plexus surgery, and the others for bridging a nerve gap due to various aetiologies. The maximum length of the nerve gap for the chemically-washed and cryopreserved decellularised nerve was 5 cm and 10 cm, respectively. Quantitatively, the functional outcomes are as follows: static 2-point discrimination (range: 3 - 15 mm), moving 2-point discrimination (mean: 2 - 15 mm) for motor assessment; and all patients had > M3, according to the MRC score. No complications were reported in all studies. Other parameters, such as Semmes-Weinstein Monofilament and the Quick Disabilities of the Arm, Shoulder and Hand (QuickDASH), were not commonly used by all studies.

Conclusions: Our study is the first to investigate the clinical results of using a decellularised nerve. It was found that the decellularised nerve has been used for bridging nerve gaps ranging from 5 - 100 mm, with associated satisfactory outcome in both S2PD and M2PD. In order to further advocate the use of this method, future clinical studies should be performed with a standardised way of measuring outcome, after peripheral nerve surgery.

A-0374 Rehabilitation in focal hand dystonia: results with three case series

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Objective: Our study aims to investigate the results after proprioceptive- and activity-based rehabilitation, in musicians with focal hand dystonia.
Methods: Three musicians with task-specific focal hand dystonia were recruited to the study. All musicians were guitarists. The Unified Dystonia Rating Scale (UDRS) was used for addressing dystonia symptoms, the Canadian Occupational Performance Measurement (COMP) was used to assess the participants' preferred activity performance and satisfaction. The Disability of Arm, Shoulder and Hand in Turkish (DASH-T) was used for addressing daily living and instrument playing-related barriers. Additionally, we recorded the metronome beats per minute, when the dystonic movement started while performing. All participants were recruited to a rehabilitation program for 8 weeks, three times a week, for 45 minutes each session. The rehabilitation program changed weekly, as follows: the Week 1 program included relaxation methods, cortical awareness and normal movement imaging exercises; Week 2 included instrument playing modification and postural exercises; Week 3 included slowed instrument playing and awareness of normal movement and playing modification; Week 4 - 6 included sensory education, non-modified instrument playing in slow speeds, Week 6 - 8 included performance training, like speed and technique, and training of tasks that had caused the dystonic movement up to the task's normal bpm.
Results: Three professional male guitarists with two left-hand and one right-hand dystonia were included. In COPM, all musicians reflected guitar-playing related activities. The mean performance score was 1.3 ± 0.5; and the satisfaction mean score was 1.3 ± 0.5, according to COPM. All participants had severe dystonia symptoms in their hands, according to UDRS. The DASH-T mean score was 11.5 ± 1.25, the DASH-T musician part score was 77.08 ± 3.6. The mean metronome beats per minute (bpm) that dystonic movements starts were 78.3 ± 7.6 bpm. After 8 weeks of intervention, the participants' COPM satisfaction and performance scores increased to 9.0 and 7.3 ± 0.5. Participants stated that mild dystonia symptoms in the UDRS and bpm increased to 126.6 ± 15.7 bpm. The DASH-T score decreased to 9.1 ± 8, while the musician part decreased to 12.5 ± 6.25.
Discussion: Our rehabilitation program was prepared, because existing programs only focus on the dystonic extremity, which leads to inefficient recovery in focal hand dystonia. Different rehabilitation approaches to dystonia were stated in literature. Recent studies show proprioceptive and cortical changes in dystonia. Rehabilitation lasting for 8 weeks, based on cortical awareness, proprioception and adapted instrument playing were found to decrease dystonic movements. This study presented a standardised rehabilitation program for focal hand dystonia that showed efficient results. It is recommended that adding cortical awareness, proprioception and adapted instrument playing approaches to rehabilitation programs, by rehabilitation specialists working with focal hand dystonia, can enhance rehabilitation efficiency.

A-0377 Adaptation and validation of Turkish version of musculoskeletal pain intensity and interference questionnaire for musicians

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Objective: There are certain pain questionnaires or scales that are translated and adapted to Turkish; however, we observed an absence of an assessment tool to examine pain in Turkish-speaking musicians. The Musculoskeletal Pain Intensity and Interference Questionnaire for Musicians (MPIIQM) evaluated not only the severity of pain, but also the impact of pain on quality of life and the experience of playing the instrument. The aim of this study was to translate and adapt the MPIIQM in Turkish; and to test its validity and reliability for Turkish-speaking musicians whom have pain and pain-related music-playing issues.
Methods: The MPIIQM was translated into Turkish by two independent native Turkish speakers. Translations were compared for inconsistencies and aggregated into a single Turkish version. This version then also was back-translated into English by two independent native English speakers. After the back-translations were compared for inconsistencies and aggregated into a single form, the final English version and the

original questionnaire were also compared for inconsistencies. Finally, the original English questionnaire and the Turkish questionnaire was reviewed by a bilingual team, to check for the errors of interpretation and nuances that might have been missed. The Turkish questionnaire was finalized after consensus. The study was conducted on 60 professional musicians whom had pain-related playing issues. The McGill Pain Questionnaire and Disabilities of Arm, Shoulder and Hand questionnaire (DASH) were also administered, within an interval of 7 days (retest). Instrument test-retest reliability was assessed with the interclass correlation coefficient (ICC) and with the Pearson's correlation coefficient.
Results: Translation and back-translation revealed no major difficulties. Reliability of the Turkish version of the questionnaire was very good, with high consistency and reproducibility. The MPIIQM Turkish version showed a high correlation with the DASH and McGill questionnaires.
Conclusions: In conclusion, the results displayed that the Turkish version of the MPIIQM is a reliable and valid region-specific version and proper for use on musicians. It seemed to be a reliable, consistent and valid instrument in evaluating the pain intensity and impact of pain on musicians.

A-0378 Nirschl vs. arthroscopic technique for the treatment of chronic recalcitrant tennis elbow

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Objective: To compare the outcomes of an arthroscopic procedure with those of the Nirschl technique, using a validated outcome measure.
Methods: We searched the electronic medical record database at our institution for patients whom underwent the Nirschl or arthroscopic procedure for chronic tennis elbow, from January 2008 to May 2013. We assessed the outcomes subjectively, with the Quick Disabilities of the Arm, Shoulder and Hand (Quick-DASH) questionnaire, in addition to the visual analogue scales (VAS) for pain, in three domains (average pain, pain at rest, and pain at hard work or during heavy lifting); and objectively, with pain-free grip strength, tenderness at the lateral epicondyle, and the Thomson test. Outcomes were compared between the two surgical procedures.
Results: There were 18 elbows of 15 patients that received the Nirschl procedure and 29 elbows of 28 patients received the arthroscopic debridement procedure instead. Demographic and pre-operative clinical data were comparable between the groups, except for a higher pain VAS score at rest, and a higher Quick-DASH score in the Nirschl group ($p = 0.007$ and $p = 0.038$, respectively). After surgery, both groups showed a significant improvement in both subjective and objective outcome measures; however, the Nirschl group achieved a significantly greater improvement in Quick-DASH score ($p = 0.011$) and in pain VAS score at rest ($p = 0.006$). In addition, the Nirschl group showed a trend towards better results in all the subjective measures and physical examinations, although these differences did not reach statistical significance.
Conclusions: The results of our study indicated that the Nirschl technique may be more effective than arthroscopic debridement in the treatment of chronic, recalcitrant tennis elbow.

A-0379 An easy technique of making correct osteotomy for distal radial deformities

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Objective: Distal radial malunion is being treated by traditional techniques, with unpredictable results. The purpose is to report our experience of a special technique of corrective osteotomy, followed by fixation with locking volar plate to restore the best possible anatomy.
Methods: We operated on 24 patients with different types of malunion during last 1 1/2 years. Preoperative evaluation required clinical, radiological or computed tomography (CT) scan; assessment was followed by preparation of the preoperative template. Under the C-arm control, open wedge osteotomy was performed by directing the oscillating saw under the guidance of two K-wires, passed parallel to the articulating surface through two different planes (sagittal and horizontal). Additionally, the cortico-cancellous iliac bone graft was used and fixed with 2.7 mm titanium fixed-angle locking volar plate. The postoperative results were evaluated by radiological and clinical parameters.
Results: This technique significantly improved radiological parameters. Radial height, radial inclination and Volar tilt improved from 7.9 mm (SD ± 2.4), 17.63º (SD ± 3.5), - 1.42º (SD ± 7.50), respectively; to 10.33 mm (SD ± 1.7), 20.39º (SD ± 3.7) and 10.53º (SD ± 10.53), respectively. Clinically, there was eminent improvement in wrist and forearm function, finger movements and grip strength.

Conclusions: Anatomical restitution is the hallmark of this surgery, which can only be achieved by the correct way of osteotomy. Rigid peculiarities of volar plates provided the best fixation, allowing early postoperative motion with a credible outcome.

A-0382 Average location of a volar locking plate in the practical setting of displaced distal radius fracture treatment

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Background: A too distal placement of a volar locking plate might be dangerous, due to the concern for delayed flexor tendon rupture. Therefore, it is recommended not to place the locking plate beyond the watershed line; however, it is not known how distally the locking plate was placed, in a practical setting. The purpose of this study was to find the average location of the locking plate in the practical setting, keeping the danger of too distal a placement in mind.
Materials and methods: We retrospectively reviewed 198 distal radius fractures treated using volar locking plate, from January 2010 to April 2014. Of the 198 distal radius fractures, there were 85 AO A Type (A2: 65, A3: 20), 14 AO B Type (B1: 4, B3: 10) and 99 AO C Type (C1: 43, C2: 56) fractures. Preoperative simple X-rays and computed tomography (CT), with or without three-dimensional (3D) reformatting, were reviewed to detect the shortest distance from the transverse ridge of the volar marginal lip of the radius to the most distally extended fracture, to the volar cortex of the distal radius (A). Postoperatively, the lateral radiographs were reviewed to find the distance from the transverse ridge of the volar marginal lip of the radius, to the most distal margin of the locking plate (B).
Results: The average distance from the transverse ridge of the marginal lip of the radius to the most distally extended fracture was 9.5 ± 2.41 mm. The average distance from the transverse ridge of the marginal lip of the radius, to the most distal margin of the locking plate, was 3.4 ± 1.78 mm. There was a statistically significant correlation between the A and B groups ($p < 0.05$). Despite a trend that the more complex the fracture pattern, the more distal the placement of the locking plate was, it was not statistically significant.
Conclusion: Practically, the average distance from the transverse ridge of the marginal lip of the radius to the most distal margin of the locking plate was shorter than expected. Therefore, intraoperatively, the location of the distal margin of the volar locking plate should be checked more carefully and accurately, for the prevention of delayed flexor tendon rupture.

A-0385 Functional outcome in distal radioulnar joint (DRUJ) replacement: our experience

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Objective: Distal radioulnar joint (DRUJ) replacement is an elective indication in patients suffering from arthrosis, articular chronical instability, rheumatoid arthritis, ulna head comminute fractures or the outcome of previous distal ulnar resection. In comparison with the techniques of resection used in the past, or with arthroplasty techniques, this kind of surgery restores articular contact, ulnar head 'camme' effect, affording soft tissues stabilisation and allowing a complete biomechanical forearm system. The aim of our study is to assess the functional and radiological outcomes over time, in patients whom underwent this kind of surgery and to compare that with the literature.
Methods: We did a retrospective study of 14 patients, nine female and five male, with an average age of 59 years, whom had undergone surgery in the period between 2008 and 2014. In total, we treated 15 wrists. The patients were evaluated using the Disabilities of the Arm, Shoulder and Hand (DASH) score and the Mayo wrist score; furthermore, we did an evaluation of the lingering pain and checked the rate of satisfaction of each patient. We had also done an evaluation about prono-supination parameters, flexo-extension, radioulnar deviation, carpal clinical stability, grip strength and clamp strength. Each patient underwent radiological investigation over time, with the aim to evaluate radioulnar wear, anterior or posterior instability, disconnection or replacement fractures.
Results: One patient underwent bilateral carpal replacement and six patients had comorbidity at the time of surgery. Seven patients were suffering from post-traumatic arthrosis, four were affected by rheumatoid arthritis and three had outcomes of previous surgeries. One patient underwent replacement review, due to heterotopic calcification, which caused joint displacement. Two patients had carpal long extensor synovitis; three of them had lingering pain which was not disabling for normal daily activities. Radiologically, in nine patients who had underwent surgery, we could see replacement collar reabsorption; in two cases of peri-implants, calcifications; and in three cases, stress on the radial articular surface.

The average increase in grip strength and lifting capacity was 30.2 kg and 8.8 kg, respectively. Supination improved by 15.2°, on average. The DASH and Patient-Rated Wrist Evaluation (PRWE) scores decreased on average 29.4 and 41.23 points, respectively. The average Mayo Wrist score was > 75 points. We found that 92% of the patients were painless, and just in two cases, we found persistent radioulnar joint instability.
Conclusions: In conclusion, we can say that radioulnar joint replacement was a valuable surgery option, especially in resolving pain and in restoration of carpal articular function. It is important to pay particular attention to replacement tracking and to articular structures' reconstruction. We found that 11 of our patients were ready to undergo once again, this surgical technique. Anyway, we suggest more extensive studies for a longer follow-up period.

A-0389 The 'four corner' fusion: about 61 cases

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Objectives: The midcarpal fusion described by Watson is indicated in all cases of SNAC and SLAC wrist, where the radiocarpal joint is spared while there is significant midcarpal damage. We reported on our experience in about 61 patients, since 2008.
Methods: From January 2008 to June 2014 in our department, 61 patients (with an average age of 47.3 years; eight women and 53 men) had been operated on using this technique: in most of the cases (n = 52), the patients were suffering from SNAC wrist in Stage 2 - 3; and in nine cases, from a SLAC wrist in Stage 2 - 3. The materials used were staples or plate (Aptus four-corner plate) and screws. In almost all patients, a radial styloidectomy was associated. After 4 weeks of immobilisation, all the patients had started the re-education program, and had been followed by X-rays and clinical evaluations (at 30, 60 and 180 days). Six patients were considered lost to follow-up.
Results: Except by the first eight patients, where some technical mistakes had been done with the poorest instrumental and clinical results and early complications (persistent pain, global range of motion (ROM) of 30 - 40°, with a partial or complete lack of extension; screw rupture; and insufficient DISI correction), for which they requested a new operation in six cases, our mean clinical results were satisfying: the average ROM recovery was 40° in flexion and 50° in extension; the mean grip strength was 25 Kg. There were no significant outcomes differences between the patients treated by plates or staples. The X-rays at 180 days showed no mobilization signs for the implants and good bone integration.
Conclusions: This technique is recommended for highly demanding patients, rather than first row removal. By our experience, the technique's results are satisfactory, although long-term complications (i.e. radiocarpal arthritis) cannot always be prevented.

A-0392 Factors affecting the occurrence of DRUJ arthritis after ulnar shortening osteotomy

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Objective: Ulnar shortening osteotomy is a common operation for the treatment of ulnar impaction syndrome. Large amounts of ulnar shortening may cause distal radioulnar joint (DRUJ) incongruity and lead to arthritis. The purpose of this study was to evaluate the factors that may affect the occurrence of DRUJ arthritis, after ulnar shortening osteotomy.
Materials and methods: From September 2005 to August 2013, we performed 81 ulnar shortening osteotomies for ulnar impaction syndrome, and then evaluated the occurrence or deterioration of DRUJ arthritis in 58 of these patients, with a minimum follow-up of 1 year. We analysed the potential factors that may affect the occurrence of DRUJ arthritis, such as age, sex, hand dominance, pre- and post-operative ulnar variance, pre-existing DRUJ arthritis, types of radial sigmoid notch, amount of ulnar shortening, and the follow-up period. The Visual Analogue Scale (VAS) score and pain grade (0 = no pain, 1 = pain on exertion and 2 = pain on rest) were assessed pre- and post-operatively. The mean follow-up period was 24.1(12 - 97) months.
Results: DRUJ arthritis occurred or deteriorated in 32 out of the 58 patients. Regression analysis indicated there was a significant correlation between the type of radial sigmoid notch (Type 1) and DRUJ arthritis (r = 0.368, p = 0.005). Other factors were not found to be correlated with occurrence nor deterioration of DRUJ arthritis. The average VAS score improved from 6.29 ± 2.38 preoperatively, to 1.63 ± 1.65 at the last follow-up. Also, the pain grade improved from 1.53 ± 0.54 to 0.65 ± 0.62, postoperatively. The changes in VAS scores and pain grades did not correlate with the occurrence nor progression of DRUJ arthritis.
Conclusions: This study suggested that patients with inclined radial sigmoid notch to the ulnar side are more likely to develop DRUJ arthritis, after ulnar

shortening osteotomy. The VAS score and pain grade were not correlated with the occurrence nor progression of DRUJ arthritis, at a mid-term follow-up.

A-0393 Neurogenic thoracic outlet syndrome in children

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Introduction: According to the literature, neurogenic Thoracic Outlet Syndrome (nTOS) is not to be seen before the second decade of life. Here we report 10 cases (nine girls total) suffering from nTOS.
Methods: The nine girls, aged a mean of 15 years, were diagnosed clinically for nTOS: one case bilaterally, the other cases unilaterally. The duration of symptoms was > 24 months, in all cases. X-rays of the cervical spine revealed a cervical rib in five girls. A comprehensive electroneurographic investigation detected signs of nerve compression in two cases. Magnetic resonance (MR)-angiography of the subclavian artery, with elevated and adducted upper extremity, documented a stenosis of the artery as an indirect sign of compression of the brachial plexus, in nine cases.
Results: All patients underwent TOS-surgery, skalenotomy, neurolysis of the brachial plexus and resection of the cervical and first rib, which were performed via a single supraclavicular incision. They recovered from their symptoms. The procedure and postoperative course were without complications, with complete preserved motor function and slightly transient reduced sensory function. Two months later, the girls were pain free and without any symptoms.
Discussion: TOS is well documented in the literature concerning adults, focusing on the clinical symptoms as the main indication for surgery. TOS in children had not been reported up to now, but we could confirm their clinical diagnoses by objective findings. The supraclavicular incision was appropriate to perform the surgery. The presented cases showed that 'neuropathic pain' must not be neglected in children.

A-0394 Managing severe hand deformities in Cambodia

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Objective: This empirical study is on the prevalence of severe hand deformities in Cambodia and the development of outcome-based surgical treatment strategies that are relevant and achievable in the community.
Methods: From May 2013 to November 2014, a total of four 1-week visits to the Children's Surgical Centre (CSC) in Cambodia were conducted. Patients with various upper limb conditions were assessed and listed for surgery. A total of 260 patients were seen in review and 62 of these were operated by the team.
Results: The surgical nature of the cases was as follows: 21% (n = 13) burns; 27% (n = 17) neglected trauma, including bites; 29% (n = 18) nerves; 5% (n = 3) tumours and 18% (n = 11) congenital. In 77% of the cases, the operations were for post trauma situations and deformity corrections took up 50% of the operative workload. Following correction of the deformity, resurfacing procedures were as follows: pedicled groin flaps were demonstrated and supervised (n = 5), and local surgeons had done 10 independently; four reversed forearm flaps were demonstrated and supervised, and the local surgeons did two, independently.
Conclusions: This study showed that deformity correction is an important component of the surgical treatment for the upper limb neglected trauma practice in Cambodia. The selection of appropriate reconstructive procedures that are locally relevant and achievable was important in determining the sustainable deformity correction service for hand surgery in underdeveloped communities. With adequate practice and timely feedback, it is possible to rapidly train local surgeons in standard reconstructive procedures, to treat severe deformities of the upper limb.

A-0395 Training local surgeons in congenital hand surgery in Cambodia

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Objective: This presentation is an empirical study on the process of understanding the surgical learning needs of the local surgeons, to facilitate a structured skill acquisition program to manage common congenital hand cases in Cambodia.
Methods: Over a 2-year period with four visits to the Children's Surgical Centre (CSC) in Cambodia, common congenital hand cases were identified using Pareto analysis of the cases seen. This formed the basis to develop a targeted surgical skill acquisition program in the management of congenital hand cases, and the identified local surgeons were then taken through a direct teaching and flipped classroom model.

Assessment was performed through case-based discussion and direct observation of the procedures, following a period of direct supervision and practice. The usefulness and effectiveness of the program was assessed by the structured questionnaire and interviews with the participants and stakeholders.
Results: Over the period of study, 260 cases were seen by the authors, of which 52 (20%) were congenital hand cases. Furthermore, an analysis of cases presented to CSC over the last 10 years revealed a constant incidence of 18% of cases due to congenital hand anomalies. Overall, the Pareto analysis revealed the following common conditions in Cambodia: polydactyly (n = 96), syndactyly (n = 130), macrodactyly (n = 6) and radial/ulnar longitudinal deficiencies (n = 22). A curriculum focused on the commoner conditions was designed to increase proficiencies in decision-making and surgical principles. There was an increase in the knowledge base of the program participants after the program and increased surgical competency. The stakeholders perceived the program to be beneficial and to have allowed for effective transfer of knowledge and skills from the visiting surgeon to the local surgeons.
Conclusions: This study showed the methodology of designing, developing and deploying a surgical skill acquisition program in congenital hand surgery, in an underdeveloped community. The program implemented was locally relevant, effective in skill transfer and resulted in a sustainable congenital hand surgery service in Cambodia.

A-0396 Microsurgical transfer of amputated polydactyly to reconstruct other digits

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In some polydactyly patients, the remaining digits may be incompletely formed or have dysplastic tips. The amputated polydactylous part can be utilized by microsurgical transfer to reconstruct the remaining digits. We report six cases of microsurgical reconstruction of the dysplastic digits, using the amputated polydactyly digit. Six patients with non-isolated polydactyly who had dysplastic digits were microsurgically reconstructed by transfer of all or part of the amputated polydactyly. All transfers were based on a single digital artery and vein, and single neurorraphy. We present a follow-up of >1 year and an average of 4 years. In all polydactyly cases, even stelling Type 1, an anastomosable artery and vein were identifiable. All microsurgically-transferred parts were successful. Union was achieved in all cases where bone was transferred. Functional integration of the reconstructed digit occurred. Parental and child satisfaction was very high. When polydactyly occurs in association with other dysplastic digits, consider microsurgical transfer of all or some of the amputated polydactylous parts.

A-0397 Effect of interindividual anatomical variations on the plate-to-bone fit of locking plates for distal radius fractures

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Objective: In the osteosynthesis of distal radius fractures, surgeons sometimes experience poor bone-to-plate fit, because of the difference in configuration between bone and plate, which has associated risks, including flexor tendon rupture and carpal tunnel syndrome. At the FESSH 2014 meeting, we reported that there is an inter-individual difference in the anatomy of the distal radius. Continuing this research, we analysed the difference in configuration, as well as the compatibility that exists between plate and bone. Here we present our results.
Methods: First, we quantified the inclination of the distal radius, using the sagittal cross-sectional surface of CT scans. Second, we prepared three bones with different distal inclinations: bone G (gradual), bone I (intermediate), and bone S (steep). We made three-dimensional (3D) surface models from the comuted tomography (CT) data of the bones. Three locking plates (Biomet DVR®, Acu-med Acu-loc, and Synthes VCP) were scanned using a 3D scanner. The directions of the screws were also scanned, in order to determine the appropriate position for the plate. In the 3D-CAD system, the plate was installed on the bone, assuring that the plate was placed in the ideal location, such that the screws could provide support for the subchondral bone. The fit of each plate to the three radii, yielding nine combinations, was analysed by computing the distance between the plate and each of the radii. We calculated a percentage of the area, where the distance was < 0.1 mm, which is where the plate was in contact with the bone. We also made colour maps of the distances and evaluated bone-to-plate fit.
Results: Significant differences in the fit of each plate to its respective three bones were shown, using the Games-Howell tests ($P < 0.05$). Bone G was the closest approximation to that of DVR® and Acu-loc, and Bone S showed the closest approximation to that of VCP. The plate-to-bone contacts were limited to $<$

10% of the all plates. Colour maps showed distal protrusion of the plate in the case of VCP with Bone G. Acu-loc tended to protrude in the area where the flexor pollicis longus was located.
Conclusions: We demonstrated the compatibilities between bone anatomy and locking plates. Bones with gradual inclination of the distal end of the radius can easily produce a good plate fit with DVR®. Bones with steep inclination can have a good fit with VCP. To prevent flexor tendon injury after osteosynthesis, the implant should be selected according to bone anatomy.

A-0398 Arthroscopic resection arthroplasty with arthroscopic ligament stabilization for treatment of thumb CMC/STT arthrosis with instability

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Objective: Arthroscopic resection arthroplasty (ARA) for thumb carpometacarpal (CMC) degenerative joint disease has been shown to yield excellent pain relief, yet does not address metacarpal instability when present. The purpose of this study was to report outcomes of a new arthroscopic ligament stabilisation procedure for thumb metacarpal subluxation, in patients with a minimum of a 5-year follow-up whom had undergone ARA for basal joint arthritis.
Methods: This is a case series of seven patients that underwent primary ARA, combined with arthroscopic ligament stabilisation for thumb basal joint arthrosis, associated with the first metacarpal instability who had a minimum follow-up of 5 years. The mean follow-up was 84 months (range 63 - 108). The ligament stabilisation procedure, similar to an arthroscopic anterior cruciate ligament reconstruction, stabilizes the subluxed base of the first metacarpal, by stabilising it to the base of the second. Data were collected preoperatively and at postoperative intervals of 1, 3, 6 and 12 months; and annually thereafter. Objective data collected by an occupational hand therapist at each time interval included a numeric rating scale for pain (0 - 10; 0 = 'no pain' to 10 = 'worst possible pain'); the Disabilities of Arm, Shoulder, and Hand (DASH) questionnaire (0 - 100; higher score = greater disability); the range of motion (ROM), grip strength and key pinch. Patient satisfaction was evaluated at the final follow up (0 - 5; 0 = 'completely dissatisfied' and 5 = 'completely satisfied'). Descriptive statistics were used to evaluate all baseline characteristics and outcomes. Surgical Technique: Following ARA, we place the guidewire into the base of the second MC, under arthroscopic visualization, then use a cannulated drill to place a hole into the second MC, over the guide wire. We place a palmaris longus tendon into the second MC, using the standard tenodesis screw technique, then place a guidewire through the first MC from the dorsal surface into the CMC ARA space. We make a 6-mm skin incision over the guide wire. Using the cannulated drill to make a tunnel through the first MC, the soft tissues are protected. We retrieved the palmaris longus from the CMC ARA space through the first MC tunnel. We reduce the first MC onto the trapezium, using a tenodesis screw to fix the palmaris longus; then pin the first MC to the 2nd MC, for 4 weeks.
Results: There were five female patients and two male patients with an average age of 58 years (range 43 - 72). The preoperative length of conservative treatment averaged 29 months (range 1 - 48). The average time of postoperative immobilisation was 3 weeks (range 1 - 6). The mean pain value was 6 preoperatively; and 2, 1, 1, 1, 0 and 0 at the aforementioned followup intervals, respectively. The mean DASH score was 46 preoperatively and 5 at the final postoperative follow-up. All patients could reach the base of their small finger. Grip strength averaged 25.0 kg (range 12 - 43) preoperatively and 27.3 kg (range 16 - 47) at the final follow-up. Key pinch averaged 3.2 kg (range 1.4 - 4.5) preoperatively, and 6.4 kg (range 1.8 - 14.6) postoperatively. Patient satisfaction averaged 4.5 (range 4 - 5) at the final follow-up session.
Conclusions: Outcomes of ARA for thumb basal joint arthrosis, combined with arthroscopic ligament stabilization for thumb metacarpal subluxation, yields good results with respect to pain, strength, function and patient satisfaction. Pain relief was rapid and remained consistent over time.

A-0399 Three-dimensional modelling of the scapho-trapezio-trapezoid joint surface from CT scan data

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Objective: The surgical treatment of the scapho-trapezio-trapezoid joint (STT) arthritis had gradually gone from the arthrodesis described by Watson, to the interposition implant. Regardless of the materials used, the size and shape of these implants must be tailored to the STT joint, to ensure a good congruence, stability and load distribution. Because of its spatial

complexity, the STT joint is difficult to study. The descriptive methods of conventional osteology, based on dissections and dry bones, must be abandoned in favour of tomographic acquisitions and numerical analyses (signal processing, image segmentation, three-dimensional (3D) modelling, etc.).
Methods: We included 12 high-resolution computed tomography (CT) scans with helical acquisition, inframillimetric slices and no contrast injection. Performed to seek an occult carpus fracture, these exams found out neither fresh fracture, nor malunion, nor sign of wrist arthritis.
After segmentation and 3D reconstruction, the STT joint surfaces were identified and extracted. A 3D modelling algorithm was applied, to determine a mathematical model of the STT joint.
Results: A single 3D model with different scales was sufficient to represent precisely all the included joint surfaces.
Conclusions: This 3D model of the STT joint surface could help to design a future interposition implant.

A-0401 Fingertip replantation experience: about 13 cases

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Objectives: Fingertip injuries are one of the most frequent traumatic injuries of the hand. Fingertip replantation is an established surgical procedure. Today, indications for fingertip replantation are still controversial.
Methods: From September 2008 to June 2014 there were 13 patients (nine male and four female, with a mean age of 42.5 years) with fingertip amputation who underwent replantation surgery in our department. We classified fingertip amputation levels according to Ishikawa's classification: nine patients had Zone 4 fingertip amputation, three patients had Zone 3 amputation, and one patient had Zone 2 amputation. All fingertips were revascularized. Venous anastomosis was performed in nine cases. Collateral nerve sutures were performed in 12 cases. In all cases, we performed bone stabilisation.
Results: Eight of the 13 fingertip replantations were successful, and three cases after venous stasis and two cases after arterial failure were regularized. The mean length of hospital stay was 8 days. No patients required blood transfusion. No significant difference of strength between the affected hand and the contralateral hand was found, in all patients. Active range of motion (ROM) of the PIP joint was almost normal (near to 90°), and for thumb reconstruction the Kapandji test had a score of 8. The Weber test was > 10 mm, for patients with successful replantation. No patients changed their occupation after the injury. Important dysesthesia and cold intolerance were common in all patients.
Conclusions: Fingertip replantation represents a complex technical procedure for expert surgeons. Although our experience is small, according to the scientific reports, we believe that distal replantation is the most elegant and aesthetically satisfactory technique for tip reconstruction, and remains superior to other alternative methods; however, the surgical indication must be personalized for each patient: if the patient requests a simple surgery and an earlier return to work, simple stump coverage is an accepted method, despite the disadvantages of digital shortening and the risk of a painful stump.

A-0403 Artificial dermis to reduce donor site morbidity after free and pedicle flaps for hand reconstruction

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Objective: To assess the results obtained with Integra Artificial Dermis, to cover the donor site following the harvesting of pedicle and free flaps for hand reconstruction.
Methods: Between April 2010 and April 2014, 18 patients were treated with the Integra Dermal Regeneration Template (Integra Life Sciences, Inc.), to cover donor defects after raising different types of flaps for hand and finger reconstruction: the dorsalis pedis flap (one case), radial forearm flap (five cases), ulnar artery perforator flap (two cases), posterior interosseous flap (one case) and homo/heterodigital island flap (nine cases). After neodermis formation, the silicone layer of Integra was removed (on average after 22 days) and a split or full-thickness epidermal autograft placed. There were a total of 14 male patients and four female patients, with a mean age of 34 years.
Results: No infections, hematomas or bleeding were recorded during the entire phase in which Integra was applied. Two patients suffered a partial skin graft loss. Median follow-up was 22 months and after this reconstructive procedure, the donor site was evaluated according to the Vancouver Scar Scale (it was 2.7); and the Disabilities of the Arm, Shoulder and Hand (DASH) questionnaire score gave a mean result of 39. There were no cases of graft adherence to the underlying tendons nor muscles.

Conclusion: Favourable cosmetic and functional outcomes were obtained using a dermal regeneration template for the treatment of donor site defects. The major criticism of the 2-stage methods using first a dermal substitute and then STSG, is the prolonged healing time and the need for a second surgery, to place the skin graft. Patients were advised that it was possible to directly cover the donor site. In our cohort, the second stage was performed under local anaesthesia, in the majority of the cases. The high cost of Integra represented the second disadvantage: it comes in different sizes and the cost is related to its dimension. For these reasons, some institutions do not easily implement this technique, although better aesthetic and functional outcomes with a faster recovery outweigh these disadvantages. The absence of a control group and the difficulty to evaluate patients treated with different flaps from a variety of donor sites represented the major drawbacks of this paper; however, our study showed that the use of Integra artificial skin was a feasible support to reduce donor site morbidity, particularly when a pedicle forearm flap was used, with satisfactory final results. The capability of Integra to achieve soft-tissue augmentation results in better donor site contour in the exposed anatomical areas, like the dorsum of the finger, when a heterodigital island flap is harvested; therefore improving the overall cosmetic appearance. Despite the drawback of an additional surgical procedure (secondary skin graft), the use of Integra produced soft-tissue augmentation and graft-skin quality, reducing donor site morbidity.

A-0405 Tissue involvement in vascular malformations of the hand

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Objective: One of the principal challenges in surgery of vascular malformations (VM) in the hand is the involvement of different structures, such as skin, bones, nerves, muscles and tendons; by different types of malformations, i.e. venous, arteriovenous, lymphatic and their combinations.
Methods: Analysis of our casuistic 266 operations performed since 1986, on 94 cases of major VM, permitted us to verify the efficacy and safety of surgery and to suggest some tips and tricks to those whom are approaching this surgery.
Results: Skin can be infiltrated, ischemic or expanded. Amputation is sometimes unavoidable, and reconstructive procedures are rarely necessary. In the presence of infiltrating vascular malformations involving muscles, it can be necessary to resect single or groups of muscles. Nerves can be surrounded or infiltrated, especially by arteriovenous VM. External neurolysis is the first choice,
while microsurgical internal neurolysis or selective resection and grafting are the next possible steps. On the other hand, nerves can be used as a guide for dissection inside venous VM, and skin can be saved by a careful subdermal undermining. Bone involvement can be treated by direct intraosseous alcohol injections or bone graft, after resection of extra-bone malformed vessels. Tendons are seldom infiltrated.
Conclusions: Our surgical approach to hand VM has been demonstrated to be safe and effective.
No major complications were observed. Only four finger amputations, all in 36 arteriovenous VM with severe distal ischemia, were observed (11.11%). Limited VM healed after a single operation. Infiltrating lymphatic VM demonstrated the highest tendency for recurrence, followed by AVM.

A-0408 The use of lipofilling in hand and wrist post-traumatic sequels

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Objective: We report our experience using the lipofilling technique for post-traumatic outcome of the hand and wrist. This is a low invasive, effective approach to demanding, painful soft tissue sequelae.
Methods: Since 2010 to December 2013, we treated 24 patients: seven patients had a fingertip pulp dystrophy after a traumatic tissue loss, six had a painful amputation stump which were in two cases associated with a neuroma, four had an iatrogenic keloid involving terminal sensitive branches of the dorsal radial nerve, four had skin graft dystrophy and three were treated for surgical deep scars pasted to tendons and bone, after a phalangeal or metacarpal synthesis. The autologous fat had been picked up from the peri-ombilical region or the medial side of the arm, according to the tissue amount required. In the first 19 cases, the fatty graft was processed according to Coleman's protocol; the latter without centrifugation. Every patient required 3 or 4 different grafts, every 3 months.
There were 11 patients who required general anaesthesia, six patients had a brachial plexus block and seven needed only a local infiltrative anaesthesia; in all cases, the donor site was processed by a Klein solution. The patients were evaluated at 2, 6 and 9 months after their last treatment.

Results: All the patients had a benefit after lipofilling, for scar and skin quality improvement and for pain (Visual Analogue (VAS) scale). In two cases, we had to remove a recurrent amputation neuroma. We also detected an aesthetic improvement from the filler action, above all at the fingertips and under the skin grafts. The cases with a dorsal radial branch neuritis had a less disestesic skin associated with a lower VAS scale test. No surgical complications were detected.
Conclusions: We considered the Lipofilling technique a further chance for hand post-traumatic soft-tissue sequel treatment. We recorded benefits on an aesthetical, sensitive, pain and biomechanical level. It is a low invasiveness technique, often performed under local anaesthesia.

A-0409 Carpal tunnel release with and without synovectomy: 6-month follow-up

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Objective: The goal of our study was to compare the results of carpal tunnel release operations, with and without synovectomy, in a prospective randomised study.
Methods: In our unit between March and May 2014, we operated on 57 patients for carpal tunnel syndrome. The patients were selected randomly into two groups. All the patients were operated on with the same technique, but in one-half of these cases, we performed synovectomy of the tendons in the carpal tunnel, also during the operation. We followed the patients for 6 months postoperatively. We asked them to fill out a questionnaire after 1 week, 6 weeks and 6 months. Visual analogue scale (VAS) was used to evaluate the subjective complains and satisfaction of the patients. We registered the level of pain, the change in numbness of the fingers, the overall satisfaction of the patient, the need for physiotherapy, the length of this treatment, and the time needed for getting back to their daily routine activity.
Results: There was no difference between the groups in the mean age of the patients, the time from the first symptoms until the surgical intervention, the length of the incision, or in any other parameters, except the synovectomy. No major surgical complications were observed in the investigated period. At 1 week after the operation, the two groups seemed to be very similar. In the first 6 weeks, we counted more physiotherapy needs in the group with synovectomy (12% in the neurolysis group, but 25% in the synovectomy group). The overall patient satisfaction rate after 6 months was about the same (9.5 points on a scale of 10 for simple neurolysis; and 9.1 points for synovectomy). There was no difference in the decreasing level of numbness of the fingers, in the disappearing night pain, and in the rate of pillar pain in the two groups; but the patients had to estimate the time they needed to reach the final state, so we found that after synovectomy, patients needed more than the double the time of the neurolysis group (4 weeks after simple neurolysis, and 9 weeks after synovectomy).
Conclusions: We can agree with all the authors on the fact that there is no adverse effect on the long-term results if we perform synovectomy during carpal tunnel release, but we could not reach any benefit from doing so. As the patients needed more time to reach the same good results as the simple neurolysis group had, we recommend not doing synovectomy during carpal tunnel release, with the exception of in patients with extremely bulky real synovitis.

A-0410 Effects of multi-sensory education for development of activity participation, hand function and Braille reading speed in visually impaired individuals

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Objective: To investigate the effect of multi-sensory education on developing hand function, level of participation status and speed of Braille reading in visually impaired individuals.
Methods: Twelve people who had a mean age of 20 ± 1.41 participated in the study. To assess hand function, we applied the Abilhand Manual Ability Measure and to determine to the speed of Braille reading, we counted the number of words read in a 1-minute period of time. For the level of participation in selected activities during a conversation, we applied the Canada Activity Performance Measurement (COPM). After the first evaluation, we applied multi-sensory education for 10 months, for 2 days a week, for a period of 40 minutes. Manual activities providing proprioceptive, deep pressure and multi-sensory input, and accelerant awareness kinaesthetics were preferred for training.
Results: After 10 months of therapy, the pre-therapy evaluations were repeated. At the beginning of the therapy, the COPM score was 3.7 ± 0.55, and at the end of the therapy it was 5.4 ± 0.75. Before the therapy, the Abilhand Manual Ability Score was 25 ± 2.69 and at the end of the therapy, it was 36 ± 2.79. At the beginning of the therapy, the mean of the number of words read in a 1-minute period of time was 10 ± 2.17, and at of the training, it increased to 16 ± 3.43. All

parameters that were evaluated were significantly different, compared to pre-sensory therapy ($p < 0.05$). **Conclusions**: Sensory education contributed hand skills, activity participation and speed of Braille reading in visually impaired individuals. To promote the activity participation of this person, the rehabilitation program should include sensory therapy. Further studies should be conducted in a larger sampling.

A-0412 Improvement of the arch of rotation of the posterior interosseous pedicle flap using both reverse posterior and anterior interosseous vascular sources

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Objectives: The reverse posterior interosseous flap (PIAF) provides thin, soft and pliable skin with good colour and texture match, preserving the major forearm vascular pedicles covering dorsal hand defects up to the metacarpophalangeal joint and the first web space contracture. Its main disadvantage lies in the relatively short pedicle that limits its most distal use. The interruption of the distal anastomosis between the anterior (AIA) and posterior (PIA) vascular pedicles, even if described by the method of elongation of the arch or rotation, represents a potential risk of flap ischemia. The aim of this study was to verify the possibility of stretching the pedicle of the PIAF, while maintaining a valid retrograde anterior and posterior interosseous perfusion.
Methods: In 16 fresh upper limbs of cadavers injected with red latex, the PIAF flap was designed centred on the proximal one-third of the dorsum of the forearm and then dissected, following the original description. The presence and the location of the anastomosis between the AIA and the PIA, with respect to the distal wrist crease, were recorded. The AIA was ligated proximal to the anastomosis, then the interosseous membrane distal to it was opened, obtaining a variable elongation of the flap pedicle. All these measures were recorded and the modification of the arch of rotation of the flap was evaluated. These data were standardised as the percentage of elongation of the pedicle, in order to avoid bias due to the different length of the people's arms.
Results: In all of the specimens, the vascular anatomy reflected the normal vascular pattern of the forearm. The medium distance of the ramus perforans between the AIA and PIA from the wrist crease was 6.44 cm; the medium length of the flap's pedicle in the traditional pattern preparation was 13.69 cm. After the section of the AIA, the medium length of the pedicle was 17.19 cm, with a medium increase of 3.5 cm. That means a medium increase of 26% of the length of the pedicle.
Discussion: The proximal interruption of the AIA, preserving both retrograde flow of AIA and PIA, may permit reaching more distal defects of the hand, without being afraid to stretch the pedicle. The reliable vascular flow, through the connection with the reverse anastomotic arcades of the AIA at the wrist, contributes to reduce the risk of ischemia, overcoming the limit of the arch of rotation of the PIAF. The authors present their preliminary clinical results.

A-0413 Hand functioning in diabetes mellitus

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Objective: Our aim was to determine the hand function of individuals with diabetes mellitus (DM), by comparing results with healthy individuals.
Methods: Our study had 15 individuals with DM with the mean age of 47 ± 4.25 years and 15 healthy people, with a mean age of 44 ± 5.19 years. The participants did not participate in any rehabilitation programme after diagnosis. After the sociodemographic information form was applied for determining physical hand function, sensory evaluation with two-point discrimination, grip strength measurement with the dynamometer and a speed/dexterity evaluation with the Purdue Pegboard Test (PPT) were done. As an outcome measure, the Cochin Scale and Michigan Hand Outcomes Questionnaire (MHOQ) were used to indicate activity limitations and functioning of the hand. All results were compared between groups, by the Mann-Whitney U Test.
Results: Our results showed that the hand function of individuals with DM was significantly affected. The 2-point discrimination test outcomes showed that sensory function was worse than in healthy individuals. Both hand's sensory perception in the median and ulnar nerves decreased ($p = 0.008$ for the right median nerve, $p = 0.013$ for right ulnar nerve, $p = 0.003$ for left median nerve and $p = 0.007$ for the left ulnar nerve). The mean score by the Cochin scale was 17.2 ± 14 in individuals with DM; on the other hand, it was 0 in healthy individuals ($p = 0.00$). The PPT and MHOQ results of individuals with DM were also significantly worse than the healthy group ($p < 0.005$). The only parameter found not to be

significantly different than healthy subjects, was grip strength ($p > 0.005$).
Conclusions: Hand functioning was negatively affected in people with DM, when compared to healthy individuals. Physicians mostly refer patients with DM to hand rehabilitation programmes after they have significant neuropathy; however, our results showed the need for a preventive and therapeutic approach, to increase hand functionality in these patients.

A-0414 Histomorphometric evaluation of median nerve injury in Wistar rats treated with GM1

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Background: The aim of this study was to compare the morphologic alterations between traditional neurorrhaphy and neurorrhaphy combined with intraperitoneal administration of GM1 after median nerve injury of Wistar rats, using histomorphometric analysis.
Method: The 22 male Wistar rats suffering from microsurgical median nerve damage were further subdivided into two experimental groups: Group I (10 animals) were treated with external epineurial neurorrhaphy and Group II (12 animals) were treated with epineurial neurorraphy, combined with intraperitoneal GM1.
Results: Microscopic analysis containing distal stumps revealed that Group II animals had more regenerated axons, with a slightly thicker myelin sheath than Group I animals, and they had a more homogeneous and organized regeneration pattern, with a looser endoneurium in the central nerve fibre. A significant difference ($p = 0.0056$) in the mean axonal diameter of the distal segment was observed, and Group II had larger and more axons (28%) than Group I. A comparison with the existing method(s) of traditional axonal regeneration index, obtained by axon counting in both segments, was added to the diameter of the axonal myelin layer.
Conclusions: Because nerve regeneration depends upon the association between the number of regenerated axons and the myelin sheath diameter, our data indicated that Group II was more highly myelinated than Group I. There is strong evidence ($p = 0.0536$) that the GM1 used as an adjuvant in peripheral nerve surgery improved the axonal regeneration pattern.

A-0417 Treatment of old unreduced carpal dislocations and fracture-dislocations

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Objective: From 1985 to 2013, we received 32 cases with surgical operations for carpal dislocations and fracture dislocations. Out of them, we studied 10 chronic cases that were past > 6 months (range: 6 - 16 months) from the time of injury to the time of their operation, due to being overlooked by former physicians.
Patients and methods: All the study patients were male and aged 19 - 36 years, with an average age of 27 years. The average follow-up period was 36 months (range: 24 - 54 months). The fracture-dislocation type and the time period from injury to surgery were investigated for these eight cases, and the results of patient treatment were assessed by wrist joint functionality, using the evaluating method of Cooney et al. and plain radiography.
Results: According to the classification by Green and O'Brien, the 10 cases consisted of five cases of Type I (volar dislocation), four cases of Type II, and one case of Type IV (trans-triquentral-scaphoid-perilunate dislocation fracture). The average period from injury to surgery was 8 months in Type I and 10 months in the other types. All 10 cases were surgically operated, to achieve anatomical repositioning. For four cases, we performed 2-staged operations by using an external fixator. In eight of the 10 cases, we obtained the anatomical repositioning. For two cases of Type II 13 months after the injury, we had to do a proximal row carpectomy. Based on Cooney's system, there were one excellent, three good and six fair results. The average score of Type I is 84 (75 - 90) and the average score of the others is 71 (70 - 75). The radiographies at the final examination demonstrated there were no cases of VISI deformity, but one case of DISI deformity. Furthermore, two cases of arthropathic changes and three cases of osteosclerosis in the lunate and scaphoid proximal bone fragments were observed in the wrist joint, but no carpal collapse was observed.
Discussion and conclusions: As a general rule, we have been executing surgical operations to achieve an anatomical repositioning for young patients, in principle. Especially for cases of Type I, there is a possibility of getting good results, even if the case was past > 6 months since the injury; however, it is never easy to gain an anatomical repositioning in a chronic case. In some cases, it is very useful to have a 2-staged operation, by using an external fixator. We feel that all

efforts should be made to obtain a reduction of the old dislocation.

A-0418 Fifteen years of endoscopic ulnar nerve release in cubital tunnel syndrome (Hoffmann technique)

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Introduction: In 2003, the author presented his technique for the first time at the FESSH meeting. He reported 25 cases, the first was performed in 2000. At the time, the surgical management of cubital tunnel syndrome was more controversial than today. There is now a clear tendency towards in situ release of the nerve and away from transposition methods. This assumption is based on recent publications, and panels at major international and national hand surgery meetings. There is evidence that transposing the nerve gives no better results and more complications. Our own work (Hoffmann and Siemionov, 2006) and that of others show that our technique is safe and reliable, has a small learning curve and the results are at least equal to, if not better than, other methods. Meanwhile, this technique has been the subject of countless presentations, live operation and cadaver workshops at national and international meetings on all continents. The technique was adopted by leading hand and peripheral nerve surgeons around the world. Our anatomical studies have shown that it is not only Osborne's ligament, the FCU arcade and the FCU fascia that may cause compression in the distal part of the cubital tunnel; but also the submuscular membrane, with its intrinsic bands at different levels. Therefore, we advocate a long-distance decompression to achieve good results, which in our hands has been successful in more than 90% of cases. Our mean length of decompression is 23 cm (with distal and proximal combined).
Technique: Endoscopic surgery means that a large, clearly manageable cavity allows an excellent view of all the anatomical structures and permits the introduction of every instrument necessary for safely completing the procedure. The author's aim was to emulate this philosophy in the practice of endoscopic surgery for the release of the ulnar nerve. We created and maintained a cavity in which to view and release the nerve. We did not introduce instruments into the nerve tunnel, but released all the structures from above, thus applying a strict 'no touch policy'. We used scissors to release the nerve step by step, instead of blades that slice a long distance without continuous vision of the nerve and its branches. Our principle is 'you see, you cut', thus ruling out any element of blind dissection.
Results: Since our first publication in 2006, we have done more than 1200 cases in our group, with a success rate > 90%, including difficult cases with long-standing paresis.
Conclusion: The endoscopic release of the ulnar nerve is part of the development of endoscopic surgery, which has been a great leap forward for surgery in general. In 15 years of practice, this technique has stood the test of time and shown that it is not a gimmick, but part of the family of endoscopic and minimally-invasive procedures in surgery.

A-0420 The radial forearm flap as a sentinel flap to monitor rejection in solid organ transplantation

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Some solid organ transplants are difficult to monitor for rejection, as they are not visible, and current markers for rejection are neither sensitive nor specific. The addition of a sentinel flap of composite tissue, including skin from the same donor, may provide an early marker of organ rejection, reducing rejection injury in the solid organ and the amount of immunosuppression. In our unit, since April 2012, small bowel transplant recipients with a loss of abdominal cavity or severely scarred abdominal walls received a full-thickness abdominal wall, a vascularized composite allograft (VCA) from the same donor, to achieve abdominal wall closure that comprised a large skin paddle; however, the optimal sentinel flap would be a thin, pliable composite tissue, including skin of sufficient size for easy observation and multiple biopsies. It would combine the ease of inset with the potential for removal with little morbidity. We believe that the radial forearm flap meets these criteria. From June 2013, small bowel transplant recipients consented to synchronous transplantation of a sentinel radial forearm VCA. Following harvest of the abdominal organs, a standard radial forearm fasciocutaneous flap was raised from the distal forearm of the same donor, based on the radial artery, its vena comitantes and cephalic vein. The flap was flushed with cold University of Wisconsin (UW) solution, and transported in UW on ice and water. Synchronous to the small bowel transplant, a longitudinal incision was made in the recipient's non-dominant forearm over the ulnar artery, and the donor sentinel radial forearm flap inset was placed as a flow-through flap. Postoperatively, rejection was

monitored by visual inspection of the skin paddle for a maculopapular rash, and confirmed by punch biopsy for histological diagnosis, according to the Banff criteria. Small bowel endoscopy and mucosal biopsies were performed, to investigate suspected skin or small bowel rejection. We trialled a sentinel radial forearm flap with a transverse skin paddle and a longitudinal skin paddle design: the longitudinal was easier to raise and inset. There were no flap losses. One patient had an episode of rejection in the radial forearm sentinel flap (Banff Grade II - III); and overall, in our series of 16 sentinel flaps (abdominal wall and radial forearm), skin rejection was seen in five and intestinal rejection in only one patient, compared to four rejected intestines in a similar cohort of 16 intestinal transplant recipients whom did not receive a sentinel flap. The sentinel flap has also helped us to differentiate the cause of transplanted bowel dysfunction, because the absence of signs of rejection in the sentinel flap allowed these to be correctly diagnosed as infections.
The radial forearm flap is an ideal sentinel flap for the monitoring of rejection in solid organ transplantation. The inset as an interposition in the ulnar artery allows for restoration of anatomy when present, and if it requires removal. There remains debate about the utility of such sentinel flaps for other transplanted organs, but should its utility be proven, such sentinel flaps may become commonplace.

A-0421 A less aggressive surgical method for severe extremity infections using modified vacuum-assisted closure (VAC) technique

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Objective: Treatment of severe extremity infections such as necrotizing fasciitis commonly involves aggressive debridement. After eradication of such an infection, there may remain a wound that cannot be closed primarily, or a defect that needs soft tissue coverage surgery, as a result of a large incision or resection for drainage and the debridement, followed by open wound dressings such as the classic 'wet-to-dry' dressing. Here we introduce the novel modification of vacuum-assisted closure (VAC) therapy, which is effective both for infection control and for minimizing coverage surgery.
Methods: We minimized the incision or resection for pus drainage and debridement: for example, we make a 10-cm incision for a 30 cm-long pus pocket. After drainage, we remove the clearly devitalized tissues and irrigate the wound. Then we put pieces of foam between the tissues, much deeper and wider than the actual open wound: we fill the 30 cm-long pus pocket with foam pieces through the 10-cm incision. Then we fashion the main foam, which fits the actual wound opening. We put the main foam into the wound, with the deeper foam pieces in contact with the main foam. We then cover and seal the wound with a transparent adhesive dressing, and we apply negative pressure to the main foam, using a suction device and drainage tube. By this method, we can apply negative pressure to the whole aspect of infected tissues, without actually exposing the whole surface of the infected tissue. With appropriate intravenous antibiotic coverage, VAC is changed every 3 days after initial surgery, with necrotic tissue debridement at each time. Finally, we close the incision or the wound opening primarily, or perform a coverage surgery, for which the skin graft is usually sufficient. In this study, we reviewed 11 cases of such procedures.
Results: Six patients had necrotizing fasciitis and five patients had a large abscess. The infection was eradicated successfully in all patients, without any further spread of the infection extent after the initial surgery. Two of the necrotizing fasciitis patients underwent skin grafting; the other nine patients underwent primary closure. No complications developed that were associated specifically with the VAC.
Conclusions: Our surgical method using a modified VAC therapy appears to be effective for severe extremity infections, and it is helpful for minimizing the need of coverage surgery, as compared to conventional methods.

A-0422 Costs of hand injuries for the economy: the Austrian Hand Prevention Campaign to avoid hand injuries

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Introduction: Hand injuries are a frequent occurrence and account in occupational accidents for up to 41% of them. The main reasons for hand injuries are stress, inattention, tiredness and the use of maintained machinery. For that reason, in the last 10 years, much efforts had been carried out in Europe to reduce the number of hand injuries. In Austria, the Austrian Workers' Compensation Board (AUVA) started (in

2014) a prevention campaign to reduce the number of hand injuries during work. Also, the 'Circle for Leisure-Time Hand Injury Prevention' was instituted, with the aim to take measures especially to avoid hand injuries during leisure activities.

Materials and methods: Hand injuries at work were analysed in the years 2010 – 2011, with respect to the nature of the injury, time of the injury, sick leave duration and the cause of injury. Furthermore, we calculated the costs for each type of hand injury for the AUVA, companies and the economy.

Results: In all, 632,693 injuries were treated in the Austrian Workers' Compensation Board hospitals. Of these, 174,855 involved hand injuries. Each year, 4826 new pensions had been given because of injuries during work, and 1224 of these were because of an injury of the hand. Total sick leave for all hand injuries amounted in total to 474,859 days per year, which meant 12.3 days per hand accident. In 26% of the cases, it was not from powered handheld tools. We found that 25% were from building materials and in 10%, machines had been the reason for a hand injury. Hand injuries entail annual costs of 309 million € per year. The average cost per hand accident was 7778 € per patient.

Conclusion: Hand injuries are very common and account for up to 41% of all injuries. They cause annual costs in Austria of 309 Million €. So in the last decade, much effort has been made to reduce hand injuries.

A-0423 Influence of risk factors on the age of onset of Dupuytren's disease

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Background: Dupuytren's disease (DD) is a proliferative fibromatosis that is progressive, that affects the function of the hand, and whose aetiology is still uncertain. The main risk factors included in this disease susceptibility are age, ethnicity, diabetes, manual labour and local trauma, smoking, alcohol and epilepsy, but also a family history of the disease.

Objective: The reason for this research was to study the influence of the main risk factors and enunciation on the minimum age of onset (minimum decade) of DD.

Methods: A retrospective longitudinal study was performed, with the inclusion of 169 patients (142 men and 27 women), aged 32 - 83 years. The study group consisted of patients who were hospitalized and surgically treated for DD in the Plastic Surgery Reconstructive Microsurgery Clinic of the University Emergency Hospital in Bucharest, Romania, January 2000 - June 2012. Risk factors were taken into consideration separately (diabetes, manual labour, local trauma, smoking, alcohol, epilepsy and family history of disease) and in combinations of two and three, following their action on age of onset of the DD.

Results: Among the risk factors cited in the aetiology of DD, the data obtained in this study were statistically confirmed. Family history of DD, smoking (and partly the DZ) had influence on the minimum age of onset of DD: family history of DD modifies the age (by decade) for DD onset minimum, with the downside of the decade 50 - 59 years, to 40 - 49 years (statistically highly significant result, p = 0.011596, Test Likelihood Ratio). The comparison test for media of minimum age of onset in the 12.6427 years ± the presence and the absence of AHC-DD (AHC-DD = 1: 44.972 11.3318 years) gets a very significant difference ± AHC-DD = 0: 53.419 that is statistically between these media (p = 0.004, Student's test). Smoking reduces the minimum age of onset, with statistical significance, to 10.234 years (4.55 years), with p = ± 12.467 years, to 50.613 ± (from 55.165 SD 0.0481, Student's *t* test). DZ increases the minimum age of onset, with a value close to statistical significance (from 51.724 ± 11.812 years to 10.931 years (4.68 years), p = 0.0824, Student's *t* test ± 56.409.

In addition, by an association in the presence of two factors (thus DZ-smoking, alcohol-DZ, DZ-manual labour, alcohol-manual labour, smoking-alcohol and smoking-manual labour), respectively, and three risk factors (smoking-alcohol-DZ, DZ-alcohol-physical labour, physical labour-DZ-smoked and alcohol-smoking-physical labour) in the history of patients, it was observed that although there are some changes (plus or minus), the minimum age of onset of DD does not show significant changes, and the Students' *t* and analysis of variance (ANOVA) tests that we calculated, were not statistically significant.

Conclusions: Among the risk factors of DD that were cited in the scientific literature, our study noted that family history of the disease had the greatest influence on the minimum age of onset of the disease. Also, smoking and diabetes influenced the age of onset. To confirm these results would require a larger sample of patients, especially in the investigation of the combination of two to three risk factors, as in this study, the group of patients included was restricted according to an increasing number of factors.

A-0425 Dupuytren's disease clinic for patients with a family history of disease (AHC-DD)

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Background: Dupuytren's disease (DD) is a palmar fibromatosis that is characterized by progressive and permanent contracture of the fingers. Among the risk factors cited in the literature, we found that family history of the disease plays a key role, as some patients with DD present relatives whom had this condition.
Objective: The objective of this study was to observe the age of onset, with respect to clinical manifestations of DD in patients with a family history of disease.
Methods: A retrospective longitudinal study was performed, with the inclusion of 169 patients (142 men and 27 women), aged 32 - 83. The study group consisted of patients who were hospitalized and surgically treated for DD in the Plastic Surgery Reconstructive Microsurgery Clinic of the University Emergency Hospital Bucharest, between January 2000 and June 2012. The AHC-DD frequency was followed in the study group, as well as the distribution according to the sex of the patient, minimum decade/minimum age of onset, it affecting the hand uni/bilaterally, the affected number of digital rays and their distribution for each affected hand, and the stage of disease.
Results: Family history of disease was present in 11% of patients' parents, brothers, or sisters, with a male to female ratio of 5:1. The age (decade) of minimum onset of DD decreased from the decade of 50 - 59 years to the decade 40 - 49 (highly statistically significant results, $p = 0.011596$, ± Likelihood Ratio Test), with a minimum average age of onset of 44.972 years (SD 11.3318 years), with very significant ± 12.6427 years (AHC-DD absent 53.419 difference was statistically significant between these media ($p = 0.004$, Student's *t* test). The distribution localization that unilaterally or bilaterally maintains that in the general population (87.5% if right-handed, if left-handed 77.8%, or 66.7% if bilateral). The number of affected digital rays, with a small increase for each of the hands, was without statistical significance. In the right hand, the most often affected is the first digital ray, while in the left hand, there were two digital rays affected. Regarding the distribution of digital rays affected, there was statistical significance for the ray digital III of the left hand ($p = 0.001978$, Fisher test), with a frequency in the order IV, V, III, II, I for the right hand and IV, III, V, II, I for the left hand. DD is found more frequently in a lower evolutionary stage, for both hands.
Conclusions: Family history of DD influenced the minimum age (decade) of onset of the disease on the downside. Regarding the clinical DD in these patients, we observed that in the left hand, the most commonly affected were two digital rays, with a change in the distribution of rays affected, and statistical significance for the digital ray III. The results obtained could lead to the conclusion that the presence of a family history of DD determines the displacement of the disease towards the radial part of the left hand, with a larger number of rays affected, but these observations would require a larger sample of patients to support the conclusions of this study.

A-0426 Clinic on the influence of smoking on Dupuytren's disease

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Background: Dupuytren's disease (DD), a benign fibroproliferative disorder affecting both hands as an aetiology has a number of risk factors that participate in downgrading the disease and present different opinions. Among the risk factors associated with DD are listed: manual labour and local trauma, diabetes, smoking, alcohol consumption, epilepsy/anticonvulsants, hypercholesterolemia, and family history of disease.
Objective: The objective of this study was to observe the clinical manifestations of patients with this condition, which associates smoking as a risk factor, compared to the general population.
Methods: A retrospective longitudinal study was performed, with the inclusion of 169 patients (142 men and 27 women), aged 32 - 83. The study group consisted of patients whom were hospitalised and surgically treated for DD in the Plastic Surgery Reconstructive Microsurgery Clinic of the University Emergency Hospital in Bucharest, Romania, between January 2000 and June 2012. In the study group, we followed smoking frequency, the decade minimum or minimum age of onset, whether it affected hands uni- or bilaterally, the affected number of digital rays and their distribution in each affected hand, and the stage of disease.
Results: Smoking as a risk factor was highlighted, at 31%. The minimum decade of the DD debut was maintained between 50 - 59 years and that minimum age of onset is lower in smokers, with statistical significance ($p = 0.048105$, Student *t* test). The distribution locality regarding uni- or bilateral hands affected was: bilateral (56%), the left hand (54.43%) and the right hand (52.94%). The most frequently affected is one digital ray for both hands, with a total number higher of digital rays affected, but not statistically significant.

Distribution of the digital rays affected for the right hand is IV, V, III, II, I; and in the left hand is IV, V, III, I = II (there is a shift in the distribution and affected digital ray percentage). The digital ray III of the right hand obtained a value near to statistical significance ($p = 0.06179$, χ^2 test). DD is commonly encountered in an advanced stage (stage IV), for both hands.
Conclusion: Smoking in patients with DD decreases the minimum age of onset of disease, changes the damage distribution between uni and bilateral hands, changes the distribution of digital rays affected, as well as gives a higher frequency of being at an advanced evolutionary stage. To confirm these results, undertaking studies on a larger sample of patients is needed.

A-0428 Equal treatment effects of needle fasciotomy and collagenase in Dupuytren's disease: an ultrasonography study

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Objective: Local treatments of the cord in Dupuytren's disease, either by collagenase injection or needle fasciotomy leading to rupture of the cord, have become increasingly used methods. The purpose of this study was to ultrasonographically investigate any differences in the ruptured cord after collagenase and needle fasciotomy, with respect to the size of the gap.
Methods: A prospective, randomised study was undertaken in patients with Dupuytrens' contracture treated with either collagenase (Xiapex®) or needle fasciotomy. The inclusion criterion was a minimum 20° MCP-contracture, with a well-defined pretendinous cord. The patients were examined by ultrasound of the cord, before and after randomisation and treatment; with special regards to the size of the gap in the cord. The change in MCP-motion was also measured. We included 40 patients: 20 patients were randomised to the collagenase treatment and 20 patients, to needle fasciotomy. In each patient, ultrasound of the cord was performed before randomisation and directly after the cord had been ruptured. The distance between the distal and the proximal part of the ruptured cord was measured, as well as the difference in passive MCP-joint movement, prior and after treatment.
We found that 21 patients had contracture of the fifth finger, 17 patients of the fourth finger and two patients had contracture of the third finger. Median age was 66 (47 - 77) years, and 35 patients were male and five patients were female. The preoperative median MCP passive extension deficit was 43.5° (22 - 90) in the collagenase group and 41° (20 - 80) in the needle fasciotomy group.
Results: The mean decrease of extension deficit was 57° in the collagenase group and 48° in the needle fasciotomy group. There were difficulties in defining the proximal and distal parts of the cord in four of the patients treated with collagenase, leading to adequate measurements in 16 patients. The median length of the rupture measured by ultrasound was 18 mm, in both groups.
Conclusion: There were no significant differences between the collagenase group and the needle fasciotomy group, in either extension gain or size of the rupture.

A-0430 Dermal scaffold and enhanced fractional cells: usage for upper extremity burn contractures as an alternative to free tissue transplants to obtain functional and aesthetic tissue healing

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Objective: There is a significant increase in the survival rates in acute burn treatment, as a result of recent developments. Similar results were not observed in the long-term consequences of burn patients. In advanced stages of burn scars, they are likely to be encountered with extremity contractures; these contractures are especially common in the upper extremity and may lead to extensive functional impairment. Contractures tend to repeat, so reconstructive surgical initiatives should increase the function and reduce the recurrence. Therefore, dermal scaffold (DS), stem cell and fat graft applications, and platelet rich plasma (PRP) injections were combined with conventional flap or graft surgeries, to obtain better results. In this paper, we examined the alternative possibility of our treatment modalities, which were created as a result of the current strategies for the treatment of burn contractures, to the conventional treatments.
Methods: Patients with complaints of upper extremity burn contractures were admitted to our clinic. Patients were divided into three groups, according to the presence of low (L), moderate (M) and severe (S) contractures. After contracture release, dermal scaffolds and split thickness skin grafts (STSG) were applied for the L group. DS, PRP and STSG were applied for the M group. DS, PRP, bone marrow

aspirate concentrate and STSG were applied for the S group. Vacuum-assisted closure was performed for all patients. Physical therapy was started on postoperative Week 1. Lipoinjection procedures were performed on postoperative Month 6, for all groups to contour. Preoperative, early and late postoperative range of motion (ROM) was measured.
Results: We included 15 patients between the ages of 2 - 41 (mean 13.8) in the study. Follow-up time was 18 months. Significant differences were found between the preoperative and postoperative ROM. There was improvement in skin quality and flexibility, and reduction of hypertrophic scarring.
Conclusions: Inadequate skin quality and flexibility, insufficient ROM and high recurrence incidence are common problems in burn contracture treatment. Inability to use local or regional flaps is another problem for extremities with wide hypertrophic scars. Treatment options are limited to STSG and free flaps for these patients. Donor area morbidity, long hospital stay and economic limitations were disadvantages for the free flaps. DS and STSG usage provided skin quality and flexibility, and reduced hypertrophic scar formation and recurrence. PRP injection provided tissue regeneration and the integration of the graft-recipient site.

A-0432 Major pain relief following bionic extremity reconstruction in patients with brachial plexus avulsion injury

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Objective: Root avulsions of the brachial plexus represent one of the most severe nerve injuries. Next to apparent sensorimotor functional deficits, the avulsion injury often leads to unbearable pain, frequently referred to as differentiation pain. In avulsion injuries of the inferior trunk, the burden of pain is most intense and the hand function that can be expected by reconstructive, surgical approaches (intra-/extraplexual nerve transfers) is less than poor. We report of five patients with global plexopathies with avulsion of at least one nerve root, who had approached our specialist centre for extremity reconstruction, within the years 2010 - 2014. The impact of bionic extremity reconstruction on hand function, differentiation pain and quality of life is presented.
Methods: In all five patients, multiple selective nerve transfers (and muscle transfers in selected cases) were performed on the affected limb. Surgery was not able to restore motor function in the hand, but thereby generated electromyography signals that could be used for the control of a prosthetic device. After intense rehabilitative training, the functionless hand was electively amputated and replaced by a functional prosthesis, defined as bionic reconstruction. The patients were evaluated pre-interventionally (before bionic reconstruction), during the rehabilitative process after amputation, as well as prosthetic fitting. The pain state was assessed with the Visual Analogue Scale (VAS). Additionally, pre- and postinterventional pain medication was documented, and the quality of life, as well as general health state were assessed on a regular basis (Health Survey SF-36).
Results: In all five treated patients, the bionic reconstruction led to significant pain reduction, compared against the pre-interventional pain conditions. Pain medication intake was ceased in each patient after the prosthesis had been incorporated into the user's activities of daily living. Quality of life, subjectively perceived health state, and psychological role functionality also improved dramatically.
Conclusions: The functional and cognitive reintegration of the extremity into the patient's body image led to major pain relief, as well as markedly improved quality of life in all of the so far treated patients. In some patients, even a re-entry into working life was permitted by the functional gain of the prosthetic hand, which also brought social and economic benefits.

A-0433 Reconstruction of osteochondral defects of the distal radius using metatarsal osteochondral autografts: a preliminary result

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Objective: Delayed reconstruction of the articular surface of the distal radius after trauma is a difficult problem for hand surgeons, and the common solution is usually some form of wrist fusion, which reliefs pain, but sacrifices motion. A novel reconstructive technique addresses the problem with a free osteochondral flap, using the third metatarsal bone. We investigated the possibility of using the same donor as a graft, rather than a free flap, and present the preliminary findings.
Method: A prospective clinical study of patients with lunate fossa damage post-trauma, whom underwent surgery to remove the damaged articular surface and have the defect reconstructed with an osteochondral graft from the third metatarsal base. All patients

were followed up at specific time intervals, with pre- and post-outcome measures taken, including: Visual Analogue Scale (VAS), grip strength, range of motion (ROM) and post-operative radiographs and computed tomography (CT) scans to evaluate resorption. Only patients with isolated distal radius defects were included.
Results: Preliminary results of seven patients included an average improvement of the pain score by 3 points (VAS) and an average arc of motion of 110°. In all, there was radiographic evidence of full incorporation of the graft, with no resorption. Donor site morbidity was minimal.
Conclusions: The current gold standard for distal radius articular surface reconstruction is a free third metatarsal osteochondral flap; however, our preliminary results using the third metatarsal base as a graft showed promise, and if further follow-up confirms comparable results to the free flap technique, this would mean an easier and equally robust reconstruction, without complicated microsurgery.

A-0434 Free flap based on radial artery superficial palmar branch: various types

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Purpose: To evaluate various type of free flap, based on the radial superficial palmar branch, for treatment of defects of digits.
Methods: We performed 65 free flaps, based on palmar branching of the radial artery. The vascular pedicle branched out from the radial artery 2.5 cm proximal to the wrist and travelled toward the scaphoid tubercle, which is constant anatomy. The average diameter of the vessel ranged from 0.8 - 1.4 mm. This flap was used as a non-innervated flap (thenar free flap) in 51 cases and as an innervated flap (innervated radial superficial palmar branch flap) in 14 cases. The palmar cutaneous branch of the median nerve (PCMN) was used as a nerve supply to the flap. If additional blood supply to the distal part was required, a flow-through type flap was performed (eight cases). Deep palmar branching of the radial artery was dissected from thenar muscle and anastomosed to the distal digital artery. When multiple defects were present at the fingertip, a bridge free flap was used (in seven cases), which needed secondary division surgery. The donor site was closed primarily, in all cases.
Results: All patients had a successful result, without serious complications in either the donor or recipient site. The artery was constant, with reliable direct skin perforators and compatible in size to a digital artery, and the palmar cutaneous branch of the median nerve was present in all cases. The colour and texture of the flap was excellently matched with the palmar defect, with durable coverage.
Conclusions: Free flap based on the radial artery superficial palmar branch was useful to cover various defects in the hand.

A-0436 Arthrodesis of the rheumatoid wrist with proximal row carpectomy

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Objective: Arthrodesis of the wrist is an accepted surgical procedure in severe rheumatoid arthritis. Carpal collapse makes it difficult to freshen bone surfaces and their positioning, with risk of nonunion. The purpose of this study was to evaluate the clinical and radiological outcomes of rheumatoid wrist arthrodesis with proximal row carpectomy.
Methods: Between 2005 and 2012, there were 38 Millender arthrodesis with proximal row carpectomy performed in 36 patients with rheumatoid arthritis. The radiocapitate coaptation was immobilised by an intramedullary pin, introduced between the second intermetacarpal space, supplemented by staples. The ulnar head was resected after synovectomy. At the last follow-up, clinical assessment was performed with the Visual Analogue Scale (VAS), Patient-Rated Wrist Evaluation (PRWE), grip strength and patient satisfaction. We evaluated the position and fusion of the arthrodesis, by analysis of standard radiographs. Carpal height was performed with both the McMurtry and Youm Index and with the Bouman and Senwald Index. The ulnar translation of the carpus was measured with the DiBenedetto Index and the radial deviation, with the Shapiro method.
Results: At an average follow-up time of 50 months (range 18 - 97 months), the mean VAS was 0.4 points (range 0 - 7), and the mean PRWE was 21 points (range 0 - 80.5). The grip strength was 90% of the contralateral hand, if the operative side was dominant; and 50% if the operative side was non-dominant. We had 34 patients (90%) whom were subjectively satisfied or very satisfied. The average position of the fusion was 3.6 ± 6.1° in extension and 9.3 ± 7.5° in ulnar deviation. The fusion rate was 92%. Two of the three nonunions needed reoperation. There were no correlations between the carpal height loss and grip strength loss, nor ulnar deviation of the fingers.

Conclusions: The overall results of total wrist arthrodesis associated with proximal row carpectomy are consistent with the results reported by other authors. In cases of severe arthritis of the wrist, the proximal row of the carpus is often destroyed or dislocated, and this makes the arthodesis difficult. We argue that our technique is easier than conventional procedures. The bones from the proximal row can also be used as a graft: we have never needed to harvest additional graft material. A single joint fusion is obviously easier than both the radiocarpal and midcarpal joints. Finally, one could assume that relative lengthening of the flexor and extensor tendons would affect strength and finger deviations. We did not observe these phenomena.

A-0437 Induced migration of Schwann cells using magnetic field stimulation

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Objective: Evaluate whether magnetic nanoparticle beads (MNBs) attached on cultured Schwann cells (SCs) could enable the SCs to move towards their desired direction, through magnetic field stimulation (MFS), depending on the stimulus time.
Methods: Sciatic nerves were taken from P5 rat pups. These nerves were cut into pieces and cultured for 3 days. The MACS system was used to attach the MNBs on the cultured SCs, on the cellular membrane. The MACS procedure was carried out, following the manufacturer's instructions. After growing purified SCs on an AXIS chamber for 24 hours, the SCs were stimulated for 5 and 10 minutes, respectively, using a permanent magnet, for 5 consecutive days. The sample was compared with the negative control, which was not being stimulated. To observe the degree of the SCs' movement caused by the magnetic field, SCs were immunostained with S100 and their nuclei were counterstained with DAPI, and then observed with a confocal microscope.
Results: In a comparison of the MFS and non-MFS groups, the MFS group promoted faster movement of SCs than the non-MFS group, in the bridge of AXIS. For the stimulation time group, the 10 min MFS group showed faster migration than the 5 min MFS group.
Conclusions: MNBs attached to SCs were able to be stimulated to move in a desired direction through the MFS. The control and experimental groups showed a difference in the moving velocity and the distance moved. Also, the degree of movement was dependent on the stimulation time. For further study, after determination of the optimum stimulation time and cytotoxicity, this model will be applied in an in vivo experiment for a peripheral nerve regeneration study.

A-0438 Do preoperative nerve studies predict clinical outcome after carpal tunnel release?

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Objective: Carpal tunnel syndrome (CTS), the most common entrapment neuropathy, is usually diagnosed based on clinical and neurophysiological findings. This condition can limit daily activities, due to sensory-motor impairment. Up until now, few studies have investigated the relationship between the electrophysiological and the clinical results, in carpal tunnel release. The aim of this study was to investigate the eventual correlation between electrophysiological and clinical outcomes, in patients treated with mini approach decompression.
Methods: Patients undergoing open carpal tunnel release (mini approach decompression) in our institution during the year of 2013 were enrolled in this study. A clinical and electrophysiological evaluation was performed preoperatively. CTS was diagnosed based on the presence of pain, paresthesia and/or hypoesthesia in the region innervated by the median nerve; along with a positive Tinel, Phalen and Durkan test upon physical examination. All patients underwent a preoperative electromyography (EMG). Electrophysiological findings were graded in four categories, according to the American Association of Electrodiagnostic Medicine (AAEM): mild, moderate, severe or very severe. The severity of symptoms and functional status of each patient was evaluated according to the Boston questionnaire scale (Portuguese validated version), 6 months after surgery. Cases with peripheral nerve disease, polyneuropathies, recurrent carpal tunnel syndrome, cervical radiculopathies, endocrinological pathologies, and inflammatory and infectious arthritis; and patients with wrist trauma history, were excluded from the study. In addition to these disorders, patients who were pregnant and those < 18 years old were not included in the study. In all, decompression was performed through mini-incision. All patients were encouraged to use their hand normally. Sutures were removed at the second week. Statistical analysis was performed with the Statistical Package for the Social Sciences (SPSS) 20.0 version, and results were considered significant at a value of $p < 0.05$.

Results: We had patients (51 women and seven men), for a total of 60 hands and with a mean age of 54.2 years (range 29 - 74 years) meet the inclusion criteria. We found differences between the preoperative electrophysiological findings and the clinical outcomes (severity of symptoms and functional status). Patients who had a preoperative electromyography graded as mild were significantly less symptomatic (score 1.87 ± 1.19) at 6 months, compared to the group of patients with moderate (2.88 ± 1.47) and severe (1.58 ± 0.93) preoperative electromyography ($p < 0.05$). Moreover, patients who had a preoperative EMG graded as moderate (3.28 ± 1.71) achieved a higher functional score, when compared to the preoperative 'mild' group (1.65 ± 0.89), $p < 0.05$.
Conclusions: We found a relationship between the pre-operative EMG and post-operative Boston scale. Patients with mild CTS seem to be the ones who benefit most from treatment, when compared to patients with moderate or severe CTS. Likewise, it was expected that patients with mild CTS get a better functional result, when compared with patients with moderate CTS. The results of this study are in contrast to some previous studies, which found little to no value of EMG in predicting postoperative functional and subjective outcomes. These findings will allow the surgeon to counsel patients preoperatively on the expected clinical outcome, based on the severity of their CTS.

A-0439 Kinesiophobia and hand-related factors affecting kinesiofobia in diabetic individuals

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Objective: The aim of the study is to show the presence of kinesiophobia and its relationship with hand-related factors, in individuals with diabetes mellitus (DM).
Methods: We evaluated 16 individuals with DM (mean age of 50 ± 7.48 years) and 15 healthy individuals with a mean age of 45 ± 8.19 years. Sociodemographic form was applied to all participants. The Tampa Kinesiophobia Scale was used to assess their kinesiophobia level. Sense, strength and dexterity of the hand of the diabetic individuals were evaluated with related tools. Sensory evaluation was done with a 2-point discrimination test, grip strength was measured with the grip dynamometer and speed/dexterity was evaluated with the Purdue Pegboard Test. The kinesiophobia level was compared between individuals with DM and healthy individuals, by Mann-Whitney U test. The relationship between kinesiophobia results and hand evaluation results was also investigated by correlation studies.
Results: The Tampa Kinesiophobia Scale score was 51.30 ± 7.87 in the diabetic individuals and it was 34.6 ± 7.51 in the healthy individuals. The high score indicated the presence of kinesiophobia in diabetic individuals with a significant difference ($p < 0.01$). This fobia was found to be related with hand dexterity and median nerve sensory evaluation ($p < 0.01$).
Conclusions: It was remarkable that individuals with DM deal with kinesiophobia, which is a very important factor that can affect functionality. It is known that immobility has a negative effect on DM. Therefore, kinesiophobia should be analysed in detail, in DM. Sense and dexterity were found to be most related with kinesiofobia. Therapists should focus on hand speed, fine motor skills and sensory education, while planning treatment for individuals with DM to also deal with kinesiophobia.

A-0440 Ultrasound diagnostics of peripheral nerve lesions of the hand and forearm

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Objective: Treatment of patients with pathological processes of peripheral nerve lesions is an urgent problem, which is stipulated by the high percentage of poor results and the mistakes in diagnostics. We studied 238 patients with pathological processes of peripheral nerve on the hand and forearm.
Methods: USID of the nerves was carried out using devices that operate in real time and are supplied by a linear transducer with a frequency of oscillation of 10 - 15 MHz. The study should be conducted by a special technique, taking into account anatomical and physiological features of the upper extremity, which will enable the correct interpretation of the obtained data. On the forearm, the median, ulnar and radial nerves can be visualised, to get information not only about their appearance (shape and diameter), but also about their internal structure. Dissecting the nerve on the sonogram can be set from the first days after injury. We can define it by its sign of the interrupted sonographic image of the nerve trunk, so that it forms a hypoechoic area of the defect. Central fragment ends

by the neuroma, the mass of dramatically reduced echogenicity. The end of the peripheral fragment is determined by the progressive degenerative changes: the result of Wallerian degeneration, and sometimes, it reveals the formation of a similar neuroma. Ultrasound has the advantage of the ability to conduct an accurate topical diagnosis of the injury and the location of the nerve fragments. This greatly limits the time of surgery and trauma. Ultrasound is the only method to reliably establish or exclude multiple nerve damage, because it can help to investigate the nerve and its branches throughout the limb. During the diagnostication of internally-trunked nerve injuries, ultrasound gave the possibility to determine the reasons that caused the compression of the nerve trunk (tumour, foreign bodies, adhesion adjacent to soft tissues, and others). In some cases, this is a determining factor in the selection of treatment and the extent of nerve damage becoming less important.

Results: As a result of ultrasound research, 238 patients displayed the features of the full lesion of 138 nerves, partial lesion of 15 nerves and the intra-trunk lesions of 133 nerves. The data received from ultrasound was used for operation planning. In all cases, the ultrasound research data was confirmed during the operation. Results of surgical treatment and histological research showed ultrasound sensibility of 85.7%, specificity of 88.2% and a diagnostic efficacy of 0.85.

Conclusions: The findings of this research make it possible to state that ultrasound is a highly informative method for the study of nerves of the upper extremity.

A-0441 Hemi-hamate autograft arthroplasty for proximal interphalangeal joint revisited: a new approach

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Objective: The hemi-hamate arthroplasty for proximal interphalangeal joint (PIPJ) dorsal fracture dislocations is a well-established technique that deals with a difficult fracture pattern. The technique relies on the complete dislocation of the joint during surgery, in what is known as the 'shotgun' approach. This provides an excellent surgical field, but compromises the outcome, due to the inevitable damage to the delicate intrinsic structures stabilising the joint. We present a preliminary report on a new approach to the joint, when performing the hemi-hamate arthroplasty.

Method: Patients in our study all sustained dorsal fracture dislocations of their PIPJ as closed injuries, with unstable joints, and over 40% of the articular surface involved. The surgical approach is volar, and involves freeing up the whole tendon sheath periosteal unit as a single layer, and retracting this to one side. The articular surface of the joint can then be accessed with a little distraction and hyperextension. The method does not breach the tendon sheath, nor does it damage the collateral ligaments nor volar plate. It is akin to the radical total anterior teno-arthrolysis (TATA) technique used for contracted joints, with some crucial differences.

Results: Five patients underwent a hemi-hamate arthroplasty using the new approach, and preliminary results demonstrated an active flexion range of 92°, with 0 extension lag.

Conclusions: Despite only preliminary results, the range of motion (ROM) gained after surgery appears to be better than in a traditional hemi-hamate arthroplasty series. We postulated that the new approach would cause far less iatrogenic damage and reduce the risk of contractures developing. A further, longer follow-up and a larger cohort of patients are planned.

A-0443 Two-stage finger reconstruction for severe Poland syndrome and symbrachydactyly with bone instability using toe-phalanx transfer: preliminary study of seven cases

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Proximal instability of MP joints may be a contraindication to the separation of syndactyly in severe Poland hands, and in symbrachydactyly. We present a 2-stage reconstruction program, with bony stabilization of the MP joint prior to the cutaneous time of desyndactylisation. Five Poland hands with complete syndactyly of the central digits and severe volar instability of the MP joints, and two Poland-like symbrachydactylies with normal pectorals had a 2-stage procedure and then were evaluated with a 1 - 15 year follow-up. For three digits, the hypoplastic metacarpals of the second or third ray were stabilised by immediate lengthening, using an intercalated toe-phalanx free graft. Eight times, the volar MP joint instability was due to hypoplasia of the base of the first phalanx; and this osteochondral base was replaced by a free non-vascularized hemi-joint transfer, using the proximal part of a toe phalanx. Syndactyly was not addressed in the same session, in order to not mix bone fixation with skin grafts and plasties. The digits were separated a

few months later, when bone healing and MP joint stability were achieved. All hands were reviewed and the stability of the MP joints evaluated. The anteroposterior stability was effective, but lateral stability may remain incomplete, as well as active mobility of the digit. This 2-stage strategy is a progressive reconstruction of severe central hypoplasia and proximal instability that is associated with syndactyly. It may allow for further and secure reconstruction and conservation of very hypoplastic digits. The limitations and conditions of this advance were exposed.

A-0444 Which factors would affect postoperative extension loss of DIP joint when extension block pinning is used for treatment of mallet finger fractures?

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Purpose: To analyse what factors affected post-operative extension loss when extension block pinning was performed, for treatment of mallet finger fractures.
Materials and methods: We retrospectively reviewed 32 patients with a mallet fracture of distal phalanx, treated by our extension block pinning, between March 2007 and February 2012. We measured the preoperative and postoperative range of active motion of the DIP joint, with a goniometer. We evaluated the pre- and postoperative X-rays, to check for articular involvement (%), presence of DIP subluxation, flexion angle of DIP joint by pin fixation, mallet fracture angle and fragment size. The injury mechanism was also presented by the finger position when the injury force was applied. A statistical analysis was performed.
Results: All fractures united at a mean time of 6.6 weeks (5.8 - 7.3). Congruent joint surfaces (anatomical or intra-articular step-off of < 1 mm) were present in all patients. At the final follow-up session, mean loss of voluntary extension was 4.7° (0 - 20). Mean fixation angle was 5.6° (-20 - 25), and mean articular involvement was 44.7% (35 - 60). The mean fracture angle was 40.5° (20 - 60), and the mean fragment size index was 18.8 (7.5 - 30). According to statistical analyses, the fixation angle and extent of articular involvement did not correlate with loss of voluntary extension, but the injury mechanism, fracture angle and fracture size had a strong correlation with loss of voluntary extension.
Conclusion: Although mallet finger fracture was fixed with DIP joint flexed by an extension block pin, it would not make significant postoperative extension loss; however, when the injury force was applied to the fingertip with DIPJ flexion and/or the mallet fracture angle was small, and/or the fracture size was small, postoperative extension loss might remain significant, although the mallet finger fracture was successfully reduced and healed.

A-0446 Effect of NSAIDS in peripheral nerve regeneration in an experimental model of end-to-side neurorrhaphy in rats

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Objective: The main purpose of this experimental study is the evaluation of the effect of non-steroidal anti-inflammatory drugs (NSAIDS), and especially ibuprofen, in peripheral nerve regeneration in an experimental model of double end-to-side neurorrhaphy in rats. In this study, especially with the use of the peroneal function index (PFI), we tried to access the capability of NSAIDS to regenerate the large diameter neuraxons; therefore, to enhance nerve regeneration after peripheral nerve injury.
Materials and methods: We examined 24 Wistar rats, divided into two subgroups (10 rats in the control group and 14 rats in the experimental group). In both groups, we performed a section of the peroneal nerve of the right leg and treated the injury with two end-to-side neurorrhaphies of the peroneal nerve to the tibial nerve, with a 0.6 cm distance between the two neurorrhaphies. In the control group, no drug was administered to the rats; while in the experimental group, ibuprofen was administered in a dose of 60 mg/kgr/day for the first 7 days (the first dose was administered 1 hour after surgery). For both groups, we performed gait analyses and we evaluated PFI on the 2nd, 5th, 7th, 14th, 28th and 56th day after the operation. Statistical analyses were performed with SPSS.
Results: From the statistical evaluation, we observed a continuous decrease of the PFI for the control group, for the first 14 days postoperatively (PFI14 = - 45,866) and a continuous increase from the 14th to the 56th day, postoperatively (PFI56 = - 29,109). In the experimental group with the administration of ibuprofen, we recognized a continuous decrease of the PFI for the first 5 days (PFI5 = - 44,863) and a continuous greater increase from day 5 to 56 (PFI56 = - 27.86), which is closer to normal values than the control groups. The differences were statistically significant.
Conclusions: From the results of this experimental study of the double end-to-side neurorrhaphies model, NSAIDS seemed to enhance peripheral nerve regeneration, after peripheral nerve injury.

A-0447 Osteosynthesis by dual approach: which management to retain, for complex distal radius fractures?

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Objective: Since the development of plates with variable angle for distal radius fractures, indications for osteosynthesis by volar or dorsal approach have increased; however, some complex fractures required management with a dual approach. We wanted to evaluate the characteristics of these complex osteosyntheses, to estimate benefit and develop guidelines.
Methods: Between 2010 and 2013, we treated 41 patients with a mean age of 52 years, with 38 months follow-up time (according to the AO classification, there were two A3, 11 C1, 13 C2 and 15 C3). Preoperative evaluation was conducted on the location of the shear fracture, with the presence of dorsal comminution and a scaphoid or lunate die-punch. The palmar approach had been chosen in 38 cases for a standard volar plate, in two cases for isolated LCP plates and in one case, for K-wire fixation. The dorsal approach was used in seven cases, for a reduction manoeuvre only; in nine cases for free screw support and in eight cases for arthroisis plate; in five cases for a lunate surface plate, in two cases for scaphoid surface plate; in six cases for a double support plate, in two cases for external fixation and in two cases, for K-wire fixation. Clinical evaluation was performed in range of motion (ROM), grip strength and the pain value at the last follow-up control. The delay and the reason of hardware removal were also evaluated, the same as complications related to the implant.
Results: The average time of osteosynthesis was 147 minutes, and 40 fractures consolidated. We found associated lesions in 13 cases (32%): seven TFCC instabilities, three scapholunate ligament instabilities, two carpal tunnel syndromes and one open fracture. Radiological examination found that 36 cases (88%) had a dorsal comminution and 28 cases (68%) had articular impaction. Two cases (5%) had shear fracture beyond the watershed line. Radiographic measurements preoperatively and immediately postoperative, respectively, showed a sagittal radial tilt of - 3.3° and 5°, a frontal radial tilt of 10° and 20°, and a radial height measurement of 8.6 mm and 12 mm. Clinical assessment found flexion-extension and pronation-supination of 95.2° and 135°, respectively, and that the grip strength was 80% (18 Kg) of the contralateral side. The average functional assessments were 41.1 for the Quick-DASH questionnaire and 61 for the Mayo-wrist-score. Five patients had not been able to return to their professional activity; while 29 patients (71%) had removed their implant at an average of 11 months, because of equipment. Complications were: four chronic pain syndromes, eight tenosynovitis of the extensor, two malunion, one nonunion and one secondary breaking TFCC plasty.
Conclusions: The dual approach for the management of complex distal radius fractures seemed to be helpful in major dorsal comminution, associated with joint impaction, requiring a direct joint approach and a stable anterior fixation. It is advisable to look for associated lesions that are frequent. The most comminuted lesions had better management by an arthrorisis plate and articular surface reconstruction. It would be useful to conduct an evaluation on bone devascularisation, according to the surgery with a dual approach, to better adapt our management of these osteosynthesis.

A-0449 One-year results of needle fasciotomy and collagenase injection in treatment of Dupuytren's contracture: a two-centre prospective randomized clinical trial

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Hypothesis: Is there any difference in the early and 1-year outcomes after treatment with needle fasciotomy and collagenase injection, for finger contracture in Dupuytren's disease?
Methods: Patients with primary Dupuytren's contracture deemed suitable for fasciotomy (palpable cord and total extension deficit from 30 - 135˚ were randomised to the treatment with either needle fasciotomy or a collagenase injection, at two centres. Passive extension deficits for each joint before and after treatment, and at 3 and 12 months, were recorded together with complications. The Mann-Whitney U-test and Chi-Square test were used for statistical analyses.
Results: In 93 patients (i.e. 96 rays), 46 rays were randomised to needle fasciotomy and 40 rays to treatment with collagenase injection (five patients were excluded, due to medical reasons (n = 3) or a preference for the collagenase treatment (n = 2)). Five patients (three needle fasciotomies and two collagenase injections) were lost to 3-month follow-up and a further five patients, to the 12-month follow-up (four needle fasciotomies and one collagenase injection). The mean (median) extension deficit pre-treatment for the MCP joint was 53˚ (55) in both groups. The mean (median) PIP joint extension deficits were

14° (5) in the needle fasciotomy group and 7° (0) in the collagenase group (p = 0.10). The total extension deficit was reduced by 82% (82) in the needle fasciotomy group and by 90% (96) in the collagenase group, immediately after treatment (p = 0.01), and by 75% (79) and 75% (78), respectively, at 3 months (p = 0.94), and by 70% (76) and 70% (75) at 12 months (p = 0.73). Four patients in the needle fasciotomy group and eight patients in the collagenase group had skin ruptures (p = 0.13); all healed uneventfully. No sensory disturbance was recorded in any group. Seven patients in the needle fasciotomy group and eight patients in the collagenase group still had sporadic pain or discomfort, at 3 months (p = 0.6).

Summary: At 3 months and 1 year of follow-up, the needle fasciotomy and collagenase injections were not different in the correction of finger contracture in Dupuytren's disease, and both had minor complications.

A-0450 Designing, developing and deploying a brachial plexus service in Cambodia: conception, training and establishment

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Objective: Brachial plexus injuries (BPI) remain serious, life-changing injuries with challenging treatment options. In developing countries, these challenges are compounded by poverty and lack of access to appropriate medical and surgical care. In Cambodia, the commonest modes of transport remain motorcycles, with recognized associations with high incidence of BPI. Despite this, the relative incidence of BPI and a delivery infrastructure of care remain relatively nonexistent. This presentation is an empirical study of the process of developing a service of care for BPI victims, with the emphasis on training of the local surgeons and health care professionals, to treat these patients in the long term.

Methods: From May 2013 to November 2014, we conducted a total of four 1-week visits to the Children's Surgical Centre (CSC) in Cambodia. Patients with various upper limb conditions were assessed and listed for surgery. A realistic surgical strategy for BPI that is relevant to the community was developed and a targeted surgical skill acquisition program was formulated for the local health care professionals. The identified local surgeons were taken through direct teaching and a flipped-classroom model, culminating in a micro-neural workshop with emphasis on practice and on feedback provided to assess the digital recording of practice sessions. We performed the clinical assessment through case-based discussion and direct observation of procedures. Simultaneously, consultations were held with national directors of trauma services, to highlight the problems of BPI, so as to formulate a coherent and combined effort to assess the burden of disease and a strategy of care for this relatively neglected condition in Cambodia.

Results: A total of 260 upper limb patients were reviewed in four visits. Of these, 29% (n = 65) were nerve injuries, with 30 the result of BPI, with a total of 12 BPI patients who were operated on in the initial visits. The commonest reason for declining treatment was a late presentation (> 6 months post-injury). The commonest injuries were pan-plexal (C5 to T1) (95%) and the remaining ones were upper plexal injuries (C5, C6). A surgical algorithm was designed for the local surgeons, using highly selective nerve transfers for the restoration of shoulder abduction, spinal accessory nerve to suprascapular nerve; and for elbow flexion, a phrenic nerve transfer to the biceps branch. The FCU branch of the ulnar-nerve-biceps transfer was used for the upper plexal injuries (Oberlin transfer). Shoulder and elbow reanimation (M3 or M4) were seen 1 year after surgery. Encouraged by the visible results, there was an increase in both local and national referral, and the requests for participation in the BPI service. Awareness of the service made it known to key stakeholders, with an emphasis on early referral.

Conclusions: This study showed the methodology of designing, developing and deploying a surgical skill acquisition program for adult BPI, in a developing country. Limited resources necessitated the tailoring of surgical strategies, with a focus on the training of local surgeons. The setting up of a national database and involvement of key figures in healthcare should result in a more effective and sustainable BPI service within Cambodia.

A-0453 Outcomes from a subgroup analysis of a national registry study on the utilization of processed nerve allografts for large gap nerve discontinuities

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Objective: Long gap nerve repair injuries provide a significant challenge, especially when available autograft donor nerve is inadequate. We studied a subgroup from a national registry on the functional recovery outcomes of processed nerve allografts in long gap nerve injuries between 30 mm and 65 mm, to determine their efficacy in this application.
Methods: The RANGER Study is a multicenter registry designed to collect data on the use of processed nerve allografts (Avance® Nerve Graft, AxoGen, Inc). International Review Board (IRB) approval was obtained and standardised data reports were used to collect utilization, safety and functional outcomes. The registry database was queried for nerve repairs measuring ⩾ 30 mm that reported sufficient quantitative data to determine the outcome of the repair. The long gap cohort was further stratified by nerve type. An analysis for meaningful recovery of nerve function of all subjects was performed, based on the last reported follow-up visit. Collected sensory and/or motor assessments included 2-point discrimination, Semmes-Weinstein Monofilament (SWMF) testing, range of motion (ROM), electromyography (EMG) studies and safety assessments. Reported outcomes data were incorporated into the MRCC scale for sensory and motor function. Meaningful recovery was defined as ⩾ S3/M3 on the MRCC scale. with higher thresholds of recovery defined at S3+/M4 or greater.
Results: The current RANGER® registry had sufficient quantitative outcomes data on 130 nerve repairs. From this population, the long gap cohort consisted of 39 injuries (19 sensory, 17 mixed, and 3 motor nerves) occurring in 32 study subjects. Mean age of the cohort was 39 ± 16.4 (19 - 70) years and was predominantly of male gender, at 71.9%. Mean gap length was 36 ± 8.9 (30 - 65) mm, with a mean follow-up time of 320 ± 160 days. Injuries included 18 digital nerves, 17 with other upper extremity injuries, three lower extremity and one head/neck. Meaningful recovery was observed in 90% of repairs, with 62% reaching higher thresholds of function. Analysis by nerve type observed meaningful recovery in 95% of the sensory, 88% of the mixed, and 67% of the motor nerve repairs. Mean static 2-Point Discrimination for the sensory and mixed nerve repair in the upper extremity was shown to be 9.6 ± 2 (5 - 13) mm. Reported MRCC scores for motor function included: five M0, one M2, five M3, six M4 and one M5. There were no reported implant complications, tissue rejections, or adverse events related to the processed nerve allografts.
Conclusion: Overall meaningful recovery for all repairs was reported at 90%, with no related adverse events reported. Further, higher standards of recovery (S3+/M4) were reported in 62% of the repairs. Although direct comparison cannot be made, our outcomes compare favorably to those reported in the literature for nerve autograft. The role of processed nerve allograft continues to evolve and this data suggested they have clinical utility in larger nerve gaps. The registry is ongoing and continues to collect outcomes data on the use of processed nerve allografts for long gap nerve reconstructions.

A-0454 Multisensor interaction through video-games on mobile devices: new frontiers in the rehabilitation of pediatric hand

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Background: Rehabilitation of a pediatric hand calls for a continuous search of novel engaging activities that allow achieving the rehabilitation goal. An effective clinical recovery might require an intensive prolonged treatment that involves not only the young patient, but also the whole family.
Modern ICT technology can provide the instruments upon which to build exer-games (games that have as a main target, exercising) that are engaging, safe and effective; and at the same time can be used by the therapist to train the patient and by the family to extend training at home.
Methods: In this preliminary paper, we investigated the possibility to use a smart phone and low-cost pressure sensors. We created a suit of four exergames that provide exercise-leveraging engagement provided by a gaming experience, exploiting the IGER platform (Intelligent Game Engine for Rehabilitation) recently developed to support rehabilitation. A full bidirectional translational research approach was used with a tight collaboration between clinicians and computer scientists. The overall cost was kept very low (a mobile phone and a pressure sensors of a few dozen euros are required) to favour massive deployment. The games mechanics is kept simple, to be adequate to young patients: it is animating an avatar to jump over obstacles or guiding an airship in the sky to avoid birds. In a first set of modalities, the interaction is achieved by a player moving his/her own fingers adequately, to achieve the task; thus, stimulating their movement. In a second innovative set of modalities, the interaction is achieved by pressing on a sensor

embedded in a real toy. In this second modality, force is exercised.
Results: We carried out preliminary tests on young patients (ages 4 - 9) with good results, in terms of compliance, usability and engagement. Older patients might require more rich game mechanics to keep the level of engagement high. Moreover, the platform is able to provide an objective evaluation of the patient's status that is related to the tasks implemented. Such an evaluation can be repeated over time, also at home, and can offer to a remote therapist, fine, useful information on the patient's progress.
Discussion: These exer-games were complemented by a web interface that allowed the therapist to review remotely the results, and the progression of the patient, and to tune the exercises for his/her improvement. Once the prototype of the platform is realized, it can be extended and tailored to specific rehabilitation needs, thus addressing different populations of patients.

A-0456 Retrograde percutatneous intramedullary K-wire fixation for multiple closed metacarpal bone fractures

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Introduction: Most multiple metacarpal (MC) fractures are unstable and require surgical fixation. Various kinds of techniques have been described.The purpose of this retrospective study was to access the clinical and radiologic outcome of retrograde intramedullary fixation in multiple MC fractures.
Materials and methods: We included a total of 16 patients with 33 extra-articular closed metacarpal fractures, with a mean age of 31.2 years (range, 11 - 84 years) whom were followed up > 6 months. The involved bones were two second MC, seven third MC, 15 cases with fourth MC and nine with fifth MC. The location of the fractures were: six in the neck, 11 in the shaft and 16 in the base. Under fluoroscopic guidance, their fractures were reduced by the Jahss technique. A single K-wire was inserted from the metacarpal head, to pass through the carpometacarpal joint with maximal flexion of the wrist joint; and then the pin was backed out at wrist, so that it didn't remain in the metacarpophalangeal (MCP) joint.
Results: Bony union was achieved at 5.5 wks, and full range of motion (ROM) was recovered in all but one patient, whom had suffered from chronic regional pain syndrome. Three patients complained of extensor irritation after the pin removal, but at the last follow-up session, the symptoms had been resolved. The average dorsal angulation of the fractures was improved from a preoperative 25.5˚, to a postoperative 3.1°. In the neck fractures, angulation improved from 51.3˚ to 7.5°, in the shaft from 28.5˚ to 3.1°, and in the base from 13.8˚ to 1.4°.
Conclusion: Retrograde intramedullary fixation is a reliable method in not only single MC fractures, but also multiple MC fractures. Correction of the angulation is more effective in a proximal fracture.

A-0457 Hand surgery training in a developing country: development of a community-based and outcome-oriented hand surgery curriculum in Cambodia

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Objective: The global burden of hand surgery conditions remains a challenging one worldwide. In developing countries, the challenges of hand-focused surgical practice and education includes the lack of trained surgical educators and a relevant curriculum that is community-based and outcome-oriented. There is a dependency on volunteerism by international surgeons to provide a fragmented and non-sustainable service, with little transfer of skills to local surgeons. The objective of this paper is to document our experience in developing a hand surgery curriculum for Cambodia, founded on the principles of a sustainable long-term development and empowerment of local surgeons.
Methods: The curriculum resulted from a three-part process of:

- Discerning the community needs;
- Designing the curriculum (around the community needs); and then
- Delivering the curriculum, using pedgagogical methods appropriate to the local community.

This formed the basis to develop a targeted surgical skill acquisition program in the management of common hand cases and the identification of local surgeons to be included in the educational program, which included: problem-based teaching, and flipped-classroom and workshop models. Assessment was performed through case-based discussion and direct observation of procedures following a period of direct supervision and practice. The usefulness and effectiveness of the program was assessed by the structured questionnaire and by interviews with the participants and stakeholders.

Results: A total of 260 cases were seen in four 1-week visits, over an 18-month period (May 2013 - Nov 2014), with 62 cases operated on. The breakdown of cases was as follows: burn contractures (21%); congenital hands (18%); trauma deformities (27%); nerve injuries including plexus injuries (29%) and tumor reconstructions (5%). A separate audit of the past 600 cases (before the arrival of the visiting hand surgeons) was performed, with the following breakdown: burn and trauma deformities (75%), congenital hands (24%) and nerve injuries (0.8%). The increase in treating nerve injuries (0.8% to 29%) was seen as a direct result of the available visiting expertise, improving hand assessment by local surgeons and the conduct of a micro-neural workshop for the local staff. Following analysis of the local community needs, a curriculum focused on three main conditions was designed for congenital hand differences, deformity corrections (from burns, trauma and venomous injuries) and nerve reconstruction. Use of the latest educational technology support ensured there was continuous training and feedback in-between visits. Objectively and subjectively, there was an increase in the knowledge base of the participants and increased surgical competencies. The stakeholders perceived the program to be beneficial in allowing for effective transfer of knowledge and skills from the visiting surgeons, to the local surgeons.
Conclusions: This study showed the methodology for developing a surgical skill acquisition program in hand surgery for an underdeveloped community. It was anticipated that future World Health Organization (WHO) attention would be increasingly placed on non-communicable diseases, such as hand injuries, and on the development of hand curriculums in developing countries. We demonstrated a program that is locally relevant, effective in skill transfer and resulted in a sustainable hand surgery service for Cambodia. The model can potentially be reproducible in other countries.

A-0459 Responsiveness of the six-item CTS, Quick DASH and EQ-5D Index health instruments for outcomes assessment in carpal tunnel syndrome

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Purpose: The objective of this study was to evaluate the responsiveness of the 6-item CTS (CTS-6); Quick Disabilities of the Arm, Shoulder and Hand (QuickDASH) questionnaire; and the Euroqol 5D (EQ-5D) Index for patient-reported outcomes (PRO) instruments, for outcomes assessment in carpal tunnel syndrome (CTS) surgery.
Methods: Study population: 40 patients with a diagnosis of CTS based on clinical and electrophysiological criteria. Clinical design: prospective or classic cohort study. Instruments and measures: the Spanish versions of the CTS-6, QuickDASH and EQ-5D were self-administered to the sample population the day before and 3 months after an open carpal tunnel release. The CTS- 6 measured symptom severity related to CTS, scoring from 1 (best) to 5 (worst). The QuickDASH measured upper extremity disability, scoring from 0 (lowest disability) to 100 (highest disability). The EQ-5D measured quality of life, scoring from 0 (worst health) to 1 (best health). Data analysis: The mean differences form before and after surgery scores were compared by a paired *t* test, with a level of significance (p) of 0.05. The responsiveness was evaluated based on the effect size (ES) and standardized response means (SRM). A large, clinical improvement was considered with a responsiveness level > 0.8.
Results: All the PRO instruments scores presented a significant improvement from before, to 3 months after the surgery ($p < 0.001$). The CTS-6 instrument showed an ES of 3.06 and a SRM of 2.94, the Quick DASH presented lower responsiveness, with an ES of 1.62 and SRM of 1.34. The EQ-5D Index presented the lowest sensitivity to clinical change, with an ES of 0.76 and a SRM of 0.79.
Conclusions: The CTS-6 instrument is more sensitive for detecting clinical change than the QuickDASH and the EQ-5D Index, and it should be considered as the primary outcomes measure in clinical outcome studies of CTS, done 3 months after surgery.

A-0460 Versatility of dorsal intermetacarpal flaps and their clinical applications

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Introduction: Intermetacarpal dorsal flaps and their variations are increasingly used in the reconstruction of the dorsum of the hand and fingers, due to their versatility and the ability to provide tissues similar in colour and quality. The intermetacarpal flap, as originally described, is based on the cutaneous branches of the dorsal metacarpal artery. To

obviate some limitations of the maximum extension of the flap and improve its clinical application, many study on vascular anatomy of the dorsum of the hand have been conducted. The use of the Quaba perforator from the dorsal communicating branch of the common digital artery as a main pedicle flap increased the ability to cover defects up to IFP. Moreover, the composite version of this flap allows the reconstruction of complex tendon injuries associated with the harvesting of the extensor tendons (indicis proprius and digiti minimi) with the fasciocutaneous portion.

Materials and methods: In our clinical practice, these flaps have been used with excellent results for the treatment of scar contractures in outcomes of burns, for loss of substance due to trauma and for covering defects of the dorsum of the fingers after oncology demolition. In 10 patients (median age 52 years) the propeller version of the intermetacarpal flap covered the dorsal aspect of the proximal phalanx and the proximal interphalangeal joint. The associated use of indicis proprius extensor tendon and digiti minimi extensor tendon as composite flaps in two patients who have been reconstructed simultaneously, extend on tendon apparatus and skin loss of tissues of the second and fourth fingers. We conducted a retrospective study on patients treated in our Hand Surgery with this flap and its different versions, to evaluate the long-term results and possible complications.

Results: All flaps were stable, without acute complications. At a mean follow-up of 20 months, the results proved there was satisfactory function and morphology. The patient treated with composite reconstruction flaps presented good recovery of the range of motion (ROM).

Discussion: The flaps based on the dorsal metacarpal vascular network are thin, pliable, easy to set up, with minimal donor site morbidity and able to provide coverage for defects until the proximal one-half of the middle phalanx. The possibility to create a composite flap with vascularized extensor tendons offers a useful solution, even in complex dorsal finger injuries.

A-0461 Fat grafting in Dupuytren's disease

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Introduction: Several pathogenetic hypotheses were described, but no one seems to be singularly responsible for fascia proliferation in Dupuytren's disease. The surgical approach aimed to treat the macroscopic manifestation of finger retraction, often with an aggressive approach needed in the most advanced disease stage. It became necessary to investigate the cellular Dupuytren's disease development, to find out new therapeutic approaches that permit a more sparing surgery and to treat all severe cases. In fact, some clinical studies assess, in addition to fascia, palmar skin and fat-derived cells, as they may be a potential source of cells causing the Dupuytren's disease. Based on this observation, the introduction of the fat graft palmar replacement by the lipofilling technique for joints to traditional aponeurectomy, have shown promising, long-term, good results.

Materials and methods: A retrospective study was performed on all of our patients treated for Dupuytren's recurrence, by aponeurectomy joined to a fat graft from the abdominal region. We treated 20 patients, with a medium follow-up of 2 years, in our Centre for Dupuytren's disease. An aponeurectomy was performed in all cases, according to the traditional surgical approach, with complete removal of the affected fascia. At the end of the skin closure, all the surgical sites and the unaffected neighboring rays were filled by a fat graft harvested from the abdomen, following the Coleman technique (mean 12 cc of fat graft for each patient). The primary endpoint of the treatment was to observe the recurrence of disease; and a secondary endpoint was to evaluate the skin texture, scar quality, tendon and finger gliding, pain, discomfort and all technique-related complications.

Results: The patients were evaluated for long-term stable results. Three cases are actually at their four-year follow-up. Five cases were submitted to ecography evaluation. All cases were submitted to clinical evaluation, in term of maintenance of low contraction grade, mobility, pain, sensibility, strength and scar conditions. Only one case presented recurrence after 2 years, and slide tendon and finger functionality revelead a satisfactory result. Ecography evaluation at 6 months and 1 year demonstrated the permanence of the fat pad under the superficial skin layer, providing a sliding tendon a good environment and, overall, a barrier from the affected surrounding fascia.

Discussion: Fat grafting is a common procedure in reconstructive and aesthetic surgery and commonly defined as 'lipofilling'. It's commonly employed in several clinical fields for its filler role in volume replacement, both overall for its stem cell content known as adipose-derived stem cells (ADSC) and its capability to provide numerous cytokines. Furthermore, for such reason, several clinical experiences were based on its utilization; also in severe Dupuytren's treatment, even for providing a viable subcutaneous fat capable to protect the neurovascular and tendon structure, and even for its possible role in modulating the fibroproliferative

diathesis. Preliminary satisfactory results have represented a stimulating challenge to introduce this procedure as scheduled, with possible future perspectives of numerous clinical data-collecting, specific examination, long-term follow up, molecular studies and useful guidelines for therapeutic purposes.

A-0462 Modification of the twisted toe technique for thumb reconstruction

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Objective: describe a modification of the twisted toe technique for microsurgical thumb reconstruction.
Methods: The twisted toe technique is a good option for thumb reconstruction. Modification of the Iglesias version is given, to improve the functional results on the recipient site. A series of five cases performed in 1 year is presented, with a 18-month follow-up.
Results: Good functional and cosmetic results in the donor and recipient sites were achieved. On donor site 3, a case of nail complex dystrophy is noted.
Conclusions: Our original modification of the technique improved the well-known advantages of this technique for thumb reconstruction, reducing the impact on the donor site, expecially for Lister Class 2 - 3 amputations.

A-0463 Soft tissue reconstruction of the hand: raising the SCIp

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Objective: Compare the result of soft tissue reconstruction of the hand with different perforator flaps.
Methods: Different options are presented between ALTp, SCIp and TAp flaps. The advantages and disadvantages of each are analized over a series of nearly 40 free flaps in 2 years, for soft tissue defects.
Results: In small and middle sized defects, the SCIp flap proved to be a good option, if compared to ALTp and TAp.
Conclusions: The advantages of the SCIp are low donor site morbidity, long pedicle and glabrous flap which make of it one of our first options in hand reconstruction. Large defects require harvesting on perforators of the superficial and profunda branch of the SCIA, thus reducing the advantages.

A-0465 The amnion muscle combined graft (AMCG) conduits: a new alternative to repair wide substance loss of peripheral nerves: our clinical and experimental experience

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The use of autologous sural nerve grafts is still the current gold standard for the repair of peripheral nerve injuries with wide substance losses, even if this technique has some limitations, like a limited donor nerve supply and morbidity of donor site. At present, tubulization through the muscle vein combined graft is a viable alternative to the nerve autografts, although this technique is currently limited to a critical gap of 3 cm, with less favorable results for motor function recovery. We present our experience regarding a new tubulization method, the amnion muscle combined graft (AMCG) technique. It consists in the combination of the human amniotic membrane hollow conduit, with autologous skeletal muscle fragments for repairing the substance loss of peripheral nerves.
In a series of seven patients with loss of substance of the median nerve ranging from 3 - 5 cm at the wrist, excellent results graded as S4 occurred in three cases, S3+ in three cases, and S3 in one case; plus M4 in five cases and M3 in one case were achieved. No iatrogenic damage due to withdrawal of a healthy nerve from the donor site was observed. We also present the clinical and histological results of an experimental study on a rat model with a median nerve gap of 1.5 cm, treated by means of AMCG. The clinical and experimental results suggested that the AMCG is a reasonable alternative to traditional nerve autograft, in selected clinical conditions.

A-0469 V advancement flap for fingertip injury to prevent necrosis and hook nail deformity

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Objectives: The V-Y advancement flap has been a reliable method to reconstruct fingertip defects, since being described by Tranquilli-Leali (1935) and popularized by Atasoy later, in 1970. But flap necrosis and

hook nail deformity due to suture line tension have been pointed out as having relatively common complications in the V-Y advancement flap for fingertip reconstruction. Concerned about these problems, several authors have described a modification of this technique. The aim of this study was to describe our modification of V advancement flap, based on the V-Y concept, and to review the outcome of this procedure for fingertip amputation in 28 patients.

Methods: This study was conducted from January 2006 to February 2014, and involved 28 consecutive patients (20 men and eight women) with 30 fingertip amputation injuries that were treated operatively with the same procedure. All patients with a fingertip defect of > 1.0 cm^2 in area from the tip to lunula were included in this study. The causes of injuries were crushing with or without avulsion in 21, amputation with sharp laceration in eight, and human bite in one patient. We found that 27 injuries were transverse or dorsal oblique type, and three were mild volar oblique type. According to Allen's classification, 18 cases were Type 2, 11 were Type 3, and one was Type 1. To allow for a tension-free closure, the proximal incision was left unclosed to heal by secondary intension. In addition, the distal nail bed was supported and maintained eversion against the base of the flap, with a minimal number of horizontal mattress sutures, and there was no suture crossing over the top, to prevent hook nail deformity. Postoperatively, dressing changes were performed once daily for 3 or 4 weeks, until re-epithelization was observed.

Results: The mean age of the patients was 43.6 years (range, 24 - 65 years). The average follow-up period was 15 months (range, 12 - 37 months). All patients underwent objective and subjective assessment at 6 and 12 months routinely, and at the final follow up. At the final follow-up, all flaps healed uneventfully. In an objective evaluation with the Semmes-Weinstein monofilaments test, 24 cases were recognized with the 2.83 monofilament (0.07g), and six cases recognized the 3.61 monofilament (0.4 g). In a static 2-point discrimination test, the mean values were 4.61mm in the injured finger and 4.00 mm in the contra-lateral finger. None of the patients developed a noticeable hook nail deformity. None of the patients complained of hypersensitive digit; however, three patients had some residual short nails and two patients had mild nail ridges. Patients' subjective rating of the outcome was recorded as 'excellent', 'good', 'fair' and 'poor'. Excellent or good results were achieved in 28 cases. Two cases had fair results, and none of the patients had a poor result.

Conclusions: This modified V advancement flap technique, when properly designed and executed, can minimize morbidity and give successful results in good wound healing, without necrosis and hook nail deformity for fingertip injury.

A-0470 The effect of the peripheral nervous system on bone biomechanics and upper limb maturity: an experimental study

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Objective: The main objective of this specific study is to present possible differences as far as it concerns the structure, as well as the mechanical behaviour, of the humerus after total lesion of the brachial plexus.

Methods: We used 20 male Wistar rats 3 weeks old for the specific study. They were given ketamine subcutaneously for anaesthesia, and the roots of the brachial plexus (C5-T1) from the left side were avulsed. After 6, 9 and 12 months, respectively, the rats were sacrificed and both humerus bones were taken, in order to perform a biomechanical study (3-point bending) and micro-computed tomography (CT) scanning.

Results: The length of the denervated humerus was in every rat found to be shorter, and the width was smaller, compared to the contralateral ones. Moreover, the bone density of the humerus was found to be lower in the denervated bones. Biomechanical studies showed that the denervated bones were more fragile and more flexible than normal bones.

Conclusions: Till now, experimental results showed that denervated bones become gradually more fragile and more flexible. They become also osteoporotic, at the trabecular site of the bone, and they grow less both in length and width, compared to normal bones.

A-0471 Tips on harvesting pronator teres transfer

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During the 19th century, surgeons first realised that transferring tendons could restore function to an extremity. The paralysis results of the polio epidemic in Europe contributed to the advancement of tendon transfers. Due to contributions of surgeons such as Leo Mayer,Sterling Bunnell,Guy Pulvertaft and Joseph Boyes,tendon transfer surgery expanded, not only to those with paralysis after polio and cerebral palsy, but also to patients who required reconstructive surgery

for the traumatic injuries that were incurred during World War I. Robert Jones (1921) was the first to mention pronator teres (PT) transfer, describing the transfer to the wrist extensors for irreparable radial nerve paralysis in infantile hemiplegia, although a detailed description, indication and surgeries' result was published later by Stelling and Meyer (1959) and by Keats (1970). The pronator teres (PT) is usually selected as the transfer tendon to reconstruct the wrist extensors, but the choice of a transfer tendon for reconstruction of a finger extension is not as straightforward, and the flexor carpi radialis (FCR), the flexor carpi ulnaris (FCU), and the flexor digitorum superficialis (FDS) are all donors. A pronator teres (PT) tendon transfer today was used to treat patients with multiple pathologies, including radial nerve palsy, cerebral palsy and tetraplegia. The authors describe techniques, skills and complications in 25 patients with brachial plexus paralysis. Good anatomical understanding of the PT location is essential, to expedite the procedure and limit unnecessary tissue dissection. The harvest of the PT tendon was best performed through a systematic and anatomic approach.

A-0473 The efficiency of bone suture anchors in the treatment of acute ruptures of the ulnar collateral ligament of the MCP joint of the thumb

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Objective: The ulnar collateral ligament (UCL) of the metacarpophalangeal (MCP) joint of the thumb is an important joint stabilizer. Rupture or avulsion of UCL can cause painful instability of the joint and compromise hand function. In the past, these injuries were treated with the use of tendon transfers and transosseous tunnels and sutures. The results were not always satisfactory. The aim of this study was to evaluate the results after surgical treatment of the acute injuries of the UCL of the MCP joint of the thumb, using bone suture anchors without tendon transfers, bone tunnels and transosseous sutures.
Methods: We followed 23 patients with an injury of the UCL, retrospectively. Ligament repair was performed with the use of suture anchors. The mean age of the patients was 38 years; 16 patients were male and seven were female. Surgery was performed under regional anaesthesia, with axillary block. After surgery, immobilisation of the affected hand was performed with the use of thumb spica for 4 weeks, while a part-time splint was used for another 2 weeks. Patients were allowed freehand loading, 4 months after surgery. The post-operative evaluation was performed, using the Glickel scale. Pain, stability, pinch strength and return to work were evaluated.
Results: In 18 of the 23 patients, a Stener lesion was identified. No tendon graft was necessary to augment UCL reconstruction. Mean follow-up was 4 years (20 months - 6 years). The results were excellent in 18 and good in five patients. We found that 19 patients had no pain postoperatively, while the other four complained of mild intermittent pain, associated with weather changes only. A total of 17 patients regained full stability at the MP joint, and six patients had mild laxity, but with a firm end point. The mean loss in pinch strength was 14 N. All patients returned to their previous activities. No complications were noted, with the exception of some discomfort at the ulnar side of the joint in four patients, which resolved within 1 year.
Conclusions: Treatment of the UCL injuries of the MP joint of the thumb, with the use of suture anchors, is an effective and simple-to-perform technique. Especially when secure fixation of the ligament on the bone was necessary, suture anchors could safely be used, greatly facilitating ligament repair. Tendon transfers and bone tunnels for the passage of tendon and trasnsosseous sutures are no longer necessary.

A-0475 Distal interphalangeal joint arthrodesis with compression screw for degenerative osteoarthritis: a functionally and aesthetically successful procedure

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Objective: Degenerative osteoarthritis is a very common condition. Our purpose was to assess the objective and subjective outcomes of distal interphalangeal joint (DIPJ) arthrodesis with a headless compression screw, in a homogeneous series of these patients.
Methods: We retrospectively analyzed 153 cases of distal interphalangeal joint arthrodesis, performed with headless compression screws. We included only primary cases of degenerative osteoarthritis with a minimum follow-up of 6 months. We identified the appropriate bone coaptation and hardware positioning on postoperative radiographs, in all digits.

Results: In 133 of 153 cases, patients were fully satisfied; in 13 cases, they were satisfied. Seven complications occurred: three cases of prominent hardware, three complex regional pain syndrome Type 1, and one symptomatic bony callus on the fused joint. No nonunion, malunion, nail dystrophy, pseudarthrosis nor infection occurred. All arthrodeses healed.
Conclusions: Distal interphalangeal joint arthrodesis with headless compression screws was shown to be safe and effective in cases of degenerative osteoarthritis, with a low complication rate.

A-0476 A biomechanical assessement of a new technique for proximal interphalangeal joint arthrodesis using a compression wire

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Objective: To asses the biomechanical stability of proximal interphalangeal joint arthrodesis of the fingers II – IV, with a newly-developed compression wire (Koenigsee Implantate, Allendorf, Germany), in comparison to intraosseus wiring: a prospective experimental in-vitro study, using human cadaveric bones.
Methods: Using a cross-over design, each specimen was equipped with three different techniques for proximal interphalangeal joint arthrodesis, in the following order: intraosseus wiring as proposed by Lister in 1978, one single compression wire and two crossed compression wires. In order to eliminate the intra- and interindividual differences in bone quality, each specimen was tested in flexion, as well as extension. For this exercise, the specimens were divided into two groups. In the flexion group (n = 11), the flexion was simulated prior to the extension; while in the extension group (n = 10), bending was simulated in the reverse order. All arthrodeses were in a 4-point bending test in intervals of 0.25°, to a maximum bending load of 5°; and the required force was recorded. The compression wire's diameter decreased from 1.8 mm proximally to 1.0 mm distally; and, like the Herbert screw, features two threads of a different pitch, which are separated by a threadless section. For the intraosseus wiring, cerclage wire of 0.8 mm and K-wires of 1.0 mm were used. Prior to testing the bone mineral density of all specimens used, it was detected by dual energy X-ray absorptiometry. The specimens were stripped of all soft tissues, but the collateral ligaments and were stored embalmed, in a buffered fomaldehyde solution.
Results: Statistical evaluation showed a significant carry-over effect, in which the second series of each group was not allowed to be included in the statistical evaluation. Nevertheless, two crossed compression wires were significantly superior to the other techniques ($p < 0.0001$) in both loading directions, so was the single compression wire to intraosseus wiring ($p < 0.05$). Flexion bending showed the following mean results for intraosseus wiring: 10.94 N (± 3.86 N); one compression wire: 12.82 N (± 5.56 N); two crossed compression wires: 20.42 N, (± 6.57 N); for extension bending: intraosseus wiring 9.71 N (± 3.72 N), one compression wire 13.42 N, (± 6.57 N), two crossed compression wires 22.56 N (± 3.43 N).
Conclusions: Considering the results of the statistical evaluation, the compression wire seems to be a suitable implant for proximal interphalangeal joint arthrodesis, from a biomechanical stand point. Further biomechanical studies, as well as clinical trials, should be conducted in order to gain more data to promote and accelerate its establishment as a new technique for proximal joint arthrodesis.

A-0479 A global rehabilitation approach on the child affected by upper limb congenital malformation

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Objective: Our clinical experience in following children with upper limb clinical malformation highlighted the importance of a global rehabilitative approach. The aim of our study is to review in the literature the principal features of syndromes characterised by hand congenital malformation.
Methods: We researched articles, reviews and original articles on PubMed, using these keywords: congenital hand malformation, Activity of Daily Living (ADL), independence, children, syndromes, and rehabilitation. We considered articles from 2000 to 2014.
Results: Many authors underlined that even the strongest grip is not enough for children's independence: elbows and shoulders need to participate in complex activities, such as feeding and hygiene. A flexed elbow is needed in most functions, but a child

will need a stable elbow to transfer, for example, from bed to chair (Watson et al., 2000). In everyday life, each baby is different from another in disabilities: both cognitive and motricity aspects are important. Some of the papers are focused on children's quality of life: to improve it and to give advice to the family, the hand therapist needs to consider the age of the patient and his needs, because they can change the motivation about rehabilitation (Lake et al., 2010).

Conclusions: Lots of syndromes affect not only hands, but also other physical and cognitive aspects, so it is important to have a very complete analysis, to understand early if there is a psychomotor delay. A good hand therapist must know normal neurodevelopment, to understand problems and to improve every child's skill in his total being. Having a team able to work together around the patient and compare the specialist's opinion is the main feature to have a better result. Every little patient has to reach a maximum level of independence and quality of life, through observation and the work of the whole team.

A-0480 Multicenter study comparing matched outcomes of processed nerve allograft, tube conduit and nerve autograft

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Objective: Few studies have looked at the comparative efficacy on processed nerve allograft, tube conduit and nerve autograft. Here, we report on contemporary cohorts from a multicenter study of peripheral nerve gap repair outcomes.

Methods: In the International Review Board's (IRB)-approved multicenter RANGER® registry, centers contributed subjects with quantitative functional outcomes data for each of the three treatment groups. Subject demographic analysis was then performed for the tube conduit and nerve autograft groups, and all matching processed nerve allograft repairs were selected from the RANGER® database. The contemporary cohorts were analysed, and then comparisons were made between treatment groups by site. Response to treatment was defined as reported improvement from baseline. Meaningful recovery was defined by the MRCC scale at S3/M3 or greater, for sensory and motor function.

Results: From this dataset analysis, there were 73 subjects with 121 nerve injuries in the upper extremity distal to the elbow (74 processed nerve allografts, 34 tube conduits and 13 nerve autografts). There were 103 sensory and 18 mixed nerve repairs in the dataset. Subject demographics, medical history and concomitant injuries were comparable between these treatment groups. Tube conduit repairs were all 30 mm or less (mean 18 +/- 6 mm) and nerve autograft repairs ranged from 20 to 60 mm (mean 39 +/- 14 mm). The processed nerve allograft group was divided into gaps 30 mm and less (mean 15 +/- 8 mm), for comparison to tube conduit, and gaps 20 mm and greater (mean 30 +/- 11 mm) to compare to nerve autograft. In this subset, quantitative data reported meaningful levels of recovery in 83% of the processed nerve allografts, as compared to 44% of tube conduits and 79% of processed nerve allografts; as compared to 62% of nerve autografts. Statistical analyses conducted on the Processed Allograft and Tube Conduit groups found there was a statistical difference between the two, with processed nerve allografts reporting higher levels of meaningful recovery. Enrollment in the autograft group is not yet sufficient to warrant full statistical analysis. There were no reported adverse events related to the treatment groups.

Conclusion: This comparative study found that in these matched cohorts, the Processed Nerve Allografts were more likely to return to functionally useful outcomes, as compared to the tube conduit ($p < 0.001$). While this study currently lacked sufficient sample size to perform this comparative analysis between the processed nerve allograft and nerve autograft groups, no obvious differences were observed between the groups in the preliminary analysis. Outcomes are comparable to historical literature, for each of the treatment groups. The registry remains ongoing; additional clinical data collected from participating sites will allow for further understanding and comparison of these three treatment modalities.

A-0484 Pisciform dislocations: a case report and radiological study to assist in making the diagnosis

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Introduction: We report on an interesting case of a pisiform dislocation. These rare injuries are often missed, due to the difficulty in identifying the dislocation on routine X-rays of the wrist. A dearth of literature defining normal radiological pisiform relationships prompted this study. The aims of this radiological study were to describe the normal parameters of pisiform location, relative to surrounding carpal structures on a

AP/PA X-ray. Further more, we aimed to identify reproducible radiological features that may be used to exclude a pisiform dislocation.
Methods: Patients were prospectively recruited into the study, from a population of patients referred for X-rays at Groote Schuur Hospital, over a 1-month period. Strict exclusion criteria were employed to minimize the chance of pisiform pathology being included in the study. Measurements were performed by two independent reviewers, using digital X-ray imaging software. These measurements were repeated on X-rays of known pisiform dislocations, both in the case report and in the literature.
Results: We had 112 consecutive patients receive wrist or hand X-rays, of which 41 patients were suitable for inclusion. Significant findings were:

- The center of the pisiform always fell within the triquetrum and two-thirds of the time, this was in the proximal ulnar quadrant.
- The distance from the distal margin of the pisiform to the base of the fifth metacarpal is consistently one-half the distance between its proximal margin and the base of the fifth metacarpal. A P-5 MC ratio of 0.5 (95% CI 0.48 - 0.54).
- On the dislocated pisiform X-rays, the pisiform center fell outside the triquetrum, and the above P-5 MC ratio deviated significantly from 0.5 ($p = 0.0005$).

Conclusion: In a patient with a history of acute trauma, a pisiform center that falls outside the triquetrum should raise the suspicion of a dislocation, and should be further investigated and correlated with clinical findings.

A-0485 Long-term results following the hemi-hamate procedure for intra-articular fractures of the middle phalanx

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Objective: The hemi-hamate arthroplasty procedure has gained popularity over the last 10 years, as a solution for the complex problem of proximal interphalangeal joint reconstruction, following intra-articular fracture of the middle phalanx. With articular fragments of > 30%, extension blocking is inadequate. Standard surgical options included reconstruction or wire frame procedures. Although its long-term outcomes remain in doubt, advocates of the hemi-hamate procedure maintain that it offers the best in like-for-like biological reconstruction. We present one surgeon's experience with the hemi-hamate operation and its outcomes, in a consecutive patient series: to share tips, pitfalls and rehabilitation following this procedure.
Methods: 12 consecutive hemi-hamate procedures were assessed by X-ray and for qualitative and quantitative functional outcome measures including patient satisfaction, return to work and range of motion (ROM) over follow-up periods ranging from 6 - 48 months.
Results: We carried out 12 hemi-hamate procedures in a 4-year period: nine men and three women, with a mean age of 34, underwent the procedure. The operation was carried out on five middle fingers, three ring fingers, two little fingers, one index finger and one thumb. Long-term follow-up results were presented. Functional outcome measures were analysed, with reference to the senior author's preferred technical refinements, and were presented along with a discussion of patient selection and preferred rehabilitation protocols.
Conclusions: The hemi-hamate procedure is gaining popularity as a solution to the problem of intra-articular fractures at the base of the middle phalanx. We present the learning curve for the procedure, with medium and long-term outcomes, and offer guidance and discussion points for those keen to adopt it into their reconstructive armamentarium.

A-0487 Preliminary results of four-strand flexor tendon repairs in Zone 2 after implementation of a compliance-dependent treatment regimen

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Objective: The introduction of multiple strand sutures has raised hope of better clinical outcomes after flexor tendon injuries, as they bear the potential of active treatment protocols. In 2011, we introduced a treatment regimen for Zone 2 flexor tendon lesions, which included a 4-strand suture along with either an active or a classical Kleinert rehabilitation protocol, depending on the compliance of the patient. Here we present our preliminary results after implementation of the new treatment concept.
Methods: Between 2011 and 2014, we treated 33 patients with a Zone 2 lesion of the flexor tendon, 17 of whom were assessed up to now, in this study. The average follow-up period for this study was 1.5 years (range 1 - 2.5 years). All patients were treated by a modified Kirchmayr-Kessler four-strand suture (Ethibond 3-0) and a circular adaptation suture (PDS 5-0). Depending on the compliance of the patient, either an active or a classical Kleinert treatment was performed, starting on the second postoperative day. The Disabilities of the

Arm, Shoulder and Hand (DASH) questionnaire, TAM and Strickland scores, as well as the grip strength, were measured postoperatively after 12 weeks, at the 6-month and 1-year time points.

Results: Eight (47%) patients sustained an injury of the deep flexor tendon of the little finger, five patients on the index finger, and four patients on the middle finger. Only one patient suffered an injury of both the superficial and the deep flexor tendons. Overall, only three patients were enrolled in the active treatment protocol. The only re-rupture was found in this group, 3 weeks after surgery. After 12 weeks on average, all patients returned to their previous work. Based on the original Strickland criteria, 16 out of 17 digits achieved an excellent to good function. The average power grip strength was 95% that of the unaffected side.

Conclusions: The implementation of the compliance-dependent treatment protocol generally yielded good to excellent results; however, only three patients were actively treated, and precisely in that group we had found the only re-rupture. Although the power of this study is limited, given the small number of patients, we feel encouraged to carefully select patients for active treatment protocols. At this stage, our results do not support a recommendation towards general active treatment after flexor tendon injuries.

A-0488 Purpose of a novel bioactive composite device for ligament regenerative substitution

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Objective: Our objective is to develop a highly bio-compatible and bio-active material, to be used as a scaffold for ligament replacement, which may be additionally seeded with cells, and/or adequate growth factors. The specific aim is to test novel functional bio-engineered bio-materials as a scaffold for regeneration of human ligaments. The use of polyelectrolite co-polymers to coat artificial fiber scaffolds could allow the synthesis of composite biomaterials, which are not only able to improve ligament cell attachment and proliferation, but also to bind and release growth factors that induce cell growth and differentiation.

Methods: We obtained new acrylic polymers polyelectrolyte-modified HEMA-hydrogels by copolymerisation of 2-hydroxyethyl-methacrylate (HEMA) by cationic monomer 2-methacryloxyethyltrimetilammonium-chloride (METAC) and/or anionic monomer 2-acrylamido-2-methylpropane-sulphonicacid (AMPS). These polymers were studied for their capability to modify their structure in a the change of the external microenvironment, and to facilitate the interactions both with cells and proteins, such as extracellular matrix components or growth factors. The polymer-bound ionic groups were tested for electrostatic interactions with charged solutes, or with charged biological molecules such as collagen, glycosaminoglycans, proteoglycans and some growth factors. In particular, we investigated the effects of pH and ionic strength on the swelling properties of the hydrogels, and the mechanical properties (elastic module, break stress and break strain) and physical state (glass transition) of the neosynthetized polymers containing different rations of cationic and/or anionic monomers. Further studies have been performed, to elucidate the kinetics of the polymerization process, the distribution of different monomers in copolymer chains (solid state NMR) and the superficial composition of copolymer films (ESCA analysis). In vitro morphological, chemical, mechanical and biological characterisation of the scaffold was defined.

Results: These new polyelectrolyte-modified HEMA-hydrogels have no mechanical resistance and will be applied as coatings on biodegradable and non-biodegradable scaffold materials, in order to increase their surface biological properties. The biodegradable material is Poly-L-Lactic-Acid (PLLA), which has to provide the mechanical resistance to rupture for the tissue cicatrization period and has to resorb within 6 months - 2 years. PLLA can be prepared in three different forms: woven 0.6 mm diameter; woven 0.8 mm diameter and woven plate 4 mm in width, in order to estabilish optimal surface morphology for polymer coating. The non-biodegradable material is PolyEthylene-Terephthalate (PETF). It can be prepared, crossed to create a flat bend large 5.8 mm (so resulting in different 'porosity'), in order to estabilish the optimal surface morphology for polymer coating.

Fibroblasts cultured on this scaffold showed no toxicity, demonstrating the good biocompatibility of the device; and when adding growth factors, we observed an increase in cellular proliferation, with FGF2 in particular, and in the mesenchimal stem cells' differentiation into fibroblasts/tenocytes oriented in the direction of the scaffold fibers.

Conclusions: The selected and proposed bioactive-coated scaffold material, powered by growth factors and cells, had shown promising results in vitro. Further in vivo experiments are needed, to assess the biological and mechanical properties of the neo-ligament, as a modulator of autogenous tissue repair in its physiological environment. The treatment of ligament injury with the new engineered composite devices could allow the affected people to return earlier to daily life and/or sport activities; moreover, a secondary degenerative joint disease could be prevented in the long term.

A-0492 Surgical treatment as the preparatory stage for prosthetics in children with ulnar hemimelia combined with congenital elbow joint flexion

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Summary: The different surgical methods used for preparation of under-developed upper limb to prosthetic fittings are presented.
Introduction: Ulnar hemimelia with congenital flexion of the elbow joint is one of the rare and severe forms of congenital pathology of the upper limbs. In the world literature, there are descriptions and results of prosthetics in individual patients, but the detailed characteristics of anatomo-functional features and the aspects of medical rehabilitation are absent. The purpose of this article is to define the anatomo-functional characteristics of the anomaly, and give an analysis of surgical methods of treatment and its results.
Methods: We treated 40 patients, from a 10 month-old up to an 18 year-old, for a total number of 49 extremities: 31 patients had unilateral, nine persons had bilateral defects. We operated on 16 patients (18 under-developed limbs). Six patients were operated on for an underdeveloped hand (six hands).
Results: The clinical anomaly is characterized by hypoplasia of the elbow joint, elbow joint flexion, combined with shortening of a neurovascular fascicle and deficiency of soft tissues on a forward surface of a forearm. The forearm is presented by a unique ulna, which is joined with a rudimentary hand, consisting of a maximum of three fingers. The linear and volume sizes of all segments of the under-developed extremity are reduced. The function of the under-developed extremity is limited and depends on the degree of under-development. In most cases, patients serve themselves, using a compensatory grasp. All operative measures were divided into three groups:

- Operations referred on elimination of a flexion contracture of the elbow joint;
- Reconstructive surgical interventions on the hand; and
- Operations referred on elimination of accompanying pathology of another limb.

The elimination of a flexion contracture of the elbow joint included the following stages:

1. A soft tissue transposition in the field of pterigium, mobilisation of neurovascular fascicle, if necessary combined scin grafting;
2. Applying of the Ilizarov frame; and
3. Applying of the circular plaster splint after elimination of a flexion contracture of the elbow joint, using the Ilizarov frame.

The surgical treatment resulted in improvement of anatomic characteristics of the affected extremities, their appearance and their function.
Conclusions:

1. Ulnar hemimelia with congenital elbow joint flexion is characterized by under-development of all segments of the rudimentary limb, with primary affection of distal parts;
2. Basic methods of surgical treatment are the methods aimed at elimination of a flexion contracture of the elbow joint, and maintenance of optimum conditions for the subsequent prosthetics; and
3. The success of abilitation can be provided with early surgical treatment.

A-0494 Neuroregenerative and immunomodulating properties of human epineural sheath conduit augmented with human mesenchymal stem cells: a new biologic construct supporting peripheral nerve regeneration

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Background: Despite the vast array of treatment modalities, effective peripheral nerve injury repair remains a challenging task. Furthermore, application of autografts, the gold standard of care for nerve defects repair, fails to address the needs for nerve reconstruction in patients suffering multiple-site injury. We propose a new biologic construct for nerve regeneration: epineural conduit consisting of epineural sheath filled with mesenchymal stem cell (MSC)

supportive therapy. Our previous study demonstrated the anti-inflammatory and neuroregenerative potential of the epineural sheath conduit, supported with MSC, in a rat model. To bring this approach to clinical applications, we developed a new biologic construct for nerve regeneration: human epineural conduit (hEC), consisting of human epineural sheath (hES) filled with human mesenchymal stem cells (hMSC). The aim of this study was to evaluate the feasibility of using hEC in peripheral nerve repair, in the nude rat model.

Methods: Sciatic nerve defect (20 mm) was created in 24 nude male rats. Animals were divided into four experimental groups: Group 1: no repair of the defect; Group 2: repair of the defect with autograft; Group 3: repair of the defect with hES filled with saline; and Group 4: repair of the defect with hEC (supported with 3 - 4 x 10^6 hMSC). The hES was created by fascicles removal, using the pull-out technique. To ensure homogenicity of hMSC, cells were cultured for 14 days and immunostained for hMSC-specific markers, prior to injection into the hES. Outcome assessment included: sensory pinprick (PP) and motor toe-spread (TS) tests at 1, 3, 6 and 12 weeks. Somatosensory evoked potentials (SSEP), gastrocnemius muscle index (GMI), histomorphometry, and fluorescent immunostaining for GFAP, NGF, S-100, HLA I / II, vWF and laminin B2 were performed 12 weeks post-surgery.

Results: Cultured hMSC expressed CD105, CD73 and CD90; and lacked expression of the CD45, CD34, CD14, CD11b, CD79a, CD19 and HLA-DR surface molecules. No leakage of cells was observed at the time of injection, during conduit implantation. The hEC maintained its shape and integrity at 12 weeks, following repair. No local inflammation nor scarring was observed at the end of the follow-up period. Clinical evaluation and SSEP analysis confirmed the sciatic nerve recovery in Group 3 and Group 4, with outcomes comparable to nerve autograft repair. Immunostaining showed the presence of the hMSC in the conduit at 12 weeks post-implantation. Muscle histological analysis (GMI and mean muscle fiber area ratios) demonstrated a trend towards faster recovery from muscle denervation atrophy at 12 weeks, following repair. Quantitative nerve analysis is currently in progress.

Conclusions: The feasibility of the application of hEC for restoration of PNI was successfully confirmed in this study. The functional outcomes following the use of hEC were comparable to the gold standard of autograft repair. Use of hEC is a promising new technology for regeneration of long gap nerve defects, which combines the effects of neurotropic properties of hES and the immunomodulatory properties of hMSC.

A-0495 'The hand of the child' Campus: an opportunity to meet, play and compare

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Objective: Within our department, it is a well-established 20-year tradition to work in interdisciplinary teams. This intervention method makes us consider the patient and his family, beyond the disease of the hand. In the last years there has increasingly grown a demand for comparison between patients. This can't be easily satisfied in organized groups with predictable and regular frequency in our department, since our patients come from every part of the country, and also from abroad.

Methods: Every year in our Hand Surgery Department, takes place a Campus that is open to children and their families. This year, there were 325 guests (children and their families). The Campus is organized on one day, in which there are games for children according to different age groups, while the parents have the possibility to share considerations and experiences among themselves and with the medical team. Everything occurs in an informal context. During the day, the parents also have the opportunity to participate in two seminar sessions, one in the morning and one in the afternoon. Such sessions are held by the doctor, the physiotherapist and the psychologist. This type of meeting also gives an opportunity to reflect and focus on the critical issues raised directly by the parents during an occasion that rewards comparison.

Results: The families who participate in this initiative are satisfied in their need to deal with people who are facing the same problems: hand congenital malformation or trauma. At the same time, this occasion also helps parents to know in advance the situations and experiences already lived by others (surgical-rehabilitative choice or social relationships of the child). These experiences allow families to cope with such peculiar diseases as those affecting the limbs.

Conclusions: The Campus, thanks to comparisons between parents and between children with hand malformations, is a useful and important opportunity for the family system, for compliance the treatment protocol and to improve the relationship between parents and children.

A-0498 Treatment of volar marginal rim fractures with variable-angle LCP volar rim distal radius plates

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Volar plating is currently probably the most widespread surgical option for treatment of distal radius fractures, where different fracture patterns can be addressed. Inadequate specific treatment of the fracture of the volar marginal rim fragment provokes great instability, inducing functional catastrophical volar radiocarpal dislocation. Although several fixation systems are available to capture this fragment, adequately maintaining of internal fixation is difficult. Fragment-specific wireforms and other constructs are difficult to place and have limited resistance to bending and axial load. Fixed-angle volar plates have limited positioning possibility for distal translation beyond the watershed line, without increasing the risk of flexor tendon rupture. We present our experience of the first 10 cases with the 2.4 mm variable-angle LCP volar rim distal radius plates (Synthes), a low-profile volar hook plate designed specifically for distal plate positioning and stable buttressing of the volar marginal fragment. The female-to-male ratio was 5:5 and the mean age was 52.2 years (range 17 - 80). The mean follow-up period was 11 months (range 5 - 19), postoperatively. Patient satisfaction was high. Recuperation of mobility was 85%, comparing pre-trauma status. Recuperation of the overall function, according to the Quick Disabilities of the Arm, Shoulder and Hand score, was by 90%. Residual pain was 1.5 on the visual numerical pain rating scale. Subjective and clinical objective wrist stability was obtained, with disappearance of visual wrist deformity. Radiological evaluation revealed fracture consolidation, satisfactory reconstruction of ulnar variance, volar angulation and volar rim. These medium-term results suggested that the variable angle LCP volar rim distal radius plates produced satisfying and reproducible outcomes for treating difficult volar marginal rim fractures.

A-0499 Parents and children: how family systems cope with congenital malformation and the treatment protocol

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Objective: In order to meet the complex needs of our young patients and their families, in the face of the core themes emerged during interview, we considered important to ask ourselves how the treatment protocol we proposed affected the family's relationship. This also addressed their emerging needs.
Methods: To measure the quality of the relationship, we administered to parents the questionnaire PSI - SF (Parenting Stress Index). The instrument, self-reported, is useful to identify stressful 'child - parent' systems. Besides a scale control, the test is composed of three subscales, which judge the three major domains of stressful factors: the characteristics of the child, the characteristics of the parent and situational stressors (Abidin, 2008). The sample comprised 60 family systems during different steps of the treatment protocol: 15 in the first visit, 15 after the first surgical procedure, 15 during physiotherapy protocol following surgery, and 15 families of patients who were treated in our unit for > 4 years. The PTSI - SF was administered to parents in reference to their child with hand malformation and in reference to other children of the family system.
Results: Our results showed significant differences in the steps of the treatment protocol, compared to the level of stress in the parent-child relationships.
Conclusion: These findings make us focus on the critical specifications of each stage and work by having us pay attention to the prevention of distress.

A-0503 Arthroscopic appearance of secondary arthrofibrosis at the radiocarpal joint following intra-articular distal radius fractures

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Objective: The purpose of this study was to describe the multiform appearance of arthrofibrosis after intra-articular distal radius fracture (DRF) by arthroscopy and to examine its clinical implications.
Methods: This retrospective study comprised 18 patients (7 male and 11 female patients) in the years 2011 – 2013, with a mean age of 52 years (25 - 75) who were treated for intra-articular DRF by open reduction and internal plate fixation. The pattern of fibrous tissue formation (FTF) was assessed arthroscopically upon hardware removal. It was related to the course of intra-articular fracture lines (by computed tomography (CT)) and the limitations of carpal motion (by fluoroscopy).

Results: DRF were classified according to the AO classification (C3 n = 12; B2 n = 5). The majority of fracture lines traversed the dorsal radius rim, 40% were multiple, in a 'Y-form' around the Lister tubercle. FTF was found in all remaining fracture gaps. In all FTF was spanning the radiocarpal joint, extending from the former fracture lines to the scapholunate ligament and the joint capsule. They could be described as fibrotic strands (Type 1), fibrotic fan with dorsal capsular attachment (Type 2), fibrotic fan with palmar capsular adhesion (Type 3), a complete joint separating fibrous membrane (Type 4) and an obliteration of the dorsal capsular recess (Type 5). Type 4 and type 5 showed carpal joint narrowing, with limited carpal motion and had to be shaved in order to be dissected. Type 1 was the only one to be broken by a hook. Fracture lines from the Lister tubercule along the course of the SL ligament or cartilage defects > 3 x 3 mm showed Type 4 arthrofibrosis. Most fibrotic fans extended dorsally to the DCSS. All Barton fractures close to the the dorsal rim of the radius showed obliteration of the dorsal capsule.
Conclusions: Secondary arthrofibrosis was evident in all patients after intra-articular DRF. Bridging FTF extended from fracture gaps to neighbouring soft tissue. Type 3, Type 4 and Type 5 FTF impaired carpal motion. The correlation of intra-articular FTF with radiological fracture patterns allowed us to identify risk factors for the development of clinically-relevant arthrofibrosis, after intra-articular DRF.

A-0505 Results of major upper extremity replantation or revascularization: 13 years of experiences in a single center. An indirect comparison of outcomes with arm transplantations

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Objectives: Major upper extremity replantation is defined as replantation of limbs proximal to the wrist. Advancements of microsurgical techniques and equipment have improved the functional results of major replantations. The goal of treatment is to obtain a nearly normal functioning extremity, with an acceptable cosmetic result. This study is to review our experience with major upper extremity replantations or revascularizations, after complete or incomplete amputation injury, performed from 2000 - 2013. This report provides an indirect comparative analysis of the functional results after major replantation, versus previously published reports of arm transplantation in an upper extremity.
Methods: There were 25 consecutive patients who underwent major upper extremity replantations or revascularizations evaluated retrospectively in this study. The mean age at time of surgery was 35.6 (range 14 - 70) years. The mean follow-up was 34.4 (range 7 - 85) months. There was no bilateral amputation. There were four complete amputations and 21 incomplete amputations. The mechanism of injury was crush-avulsion (n = 5), guillotine or deep laceration (n = 16), crush (n = 2), and avulsion (n = 2). There were eight shoulder and upper arm level, seven elbow and forearm level, and 10 distal forearm and wrist-level amputations in the upper extremities. Functional results were assessed using the Korean version of the Disabilities of the Arms, Shoulder and Hand (DASH) and Chen's criteria.
Results: The mean ischemic time was 380.1 (range 120 - 600) min. We had 23 of 25 limbs survive. There were no significant differences in ischemia time between the two groups of patients, with respect to limb survival (p = 0.273). The type of amputation and level of injury had no significant association with limb survival (p = 0.65 and p = 0.076, respectively). In the upper extremity, the mean 2- point discrimination test result was 7.7 (range 4 - 15) mm, mean Visual Analog Scale (VAS) score was 2.91 (range 1 - 7), and mean DASH score was 13.2 (range 2 - 85). When analysed by Chen's criteria, there were 15 Grade I, three Grade II, three Grade III and two Grade IV results. One out of two patients with reperfusion events had proximal amputation. None of the patients developed nonunion or osteomyelitis. We had 12 out of the successful 23 replants undergo at least one secondary procedure: 10 of the successful replants had pain or cold intolerance, but improved with time, and all used the replanted arm for daily activities.
Conclusions: The promising results achieved in our major upper extremity replantation or revascularization patients, which was in some respects superior to those in arm transplantation patients, lead us to recommend that replantation or revascularization continue to be considered as a first-line treatment.

A-0507 The association between vibration and Dupuytren's disease: a comparison between elderly field hockey players and controls

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Introduction: Dupuytren disease (DD) is a fibroproliferative condition involving the palmar fascia of the hand. The etiology remains largely unknown, and the role of exposure to vibration as a risk factor has been studied, with contradicting results. The hypothesis of the current study was that vibration is associated with DD in elderly field hockey players.
Methods: In this cross-sectional study, the hands of 174 elderly male field hockey players and 152 male controls were examined for signs of DD. Details about the participants' age, lifestyle factors, medical history, employment history and leisure activities were gathered during an interview. The association between vibration exposure and DD was determined, using multivariable logistic regression analyses.
Results: DD was found in 48.3% of the field hockey players, and in 25.0% of the controls. Multivariable logistic regression analysis showed age and vibration as dichotomous variables, and were significantly associated with DD (resp. OR = 1.13, 95% CI: 1.08 - 1.17; OR = 4.00, 95% CI: 2.05 – 7.81). To test whether there was a dose-response relationship, a multivariable logistic regression analysis within the group of field hockey players was conducted, using vibration as a continuous outcome (hours/week by years). Using this model, only age was significantly associated with DD (OR = 1.12, 95% CI: 1.04 – 1.19).
Discussion: In this sample, exposure to vibration was associated with DD; however, a dose-response relationship could not be found. As the power in this study was sufficient, the results suggested that the intensity and duration of the vibration is not an important risk factor for DD. It might be that other factors, such as recovery time or vibration frequency, play a larger role.

A-0511 Wide-awake versus brachial plexus block trapeziectomy with ligament reconstruction and tendon interposition: a retrospective study

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Purpose: Wide-awake hand surgery (WAHS) allows performing various procedures under pure local anesthesia, by injecting lidocaine with epinephrine. Therefore, it eliminates the need for sedation, regional or general anesthesia and use of a tourniquet. Although repair of finger flexor or extensor tendons, phalanx osteosynthesis, as well as carpal tunnel release under WAHS are regularly performed with favorable results, the clinical outcome of trapeziectomy with ligament reconstruction and tendon interposition (LRTI) under local anesthesia remains unclear. The purpose of this study was to evaluate postoperative pain and patient satisfaction after LRTI in WAHS.
Methods: We performed a retrospective comparison between two groups of six patients undergoing trapeziectomy and LRTI: one under wide-awake surgery and one under brachial plexus block (BPB). The following variables were assessed: patient demographics, postoperative pain on a visual analogue scale (VAS) on postoperative days one and seven, complications requiring a reoperation, post-operative satisfaction and willingness to repeat surgery. The cost of the procedure was evaluated using the Swiss pricing system for ambulatory surgery. Due to the small number of patients, only descriptive statistics are provided.
Results: Pain scores in the WAHS group were slightly lower on postoperative days one and seven, compared to patients in the BPB group. The cost of the procedure was 23% lower in the WAHS group; however, long-term satisfaction and willingness to repeat the operation were not different.
Discussion: In this limited group of patients, the clinical outcome of patients undergoing trapeziectomy under WAHS is similar to BPB, while the costs are 23% lower. Clinical relevance:
WAHS might be considered as an alternative to BPB or general anesthesia when performing trapeziectomy and LRTI. In this way, patients no longer have to refrain from eating and drinking before surgery, there is no need for a tourniquet and sedation is no longer required.

A-0512 Treatment options and related outcomes in Dupuytren's disease: a systematic literature review

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Introduction: The goal of this systematic literature review was to analyse published treatment options and related outcomes in Dupuytren's disease, in order to find or define recommendations in indication and for outcome measurement in this common disease. There is a big variation among different guidelines and methods described in the literature, which mainly depends on healthcare systems and societal preferences. A variety of studies about different surgical and non-surgical therapies are published in the

literature, but there seemed to be no consensus about the indications for treatment and the outcome methods used to describe the results, accordingly.
Methods: The online literature search was performed in Medline, EMBASE, Cochrane and Scopus, starting in January 1995 and last updated in April 2014. Studies were screened and selected by three independent reviewers, and considered as potentially relevant and included if the following criteria were fulfilled: existence of Dupuytren's disease, description of treatment modality, clinical trial with 10 or more patients; and publication in the English, German or French language.
Results: In total, 114 published studies met the criteria and were evaluated. Overall, 20,505 patients were described, divided into a total of 191 intervention groups, including different treatment regimens of all possible interventions known. Mean follow-up was 3 years among all these studies. The rate of complications and recurrence varied from 0 - 100%. Not all studies published subjective outcome data: if so, the Sollermann Test; Disabilities of the Arm, Shoulder and Hand (DASH); patient satisfaction and Michigan Hand Outcome Questionnaire were the most widely used. Objective outcome measurement of mobility was documented in at least eight different ways. Only a few studies reported about grip strength and sensibility. The description of complications, as well as the definition of recurrence, was inconsistent and not systematic.
Conclusions: This literature review about treatment options and related outcomes in Dupuytren's disease revealed that there was no consensus about therapy modalities and the measurement of their related outcomes. Due to the inconsistency in pre- and post-interventional subjective and objective outcome measures, and the missing comparable definition of complications and recurrence rates, the published data allows no clear conclusion, comparing different treatment modalities. None of the analysed studies were randomised, and only a few were prospective. Most articles included a retrospective data analysis with a short follow-up, not exceeding level IV evidence. The definition of recurrence varied in almost all studies. In order to improve the comparison of results, there is a need for standardized documentation of the disease, its stages, the chosen treatment regime and the related outcome. A consensus regarding these factors is urgently needed, ideally in a similar process as in the Dupuytren's Contracture Recurrence Project, published in 2014 (1).

Reference:
1. Felici et al. HaMiPla, 2014. doi: 10.1055/s-0034–1394420.

A-0513 Six-year results after four-corner fusion in 30 SLAC and SNAC wrists

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Objective: Scapholunate ligament injury or scaphoid non-union often leads to painful wrist arthrosis. Four corner fusion (4CF) is a treatment option if the radiolunate joint is spared. We performed a retrospective follow-up study of all patients operated between 2001 - 2012.
Methods: We treated 30 wrists in 27 patients (17 men) with a mean age of 51 (22 - 71) years in our department, due to SLAC (22) or SNAC (8) wrist degeneration with 4CF, bone transplantation and K-wire fixation followed by cast immobilisation. There were 10/19 SLAC patients who had bilateral wrist affection, three of these were bilaterally operated with 4CF. At follow-up, we recorded complications; AROM; radial and ulnar pain (by Visual Analogue Scale (VAS)) at rest and activity (rr,ra,ur,ua); Quick Disabilities of the Arm, Shoulder and Hand (QDASH); PRWHE; grip-strength and key-pinch. Radiographs of both wrists and computed tomography (CT) of the operated wrist were taken at the final follow-up.
Results: All patients attended the '6-year follow-up' at 2 - 13.5 years after surgery. Three patients had postoperative complications: one deep infection was treated with revisions and long-term antibiotics, and two superficial wound infections healed uneventfully. Three patients developed midcarpal non-union; one was converted to total wrist arthrodesis, one refused reoperation due to minor symptoms and one was only diagnosed at follow-up. Altogether, seven wrists were converted to total arthrodesis (n = 5) or total wrist arthroplasty (n = 2), due to pain and increasing arthrosis 1.5 years (1.1 - 2.0) after primary surgery. At follow-up, the QDASH was 30 (5 - 75), PRWHE was 38 (2 - 82), and AROM 93 (50 - 130). All patients had motion around the neutral axis. VAS for rr, ra, ur, ua were 2.2 (0 - 8.0), 3.7 (0 - 10), 1.5 (0 - 8) and 2.1 (0 - 8.0), respectively. Grip strength was 26.1 (6 - 52) kgs and Key Pinch, 8.0 kgs. In the 13 patients with an uninjured contralateral wrist, AROM was 40% (89° versus 220°), grip strength was 66% (25 versus 38 kgs) and Key Pinch was 92% (8.0 versus 8.7 kgs) of the uninjured side. Prior to 4CF, none of the wrists showed radiolunate degeneration on standard radiographs; at follow-up 5/23 demonstrated narrowing or irregular joint surfaces. In 26 wrists with preoperative CT, minor dorsal or volar degenerative changes were noted in 10 wrists at follow-up and increasing degeneration was

noted in 20/23 wrists, most prominently on the dorsal and volar aspects. One patient was scheduled for conversion to arthroplasty after conclusion of the study.
Conclusions: 4CF gives satisfactory pain control, functional motion and postpones total wrist arthrodesis or wrist arthroplasty for the majority of patients. The patients can expect some residual pain and reduced wrist function. A relatively high conversion rate (25%) and increased degenerative changes in the radiolunate joint is concerning. Follow-up revealed patients with substantial wrist problems, and we are therefore following up with these patients more regularly than we did previously.

A-0516 Ligamentous reconstruction for posterolateral instability of the elbow: a review of 14 patients with an average 5-year follow-up

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Introduction: Posterolateral rotatory instability of the elbow is a rare pathology. It was first described as a clinical entity in 1991. It is caused by insufficiency of the lateral ulnar collateral ligament (LUCL). The purpose of this study was to assess the clinical and functional results of the lateral ligament complex reconstruction with a tendon graft.
Methods: Between 2003 and 2013, we performed14 LUCL reconstructions with a tendon autograft for treating posterolateral rotatory instability, in 9 men and 5 women with a mean age at the time of surgery of 32 years (range, 16 - 50 years). Thirteen patients had post-traumatic instability and one, iatrogenic. The ligament was reconstructed with the palmaris longus tendon in nine cases, with the lateral one-third of the triceps fascia in four cases, and with gracilis tendon in one case. A corrective osteotomy was added for cubitus varus deformity, in one case. Clinical assessment was performed at the latest follow-up, with physical examination (range of motion (ROM), lateral pivot shift test and push-up test); and the Mayo Elbow Performance Score (MEPS); the Quick Disabilities of the Arm, Shoulder and Hand (Quick-DASH) score and subjective satisfaction.
Results: At an average follow-up of 5 years (range, 1 - 10.8 years), the mean MEPS score was 92 points (range, 75 - 100) and the mean Quick-DASH score was 10 points (range, 0 - 36.3). According to the rating system of Nestor et al., the result was excellent in eight, good in three, fair in two and poor in one patient. The ability to rise from a chair pushing with both arms was limited in four cases. There was one failure in a patient who had a positive post-operative lateral pivot shift test, in whom the reconstruction was revised. All patients were subjectively satisfied with the outcome of the operation.
Conclusion: The posterolateral rotatory instability of the elbow is a challenging diagnosis. Reconstruction using a tendon graft provided satisfactory clinical results, with restoration of stability.

A-0519 Surgical technique for subtotal medial epicondylectomy: indications for treatment of cubital tunnel syndrome and persistent epicondylitis

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Objective: Cubital Tunnel Syndrome (CTS) is a common condition frequently associated to epicondylitis, requiring ulnar nerve release at the elbow, for which various surgical procedures have been described. Partial medial epicondilectomy in particular was created by Le Viet in 1991, in order to avoid complications following total osteotomy: our work is aimed at highlighting the key points of this technique, our indications for which include CTS complicated with ulnar nerve subluxation, medial epicondylitis and epicondylar fractures.
Methods: The technique involves an 8-cm curved incision on the medial surface of the elbow, followed by subcutaneous tissue dissection, to identify and protect the ulnar nerve under the medial intermuscular septum, which is released. A frontal medial epicondylectomy is then performed, allowing for anterior ulnar nerve transposition: care must be taken to ensure that the surface is smooth enough for the nerve to glide over.
Results: The final results were assessed at a mean of 38 (range 4 - 97) months post-operatively, using the Wilson and Krout grading system (1973). Our case series showed that nerve recovery through partial medial osteotomy is comparable to other surgical procedures over the medial epicondyle.
Conclusions: After extensive post-operative follow-up and re-evaluation of our cases, we agree with other authors in that partial medial epicondylectomy is to be considered the gold standard technique in CTS and persistent epicondylitis, because it allows for preservation of the local blood supply and nerve gliding, while providing a good grade of pain relief.

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A-0523 A novel treatment option for finger deformities and skin defects in epidermolysis bullosa

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A main manifestation site of severe dystrophic epidermolysis bullosa is the hand. It is affected by pseudosyndactylies of the digits and contractures, leading to a complete loss of function in the so-called mitten-hand deformity, where all fingers are constrained in scar tissue. There is no causative therapy, but by surgical release of the fingers, a satisfactory hand function can be temporarily reconstituted. Here, the creation of large skin defects in a delicate environment is inevitable: the lack of healthy autologous skin for grafting remains a difficult challenge. We propose a new technique to answer this problem: it adopts a treatment strategy from the therapy of large extent burns, consisting of a combination of autogenic and allogenic skin grafting. Otherwise, we propose a custom-made immobilization system by an external fixation device consisting of K-wires, connected by a frame of polymethyl methacrylate (PMMA) bone-cement (Palacos®). We experienced a very beneficial and long-standing outcome in the first 10 patients treated in this manner, since 2011.

A-0524 Review of 14 cases with arthroscopic bone grafting of scaphoid nonunion

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Objective: Nonunion is a known complication of scaphoid fractures and untreated, it develops into wrist arthritis. With standard corticocancellous bone grafting combined with internal fixation, the healing rate is around 90%. Arthroscopic bone grafting (ABG) leads to minimal surgical trauma of the ligaments and the blood supply of the proximal fragment is not disturbed, providing a favourable environment for bone healing. Eventual associated ligament or TFCC injuries could also be addressed during the operation. Wong and Ho (2011) reported a 91% union rate for the first 68 cases operated with their technique.
Methods: The surgical technique was based on the description of Wong and Ho. The operation was carried out under general anaesthesia. The patient lies supine, with the hand mounted to a traction tower. The author prefers dry arthroscopy, with intermittent saline lavage. Standard diagnostic arthroscopy was carried out with a 2.4 arthroscope, followed by synovectomy and eventual treatment of associated injuries. The site of nonunion was debrided with a shaver, curette and burr through the midcarpal joint, until the intact spongious bone was exposed, both proximally and distally; punctate bleeding from the proximal pole was observed. The hand released from the traction, a closed reduction and pin fixation was carried out under fluoroscopy control. The hand was mounted to traction again. Cancellous bone graft was harvested, cut into small chips and with the aid of a 2.5 mm drill guide, advanced into the defect. The graft was tightly packed and contoured, until the void was filled. At the end, the midcarpal joint was filled with fibrin glue, to retain the graft. Eventually, a cannulated headless screw can be inserted along a previously placed pin; in this case, the pins can be removed. The skin was closed with suture or steri-strips, followed by bandage and immobilisation with a plaster splint. The author operated on14 cases with established scaphoid nonunion, with this technique. The mean age was 24 (range 14 – 37); there were13 male patients and seven right hands. The localisation was at the waist of the scaphoid, in eight and in the proximal one-third in six cases; six cystic and eight linear nonunions. The origin of the cancellous bone graft was the radius in eight and the iliac crest in six cases. The fixation was carried out with pins in six and with screw in eight cases.
Results: Bony healing was considered in all the cases. No complication was observed.
Conclusions: ABG of the scaphoid nonunions is a promising method; however, it is technically demanding and more time-consuming than other open procedures. The author recommends this technique to hand surgeons familiar with wrist arthroscopy.

A-0525 The best of both worlds: combined synthesis with external fixation and locking plate stabilization for complex distal radius trauma

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Objective: Wrist trauma involving the distal radius often consists of highly challenging intra-articular lesions, for which internal fixation with locking plates is the treatment of choice, but unstable or extremely distal lesions (namely Types 23 B2, C2.3 and C3 of the AO classification system involving dorso-lateral radiocarpal instability and/or extending through the insertion of the pronator quadratus muscle) call for additional stabilisation. Such cases are ideal candidates for combined synthesis with external fixation and plating, which is thus indicated in complex wrist trauma for both rapid initial stabilisation and accurate definitive treatment: our work aimed at creating and describing a therapeutic algorithm for combined synthesis in complex wrist trauma, in order to foster unambiguous management of such arduous clinical challenges.
Methods: Our technique requires the use of either a traditional axial 'Penning' Orthofix external fixator or a radio-transparent 'Nelson' Orthofix device, combined with Synthes LCP 2.4 mm locking plates: in such a therapeutic algorithm, the fixator provides fragment diastasis, doubling as both a distractor during surgery and a neutralizer/stabilizer for the first 10 days, post-operatively.
Surgical internal stabilisation is simultaneously achieved through a modified Orbay volo-radial DRUJ access, with additional dorsal joint opening to achieve lunoradial congruency, if need be.
Emphasis should be placed on meticulous restoration of the central radial column of the wrist, consisting of the radial sigmoid cleft and the dorsal lunar articular surface, for it bears the majority of the total axial load on the wrist.
Results: All of the patients treated with combined synthesis in our trauma center benefited from the additional external fixation unloading the joint, since diaphyseal fragment reduction was safely maintained throughout treatment: emergent external stabilization allowed, in fact, for significant improvement in patient intensive care unit (ICU) nursing and enabled a considerable reduction of local neurovascular and articular complications, as well. Our technique was thus proved effective and promising so far, though we are aware of the need for further research to be conducted on homogeneous patient groups.
Conclusions: The goal of combined synthesis could be summarised as getting the best of both worlds: external fixation alone is in fact suboptimal in treating volar fractures, and may result in joint stiffness and algodystrophy, while plating raises concerns of either weak dorsal fracture control or necrosis-inducing excessive dorsal dissection. Thus, combined synthesis allowed for timely management of such challenging wrist trauma, safely maintaining dorsal reduction of the radial diaphysis, while at the same time enabling accurate definitive treatment through effective stabilisation.

A-0526 Natural recovery of shoulder exrotation after birth palsy

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The lack of recovery of active exrotation of the shoulder is an important problem in children suffering from brachial plexus lesions involving the upper roots. The purpose of this study was to describe the natural history of infraspinatus muscle recovery and its correlation to elbow flexion recovery. Between 2006 - 2012, we got 484 new birth palsy patients. Inside 4 weeks, a total of 261 (54%) babies had gotten elbow flexion; and they all got fully active exrotation, inside 6 months. Primary nerve reconstruction was done when elbow flexion was < M3 inside 5 months, for 34 babies (7%).This was a retrospective study. We focused on those patients who got active elbow flexion between1 - 5 months and avoided nerve reconstruction. This group consisted of191/484 babies (39%). Group A got active elbow flexion for between 4 - 10 weeks, and 83% of these babies got active shoulder exrotation and their mean recovery time was 13 months. When active elbow flexion occurs between10 - 14 weeks (Group B), active shoulder exrotation started in 47% and the mean recovery time was 17 months. Group C babies got active elbow flexion between 14 - 20 weeks, and only 40% reached active shoulder exrotation. Mean recovery time was 21 months. None of our patients reached active exrotation after 26 months. This material helped us to draw up the scheduled plan for nerve or tendon transposition surgery, for shoulder reconstruction.

A-0529 Acetyl-L-carnitine prevents mechanical hyposensitivity and loss of epidermal non-peptidergic nerve fibers in streptozotocin-induced diabetic rats

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Introduction: Diabetic peripheral neuropathy is a common, long-term complication of diabetes. A dietary supplement, acetyl-L-carnitine (ALCAR), has been shown to have positive effect on diabetic neuropathy; however, an extensive study examining the effect of ALCAR on subgroups of epidermal sensory nerve fibers after induction of diabetes is lacking. The aim of the current study was, therefore, to examine the effects of ALCAR on the development of diabetic peripheral neuropathy and the density of epidermal sensory nerve fibers in Streptozotocin (STZ)-induced diabetic rats.
Methods: Peripheral neuropathy was determined by mechanical and thermal sensitivity in diabetic and ALCAR-treated diabetic rats, during 12 weeks of follow-up. In addition, the density of epidermal (peptidergic and non-peptidergic) nerve fibers were studied in the plantar skin of non-diabetic, diabetic and ALCAR-treated diabetic rats.
Results: The mechanical withdrawal threshold in the diabetic animals was at 60 ± sem gram, which was significantly increased, compared to the non-diabetic animals at 10 ± sem gram and the ALCAR-treated diabetic animals at18 ± sem gram. Moreover, the density of epidermal nerve fibers in diabetic animals was more than one-half decreased, when compared to non-diabetic animals. Although the epidermal innervation in the ALCAR-treated diabetic animals was also reduced, it was significantly less decreased, compared to the untreated diabetic animals.
Conclusions: The present study demonstrated a correlation between mechanical sensitivity and epidermal non-peptidergic nerve fibers. Moreover, the results of the current study strongly suggested a preventive role for ALCAR, as a treatment basis for diabetic peripheral neuropathy.

A-0533 No difference between anatomical position and amount of osteoarthritis 15 years after a distal radius fracture

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Introduction: The development of volar plating with fixed angle screws has increased the tendency to perform surgery as a primary treatment, when a distal radius fracture (DRF) is dislocated. It is generally believed that restoring the anatomical position leads to less osteoarthritis (OA). Patients that should have received operative fixation, according to current AAOS guidelines, should have developed more OA after 15 year. This study primarily focusses on the relation between the anatomical position and radiological OA. Secondary to this, the functional outcome was studied.
Methods: We included 65 patients in this retrospective study, with an average 15-year follow-up time after a DRF. The patients were between 50 - 70 years old at the time of their DRF. The initial treatment and X-rays were reassessed. Patients with an anatomical position of their DRF were placed in Group 1. All others were placed in Group 2. Group 2 was subdivided. Group 2a consisted of patients who, according to the current AAOS guidelines, would have received conservative treatment. Patients in Group 2b would have received operative fixation, according to the guidelines.
For control, the non-fractured contralateral wrist was assessed. All patients received new X-rays of both wrists, a physical assessment (including range of motion (ROM) and grip strength) and questionnaires (Patient-Rated Wrist Evaluation (PRWE); Quick Disabilities of the Arm, Shoulder and Hand (Quick-DASH); and SF-36). Radiological OA was measured with the Scaphoid Lunate Advanced Collapse (SLAC) classification.
Results: Of all patients, 61% had OA on the fractured side and 64% had OA on the non-fractured side, 15 years after a DRF. These results were not significantly different. Moreover, no significant difference between the three groups was seen in the development of OA after a DRF.
The PRWE questionnaire showed that Group 1 had a significantly lower PRWE score, when compared to Group 2a and Group 2b ($p = 0.04$ and $p = 0.007$, respectively). No significant difference was seen between 2a and 2b. No significant difference between the groups was seen on the Quick-DASH or SF-36. The functional outcome, in terms of ROM, grip strength and OA is summarised.
The ROM in Group 1 was comparable to the contralateral wrist. Flexion, supination, radial deviation and ulnar deviation were significantly decreased in Group 2a, when compared to the contralateral wrist. Ulnar deviation and in the pronation-supination arc were significantly decreased in Group 2b, when compared to the contralateral wrist.
Discussion: Patients that in retrospect, according to current guidelines, should have received operative fixation do not have more OA than patients with an anatomical or acceptable position after their DRF. The ROM and grip strength in this group was significantly limited, compared to the contralateral wrist; however, they are not limited in their functional outcome, when compared to patients with an anatomically acceptable position of their DRF.

Conclusions: Patients with a non-anatomical position of their DRF do not show a higher amount of OA after 15 year. Although their ROM and grip strength are decreased, there is no functional deficiency.

A-0535 A new method to predict subluxation following a bony mallet injury

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Introduction: Lateral finger radiographs in a splint often show mild subluxation of the distal phalanx, relative to the middle phalanx. Our hypothesis was that lateral radiographs taken whilst extension stressing the distal phalanx of patients with bony mallet injuries would predict instability, i.e. the risk of significant subluxation or dislocation of the distal phalanx. The aim of this study was to test this hypothesis.
Methods: It was anticipated that the distal phalanx would glide, i.e. remain congruent and so remain stable or pivot about the dorsal base of the main part of the distal phalanx, and those would sublux.
All patients presenting with a bony mallet injury, with a dorsal bony fragment, had new postero-anterior and lateral radiographs and an extension lateral radiograph performed whilst pushing the tip of the finger into extension at the first fracture clinic appointment, within 10 days of injury.
Treatment: All patients had immobilisation in a splint, in slight extension. Treatment was not changed based upon the stress radiographs. Patients who were anticipated to be stable, had follow-ups around 6 - 12 weeks later. Patients anticipated to be unstable (potentially needing surgery) had a weekly follow-up for up to 3 weeks from the injury, when the DIP joint should remain stable. Radiographs were performed at each follow-up appointment. Where significant subluxation occurred within the first 3 weeks of injury, surgery was often, but not always recommended, based upon clinical assessment.
Patients: All patients with closed bony mallet injuries presenting to the fracture clinic within 10 days of injury were included. Patients already with significant subluxation needing surgical stabilisation were excluded.
Results: There were 16 men and nine women, with mean ages of 47 years (men) and 44 years (women). There were three, and not the anticipated two, types of findings on the lateral extension radiographs: gliding; pivoting and tilting. Tilting was a combination of both gliding and pivoting: the distal phalanx mainly glided, but with a small opening up of the volar side of the joint.
The final radiographs showed three patterns: congruence; partial subluxation up to 1 - 2 mm (minimal subluxation) and substantial subluxation > 2 mm. There was a very close correlation with pivoting (seven cases) and substantial subluxation, and a similar strong association between gliding (12 cases) and congruence. Tilting (seven cases) gave mixed results, i.e. some subluxed and some remained stable. There was also a correlation between pivoting and the size of the fracture fragment.
Conclusions: Lateral stress radiographs helped predict DIP joint instability, following bony mallet injuries. The study showed that fingers which glide are almost always stable, and at most sublux minimally, which will probably not give a poor outcome. Fingers that tilt or pivot need to be watched carefully, lest they sublux, risking a poorer outcome. Further data and correlation with fracture fragment size will help further predict DIP joint subluxation; and hence, the probable need for surgical stabilisation. This will help predict those whom would benefit from surgery, reducing risk and cost.

A-0537 Trustworthy clinical practice guidelines for adult distal radius fractures

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Objective: The purpose of the present work was to provide evidence-based guidelines for the treatment of distal radius fractures, on behalf of the Norwegian Orthopaedic Association (NOA). These guidelines cover indications for operative treatment, different types of operative treatment and functional rehabilitation, postoperatively. They are instruments, which have the purpose to prevent undesired variation in treatment quality, between patients or patient groups.
Methods: The evidence on the treatment of distal radius fractures was gathered by searching for existing treatment guidelines or systematic reviews. By lack of such, meta-analysis of existing randomised controlled trials (RCT) were performed. The Grading of Recommendations Assessment, Development, and Evaluation (GRADE) methodology was applied in the

quality appraisal of the evidence; and in the evaluation of the balance between benefits and harms, patient's values, preference and resource use. We subsequently also made such in cohort studies, and also adopted parts of the guidelines for treatment of distal radius fractures of the Danish Health and Medicines Authority. By applying the MAGIC (Making Grade the Irresistible Choice) application, an online collaborative authoring and publication platform, the work was facilitated.

Results: Based on the present evidence, we strongly recommend operative treatment of unstable distal radius fractures (defined as dorsal angulation 10°, ulnar variance 2 mm, intra-articular step 2 mm, comminution of the volar or dorsal cortex of the distal radius, and incongruency of the distal radioulnar joint) in adults; whereas in patients > 65 years, we downgraded the recommendation to a weak recommendation. We also recommend volar locking plates above percutaneous pinning and external fixation; however, restraint should be exhibited with respect to operative treatment for patients with a low-functioning level (permanent inability to deal independently with day-to-day activities).

Conclusions: The results of this work process are online in multi-layered evidence-based guidelines for the treatment of distal radius fractures, using the GRADE methodology. These guidelines set a standard for assessment, treatment and follow-up of patients with distal radius fractures, and they serve as an aid to healthcare personnel in decision-making, in their everyday clinical practice.

A-0538 Disability and return to work after MRI in suspicion of scaphoid fracture: influence of MRI pathology and occupational mechanical exposures

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Objectives: The aim of this study was to determine the prognosis after wrist trauma examined with magnetic resonance imaging (MRI) on suspicion of scaphoid fracture, with respect to disability and return to work. The hypothesis that pathological findings upon MRI and heavy manual labour as a negative prognostic factor was examined.

Methods: The study design was a combination of a register-based follow-up study and a questionnaire. We included 469 patients, aged 18 - 90 years, whom in the period 2006 - 2010 had a MRI done upon clinical suspicion of scaphoid fracture. The questionnaires included the Disabilities of the Arm, Shoulder and Hand (DASH) and the Patient-Rated Wrist Evaluation (PRWE), educational level, designation of occupation and lifestyle information. Data on long-term sickness absence was obtained by linkage to the national register on social transfer payments (DREAM register). Return to work was defined as the number of weeks until the patient returned to work for 4 consecutive weeks after the trauma. Cox proportional hazards models were used.

Results: 249 patients (53%) responded to the questionnaire a mean of 4.8 years after the trauma. Mean age was 43.5 years (SD 19.7); there were 43% male patients and 57% female. We found that 46% of the respondents had pathological findings on MRI. Predictors for a DASH score > 20 and PRWE-score > 20 were: pathological findings on MRI, female gender, body mass index (BMI) > 30, and tobacco smoking. There were125 respondents in active employment at the time of their trauma. Predictors for prolonged sick leave before return to work were: being on sick leave within a year before the wrist trauma, MRI findings and heavy manual labour.

Conclusions: MRI findings, former sick leave and heavy manual labour were all important factors affecting sick leave after wrist trauma. Lifestyle factors such as tobacco smoking and obesity were also significant predictors of prolonged symptoms after wrist injury.

A-0539 Wrist flexors and extensors biomechanical comparison

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Introduction: The wrist is one of the most important joints used during everyday living activities. It is not at the point where there are the strongest muscles, but the site of precise movements. The loss of its function significantly affects the comfort of a patients' life. It is a common belief that the dominant side should achieve better results in all aspects. The aim of the study was to verify the wrist flexors and extensors' biomechanical parameters and grip strength, due to limb domination.

Materials and methods: We examined 78 healthy, right-handed volunteers with the Biodex System 4

Pro isotonic protocol. The excluding criteria were: previous upper limb trauma, upper limb range of motion (ROM) restrictions, upper limb neuropathies and cervical pathologies. The isotonic protocol consisted of three trials (0.5/1/0.5 Nm) with four repetitive wrist extension - flexion movements, each. Grip strength was examined with the Biometric dynamometer in three repetitive trials.

Results: Significant differences were observed between the wrist extensors' average peak velocity ($p < 0.05$) in all trials, due to the limb dominance. Accordingly, the time to reach peak velocity during the extension movement was significantly greater for the dominant limb (110ms/200ms/110ms). There were no significant differences between the wrist flexors' average peak velocity and time to reach peak velocity, and the full ROM due to limb dominance. The difference between the agonist to antagonist ratio, due to limb dominance, was statistically significant ($p < 0.05$) and it was greater for the dominant limb (60.5%/55.6%/60.6%). The difference between grip strengths were not significant due to limb domination, with 37.6 ± 1.3 kg for the dominant and 35.7 ± 2.1 kg for the nondominant limb.

Conclusions: Flexors present similar biomechanical parameters, regardless of domination, which indicates the similarity in overloading the dominant upper limb in everyday life. Extensors showed statistically important parameters of the dominant side, as indicated by a higher loading in everyday life (lifting, writing, etc.).

A-0542 Comparison of arthroscopy versus fluoroscopy in the treatment of cominuted distal radius fractures

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Objective: Distal radius fractures are serious wrist injuries that comprise both bony and ligamentar lesions. Their surgical approach can be assisted by fluoroscopy or arthroscopy: the superiority of one over the other is not yet established. Our purpose was to test which is superior, when dealing with cominuted fractures.

Methods: In a cohort study, we analysed a group of 22 adult patients with cominuted distal radius fractures, submited to volar locking plate and screw fixation, and intra-carpal soft tissue injury repair by the senior author, and followed for an average of 22.5 months. Eleven patients submited to arthroscopically assisted surgery (Group 1) were compared to 11 patients whom had fluoroscopically assisted surgery (Group 2). The two cohorts were analysed for the type of fracture (AO classification), the presence and type of intra-articular lesions, age group (under 50, 50 - 65, and over 65 years old) and a functional evaluation using the Quick Disabilities of the Arm, Shoulder and Hand (Quick DASH) score. Variations in the Quick DASH score were determined.

Results: Group 1, of mean age 61, fracture Type C (n = 10), presented ligamentar injury in eight cases. In Group 2, of mean age 51, fracture Type C (n = 9), were diagnosed with four ligamentar injuries. From these, two patients had preoperative computed tomography (CT) scans that showed increased scapholunate distance, none had magnetic resonance imaging (MRI). The average Quick DASH score in Group 1 was 28 and in Group 2, it was 17. The Quick DASH was superior in Group 2 (p 0.014 Student's *t* test, p = 0.019; Mann Whitney test, 95% CI). In Group 1,the presence of intra-articular lesions correlated positively with increasing age (p = 0.024; Pearson Correlation 95% CI) and did not correlate with either fracture classification or functional result. Within Group 2, there was no correlation between age and fracture classification, or between the Quick DASH score and fracture type.

Conclusions: Fluoroscopy is an adequate means to evaluate distal radius fractures and the presence of intra-articular lesions. Group 2, controlled fluoroscopically, had a mean age over 60. These patients may not benefit from arthroscopically-assisted treatment.

A-0543 Skin flap based on one of the volar perforators arising from common digital palmar arteries: clinical application

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Objective: The objective of this paper is to describe a skin flap, based on one of the volar perforators, as well as the first clinical case. The anatomy of the volar perforators was described previously. The skin of the palmar triangle is an area that is highly vascularised by perforator arteries arising from the common digital palmar arteries. They can be used as a blood supplying vessel for a skin flap, in order to reconstruct a skin defect in the hand or fingers.

Methods: Sixteen fresh anatomical specimens (12 of which were injected with coloured silicone) were dissected, in order to define the anatomy and to study

the feasibility of the flap while preparing for its possible clinical use. When a suitable clinical case occurred (deep electrical burn over the palmar aspect of the first phalanx), the flap was used to cover its anterior aspect.
Results: Volar perforators from common digital palmar arteries proved to be a constant finding. There are on average six perforators arising from every common digital artery in the volar triangle.
The anatomical dissections showed a feasibility of the flap, based on one of these perforators.
The clinical application was successful, with good survival of the whole of the flap, despite a minor venous congestion during the first days, postoperatively.
Conclusions: This study shows the feasibility of a 'propeller' flap, based on one of the perforators arising from common digital palmar arteries. The successful clinical case and its good clinical outcome is an illustration of the pertinence of the flap and contributed to the choice of possibilities in the skin reconstruction of the hand.

A-0545 Complex carpal lesions: state of the art

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Objective: Complex carpal lesions are rare and involve carpal dislocation with ligament lesions and/or bone fractures. The most frequent injuries are perilunate dislocations: 65% of these are dorsal trans-scaphoid perilunate fracture-dislocations. A wide multicentric study reports that despite the severity of the injury, the diagnosis can be missed in 25% of cases, at the time of the injury. The purpose of this study was:

- To retrospectively review the outcomes of all cases treated in our Hand Surgery Division and to compare these results with those reported in the literature; and
- To analyse the most recent up-to-date literature, determining the main factors associated to the outcomes of surgical treatment, in order to design an algorithm treatment for perilunate fracture-dislocations.

Methods: Between 2002 and 2012, we treated 45 patients for complex carpal lesions. The data collection was performed retrospectively, by the same examiner, with a mean follow-up of 58.19 months, using the Mayo Wrist Score, the Clinical Scoring Chart and the Quick Disabilities of the Arm, Shoulder and Hand (DASH) score. A statistical analysis of the results was performed, comparing them to the most recent literature.
Results: The majority of patients returned to an acceptable hand function, with objective good results and subjective satisfaction. The mean final score with the Mayo Wrist Score was 76.8/100, the mean Clinical Scoring Chart was 82.5/100 and the mean DASH was 13.6/100. Factors influencing the outcome are open injury and delay in treatment. These clinical and radiographic results are comparable to those reported in the literature.
Conclusions: The main factors influencing outcomes are the type of lesion and the timing of surgery. An acute, non-surgical reduction is mandatory, in order to restore the normal anatomical connections as soon as possible, but it is not adequate as a definitive treatment. Treatment should always involve an open reduction and possibly an internal fixation. The issues that still remain controversial in the literature are the approach, the intercarpal stabilisation and the ligament repair techniques.

A-0546 One versus two headless compression screws in bone grafting for scaphoid nonunion

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Objectives: Scaphoid nonunion is traditionally fixed with one headless screw. Because one headless screw might not provide sufficient rotatory stability, some surgeons choose to use an additional K-wire during the first weeks. Our purpose is to compare the use of one versus two headless screws, regarding union, and the complication rates in the surgical treatment of scaphoid nonunion.
Methods: A total of 20 consecutive patients (19 male patients and 1 female patient) were treated June 2007 - May 2013 with open reduction, bone graft and internal fixation with one (Group A: 10 patients) and two (Group B: 10 patients) headless screws. The choice of the number of screws used was randomised and patients were followed up prospectively. Five cases were excluded, because screw fixation was not possible. They had very small proximal fragments and were treated with a bone vascularized graft, based on the 1,2 intercompartmental supraretinacular branch of the radial artery and K-wire fixation. A volar approach and volar fixation technique were used in all cases. Bone grafts techniques included: two non-vascularized grafts from the distal radius, four non-vascularized grafts from the iliac crest, and 14 vascularized grafts from the distal radius pedicled on the volar carpal vessels. Nonunion sites were at the

waist (n = 14), proximal third (n = 5), and distal third (n = 1). Six scaphoids showed an avascular proximal fragment in the preoperative magnetic resonance imaging (MRI). Nonparametric statistical tests (Mann-Whitney and Kruskal-Wallis) were used, as appropriate. There were no statistical differences between groups, regarding age, sex and nonunion site.
Results: Computed tomography (CT) scans confirmed healing in all cases except one. This patient needed a second procedure to obtain union. There were no screws protrusions at the proximal scaphoid, but removal was done in six patients of Group B and one of Group A, because of pain and protrusion at the entrance point. Three patients had limitation of flexion and ossification of the vascular pedicle that were treated with removal of the protruding bone. This complication was not associated with the number of screws utilised.
Conclusions: There were no differences in union rates between fixations with one or two headless screws, except for one failure that occurred after fixation with two headless screws and vascularized bone graft. The patient was successfully subsequently treated with fixation with one headless screw, and an iliac crest non-vascularized bone graft. The need for removal occurred with more frequency when two headless screws were used.

A-0548 The role of collagenase in treatment of low and moderate Dupuytren's disease: a 3-year follow-up of 80 patients

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Introduction: Enzymatic degradation is the most promising non-surgical treatment in Dupuytren's disease. There was limited follow-up and diffusion of the procedure in Italy a few months after the official introduction of the drug into the public health force, to analyse with particular care the first data on the treatment of pathological cords by injection of collagenase from *Clostridium hystoliticum*. Our center was instructed from September 2011, along with another five centers in Italy, of doing the first control on the efficacy and safety of the enzyme.
Materials and methods: At the Plastic Surgery Clinic of the Hospital University of Padua, from September 2011 to November 2014, we followed up on 80 patients (mean age 58, mostly men) treated by infiltration of collagenase from *Clostridium hystoliticum*. Prior to injection, each patient was classified according to the modified classification of Tubiana-Michon, by defining the degree of deficit extensor present. Following the extension procedure, patients were followed as outpatients, by collecting data related to their clinical course, measuring the degree of extension obtained and the strength of the rays treated, and any complications that arose. These data were collected weekly for the first 3-month period, every 3 months for the first year, and later by annual intervals with a mean follow-up of 18 months.
Results: The treatment was effective in all patients treated. Only minor and short-term complications were recorded: in 10% we observed skin tears with spontaneous healing in about 15 days; in 8%, the formation of a small hematoma at the injection site; in 15% of patients, there was a transient axillary lymphadenitis the day of the injection. Other frequently observed complications were pain and swelling at the injection site, with spontaneous regression. In these patients, we observed a complete and lasting recovery of functionality of the extensor ray, with a recurrence rate comparable to literature data and with complete recovery of the strength of the hand treated, in the long-term. Moreover, in the last cases we used different injection techniques, extending the procedure to multiple rays and along the entire aponevrotic chord, instead of a focused drug injection.
Conclusions: In agreement with the literature, the use of collagenase from *Clostridium hystoliticum* is a very effective treatment. It had a minimum rate of complications, when compared with a surgical technique, in properly selected cases. The low invasiveness and very early rehabilitation in the short term, post-procedure, are also two key aspects in preferring this method to traditional surgery, in cases of low to moderate gravity.

A-0549 Five-year follow-up after premature termination of the RCT comparing CMC arthrodesis and Weilby arthroplasty for primary osteoarthritis at the base of the thumb

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Objective: Our previous randomized trial comparing outcome of trapeziectomy with ligament reconstruction and tendon interposition (Weilby arthroplasty) with trapeziometacarpal arthrodesis for symptomatic osteoarthritis of the basal thumb joint was prematurely

terminated, due to a significantly higher rate of severe complications in the arthrodesis group. Other outcome measurements were not found to be significantly different, because the study was underpowered after termination. The purpose of this study was to evaluate the long-term outcomes of the included subjects after a mean follow-up of 5 years.

Methods: We randomised 43 women (40 years or older) with Stage IV CMC osteoarthritis to either trapeziectomy with a tendon sling arthroplasty preserving the structural integrity of the first metacarpal bone (Weilby), or a carpometacarpal arthrodesis using 2.3-mm screws and T plate fixation (Leibinger non-locking plate; Stryker, Freiburg, Germany). Before surgery, after 3 months, and 1 year after surgery, we evaluated 38 of these patients for pain, functionality (Patient-Rated Wrist and Hand Evaluation (PRWHE); and Disabilities of the Arm, Shoulder and Hand (DASH)), strength, satisfaction and their complication rate. Of these patients, 24 (63.2%) were evaluated for the same outcome measures after a mean follow-up of 5.3 years (range 3.9 - 6.2 years). Generalized estimating equations statistics were used to compare repeated measurements over time, in the two groups.

Results: After 5 years, the Weilby arthroplasty had a significantly better pain reduction, compared to 1 year after surgery, whereas the arthrodesis group had more pain (mean ± SD of the PRWHE pain score from 15 ± 3 to 8 ± 3 compared to 19 ± 4 to 22 ± 5; $p < 0.010$). Functional outcome showed similar results: the Weilby technique resulted in a significantly better functional improvement in PRWHE score (PRWHE activities score from 11 ± 2 to 5 ± 2 compared to 17 ± 4 to 23 ± 5; $p < 0.001$) and the DASH score (20 ± 3 to 7 ± 2 compared to 31 ± 6 to 35 ± 6; $p < 0.0001$). In both groups, the grip and pinch strength were higher than 1 year after surgery, but were not significantly different between groups. After 5 years, in the Weilby group 92% would choose the same surgery again, against 73% in the arthrodesis group; after 1 year, these numbers were only 86% and 50%, respectively. In the arthrodesis group, one additional nonunion requiring revision surgery was diagnosed 14 months after surgery, resulting in a total of 18% reoperations in this group, due to nonunion, and one more reoperation to remove painful osteosynthesis material. In both groups, one patient was re-operated because of pain due to scapho-trapezio-trapezoid osteoarthritis.

Conclusions: Weilby arthroplasty leads to better pain reduction and functional outcome (DASH and PRWHE scores) after 5 years, compared to carpometacarpal arthrodesis, for CMC osteoarthritis Stage II - III. The nonunion rate for CMC arthrodesis was 17.6% and four out of 17 patients had revision surgery, because of osteosynthesis-related problems. Based on the findings in this study, we do not recommend the use of CMC arthrodesis in the treatment of Stage II - III osteoarthritis.

A-0550 RCPI associated to first row carpectomy: an alternative to total wrist arthrodesis and arthroplasty in advanced carpal collapse?

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Objective: In the past decade, the Resurfacing Capitate Pyrocarbon Implant (RCPI) associated to first row carpectomy (FRC) has been used to treat symptomatic advanced carpal collapse, widening the indications of FRC to patients with capitate head arthrosis. We compared the outcomes of our case series with those of total wrist arthrodesis and arthroplasy found in the most recent literature for the same stage of osteoarthritis (OA).

Methods: We performed a retrospective review of 25 patients with SLAC-SNAC Stage IV and Kienbock Stage IV wrist arthrosis, treated with FRC and RCPI implant, between 2007 and 2014. The mean follow-up was 38 months (4 - 76). All patients were evaluated clinically (pain, range of motion (ROM), and grip strength) and radiographically. We also measured outcomes using the Mayo Wrist Score; the Disabilities of the Arm, Shoulder and Hand (DASH) score; and considered return to previous working and sport activities.

Results: There were 23 patients who showed improvement in pain, grip strength and ROM, with a satisfactory recovery that allowed them to go back to work. The mean DASH score was 18.9 and the mean Mayo Wrist Score was 78.3. We did not see any implant mobilization nor capitate fracture. We had one case of volar carpal dislocation, and one case of persistent pain and poor grip strength recovery, whom underwent surgical revision with total wrist arthrodesis. We observed no acceleration of the distal radial OA.

Conclusions: In comparing the outcomes of our case series to those found in the literature for total wrist arthrodesis and arthroplasty in patients with SLAC and SNAC III, we observed no significant difference. According to these results, RCPI associated to FRC can be considered a promising alternative in selected cases of wrist OA with some involvement of the capitate head and lunate fossa. A higher number of patients and a longer follow-up is needed to fully evaluate the role of these implants in the future.

A-0552 Treatment of distal biceps tendon rupture: why, when and how. Analysis of the literature and our experience

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Objective: The rupture of the distal biceps tendon is a relatively uncommon lesion. Even if conservative treatment may be an option in low-demand patients, young and active people may benefit from an early surgical reinsertion. Many techniques and fixation devices have been described, but in the literature there is no clinical evidence that shows the superiority of any of these. In this work, we present an analysis of the 'state of the art' and our case series of surgical reinsertion with the double access transosseus technique.
Methods: Between 2003 and 2013, we had 26 patients undergo surgical reinsertion, for acute or chronic lesions of the distal biceps tendon. The average follow-up was 22 months. All patients were evaluated using the Disabilities of the Arm, Shoulder and Hand (DASH) questionnaire and the SECEC ELBOW scores. Measurement of range of motion (ROM), supination and flexion strength was also performed.
Results: Final mean ROM was 6 - 132° in F/E and 89 - 0 - 87° in P/S; the flexion and supination strengths were 96% and 88%, compared to the opposite side. As we expected, in chronic lesions the outcomes have been worse. The main complications were two cases of heterotopic ossification, one asymptomatic fracture of the proximal radius and one temporary neurapraxia of the radial nerve.
Conclusions: Analysis of the literature and our outcomes, we found that timing of surgery appears to be crucial. Young and compliant patients, following a strict postoperative rehabilitation protocol, can achieve almost complete recovery. The choice of surgical technique remains controversial, and we believe that the double access transosseous reinsertion is a safe, costless and relatively noninvasive technique, offering good results if performed early.

A-0553 The role of the dermic inductors for a new approach to the complex lacks of the upper extremity and of the hand

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Background: Soft tissue deficits associated with exposed tendon and absent paratenon gives difficult reconstructive problems, due to tendon adhesions, poor range of motion (ROM), poor cosmesis and donor site morbidity. The Integra Bilayer Matrix Wound Dressing (Integra Lifesciences, Plainsboro, NJ, USA) is a skin substitute widely used in reconstructive surgery, including the incidental coverage of tendons; however, the Integra dressing's post-operative functionality of the tendons has not been well documented. We report the results of using the Integra dressing for soft tissue reconstruction overlying tendons with loss of paratenon in the upper extremity soft tissue defects.
Materials and methods: We reconstructed 42 patients (35 men and seven women) with exposed tendons due to trauma (n = 37), cancer excision(n = 2) or chronic wounds (n = 3) using the Integra dressing. Results were compiled in a prospective manner, including age, gender, wound location, wound size, time to final closure, operative time, follow-up length, split-thickness skin graft percentage take and active post-operative ROM. Likewise, using *Medline*, a literature search of current surgical techniques for the treatment of exposed tendons and the results from the literature were compared with these study results.
Results: All patients healed with an average split-thickness skin graft take rate of 92.5% (SD 6.1; range 80 - 100%). The 32 patients not lost to follow-up achieved an average ROM of 91.2% (SD 6.5; range, 80 - 100%).
Conclusions: The Integra dressing offers a convenient, efficient operative procedure with minimal morbidity, demonstrating good cosmesis and tendon function. Thus, the Integra dressing may offer an alternative option for immediate tendon coverage in the upper extremity.

A-0555 Our results using suspension arthroplasty technique for treating basal joint arthritis

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Objective: Osteoarthritis of the first carpometacarpal joint (basal joint) is the cause of pain in 25% of women and 8% of men aged 50 – 65 years. It is more frequent in postmenopausal women. The main symptom is thumb pain, aggravated by daily activities. We aimed to analyse the clinical outcomes of ligament reconstruction and tendon interposition arthroplasty (suspension arthroplasty) with the use of full-thickness flexor carpi radialis (FCR) tendon in osteoarthritis of the carpometacarpal joint of the thumb.

Methods: Between May 2007 and April 2013, we operated on 24 patients (4 male patients and 20 female) with basal joint arthritis by the suspension arthroplasty procedure. Mean age was 61 years (range: 42 - 69) and mean follow-up time was 19 months (range: 12 - 60). In radiographic evaluation, all of the patients had severe osteoarthritis (Eaton Stage 3 - 4). All the patients had disability in daily activities, and the indication for operation was pain that did not respond to conservative treatment, in all cases. The operation consisted of trapeziectomy, ligament reconstruction and tendon interposition with full-thickness flexor carpi radialis tendon. After 4 weeks of cast immobilisation, active exercises were initiated. Functional and clinical outcomes were assessed according to the Visual Analogue Scale (VAS) score, Kapandji score and Disabilities of the Arm, Shoulder and Hand (DASH) score.
Results: Radiographically, all of the thumbs remained stable at the final review. There were not any signs of subluxation on the base of the first metacarpal bone. All patients returned to daily activities. At the last follow-up, the VAS score was reduced from a preoperative average of 7.6 to 1.9; and the DASH score reduced from 78 to 20. The Kapandji score improved from 3.5 to 8. Mobility of the thumb improved in all patients. Two patients could reach the distal volar crease of the little finger, seven patients could reach the base of the little finger, seven patients could reach the PIP joint, five patients could reach the DIP joint and three patients could reach the tip of the little finger with his or her thumb. Wrist flexion was not affected in all patients. No intra-operative or neurovascular complications were noted.
Conclusions: Ligament reconstruction and tendon interposition arthroplasty with full-thickness flexor carpi radialis tendon is an effective surgical procedure with high patient satisfaction, satisfying joint stability, reduction in pain, and improvement in finger function and mobility.

A-0556 Preliminary results of double arthroplasty for peritrapezial osteoarthritis: a retrospective series of 13 cases with an 18-month follow-up

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Objective: The surgical treatment of advanced and symptomatic peritrapezial osteoarthritis remains a debated issue. Trapeziectomy causes an almost constant loss of strength and mobility, and can produce some failures, considering indolence as the main criterion for success.
Methods: We report a retrospective series of 13 patients (average age 67 years) treated for advanced peritrapezial osteoarthritis with two implants, during the same surgical procedure: a pyrocarbon interposition implant for the scaphotrapeziotrapezoid joint (STT) and an uncemented total joint replacement prosthesis for the trapeziometacarpal joint (TMC).
Results: At a mean follow-up of 18 months, the clinical and radiological results were encouraging, with survival of all implants, and surgical revision in two cases, for dislocation of the STT implant.
Conclusions: The short follow-up and the small number of patients were insufficient to make a conclusion, but it seemed that a double joint replacement surgery can enrich the therapeutic arsenal for advanced peritrapezial osteoarthritis. The eligible patients must be well chosen and the surgical technique must be rigorous.

A-0557 Scaphoid plating in the treatment of failed scaphoid surgery with nonunion, bone defect and loose headless screw

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Objectives: Scaphoid fracture and scaphoid nonunion disconnects the ulnar and radial side of the proximal carpal row, leading to instabilty, malposition, incongruency of the joint; and as an end result, increased cartilage wear, arthrosis and collapse of the wrist. The aim of treatment is to reconstruct size, shape and unity of the scaphoid. This is performed by repositioning, bone grafting and stabilisation. Headless bone screws inserted in intramedullary areas are used to stabilize the scaphoid, in most of cases. In case of failure of the primary or secondary procedure, with persistent scaphoid nonunion with a loose screw in the bone, the problem increases. The bone stock is in worse condition, the bone defect is not just between the proximal and distal fragments, but also around the loose screw within these fragments. Stable intramedullary screw fixation is seldom possible. In these cases, stable fixation maybe performed by using a scaphoid plate and angular stable screws.
Patient and methods: We had 10 consecutive patients with persistent scaphoid nonunion after primary osteosynthesis for fracture treatment or after secondary treatment for scaphoid nonunion, within the group. The size of the fragments and bone defects within the proximal and distal fragments did not allow the operating surgeon to use a headless screw for stabilization. All patients were treated by screw

removal, nonunion resection, bone grafting by autograft from the iliac crest and stabilization by 1.5 mm scaphoid plate, with angular stable screws through the volar approach. Surgery was followed by 6 weeks with a cast and 6 weeks of protected mobilisation. All patients were followed clinically and radiologically at 2, 6, 12 and 24 weeks after surgery, until clear signs of healing or non-healing of the scaphoid. In case of doubts about the healing process, a computed tomography (CT) scan was used for confirmation, and patients were followed up to 18 months after surgery. In two patients with a screw inserted from the proximal pole, a second approach was used with stabilisation through the volar approach. In two patients, removal of the screw was impossible, so it was decided to leave the screw within the bone with grafting around it, and applying an adjacent plate stabilisation on top.

Results: Eight patients healed the scaphoid. Wrist synovitis disappeared with scaphoid stabilisation. Pain subsided to 0 in six patients, with return of full wrist motion and function. In two cases, residual motion limitation of 20˚ and 30˚, with residual pain at the end of the motion arc in heavy load bearing persisted. Two patients who failed to heal had persistent wrist synovitis, motion limitation and pain with functional restriction. One of the persistent nonunions was a nine-year-old nonunion and the second had a small proximal fragment, with difficulty to fix that fragment with screws. In four patients, the plate was removed in the second setting.

Discussion: Persistent scaphoid nonunion after previous attempts to heal it, with a headless screw loose within the bone, mean structural problems for the operating surgeon, due to the necessity to reconstruct the shape of the bone and stabilise it by osteosynthesis. Intramedullary screws cannot be used in this occasion. Extramedullary stabilisation by scaphoid plate and angular stable screws may be the treatment of choice, as shown in this presentation.

A-0558 Autologous intra-articular fat injection: preliminary results of an innovative therapeutic option for CMC joint osteoarthritis of the thumb

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Objective: Many treatment options for CMC joint osteoarthritis rely on partial or complete resection of the trapezium. Although these methods are usually effective, there is a lack of less invasive, but efficient therapies for this common disorder. Adipose-derived stem cells contain anti-inflammatory and chondroprotective effects, and were hypothesized to relieve pain in arthritic joints. With the objective to postpone definite surgery, we injected autologous fat tissue into the CMC joint of patients with symptomatic CMC joint osteoarthritis.

Methods: In a pilot study, we treated 10 female and male patients. Inclusion criteria were age > 18 years, a symptomatic osteoarthritis of the CMC joint, together with a Visual Analogue Scale (VAS) score of at least 40/100. Liposuction from the abdomen was performed under local anesthesia. Between 1 and 2.5 ml of abdominal fat tissue were then introduced into the CMC joint under X-ray control. During the first 10 days, the patients were immobilised in a cast. Follow-up controls included X-ray, power grip and pinch, range of motion (ROM), the Michigan Hand Questionnaire (MHQ) and the Quick Disabilities of the Arm, Shoulder and Hand (Quick DASH); which were done after 1, 2 and 6 weeks, and after 3, 6 and 12 months.

Results: There were no major complications in our study. The patients usually reported an increase of pain during the first 2 weeks after injection. From 2 weeks on, there was a consistent pain relief, both in action and at rest. Almost all patients were pain free at rest. Power grip and pinch strength increased in all individuals, and all patients had improved postoperative Quick DASH and MHQ scores.

Conclusions: Our preliminary results indicated that autologous intra-articular fat injection is a promising treatment for CMC joint osteoarthritis. The new method is safe and can be performed under local anesthesia. Although it is evident that CMC instability is not treated by this method, definite surgery can be postponed by months to years. So far, results are promising; however, mid- and long-term results have to be evaluated before making a definitive statement regarding the effectiveness of this method.

A-0559 A 5-year follow-up for primary osteoarthritis at the base of the thumb: LRTI with or without bone tunnel creation in the first metacarpal bone?

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Objective: The previous randomized comparison of the Burton-Pellegrini technique (BP) and the Weilby technique for thumb carpometacarpal (CMC) osteoarthritis shows a faster recovery after surgery in favor

of the BP group, and an earlier pain reduction 3 months after surgery; where after 12 months, there is no difference in functional outcome. The aim of this study was to investigate the treatment effect of these surgical techniques after a mean 5-year follow-up.
Methods: We randomized 79 women (40 years of age or older) with Stage IV CMC osteoarthritis for treatment with either a trapeziectomy with LRTI using a bone tunnel (BP) or a tendon sling arthroplasty, preserving the structural integrity of the first metacarpal base (Weilby). Before surgery, after 3 months and 1 year after surgery, 72 of these patients were evaluated for pain, functionality (Patient-Reviewed Wrist and Hand Evaluation (PRWHE) and Disabilities of the Arm, Shoulder and Hand (DASH)), strength, satisfaction and complication rate. Of these patients, we evaluated 52 (72.2%) for these outcomes after a mean follow-up of 5 years (range 3.8 - 6.4 years). We used generalized estimating equations statistics to compare repeated measurements over time, in both groups.
Results: There were no significant differences in patient-reported functional outcome scores (PRWHE) and pain, between the treatment groups, after a mean follow-up of 5 years. More specifically, grip and pinch strength, satisfaction scores and persisting complication rates also did not differ between the BP and Weilby groups. One patient in each group was operated in another institution, due to unsatisfactory results, and two patients in the Weilby group had a revision surgery, because of symptomatic osteophytes in the trapezial cavity and between the bases of the 1st and 2nd metacarpal bones. After 5 years, 76% of the Weilby group would choose the same surgery again and in the BP group, 79.2% would choose the surgery again; whereas after 1 year, respectively, it was 66.7% and 67.7% of patients who would have chosen their surgery again. The overall treatment effect of both groups showed no significant differences between the results 1 year after surgery and 5 years after surgery. Grip strength did even improve for both groups ($p < 0.019$), between 1 year and 5 years after surgery.
Conclusions: The outcome of these two variations of trapeziectomy with ligament reconstruction for thumb CMC osteoarthritis were similar, after a mean follow-up of 5 years. The overall treatment effect showed no differences in pain and functional outcome from 1 year after surgery, with a significantly improved grip strength in both groups. This study showed that the improved function, strength and satisfaction after trapeziectomy with ligament reconstruction for Stage IV CMC thumb osteoarthritis is maintained after 5 years.

A-0560 Collagenase of *Clostridium histolyticum* for Dupuytren's contracture: real potentialities discussed after 402 cases. Is there any future for surgery?

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Objective: By the time of approval of Xiapex for the treatment of Dupuytren's contracture (DC) in Italy, because the indication was limited to a single digit and a single joint per-treatment, surgery continued to be the only choice for multiple affected joints and multiple contractures on the same hand, during the same procedure; however surgery involving three or more fingers, which most likely involved a more extensive operation, was shown to be significantly associated with increased complications and long recovery. Despite the strict indication decided by the DMA for the use of the CCH, given the estimated high prevalence of multiple cords among patients suffering from DC, an off-label expansion should be considered in Europe, in order to provide a non-surgical option for treating patients with multiple cords, during the same procedure.
Methods: The data formerly reported in the literature by recent studies supports my personal opinion that the potentialities of Xiapex are greater than the limited indications given by DMA in Europe and AIFA in Italy. From the beginning of the experimental phase in Italy (POINT X study and Compassionate Programme), 402 patients affected by DC were treated in my department at San Giuseppe Hospital. From January 2014, I started to treat multi-cord and multi-level involvement in the same patients, during a single-stage procedure. In the multilevel and multicord procedure, I usually prepared an entire bottle of the enzyme and I injected a variable quantity, from a minimum of 0.31 ml (0.58 mg) to 0.39 ml (0.9 mg), depending of the number of cords and joints I had to treat.
Results: I report outcomes and discuss results collected in 250 patients treated in the last 8 months. I asked all of my patients to express their personal opinion and grade of satisfaction for the CCH treatment: 80% were very satisfied, 18% satisfied and 2% were not satisfied. The multi-level and multi-cord technique demonstrated improved patient convenience, by allowing a one-stage procedure and correction of all the contractures at one single time.
Conclusions: If CCH is as good an alternative to surgery as it was proved, it should be available for all the patients eligible for surgery, as an equal and available

technique, and there was no clinical reason found to limit the indication for CCH to the treatment of a single cord and a single level, per time.

A-0561 Does the DASH questionnaire really reflect the patients' perceived problems in the Turkish culture?

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Introduction: The aim of the study was to analyse the inability of cultural activities of upper extremity disordered Turkish patients by the Canadian Occupational Performance Measurement (COPM) and to compare the percentage of problems that corresponded between the COPM and the Disabilities Of the Arm, Shoulder and Hand Questionnaire, Turkish version (DASH-T).
Methods: COPM is an outcome measure of a patient's self-evaluation of his or her occupational performance in the areas of self-care, productivity and leisure. It was administered to 110 upper extremity -disordered patients. Patients were asked to identify at a maximum, the five most important problematic activities due to their upper extremity disorder. Then the frequency of problems mentioned was calculated and compared with the activities expected to be problematic in the DASH-T (first 21 items of the DASH-T questionnaire).
Results: There were 359 activities that were perceived as problematic. Most problems mentioned were classified in the activity domains regarding productivity, rather than self-care and leisure. The percentage of problems that did not correspond between the COPM and the DASH-T was 23.8%. Most of the mentioned problematic activities that did not correspond with the items of the DASH-T were related to the activity domain for productivity, such as 'doing light household chores' (n = 23) (to hang out the laundry, to sweep the home, to empty the dishwasher, etc.), using a computer (n = 14), to 'squeeze a hand cloth' (n = 12) and 'taking care of the child/baby' (n = 6). The other unrelated problematic activities referred to the activity domains of self care, as 'dressing' (n = 21) (to wear a bra, to wear gloves, to wear socks, etc), 'buttoning' (n = 15), 'self care activities' (make-up, shave, comb the hair, to squeeze the toothpaste, etc.), bathing (n = 12), 'to cut nails' (n = 7), 'eating' (n = 8) and 'making a pot of tea' (n = 8). The unrelated activity domains of leisure were 'painting' (n = 2), 'using a scissors' (n = 2) and 'sleeping' (n = 2). On the other hand, eight activities (38%) of the DASH-T, such as 'garden or do yard work', 'make a bed', 'change a light bulb overhead', 'wash your back', 'put on a pullover sweater', 'recreational activities in which you take some force or impact through your arm, shoulder or hand', 'recreational activities in which you move your arm freely' and 'sexual activities', were not mentioned as being problematic during the COPM assessment.
Discussion: DASH was designed to measure patients' perception of the ability to perform 21 different fixed activities and roles that are associated with any condition in the upper limb. Although the cultural adaptation of the DASH questionnaire was performed and activities were adapted according to Turkish culture, it was seen in our study that the DASH-T seems to be insufficient to reflect all the inabilities of a Turkish patient. In order to analyse the whole inability activity profile of upper extremity-disordered patients, further studies with a larger number of patients should be done. Modifications of the DASH-T questionnaire, like replacing the not mentioned activities of the DASH-T with the problematic activities reported according to COPM should be considered.

A-0562 Collagenase of *Clostridium histolyticum* for Dupuytren's contracture: tips and tricks

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Objective: From the beginning of the experimental phase (10 July 2010) in Italy, 402 patients affected by Dupuytren's contracture (DC) were treated in our department at the San Giuseppe Hospital in Milan, Italy. At the beginning, patients were selected in order to treat only single cord and single joint contractures, injecting the standard doses into a limited area suggested by the guidelines. The infiltration technique was the one proposed by the pharmaceutical company that distributes Xiapex in the EU. Few indications are given for the traction time. We progressively developed different and more effective techniques of injection and traction.
Methods: We usually prepare an entire bottle of enzyme (0.39 ml of diluent and 0.9 mg of enzyme), injecting a variable quantity from a minimum of 0.31 ml (0.58 mg) to 0.39 ml (0.9 mg), depending on the number of cords and joints we have to treat. We distribute the drug in many target points into the Dupuytren cords, often outside the area suggested by the standard protocol. Then 24 hours later, we do the

traction in sedation and local anesthesia. In severe contracture, this type of anesthesia is essential to have good results; sedation is essential to permit a real effective traction. We believe that minimal attention is usually given to traction time. From our experience, we developed a personal traction technique that stretches all the aponeurosis, increasing loosening of the cord and improving the fingers' passive extension. We have treated some 1° web DC cords of the thumb with some good outcomes and one not satisfactory result. Most of the cases were patients with multiple diathesis risk factors, so surgery was not indicated. Involvement of the thumb and 1° web space usually reflects more severe DC. Patients should be warned that results in this location can be worse, despite some authors having reported good outcomes after thumb injection. We also treated nodules. We believe that nodules in the absence of joint flexion contracture (Stage 0, according to Tubiana and Michon) are not an indication for surgery and for any treatment in general, but some patients complained of pain and disturbance, related to their personal job and hobbies. In five cases, we injected nodules and all of them had a good outcome, with the disappearance of the nodules in the palm.

Results: We collected all the data for the series of 310 patients treated from the beginning of our experience. A comparison between the first series of patients treated with the standard technique and the patients treated since January 2014 with new skills, revealed better results in the last group.

Conclusion: This data supported our idea that a multipoint injection technique, increased dose of enzyme, traction in sedation and a specific traction technique are key points for good and better outcomes, especially when the most severe cases are treated.

A-0564 Acute elbow valgus instability: three cases of surgical treatment in young athletes

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Objective: In elbow injuries, the goal of the treatment is to restore a functional range of motion (ROM), but in case of medial collateral ligament injuries in young sportive patients, surgery should aim to allow the resumption of sport. The MCL is the primary elbow's stabilizer in valgus-stress. It originates from the anterior inferior surface of the medial epicondyle and joints the ulna to the humerus: its function is to support valgus overloads. It is divided in two bands: the anterior one is the major one stressed during elbow extension movement and the posterior one is stressed during elbow flexion. They are jointed to each other by a transverse band. Different sports predispose athletes to different injuries of the medial elbow compartment. MCL lesion is described as a chronic overuse lesion, or sometimes as an acute lesion. Furthermore this lesion can be isolated or in association with other injuries (for example, flexor-pronator muscle lesion to their proximal insertion).

Methods: In 18 months, we treated three cases of MCL isolated lesion in young sportive patients: Case 1 was an elbow injury in valgus stress with arm in extension during a hockey match; Case 2 was a fall to the ground during a football match; Case 3 was an axial compression during flexion movement as the hand approaches the ground with a combination of varus and pronation moment, running on the beach. In the last two cases, we supposed an incomplete postero-medial rotatory mechanism for the trauma.

Results: Case 1 was treated with a direct suture of the anterior band of MCL, which had a rupture at the medial third; Case 2 was treated with a reconnection of the anterior band to the epicondyle; Case 3 was treated with a reconstruction with a palmaris longus tendon autograft. After the 6-month follow-up, all three patients reached a complete ROM, with a stable elbow in varus-valgus stress. Nobody developed epicondylitis nor suffered from ulnar nerve pain.

Conclusions: MCL lesions are not common, but we believe that should be searched for in the emergency room in every patient with elbow trauma, and with pain and swelling in the medial compartment. When we suspect MCL lesion, in choosing the best treatment, we have to consider the patient's age and functional requests. A primary clinical and radiographical evaluation is needed, but to make the right diagnosis of ligamental injury, we have to also perform magnetic resonance imaging (MRI). Within 24 - 48 hours, the blood inside the joint allows us to recognise the injury like an arthro MRI. If the elbow is unstable and the patient's functional requests are high, the treatment is surgical: there are different solutions to restore MCL function.

A-0566 Fixation of cemented and uncemented cups in total joint trapeziometacarpal prostheses: a randomized clinical RSA study with 5-year follow-up

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Objective: Cup failure is a recognized problem in total trapeziometacarpal (TM) joint prosthesis and may be related to poor fixation, which can be measured by radiostereometry (RSA). We evaluated implant migration of cemented trapezium cups, in comparison with uncemented screw cups.
Methods: In a prospective, parallel-group, randomised patient-blinded clinical trial, we included 32 hands in 28 patients (5 males) at a mean age of 58 years (40 - 77) with Eaton Stage 2 and 3 osteoarthritis of the TM joint. Patients were randomised to surgery with a cemented DLC all-polyethylene cup (PC) (A; n = 16) or an uncemented hydroxyapatite-coated chrome-cobalt Elektra screw cup (SC) (B; n = 16) that was inserted without threading of the bone. Stereoradiographs for evaluation of cup migration (primary effect size), and alongside, the Disabilities of the Arm, Shoulder and Hand (DASH) and pain scores were obtained at the 5-year follow-up. Four patients entered the study with both hands, and secondarily had the last operated hand excluded from the final analysis.
Results: The 5-year total translation (TT) was similar (p = 0.09, Mann-Whitney test) with 0.90 mm (SD 1.04) for the PC (n = 7) and 0.26 mm (SD 0.20) for the SC (n = 9). Subsidence was also similar (p = 0.22, Mann-Whitney test). Four cups (2 PC and 2 SC) were revised and the two SC implants both had TT > 1 mm. Two other PC cups migrated above 1 mm TT to 5 years follow-up. Additionally, one SC cup became radiographically loose between 1 - 5 years, but had not been revised, and could not be measured with RSA, because of loose markers. Grip strength, pain and the DASH scores were similar between the two groups (A and B) at all measured points.
Conclusions: Midterm implant fixation and clinical outcome was similar with both cup designs. Bilateral cases and cases with loose or occluded markers were excluded from the statistical analysis; thus, a Type-2 error cannot be ruled out. This is the first RSA study of TM joint implants, and although RSA has natural limitations in anatomically small regions, the method seemed feasible for measurement of TM joint translational stability; however, larger studies and correlations with implant revision are needed.

A-0567 The Foucher modified technique of pollicization: our experience with long-term satisfactory results

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Objective: The thumb is a specialized organ with unique functions that cannot be replicated by any other digit. The most powerful technique for construction of a missing thumb is index finger pollicization. We reviewed our cases of pollicization performed with the Buck-Gramcko modified Foucher technique. This modified technique has been proposed to improve function and morphology of the reconstructed thumb. We evaluate results using objective criteria correlated with subjective impressions of outcome, following index finger pollicization for thumb hypoplasia.
Methods: From 2005 to 2013, a total of 54 index finger pollicization operations were performed in 42 patients. All of the operations were performed at Multimedica Hospital in Milan, Italy. There were 30 unilateral cases and 12 bilateral cases. Fifteen patients had radial club hand as an associated condition. We used a new clinical evaluation scale, in order to identify different items regarding the reconstructed thumb: function (sensibility, morbility and power grip); cosmesis (scar visibility, aspect of the web and appearance); and utilisation (integration). We got both a subjective and objective measurement analysis. In the subjective measures, the surgeon, therapist and relatives rated how the pollicized digit 'looks like a thumb' and 'works like a thumb'. For objective results, we measured appearance, strength, range of motion (ROM), stability, and ability to pick up objects. The subjective results were then correlated with objective data.
Results: In all cases, function was improved with different objective and subjective outcomes. There are a variety of factors that affect results. The principal factor is the preoperative status of the index digit and the presence or absence of adequate muscle-tendon units. A mobile index finger with robust extrinsic and intrinsic muscle-tendon units will make an excellent thumb that participates in grasp and mobility for pinch. In contrast, an index finger with limited active and passive motion may provide poorer outcomes. For this reason, pollicization gives better results in patients with isolated thumb hypoplasia, compared to patients with radial forearm defect. Another factor is age at the time of surgery. Younger age at surgery takes advantage of brain plasticity and makes easier thumb corticalization.
Conclusions: We found that this technique produces well-functioning and aesthetically appealing thumbs in 86% of the cases, and fulfils the expectations of patients and relatives. We evaluated ROM and strength of pollicization with the associated longitudinal radial deficiency: it was significantly diminished, compared with the isolated thumb hypoplasia. In severe longitudinal radial deficiency metacarpophalangeal flexion,

the opposition ROM and strength were significantly more decreased; nevertheless, patients and their parents were satisfied with the function and appearance of the new thumb. These overall results do not allow us to infer that this innovative technique is better than others, but we can assess that this was a good, reliable procedure in reconstructing the thumb.

A-0568 Osteotomy in the treatment of malunion of metacarpals and phalanges in children

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Objectives: Malunion of the phalanges and metacarpals in the hand cause malposition, pain and functional impairment. In case of symptomatic malunion, good bone stock and good soft tissue quality osteotomy of the bone is indicated. Posttraumatic malunion in the child hand is a rare condition. Growing bone and its small size need a special approach to the problem. The procedure must preserve growth ability, osteosynthetic material must be fine and postoperative care has to be aimed not only at the deformity correction, but also on preserving range of motion (ROM). The authors present a group of 12 children, patients treated by osteotomy of the phalanx or metacarpal. They describe specifics of the technique used, present results and discuss complications.
Patients and methods: In 12 consecutive patients, 13 osteotomies with 'virgin' or nonoperated posttraumatic malunion of phalanges and metacarpals were performed by the senior author, between 2001 and 2014. Four intra-articular corrections and seven extra-articular corrections were used for various malunions. The authors used different approaches to reflect bone from dorsal, dorsolateral or lateral side, according to the type of deformity and type of osteotomy. Eight cases were corrections of the proximal phalanx in the PIP region, two at the base of the proximal phalanx, one at the base of the middle phalanx, one at the head of the middle phalanx and one at the base of the first metacarpal. One patient was treated by sequential osteotomy, repeated after 3 years due to growth disturbances at the base of the middle phalanx. In three patients, bone graft from the distal radius was used to fill the gap in open wedge osteotomy. Removal of osteosynthetic material was performed in four cases. In three patients and four osteotomies, no osteosynthetic material was used. All patients had a cast for 1 - 2 weeks after surgery, followed by protected mobilisation until X-ray showed healing of the bone.
Results: All patients healed uneventfully. Deformity was fully reconstructed in nine patients, three had some residual deformity with functionally and aesthetically much better results. ROM was preserved or reconstructed in all. Functional impairments like triggering or scissoring of the fingers were relieved. Pain subsided to zero in all.
Discussion: Symptomatic malunion in fingers and metacarpals causing functional impairment is indicated as surgical treatment and osteotomy of malunited bone. Soft tissue coverage and small size of the bone put great requirements on the operating surgeon, due to risk of breakage of the bone, necrosis of small bony fragments, loosening or interference of osteosynthetic material, malposition of the bone and functionally, the risk of losing ROM after correction. Malunion in children enhanced these requirements, by risking growth disturbances and the smaller size of the operated bone. Anyway, if functional impairment is present, osteotomy is indicated. An individualised approach to osteotomy, osteosynthesis and postoperative care led to a good functional result, as shown in this presentation.

A-0569 Radial polydactyly: one-time complete reconstruction of the dominant thumb is the aim for a satisfactory outcome

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Objective: Polydactyly is one of the most frequently encountered congenital anomalies of the hand. Surgery for the duplicate thumb has progressed from a concept of simple ablation to complex reconstruction. Ablative procedures commonly result in functional and aesthetic complications. On the contrary, the aim is to reconstruct, starting from two hypoplastic thumbs, a new thumb with satisfactory function and morphology. The procedures required are also well known and need to be combined and conjoined in each single case. The procedure should include: ligamentous reconstruction; articular surface remodeling; tendinous partial resection or rebalancing; wedge osteotomy, single or combined when axes are significantly deviated; reinsertion of the thenar muscle; and sometimes, widening of the first web is well advised.
Methods: From 2000 to 2013, a total of 74 duplicated thumbs were surgically treated in 69 patients in the Multimedica Hospital in Milan, Italy. There were 64 unilateral cases and five bilateral cases. Each case

was typed according to Wassel 7-type classification, in association with a modified one that includes triphalangeal components and triplications. The surgical techniques adopted were the Bilhaut-Cloquet in really few cases, and the method of exclusion of the more hypoplasic thumb, with reconstruction of the more functional and aesthetic one. Post-operatively, the patients were evaluated from the functional and morpho-aesthetical point of view, subjectively and objectively. For the subjective evaluation, we documented patient or parent responses to questions about how the reconstructed thumb looked and was functioning. Objective evaluation was based upon measurable parameters, such as thumb length, girth, angulation, nail properties and scars. A clinical grading system was used to give an objective score to the results of surgery on each individual hand.

Results: An analysis of the results of objective assessment showed the majority had good outcomes (84%). We considered residual defects as complications of surgery. A satisfactory outcome was described as a functional thumb with < 15° of angulation, < 20% difference in the contralateral thumb length or girth, and minimal nail deformities. The most frequently encountered complications that adversely affect functionality are joint instability, angulation and stiffness. Other less serious adverse outcomes are the aesthetic results, which may not affect the thumb function, but can be unsightly. The most frequent complications were noticed in Type II and IV. In these cases, the involvement of the joint at the level of duplication produced a residual stiffness, with consequent reduction in the final functional score.

Conclusions: Our findings supported the current literature, that simple ablation of the thumb is contraindicated, because of sure residual defects, which will lead to a high reoperation rate. An experienced approach should include more complex reconstructive techniques, balanced on each single case and on the single surgical intra-operative findings. It is important to evaluate all the involved structures at the first operation, considering also the evolution with growth, in order to decrease both the complications and the need for secondary corrective procedures.

A-0570 From simple ligamentous lesions up to the complex elbow dislocation: why do we classify?

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Objective: The instability of the elbow remains a chapter of the complex pathology of this joint. The precise understanding of the instability from all points of view is mandatory. We propose a new classification that allows us to recognize and to understand all the injuries in the elbow instability and to treat them. Classification helps to standardize the diagnostic algorithm and to avoid inadequate treatment.

Methods: In classifying the instability, different elements have to be considered:

- Time lapse (acute or chronic);
- Involved articulations (humero-ulnar, humero-radial and radio-ulnar joint);
- Direction of displacement (angulation, postero-lateral and postero-medial rotation, posterior and anterior translation);
- Degree of displacement (instability or dislocation); and
- Associated fractures (radial head, coronoid process, lateral and medial epicondyle, olecranon).

Results: A systematic analysis of the injury components offers this approach to the options of therapy. Simple elbow instability indicated a dislocation with soft tissue injuries, without associated fractures. A great number of simple elbow dislocations, after closed reduction, have a good prognosis and can be managed with early motion. The term complex elbow instability replaces the words fracture-dislocation and transolecranon fractures and means the association of ligaments and bony injuries. Complex dislocations have a poor prognosis, if the corresponding injury components are not adequately recognized and treated.

We present a new Elbow Dislocation and Instability Classification (Rotini, 2013). This is a simplified new classification with only two categories of diseases involving the elbow: instability or dislocation. Subluxation is included in the instability category. The recurrent dislocation is included in the chronic dislocation category. There is a new concept: the stability of the elbow after reduction. It helps to choose the surgical treatment. The most important thing is if the elbow is reducible or not, stable or unstable. An elbow that is reduced or stable is treated conservatively; an elbow that is reduced but unstable needs surgical treatment; an elbow that is unreduced and unstable; or unreduced and stable, always needs surgery. The new concept is that neglected and inadequately-treated dislocations are considered within this classification.

Conclusions: We present a new classification system for elbow instability. It helps in choosing the most appropriate treatment.

A-0571 Increased migration and more revisions of MOTEC compared with ELECTRA cups: a 2-year RSA study of trapeziometacarpal prostheses

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Objective: Cup failure is a recognized problem in total trapeziometacarpal (TM) joint prosthesis. Several cup designs are available, but clinical documentation is sparse. Cementless cups are inserted pressfit and depend on a primary mechanical and secondary osseous stability, which may be evaluated with radiostereometric analysis (RSA). The purpose of this study was to compare cup stability with two cementless screw cups and the possible relation to cup revision.
Methods: Two consecutive prospective patient cohorts, Eaton Type 2-4, were operated on with TM joint prostheses, using two differently-designed trapezium screw cups: the MOTEC cup with a collar (n = 22), and the ELECTRA bimetal cup without a collar (n = 22). Mean age was 60 (45 - 74) years. There were 31 female patients and 13 male. Model-based RSA was used to measure cup migration with respect to the trapezium, which was marked with 1 mm tantalum beads during surgery. Stereoradiographs and the Disabilities of the Arm, Shoulder and Hand (DASH) score were measured at baseline, 3 and 6 months, and 1 and 2 years postoperatively.
Results: At 2 years, the total translation of mean 2.32 (SD 2.4) mm with MOTEC cups (n = 7) was higher (p = 0.01) than the mean 0.87 (SD 1.61) mm with the ELECTRA cups (n = 16). At 3 months, total translation was higher in cups that were revised later on (p = 0.03). There was a tendency for more subsidence with MOTEC cups (1.03 vs. 0.22 mm; p = 0.053). There was no significant cup migration between 1 and 2 years (p = 0.62). However, at 2 years, the revision rate in the MOTEC group was 41% (9/22), versus 0% (0/22) in the Elektra group (p = 0.02). There were no significant differences in the clinical results between the two groups.
Conclusions: The MOTEC trapeziometacarpal cup with a collar has a higher implant migration and more revisions, compared with the ELECTRA collarless bimetal cup, at 2 years follow-up. Early migration was higher in the cups that were later revised.

A-0575 Rewiring the arm: nerve transfer restoration of upper limb function in traumatic tetraplegia

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Injury to the cervical spinal cord results in devastating loss of upper limb function. The International Classification of the Hand in Tetraplegia guides reconstruction efforts, using traditional tendon transfers. The available donors depend on the level and severity of the spinal cord injury. There are usually limited donors available and the functional gains must be prioritised. Nerve transfer surgery involves transfer of a nerve branch or a fascicle from a main nerve trunk that is under volitional control, to a non-functioning target. The inter-fascicular branching anatomy of main nerve trunks confers advantages over tendon transfer, in that the donor is not always completely denervated and adoption from collateral sprouting at the nerve terminal may restore full function, while cortical plasticity allows the new separate function to become isolated. Nerve transfer is now a mainstream reconstruction option, following peripheral nerve injury. The application of nerve transfer surgery to tetraplegia may restore useful prehensile grip functions that are not possible in tendon transfer reconstruction. The technique will be illustrated in a patient with a traumatic C5/6 fracture dislocation, with complete spinal cord injury Grade IC-1 (Triceps minus; occulo-cutaneous sensation): the transfer of four motor nerve fascicles, two motor nerve branches, two sensory nerve branches and one tendon were used to rewire the upper limb, with the aim of restoration of reach and grasp, with sensation to the first web space. The challenges in assessment, perioperative management and rehabilitation will be discussed, together with strategies to optimise functional outcome.

A-0577 Short-term results of a stable 360 degree technique for reconstruction of the scapholunate ligament

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Introduction: The aim of the study is to present short term results of a stable 360˚ technique for reconstruction of the scapholunate ligament.
Methods: Patients with a symptomatic scapholunate ligament lesion of Geisler Type 3 or 4 were included. In the technique for reconstruction, a part of the flexor carpi radialis tendon or plantaris tendon is tunneled through the scaphoid. Then the tendon graft is tunneled through the lunate in AP direction, and then passed along the volar capsule to the tuberculum of the scaphoid and fixed with either suture at the tuberculum or a biocomposite screw in the scaphoid. Furthermore, the graft is fixed in the lunate with a biocomposite screw. Temporary K-wire fixation is used in most patients for 6 weeks, together with a

below-elbow cast for 6 weeks. All patients were evaluated preoperatively, 12 and 26 weeks postoperatively, and then yearly with range of motion (ROM); grip strength; Visual Analogue Scale (VAS) scores; and Quick Disabilities of the Arm, Shoulder and Hand (Quick-DASH) and (Patient-rated Wrist Evaluation (PRWE) questionnaires. X-ray was performed preoperatively, at 3 months postoperatively and thereafter, yearly. We operated 17 patients (two patients twice): 16 men and one woman of median age 42 years (19 - 61). Median values were used.

Results: Median follow-up was 24 months (range 3-43). Preoperative SL distance was 5.7 mm (1.8 - 8.3) and at follow-up, 2.7 mm (0 - 8). Dorsal/volar flexion preoperatively was 90% (range 23 - 185%) of the normal contralateral wris,t and at follow-up it was 76% (2 - 105%). Radial/ulnar deviation was 83% (28 - 193%) versus 76% (25 - 123%) postoperatively. Grip strength in KgF preoperatively was 39 (11 - 60) and at follow-up, 30 (11 - 65). VAS pain was preoperatively at rest/activity 19/65 and at follow-up; 2/37. The Watsons test was positive in 13 of 14 cases preoperatively, and positive in 3 of 19 postoperatively. Radiographic dorsal intercalated segment instability (DISI) was seen in 10 of 16 cases preoperatively, compared with two cases of 19, postoperatively. Quick DASH and PRWE preoperatively were 35 and 45; and at follow-up, 27 and 28, respectively. There were one superficial pin tract infection and one deep infection, in the two patients who were reoperated on due to instability. Both patients underwent a new ligament reconstruction with the same technique, but with a changed direction of the bone tunnel in the scaphoid and use of the plantaris tendon.

Conclusions: In this small series, the 360° technique for reconstruction of the scapholunate ligament seemed to have promising short-term results, with a stable fixation and good outcome concerning ROM, VAS, Quick-DASH and PRWE.

A-0578 Beware of love at first sight: our experience with an appealing bioengineering technique for reconstruction of metacarpal bone defects that did not make it

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Objective: Reconstruction of bone defects traditionally involves distraction osteogenesis with an external fixator, vascularised and non-vascularised bone grafts. We developed a novel approach to the treatment of metacarpal bone defects, using a combination of a custom-made hydroxyapatite (HA) scaffold, mesenchymal stem cells, platelet gel, vascularisation with an intermetacarpal artery and dorsal plate fixation.

Methods: Between March 2009 and November 2010, three patients (two male patients and one female) were operated on using this technique. Mean age at surgery was 37 (range 23 - 54). All patients had metacarpal shaft defects, resulting from nonunion in two cases and osteomyelitis in one case. The bone defects were filled with a custom-made cylindrical porous hydroxyapatite scaffold, filled with autologous mesenchymal stem cells obtained from the iliac crest bone marrow, and platelet gel. A dorsal intermetacarpal artery was also inserted into the HA scaffold. A dorsal titanium locking plate was used for fixation.

Results: Despite good early outcomes, at the 12-months follow-up, none of the scaffold showed osseointegration; and over time, all scaffolds collapsed, causing plate failure in one case. One of the patients underwent a secondary iliac crest bone grafting, to fill the metacarpal defect.

Conclusions: The encouraging results already obtained with biomaterials and stem cells in orthopaedic surgery, combined with the most modern concepts of bone fixation and established surgical approaches, led us to consider this technique as an effective alternative to bone grafting for metacarpal bone defects. The early outcomes were promising, but the results were not confirmed at a longer follow-up. Our experience confirms the relevance of long-term follow-up, whenever a novel technique is developed.

A-0580 First experiences of two German centers in the use of nerve allografts

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Introduction: In this presentation, we report on the outcomes from two center experiences on processed nerve allografts (Avance Nerve Graft, AxoGen Inc.) in Germany. Since November 2013, nerve allografts have been available in Germany. Until October 2014, we had used 10 allografts for different indications in two German plastic surgery departments.

Patients and method: Two sites with four experienced hand and microsurgeons contributed data from 10 patients. In three cases, the median or ulnar nerve was reconstructed by allografts up to a defect length of 5 cm. Seven finger nerves were repaired by allografts.

Results: We present the first experiences concerning the operation procedure, handling and results up to 1 year following the inital operation.
Conclusion: In all cases the operation was sucessful. Processed nerve allografts performed well and were found to be safe and effective in sensory defects up to 50 mm.

A-0585 Efficacy of the local infiltration of a new collagenasis in the treatment of localized subcutaneus hypertrophic fibrosis in a new rat model: a clinical and histological analysis

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Fibrosis is the normal physiological formation of connective tissue in an organ during a reparative or reactive process, following an injury. Hypertrophic fibrosis is defined as an increase in tissue volume, caused by an abnormal proliferation of fibroblast cells, together with an accumulation of extracellular components, such as collagen. The excessive growth of the fibrotic tissue can be of great cosmetic concern when occurring on a scar, or it can result in a functional loss, when involving tendons or articulations. We present our rat model of subcutaneous hypertrophy fibrosis obtained by infiltrating 300 mg of sterilized talc into a subcutaneous pocket. We also discuss the clinical and histological results regarding the efficacy of the subcutaneous injection of a new collagenase, in terms of a reduction of subcutaneous hypertrophy fibrosis in the rat model. Our results suggested that the above-mentioned collegenase is safe and useful in the treatment of fibrosis; and it fits numerous clinical applications.

A-0587 Congenital upper extremity compartment syndrome resulting in a Volkmann contracture: a case report and systematic review of the literature

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Background: Congenital (or neonatal) compartment syndrome or congenital Volkmann ischaemic contracture is a rare entity caused by ischemia resulting in an increased pressure within the closed space of a compartment, in the upper extremity. This myoneural necrosis causes muscular fibrosis, resulting in a contracture when not treated adequately. A surgical fasciotomy is the treatment of choice. Despite plenty of cases reported, the hetereogeneity of conditions and terms used to describe these conditions forced us to define and classify these two entities. Therefore, we provide an overview of the reported cases in history, reviewing their possible etiologies, characteristics, treatments and follow-up. We present our own case of congenital Volkmann ischaemic contracture, treated with a neurovascular free flap: one of the first reported in the literature with a long-term follow-up, next to this review of the literature.
Methods: The *Cochrane Library*, *PubMed*, *EMBASE*, *CINAHL* and *PEDro* databases were searched for all cases described until February 2014. Two reviewers independently applied the inclusion criteria to select potentially relevant studies and extracted the data.
Results: We included 29 studies, describing 68 cases of congenital (neonatal) compartment syndrome or congenital Volkmann ischemic contracture. A difficult delivery is mentioned in 28 cases. Four authors name the way of delivery as a possible cause of the pathology seen, ranging from a compound presentation to oligohydramnios. In the majority of cases (n = 64), a cutaneous lesion is present at birth, varying from edema with bullae, to full thickness skin necrosis. A contracture was present at birth in 10 cases, and in 33 cases this developed early in life. Authors see in 12 cases impaired vascular status as the possible cause of the status of the limb. Paralysis is often seen in the affected limb. In 47 cases, there was a paralysis of the hand, forearm or elbow present at birth, in three, soon after. Authors report growth disturbances (e.g. demineralisation, distortions of epiphyseal plates like flaring, premature closure, angular deformity and widening) in 34 cases, due to impaired development of the epiphyseal plates of the bones involved, most of the time the radius and ulna, resulting in a shortening, when compared to the contralateral, healthy limb. A fasciotomy is the first treatment of choice. When contracture is present, corrective surgery and rehabilitation are reported. A neurovascular free flap for congenital Volkmann ischemic contracture is rarely carried out. Flexor function of the fingers improved dramatically in our case, by using a free gracilis flap.
Conclusions: We describe one of the first cases of congenital compartment syndrome that was successfully treated with a free neurovascular gracilus flap, in

order to regain flexor function of the fingers. Next to this extensive case-report with a long-term follow-up, we hypothesized about the etiological factors resulting in this inborn disorder, by systematically reviewing the literature. Due to the heterogeneity of conditions and terms used to describe a congenital (neonatal) compartment syndrome and impending or congenital (neonatal) Volkmann ischemic contracture, we felt the need to postulate a definition and classification of these conditions, which are possibly consecutive consequences of one another.

A-0588 Free vascularised medial femoral condyle bone transplant treatment for scaphoid nonunion with an avascular proximal pole

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Objective: Patients with a scaphoid nonunion and avascular proximal pole have a troublesome clinical outcome. A promising technique in the treatment of this condition is a free vascularised bone graft from the medial femoral condyle. The objective of this study was to evaluate our primary results of this technique in a series of eight patients.
Methods: Between 2009 and 2014, patients with a scaphoid non-union and an avascular proximal pole were treated by this procedure, if there was no SNAC-type arthritis in the wrist. The eight patients who were selected were male and aged 17 - 47 years. Surgical treatment was performed 5 months to 14 years after the initial injury. Patient assessment was performed pre- and post-operatively, with an average follow-up time of 43 months (7 - 66 months). The following assessment tools were used: active range of motion (ROM) of the wrist; pinch and grip strength; Disabilities of the Arm, Shoulder and Hand (DASH) questionnaire; and the Visual Analogue Scale (VAS) for pain. Scaphoid nonunion and avascularity of the proximal pole were preoperatively confirmed, using magnetic resonance imaging (MRI) scanning. Radiographic results were evaluated using a computed tomography (CT) scan of the wrist at 2 months postoperatively, and was repeated on a 2-month basis, until consolidation was confirmed.
Results: From the eight patients, six patients achieved radiologic consolidation on the CT scan, at an average time of 7 months. All of the patients achieved pain relief, with a VAS-score of 6.3 preoperatively (range 5 - 8) and 2.6 at follow up (range 0 - 7). Most of the patients achieved an increase in ROM of the wrist. Grip strength and pinch grip at follow-up were 75% (11 - 91) and 73% (21 - 100) of the contralateral hand, respectively. DASH scores improved from a preoperative 21.3 (7.5 – 51.7) to 14.9 at the follow-up (0 – 48.3).
Conclusions: Patients with a scaphoid nonunion and an avascular proximal pole are a therapeutic challenge for the treating hand surgeon. Our results of treatment with a free vascularised medial femoral condyle graft showed consolidation in six of eight patients, and overall improvement of the VAS and DASH scores, and strength. Our study showed a relatively long time to radiologic consolidation. This might be due to the fact that we used CT scanning to confirm consolidation of the nonunion. We concluded that this procedure is a valuable tool in the treatment of this complex type of scaphoid nonunions.

A-0589 Kienböck's disease: effectiveness of the Moritomo Partial Capitate Shortening Technique from preliminary results of our 2006 - 2014 database

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Objective: The pathophysiology of Kienböck's disease revolves around a multi-factorial increase in axial load acting on the lunate bone, making it essential for surgical solutions to decompress the necrotic bone and prevent worsening of pain and fragmentation, mainly in Lichtman Stages II and IIIA. Traditional capitate osteotomies allow for considerable axial decompression, but at the same time create heavy scafotrapezial overload, resulting in progressive palmar flexion of the lunate, while distal radius shortening is only indicated in patients presenting significant positive ulnar variance.
Our work was aimed at testing the effectiveness of Moritomo partial capitate osteotomy in treating Lichtman Stage II and IIIA lunate necrosis, combining the efficacy of traditional osteotomies on pain relief and local decompression with the crucial conservation of carpal biomechanics over time.
Methods: The technique we applied was based on a dorsal longitudinal 3 - 4 mm incision, exposing the proximal articular surface of the capitate while sparing the scapholunate interosseous ligament.
A reverse L-shaped osteotomy was then performed, with the longitudinal portion following the ridge of the capitate, and the transverse segment just distal to the lunocapitate articular surface: the central portion was removed and the resulting capitate stump was then compressed and stabilized with a single headless, cannulated compression screw.
Results: Our 2006 - 2014 database consists of 10 patients, two of which belong to Lichtman Stage II,

while six were classified as Lichtman Stage III A, two as Lichtman Stage III B, with a maximum follow-up of 8 years. All of our patients underwent careful preoperative planning and periodic postoperative radiological and MRI studies: all treated patients but one achieved complete resolution of pain and tenderness, showing remarkable functional outcomes and recovery. The one patient who failed to respond was at an extremely advanced disease stage from the very beginning.
Conclusions: Extensive clinical and radiological monitoring of our patient cohort showed remarkable functional results, following the implementation of the Moritomo partial capitate shortening technique in the treatment of Lichtman Stage II and IIIA Kienböck's disease, fostering its widespread application in such settings. However important it may be to highlight the technical challenges posed by the technique, which calls for significant surgical expertise, carefulness and precision, it is crucial to keep in mind that the outcome is definitely worth the effort: such L-shaped osteotomy allows for substantial clinical improvement in wrist pain and function, because it relieves compressive forces acting on the lunate, enabling its gradual revascularisation and healing.

A-0593 Laminin rich and immunologically neutral epineural sheath conduit supported with bone marrow stromal cells to restore long nerve defects

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Background: Due to the limited amount of autologous nerve tissue available for grafting, the repair of long nerve defects (> 3 cm) in patients suffering from multiple-site traumas is a challenge. Harvesting large autografts leads to donor-site morbidity, such as hypoesthesia and pain. It also provides poor functional and sensory outcome. Over the last few years, several alternative approaches to autologous nerve grafting were developed. Nevertheless, current regenerative medicine-based techniques are severely limited and do not provide satisfactory results. Currently-used allograft conduits require immunosuppression and demonstrate poor motor recovery. The aim of this study was to test the feasibility of Epineural Sheath Conduit (ESC), supported with bone marrow-derived stromal cells (BMSC) upon restoration of a 6-cm long nerve defect in a sheep model.
Methods: The sheep model was used due to histological and morphometrical resemblance of sheep peripheral nerves to human nerves and the ability for long nerve defects creation. ESC was created from the median sheep nerve, by removing all fascicles. BMSC were obtained using the flushing technique, then purified by the buffy coat method and cultured for 14 days. Next, cells were fluorescently labeled with PKH-26 dye and injected into the empty ESC (70 - 80 x 10^6 cells). Restoration of 6-cm median nerve defect was performed in six experimental groups (n = 6): Group 1: autograft controls, Group 2: autogenic ESC filled with saline control, Group 3: autogenic ESC filled with autogenic BMSC, and Group 4: Allogenic ESC filled with autogenic BMSC. At the 3- and 6-month follow-up, nerve conduction velocity (NCV) and somatosensory evoked potential (SSEP) measurements and nerve samples were collected for immunohistochemistry.
Results: All animals recovered from the surgery without complications. The shape and integrity of the conduit was preserved in all groups. The NCV and SSEP assessments confirmed the presence of neurosensory responses in both saline and BMSC-filled conduit groups. Smaller diameter fascicles were observed in BMSC-filled conduits (Group 3 and 4), in comparison to saline-filled conduit (Group 2). Immunofluorescent staining at 3 months in saline-filled conduit showed the presence of fascicle-like structures in the proximal, middle and distal parts of the conduit. Toluidine blue staining revealed the presence of myelinated axons in all of the groups. Migratory potential of BMSCs in lymphoid organs was analysed by fluorescent staining. No presence of BMSCs was detected in liver, lymph nodes, spleen or thymus 6 months after the SCEC transplantation.
Conclusions: The feasibility of creation and application of ESC to restore 6-cm nerve defects in the sheep model was confirmed. Immunohistochemical and neurosensory assessment confirmed regenerative properties of the ESC. ESC is a novel, promising bioconstruct of naturally-occurring epineural sheath and omnipotent BMSCs, and it has the potential for successful regeneration of long nerve defects, which is currently a very challenging task. In the future, it can be included into the armamentarium of reconstructive and regenerative medicine.

A-0594 Chimeric posterior interosseus flap for the treatment of hand acute osteomyelitis

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Destructive acute osteomyelitis of the hand is a challenge to the hand surgeon, because of the lack of small muscular flap to use as fillers for the intramedullary cavity of the affected long bones of the hand.

From January 2012 - May 2014, we treated four patients with acute osteomyelitis of the long bones of the hand. All patients were men; and in all cases, acute osteomyelitis was the consequence of surgical treatment of a fracture of the hand, for a total of four metacarpal bones and one proximal phalanx. In all cases, the osteomyelitis became evident after healing of the treated fracture and in three cases, shortly after removal of the osteosynthesis material. All patients were treated initially by debridement of the soft tissues and affected bones. In all cases, the extrarticular cortical bone on one side of the infected bone was removed. After histological and bacteriological confirmation of the diagnosis and after starting an appropriate antibiotic therapy, we performed in all patients a chimeric posterior interosseous flap, including part of the extensor carpi ulnaris (ECU) and/or part of the extensor digiti minimi (EDM). The muscles included in the flaps were used as a filler of the infected intramedullary cavity, and the wounds closed with the skin paddle of the flap. All patients were followed clinically and radiologically for at least 6 months (range 6 - 18 months). All flaps survived with no complications. All patients showed, at the SPECT-CT at 6 months, no further infection. All patients were showing, at the last follow-up, adecuate function except one patient who developed a flexion deficit in the affected ray, but refused any further treatment. The posterior interosseous flap can be harvested as a chimeric flap, including the ECU and/or the EDM muscle for the treatment of acute destructive osteomyelitis of the long bones of the hand.

A-0595 Arthroscopic transosseous modified Mathoulin dorsal scapholunate capsulodesis: feasibility study and preliminary series of 10 patients

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Objective: There is no common trend concerning arthroscopic repair for chronic scapholunate ligament tears, especially when no remnant ligament subsists. The aim of this study was to assess the feasibility of an arthroscopic transosseous dorsal scapholunate capsulodesis.
Materials and methods: Our series consisted of 10 patients presenting scapholunate tears: EWAS Stage IIIC for eight patients and EWAS Stage IV for two patients. Arthroscopic portals (MCU, MCR, 1 - 2 and 6R) and a 1-cm 3 - 4 portal with no capsulotomy were used. After arthroscopic debridement of the scapholunate area, two -mm K-wires were passed through the 3 - 4 portal into the scaphoid and lunate. Two tunnels were performed, using 2.4 mm canulated drills guided by the K-wires, under arthroscopic control. A fiberwire was passed through those two tunnels and was knotted tight on the dorsal capsule. At the end of the procedure, the wrist was casted in a light extension for 6 weeks. Rehabilitation started at the end of this period.
Results: At the latest follow-up (mean 8 months), we noticed significant pain relief, significant Quick-DASH improvement and better grip strength, for eight patients. One developed a regional complex pain syndrome. Radiologically, there were no fractures and no scaphoid nor lunate osteonecrosis.
Conclusions: Despite the weaknesses of our preliminary series with short follow-up and only a few patients, our results showed a significant clinical improvement. Nevertheless, the results should be confirmed with a bigger comparative series and a longer follow-up, especially for the assessment of late osteoarthritis.

A-0598 Are health insurances and bureaucracy pulling surgeons back from patient care?A daily fight against time

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Objective: All over the world, by the 1980s, observers have continued to describe our profession as in retreat, plagued by bureaucracy, with diminished prestige and deep personal dissatisfaction. Previous surveys related to other specialities in other countries report an increasing dissatisfaction with virtually all aspects of practice, including income, workload, and time consumed by administrative tasks. This is the first report comparing the time spent to complete both administrative and scientific tasks.
Methods: The experience of a certified hand surgeon with a private practice located in Southern Swizerland is presented. During a period of 1 month, all the activities undertaken by the surgeon inside the hospital were recorded and divided into 14 tasks. Three were the places considered: the private office, the emergency room (ER) and the operating room (OR). All data records related to the time spent for each activity were collected permanently by the physician's assistant. The

time recorded was rounded off to the next 15 minutes. The purely scientific tasks (ST group) included visits of inpatients, outpatients and in the ER, time spent for surgery, clinical research or phone calls. The purely administrative tasks (AT group) included the reading, dictation or word processing, or letters or reports, certificates for health insurances, requests for surgical instruments, writing or supervision of invoices, data collection sheets or statistics. The miscellaneous tasks (MT group) included replays to intramoenia e-mails and humanitarian activities. Moreover, we compared the total number of certificates written per year in a 3-year period, divided into elective and emergency cases.

Results: The average time of work per week was 67 hours. The average time spent for the ST group was 79.8%, for the AT group was 17.5% and for the MT group was 3.7%. The time spent to address AT was 8-fold the time spent for clinical research and article readings. Writing certificates and invoice-related matters only, required almost 12 hours per week. The increase of the number of written certificates requested by health insurance companies per year was more than 6%, still more evident in emergency cases, but with decreasing difference with elective cases over time.

Conclusions: Our data confirmed previous surveys that health insurance companies and bureaucracy rob patients of the doctor's time. The reams of time-consuming paperwork that are out of proportion to the time spent caring for patients, fights for reimbursement, or loss of autonomy from insurers and fear of malpractice suits, can push doctors to retire or cut back their hours. In the long run, for people attending medical school, the choice of specialities with less demanding schedules, more regular hours and less bureaucracy could represent an unavoidable risk.

A-0599 Is adipofascial flap the trick to prevent adhesions after plating of the proximal phalanx? A retrospective study on 21 fingers

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Objective: Tendon adhesions occurring after proximal phalangeal fractures are not uncommon. After stable dorsal plating of the fracture, scar adhesions between the plate and the extensor apparatus restrict the postoperative range of motion (ROM) of the finger. A previous report described the use of an adipofascial (ADF) flap to prevent adhesions after dorsal plating of the proximal phalanx, or extended tenolysis on the dorsum of the wrist, the hand and fingers. The purpose of the current study was to compare the results of dorsal plating of the proximal phalanx, with and without the use of the ADF.

Methods: Over a period of 11 years, a retrospective study was conducted at Locarno's Regional Hospital. Clinical and radiological results of 21 fingers in 18 patients were recorded through a minimum follow-up of 6 months. Intra-articular and physeal fractures, pathological fractures, open fractures, concomitant injuries of the tendons and collateral ligaments and accidents more than 7 days before presentation were excluded from this study. For statistical analysis, the quantitative variables were reported as mean values. The Student's *t*-test was used to compare the results and $P < .05$ was considered statistically significant.

Results: A transient epidermolysis was detected in two fingers after ADF. Radiographically, there were no statistical differences between the two groups. The ADF group was statistically superior as to percentage of total active ROM, compared to the contralateral side (group without ADF mean 65.2; group with ADF mean 83.88; $P = 0.0161$) and the lesser number of reoperations associated with secondary hardware removal (0% vs. 66%). The percentage of grip strength (group without ADF, mean 78.45; group with ADF, mean 79.66; $P = 0.9037$) was not statistically significant.

Conclusions: The reconstruction of a biological gliding tissue, preventing scar adhesions, is useful to recover finger function after plating of the proximal phalangeal fractures. The ease of harvesting and performing renders the ADF a reliable tool to lessen scar adhesions between plates and the extensor apparatus of the proximal phalanx.

A-0600 Satisfaction and quality of life after reduction and internal fixation of radius fractures at the wrist

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Objective: Our aim was to determine what the factors are that lead patients to be satisfied about the outcome of surgical reduction and internal fixation of the

distal radius fracture. The main endpoint was thus, to detect predictors of outcome for the satisfaction of patients.

Methods: In this cohort retrospective observational study, we considered patients operated consecutively from March 2005 - January 2014 with Open Reduction and Internal Fixation (ORIF) of distal radius fractures, at our institution. Patients were selected from the Hospital Database application 'AcceWeb', (HiTech-S.p.a. Software-Engineering), considering the ICD-9-CM codes for distal radius fracture and ORIF. We built up a Database with all the detected parameters about sociodemographic, pathological and surgical characteristics of every patient. We excluded patients aged <18 years and those whom refused to participate in the study or were not tracked down. All the included patients were investigated with the Quick DASH questionnaire, addeding the following three questions about subjective aspects of satisfaction:

Q12) How much do you feel limited the movement of the operated wrist over the other?

Q13) How much satisfied by the intervention? Recommend surgery?

Q14) How much satisfied about the wrist in general ?

These additional questions were correlated with each of the 11 questions of the Q-DASH questionnaire, using a correlation statistical analysis.

Results: We considered a total of 481 patients with a mean follow-up of 56 months (6 - 110).

We excluded 220 patients because they were not found or did not intend to participate in the study.

We included 261 patients with mean age of 57 ± 15 years, of which 94 (36%) were male and 167 (64%) were female. We operated 141/261(54%) patients on the left wrist, while 120/261(46%) were on the right. We obtained the following mean scores for the 11 items (1 - 5) and total (11 - 55) of Q-DASH, and for the three additional questions (Q12: 1 - 4, Q13: 1 - 5, Q14: 1 - 5) and (Q1 3.4, Q2 2.4, Q3 2.4, Q4 1.7, Q5 2.0, Q6 1.7, Q7 1.6, Q8 2.6, Q9 1.9, Q10 2.6, Q11 1.4; DASH Tot. 23.63; Q12 2.3, Q13 2.3 and Q14 2.4). From the correlation of the total score of the Q-DASH with each of the three additional questions, we obtained the respective correlation curves with a gradually-increasing tendency ($p < 0.0001$), meaning that the three additional questions had a linear trend congruent with the DASH score.

Conclusions: Different factors may have an impact on the patient's functional outcome and satisfaction after a wrist fracture: pain, postoperative aesthetics, strength and ROM, coping skills, lower personal control, somatisation, serious illness worries, depression, anxiety, follow-up time, expectations and gender. These factors, to a different extent, may influence the outcome and indirectly predict the DASH score. The Quick-DASH outcome questionnaire revealed it was well correlated with aspects of conditioning quality of life, as subjective limitation of the movement of the operated wrist over the other, the degree of satisfaction about the wrist in general, and about the intervention.

A-0604 Complex microsurgical thumb reconstruction: thinking beyond step one

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Objective: Complex microsurgical thumb reconstruction represents a significant challenge to hand surgeons. These frequently multi-stage reconstructions must take into account sensibility, positioning, joint motion, opposition, donor site morbidity and aesthetic appearance. The objective of this study was to evaluate functional results of these challenging cases.

Methods: We did a retrospective review of multi-stage microsurgical thumb reconstruction cases (excluding replantations) performed over the past 5 years at the Buncke Clinic. Once patients reached an end-point, the following quantitative outcomes were measured: Semmes Weinstein monofilament testing, 2-point discrimination (static and moving), IP and MCP flexion and extension, opposition, grip and pinch strength. All patients completed a satisfaction survey. Lastly, patients were stratified by the following variables: mechanism of injury, number of flaps used in the reconstruction, level of injury, presence of absence of CMC joint, and whether nerve grafts were needed.

Results: Our retrospective review included 12 cases performed over 5 years. The following free flaps were used in these reconstructions: Great toe to thumb transplant (n = 12), fibula osteocutaneous flap (n = 6), anterolateral thigh flap (n = 5), radial forearm flap (n = 4), latissimus dorsi flap (n = 1) and rectus abdominis flap (n = 1). Mean follow-up time was 803 days. No flaps were lost. We had 10 patients demonstrate a return of light touch, by Semmes-Weinstein monofilament testing. Seven patients recovered static 2-point discrimination (mean 8.3 mm); four patients recovered moving 2-point discrimination (mean 8.5 mm). One patient had only return of protective sensation. Mean grip strength was 33 lbs (15 kg). There were 10 patients who were able to achieve opposition of the thumb to the tip of the small finger.

Conclusions: Multi-stage microsurgical thumb reconstruction represents a challenge to hand surgeons. While difficult, careful planning and thinking beyond step one can result in excellent functional and

aesthetic results. In addition to the above data, a decision-making algorithm for these challenging cases will be presented.

A-0607 Venous flaps: an ideal flap for coverage of small hand defects

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Objectives: The objective of this study was to evaluate the utility and results of microsurgical venous flaps in the reconstruction of hand defects in a retrospective fashion.
Methods: All venous flaps performed by a single surgeon over the past 3 years at the Buncke Clinic were included in this study. Defects were categorized based on location of wound, size, recipient vessels and design configuration.
Results: We included 28 venous flaps in the study: 17 of these flaps were used for volar hand/finger reconstruction; 11 flaps were used for dorsal hand/finger reconstruction. Twenty-three (23) flaps were reversed, five were not reversed. We used 14 flaps in conjunction with finger revascularisation. Sixteen (16) flaps were A-V-A pattern (artery-vein-artery); 12 flaps were A-V-V (Artery-vein-vein) pattern. The proper digital artery was used as the recipient artery for 19 cases; while the common digital artery was used for nine cases. Three cases involved composite tissue. All patients demonstrated a return of sensibility over volar flaps: 27 of the flaps fully survived. There was one total flap loss.
Conclusions: Venous flaps represented an ideal option for reconstruction of small defects of the digits and hand with exposed structures. The donor site was minimal and the results can be excellent, with very good cosmetic results.

A-0608 PIP arthoplasties: Is the lateral approach the way to improve the outcome?

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Objective: The aim of the study was to value the results of PIP arthroplasties performed through a modified lateral approach. The results were discussed and compared to those of other series, with other surgical approaches published recently. The authors also discuss those tips that were shown to be able to improve functional outcome and patient satisfaction.
Material and methods: The study is a retrospective evaluation, carried on 47 arthroplasties with silicone implants, that the 73 authors performed on the PIP since October 2000, up until April 2014.
The joint replacements had been carried out because of primary osteoarthritis (27 cases), post-traumatic osteoarthritis (31 cases), recent intrarticular fractures (seven cases), ankylosis after septic artrhitis (two cases), rheumatoid arthritis (three cases), psoriatic arthritis (two cases) and fixed dislocation of the PIP (one case). Range of motion (ROM) and the Visual Analogue Scale (VAS) score had been evaluated. The functional results had also been evaluated, with the DASH score and the Dreiser's functional index for hand osteoarthritis (FIHOA).
Results: We were able to study 47 patients (out of 73), when they were back for control by a follow-up of at least 6 months. The average range of active flexion was 69° (10°- 95°). A slight lag of active extension was observed only in five cases. The average DASH score was 2.72. The average FIHOA score was 1.6. In five cases, a clinodactily was observed. The best range of active motion was acquired in the post-traumatic osteoarthritis group. Some of the worst active ROM were acquired in multiple implants for primary OA.
Discussion: Results of surgery of the PIP joint has been very often poor, because of the difficulty to obtain at the same time early mobilisation and adequate time of healing. The dorsal approach doesn't allow a very early mobilization, because it is necessary to wait the time sufficient for the central slip of the extensor tendon to recover. Furthermore, the central slip happens to be often elongated, torn or somehow injured at the end of the intra-articular part of surgery of the PIP. The great advantage of the modified lateral approach is the complete easy viewing of all the parts of the joint, which is possible by dislocating the joint on a side. Immediate mobilisation is possible, because no tendons had been touched and they can work immediately. Rehabilitation is much faster and it is very difficult to observe residual functional impairment. The modified lateral approach to the PIP may appear more difficult to carry out, but results of implants with this surgical approach seem to be extremely interesting, when compared to other results in the literature with any dorsal approach.

A-0609 Intramedullary headless screw for transverse and oblique fractures to the proximal and middle phalanx of the digits: a different approach

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Phalangeal fractures are the most common fractures in the hand; and fractures of the proximal phalanx account for 38.2% of all phalangeal fractures. For simple and complex transverse and oblique fractures

of the P1 and P2 phalanx, the most common treatment ranges from splinting to various fixation techniques with K-wires or screws, or plate and screws. From May to September 2014, we operated on 15 transverse and oblique fractures of the proximal or middle phalanx, with an intramedullary headless screw. There were 11 men and four women, for a total of 13 P1 phalanxes and two P2 phalanxes. There were five oblique fractures and 10 transverse fractures. Three fractures were pathologic fractures, because of an enchondroma. All patients were treated with an intramedullary screw, inserted percutaneously from the next proximal joint in 12 cases; and after open reduction and bone graft in the three cases of pathologic fracture after enchondroma. We used 2.2 mm diameter titanium headless self-cutting screws in all cases. After the operation, all patients started an active mobilisation with a buddy-strapping to the next finger, within 3 days after surgery. None of the patients was protected with a splint. We followed all patients till adequate function was achieved (range 8 - 12 weeks) and we recorded the time from their injury till return to work. All fractures healed with no clinical rotational nor axial deformities. All patients returned to work within 7 weeks after surgery (range 3 - 7). Intramedullary screws for the treatment of transverse and oblique fractures of the P1 and P2 of the digit seemed a reliable option that allowed a quick return to normal activities, for the patient.

A-0610 Fibrin glue augmented microvascular anastomosis: experience in 60 free flaps

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Objective: The objective of this study was to describe our experience and outcomes in 60 free flaps with the application of fibrin glue.
Methods: Sixty free flaps were performed in 58 patients, using fibrin glue-augmented microvascular anastomosis, between May 2005 and November 2014. Most cases came from two university hospitals. Anastomoses were performed with 9-0 mononylon or 10-0 mononylon sutures, depending on the caliber of the vessels. The number of stitches in the arterial anastomosis ranged from five to seven; and in the venous anastomosis, it ranged from five to eight. The number of stitches did not depend specifically on the caliber of vessels, since in bigger vessels, we increased the thickness of the suture. The fibrin glue employed in this study was Tissucol (fibrinogen 75 to 115 mg/ml and thrombin 500 IU/ ml (Immuno AG, Vienna, Austria). We recorded the patient gender and age, the indications of the surgery, type of flap and the short outcome (flap survival or loss), pointing any existing intercurrence.
Results: There were 45 men and 13 women of mean age 28.5 years (range 2 - 69 years). Regarding the recipient site and the indications, 41 flaps were performed for the lower limb and 19 for the upper limb. In the lower limb, 31 cases were for open fractures, seven cases for chronic infections, five cases for late reconstruction of tibial defects and two cases for post-tumor resection. In the upper limb, 11 patients had free functional gracilis transfer to recover elbow flexion in chronic brachial plexus injuries, three patients had vascularised fibular graft after tumor resection at the humerus, and five flaps were performed for forearm reconstruction. In total, we performed 18 anterolateral thigh flaps, 11 gracilis flaps, eight latissimus dorsi (LD) flaps, four lateral arm flaps, 11 parascapular flaps, three latissimus dorsi flap plus thoracodorsal artery perforator flaps (TAP), and five vascularised fibular grafts. The survival rate of the flaps was 93.33% (56 of 60). Four patients had failure of the first free flap. Two of those patients were submitted to another free flap by the same surgeon, using again the fibrin glue in one of them, while the other two patients were operated on by another surgeon, due to schedule availability, and no fibrin glue was used in their second flap. No patient lost a second flap, in this series.
Conclusions: The fibrin glue to augment anastomosis was safe and reliable for free flaps. The failure rate of 6.67% (4 in 60) was acceptable, and comparable to the failure rates reported by the conventional sewing technique. It does not obviate the necessity for good anastomosis technique, and proper surgical planning and strategy by the surgeon. Nevertheless, it can be a useful auxiliary with multiple anastomoses or difficult ones.

A-0611 From wrist prosthesis to arthrodesis to another prosthesis

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Objective: Wrist arthrodesis can provide pain relief, but many patients find the rigidity bothersome. Total wrist arthroplasty has been restricted to patients with rheumatoid arthritis and low functional demands, because of the high rates of painful loosening and revision.
Methods: A 47-year-old male motor mechanic was referred for arthrodesis of his dominant right wrist,

because of painful and disabling osteoarthritis. Twenty years earlier he had sustained a scaphoid fracture that was operated repeatedly, but ended up with SNAC wrist and a dysfunctional four-corner fusion. Stiffening of the wrist would make him unfit for work as a mechanic. He wanted to try a novel, cementless modular wrist prosthesis, with screw fixation and metal-on-metal ball-and-socket articulation, which was under clinical testing.

Results: The first model of the arthroplasty was inserted in February 2001. He was very pleased with the result. The painless, stable and mobile wrist allowed him to resume heavy manual labor. After 2 years, increasing pain set in, corresponding to the third metacarpal. A thin radiolucent line visible adjacent to the distal metacarpal screw at 3 months, had progressed to surround the component, which had loosened and migrated distally. Osteolysis was seen both in the capitate and the radius, but the radius screw was still well fixed. The prosthesis was removed and we performed an arthrodesis of the wrist, with bone graft from the iliac crest and fixation with a plate. The fusion healed and became painless. The rigid wrist prevented him from continuing as a mechanic, and he got office work with much use of the PC. He was persistently annoyed by the stiffness of the wrist. Especially, he missed the radial-ulnar-deviation when using the PC mouse, and he had troublesome secondary pain in the elbow, upper arm and shoulder. Rearticulation was performed after 3.9 years with the final model of the Motec® prosthesis, including fusion of the CMC 3 joint. The prosthesis functioned excellently. The proximal arm pain disappeared. The patient was very pleased with the wrist movement he had received, and he had no problems working full time and doing manual work. At the last examination 7.6 years later, the prosthetic screws were fully integrated into the bone without periprosthetic lines nor osteolysis. Extension was 34°, flexion 18°, ulnar deviation 24°, radial deviation 12°, grip strength 28.4 kg and key pinch 10.7 kg. His DASH score was 0, compared to 57.5 preoperatively.

Conclusions: The patient had the opportunity to compare the function of total arthroplasty and fusion of the wrist, and he definitely preferred the painless mobility provided by a well-functioning prosthesis. The fully-developed Motec® wrist replacement demonstrated excellent results, even at long-term follow-up. Radiologically, the lasting intimate bone-implant contact without osteolysis implied that the shortcomings of the developmental prosthesis had been overcome with the final model of the Motec® wrist prosthesis.

A-0620 Long-term follow-up of steroid-induced avascular necrosis of the carpus: a retrospective study of four cases with minimum 10-year follow-up

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Objective: Steroid administration for collagen diseases sometimes causes avascular necrosis, not only in the femoral head, but also in the carpus. Since there have been few reports about the history of carpal avascular necrosis, the aim of this study was to clarify the clinical course of patients with steroid-induced avascular necrosis of the carpus.

Materials and methods: Three female patients and one male patient with a mean age of 45 (range: 39 - 51) years were included. They underwent steroid therapy for systemic lupus erythematosus (SLE) in three patients, and Sjogren's syndrome in one patient. The quantity of steroid induction was 60 - 80 mg of Prednisolone; pulse therapy was provided in two patients. A mean duration of 27 years (range: 20 - 35) has passed since their disease onset. Carpal avascular necrosis was seen in the scaphoid in two patients and in the lunate in two patients. Surveyed items were: the period from steroid induction to development of wrist pain, the period from development of wrist pain to radiographic carpal collapse, surgical procedures, the maximum pain by visual analogue scale (VAS) and its progress, as well as the pain by VAS, grip strength, the range of motion (ROM) and Quick-DASH score at the final follow-up. The mean follow-up period was 15 years (range: 10 - 18).

Results: The mean period from steroid induction to development of wrist pain was 9.5 years (range: 4 - 17) and from development of wrist pain to radiographic carpal collapse, 16 months (range: 0 - 36). The carpal collapse progressed gradually and irregularly, but the progression had stopped for 8 years (7 - 10), until the final follow-up. Vascularized bone graft (one lunate and one scaphoid) was performed in two patients, but both developed nonunions. The mean VAS at a maximum was 77 mm (range: 25 - 90), and the pain changed in association with the progress of the collapse, increasing as the collapse progressed and decreasing as it stopped. At the final follow-up, all patients complained of only mild occasional pain of 17 mm (range: 10 - 25) by VAS; the mean grip strength was 86% (range: 70 - 96) on the unaffected side. The mean ROM was 75° (range: 65 - 85), both in dorsiflexion and palmar flexion. The mean Quick-DASH score was 6.8 (range: 2.5 - 15.7).

Conclusions: Although the natural history and prognosis of steroid-induced carpal avascular necrosis is still unknown; in this case series, the collapse was stopped and the wrist pain was well relieved, regardless of the poor result of surgical procedures.

A-0622 How late is too late for nerve reconstruction in brachial plexus injuries?

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Objective: Distal nerve transfers have contributed to the strategies in brachial plexus reconstruction. They help to overcome the pitfalls of nerve grafting from the proximal root (or peripheral nerve) stumps. Traditionally, the degeneration of the motor endplates has placed a limit on the accepted delay for nerve reconstruction. Nerve transfers have helped to deliver growing axons very close to the target muscles, so that the postoperative denervation is shortened. Despite efforts at spreading awareness of surgical indications, there are instances where the patient presents late to a specialized brachial plexus unit. In such cases, one faces the dilemma of using traditional nerve transfers or opting for a free-functioning muscle transfer.
Methods: We present a study of 58 patients of post-traumatic brachial plexus injuries, operated on at 9 months or later (9 - 19.5 months). Only four of them were female. Their ages ranged from 4 - 57 years (mean 28.8 years). We sas that 27 of the 58 patients (46%) belonged the age group of 21 – 30 year olds. The injury was supraclavicular in 47 patients (C5T1-21, C56-15, C567-9, C8T1-2). The distal portion of the plexus was injured in 10 cases (infraclavicular). We performed 147 neurotisations (approximately three transfers per patient). These included: intercostal nerves to musculocutaneous (n = 19), ulnar to biceps (Oberlin's procedure, n = 21), median to brachialis (n = 15), spinal accessory to suprascapular (n = 39), triceps to deltoid (Somsak's procedure, n = 14) and intercostal nerves to triceps (n = 9).
Results: Only the patients with follow-up longer than 6 months were considered. The MRC grade of strength restored in the shoulder abduction and elbow flexion was noted. The rate of success was compared to that obtained in the overall series of patients. In total palsies, direct transfer of the intercostals (4th, 5th and 6th) to the musculocutaneous restored a biceps stronger than Grade 3 in 35% of cases (as compared to 65% overall, in > 300 cases). In partial palsies, transfer of a fascicle of the ulnar nerve to the biceps (+/- median to brachialis) produced elbow flexion stronger than Grade 3 in 16 out of 21 patients (76% vs. 84% overall). The spinal accessory nerve was transferred to the suprascapular nerve in 39 cases and Grade 3 supraspinatus was achieved in 21 patients; however, the cases of successful restoration of shoulder abduction included seven patients with C56 palsies and four with C567 palsies.
Conclusions:

1. In total palsies, the failure rate of intercostals to musculocutaneous and spinal accessory to suprascular nerve transfers is far higher than the overall average in my series;
2. The failure rate for ulnar to biceps transfer remains unchanged even up to 19.5 months from the accident; and
3. Shoulder abduction is a reasonable expectation after a nerve transfer in a partial palsy, even at delays longer than 10 months. I recommend not to succumb to the temptation to perform traditional nerve reconstruction in patients with frail upper limbs that present late, even if they are young. The available nerve transfers should be utilised for innervation of free functioning muscles. On the other hand, we can continue to have an optimistic outlook for C56 palsies, even after delays as long as 18 - 19 months.

A-0623 The vascularized medial femoral corticoperiosteal flap is a valuable option for hand reconstruction

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Objective: Infected bone defects, osteoradionecrosis, recalcitrant nonunions and avascular necrosis of the hand and the upper limb, including the scaphoid, lunatum and the interphalangeal joints can result in degenerative pathologies such as arthritis. Over the last 3 decades, several different types of grafting techniques have been described involving non-vascularized and locally vascularized bone grafts. The medial condyle of the femur transpired as a particularly suitable donor site for a vascularized corticoperiosteal graft, due to its size, flexibility, reliable anatomy and not at least because patient positioning allows a 2-team approach. The aim of this study was to analyse our case series and to present their outcome.
Methods: Between 2011 and 2014, we performed surgery on 12 patients whom had suffered various types of hand injuries. Within the 12 patients, three were

women, nine men, and their age ranged from 21 to 52 years (mean 33.6 ± 10.6 years). In total, nine scaphoid bones were treated: four on the right and five on the left hand. Moreover, surgery was performed on one right hand lunate, one metacarpal II and one digital bone II of the left hand. In all patients, the vascularised medial femoral corticoperiosteal flap was used for reconstruction.

Results: Mean hospitalisation time was 6.8 ± 2.6 days; and surgery lasted for 226 ± 43.4 minutes. One revision was required in a patient, for lunatum reconstruction, whereas sclerosis of the proximal segment was observed in one patient after scaphoid reconstruction. Wound healing disturbance was observed in one patient after metacarpal II reconstruction, which required revision surgery. There were no wound-healing problems at the donor site in all patients, whereas one patient reported some sustained discomfort at the harvest site. After a median follow-up of 16 ± 11 months, stable and satisfactory results where obtained in all patients, with a bony union and good functional outcome.

Conclusions: In our hands, the vascularised medial femoral corticoperiosteal flap can be used for various defects of the hand, leading to a high bony union rate and good functional result. Furthermore, the donor site morbidity was minimal, leading to high patient satisfaction.

A-0624 The Y to V palmar and dorsal web based flap for web reconstruction in patients with simple incomplete syndactyly in distal arthrogryposis

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In the distal arthrogrypotic hand, mostly both hands are affected with symmetric ulnar ('windblown') deviation of the fingers, with a flexion deformity in the metacarpophalangeal joints, and a tight first web with an adducted thumb. The skin is tight in a multi-plane manner, with skin shortage at the palmar side of the palm and fingers. In addition, most patients showed an incomplete syndactyly of the second to fourth web, resulting in the aspect of an elongated palm and short fingers. The treatment of these hands is demanding, with multiple tendon transfers, flaps and full-thickness grafts necessary to give a functional improvement of the hands; however, because of the skin shortage and web creep, the aesthetic appearance is disturbed by full thickness skin grafts on the dorsal side, and scarring with contour deficiencies of the fingers. To address this aesthetic issue, we modified a previously-described Y to V palmar and dorsal web-based flap for treatment of incomplete syndactyly release, for use in the arthrogrypotic hand, without compromising the possibility to address to the necessary interventions needed to treat those hands. Through the incisions of these flaps, we were able to perform all additional interventions for functional improvement in all our treated patients. We would like to share our long-term functional and aesthetic results, using this technique (> 1 year postoperatively) in five patients with incomplete simple syndactyly in distal arthrogryposis.

A-0626 Metaphyseal ulnar shortening osteotomy for management of ulnocarpal impaction syndrome after distal radius physeal arrest

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Objective: Up to 5% of displaced radius fractures involving the distal physis result in growth arrest. Arrest of ulna physis in a skeletally immature individual can cause serious complications. Continued growth of the ulna leads to DRUJ incongruity, ulnar impaction syndrome, or tears of the triangular fibrocartilage complex (TFCC). Ulnar impaction syndrome results from impingement of the ulna on the carpus. This commonly occurs in patients with positive ulnar variance. It can result in chronic wrist pain and, if left untreated, the condition leads to lunate, triquetral and ulnar condromalacia, potential wrist instability and wrist osteoarthritis. If the condition is diagnosed early, the treatment of choice is diaphyseal ulnar-shortening osteotomy, to correct the length discrepancy between the radius and the ulna, thus restoring normal wrist kinematics. If the ulnar physis is still open at the time of surgery, growth arrest may be surgically induced, to avoid recurrence of the deformity. The purpose of this study was to determine the efficacy of a transverse ulnar shortening osteotomy at the metaphysis, in combination with osteosynthesis using a low-profile distal ulnar plate for the treatment of ulno-carpal impaction syndrome, following distal radius growth arrest.

Methods: IRB approval was obtained. Patients with a diagnosis of ulnar impaction syndrome after distal radius growth arrest who presented within 5 years of skeletal maturity and underwent metaphyseal ulna shortening osteotomy were enrolled in the study. We collected demographic, radiographic and functional data. One-tailed paired *t*-test (alpha 0.05) was used to

compare postoperative changes in continuous variables.

Results: The study sample consisted of four female and two male patients, mean age 16.2 years (± 2.9). All patients developed distal radius physis arrest after distal radius fractures. Of these, four patients were treated with a cast and two were treated with operative fixation: all fractures healed. Statistically significant ulnar shortening was obtained with the surgical procedure. Mean preoperative and postoperative ulnar variance was 6.83 (± 2.48) and 0.17 (± 1.6), respectively ($p < 0.05$). The mean pain score significantly decreased after surgery ($p < 0.05$; 5.5 ± 1.76) to 1.00 (± 1.67). No difference was found between preoperative and postoperative range of motion (ROM). No delayed unions or nonunions occurred during the study. Mean follow-up time was 6.5 months (± 3.3 months).

Conclusions: Metaphyseal ulnar shortening osteotomy offers several advantages:

1. It allowed easy realignment of the ulna;
2. Because the technique did not interfere with the interosseous membrane, reduction of the cut bone was facilitated and robust shortening could be performed when required;
3. Metaphyseal cancellous bone provided higher healing potential, which reduced the risk of nonunion and decreased the time of return to unrestricted motion; and
4. It provided easy access to the distal ulnar physis, if surgically-induced ulnar growth arrest must be performed.

Metaphyseal ulnar shortening osteotomy provided the functional advantages of a midshaft shortening osteotomy, with improved bone healing characteristics of metaphyseal cancellous bone and reduced risk for complications. It provided the advantage of allowing correction in patients that required extreme shortening of the ulna and reduced the need for a separate incision, if ulnar growth arrest must be surgically induced.

A-0631 Trapezial cartilage damage after fixation of scaphoid fractures: a comparison of two percutaneous velar approaches

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Objective: Central positioning of a screw in the proximal and distal pole of the scaphoid offers a biomechanical advantage, compared with central placement only in the proximal pole. Several techniques have been described in an attempt to increase the clearance of the trapezium and to optimise central screw placement, when using a volar approach. The goal of this study was to compare the amount of cartilage damage at the scaphotrapezial (ST) joint, for different volar percutaneous approaches.

Methods: Measurements were performed on the three-dimensional reconstructions of the scaphoid and trapezium, based on 20 computed tomography (CT) scans of normal wrists (10 men and 10 women) A coordinate system for each scaphoid was computed, using its inertial properties. The x-axis along the length of the scaphoid was used as the central axis. Two cylinders, representing the trailing and leading thread diameters of a 3.5 mm diameter differential pitch screw, were placed along the longitudinal axis of the scaphoid. The area of the articular surface of the trapezium at the level of the ST joint was measured. The amount of cartilage damage (absolute and relative to the surface area) was calculated for both the transtrapezial approach and a volar approach with partial excision of the volar ridge of the trapezium.

Results: The mean surface area of the trapezium at the ST joint was 64.7 mm^2 (standard error of the mean (SEM) = 3.6; with 52.6 mm^2 SEM 3.2 for women and 76.8 mm^2 SEM 3.6; $p < 0.0001$). The absolute amount of cartilage damage using a transtrapezial approach is 9.62 mm^2 with a relative amount of 15.85% (range 10.34 - 25.46%). When resecting part of the trapezium, the mean area of cartilage damage is 13.47 mm^2 SEM 0.43 or 22.33% (range, 12.9 - 36.4%). The cartilage area damaged by resecting part of the trapezium is significantly larger than the area damaged by using a transtrapezial approach ($p < 0.0001$).

Conclusions: Recent studies have highlighted the importance of central positioning of a screw in the fixation of scaphoid fractures. The optimal approach of fixation of scaphoid waist fractures; however, continues to be subject of debate. When using a volar approach, central screw position at the distal pole can only be obtained by manipulating the scaphoid, resecting part of the trapezium or drilling through the trapezium. There is some concern that using these approaches could lead to an increase in symptomatic ST osteoarthritis. Our data demonstrated that using a transtrapezial approach will lead to significantly less articular cartilage damage at the ST joint, compared to resecting the volar ridge of the trapezium.

A-0632 Enhancement of nerve regeneration using muscle-stuffed veins seeded with human neural-differentiated mesenchymal stem cells (sMSV) as a nerve conduit in a rat model

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Bridging nerve gaps and enhancing nerve regeneration remains a challenge in hand surgery. A 15-mm nerve defect were created in the sciatic nerve of nine athymic or nude rats. We compared the functional outcomes for three different groups of treatment: reverse autograft (RA); nerve defect or non-treated (ND); and seeded muscle-stuffed veins (MSV). Each group had three nude rats. The rats were athymic to prevent any immunological reaction to the human muscle-stuffed veins, seeded with human neural-differentiated mesenchymal stem cells. Muscle and vein were harvested from adults undergoing below-knee amputations. Superficial veins measuring 15 mm with a 3 – 5 mm diameter and gastrocnemius muscle measuring 20 mm were harvested. Human vein and muscle were both decellularised by liquid nitrogen immersion. Meanwhile, human mesenchymal stem cells (MSCs) were harvested from excess bone marrow during interlocking nailing of femurs. Human MSCs were subjected to a series of treatments with a reducing agent, retinoic acid, and a combination of trophic factors. The neurally-differentiated MSCs were seeded on the surface of acellular muscle tissue and then stuffed into the vein. Their recoveries were analysed in terms of both behavioural and neurophysiological recovery. Objective measurements obtained were: mean Compound Muscle Action Potential (CMAP) or mean latency, and mean Sciatic Function Index (SFI). At 8 weeks post-implantation, the non-treated (ND) group had no improvement in mean CMAP, mean latency and mean Sciatic Function Index (SFI). In the RA and sMSV groups, CMAP achieved was 114% (RA) and 60% (sMSV) of the original values. Mean latency achieved was 117% (RA) and 100% (sMSV) of the original values. Despite the ability of the rats from RA and sMSV groups to walk, their toes remained contracted, resulting in poor SFI. Thus, CMAP and mean latency restoration did not translate into improvement in SFI. Hence, we gained a preliminary conclusion that SFI may not be a good indicator of restoration of muscle strength. In conclusion, reverse autograft (RA) was better than human muscle-stuffed veins (sMSV) seeded with human neural-differentiated mesenchymal stem cells, in terms of mean CMAP, but worse with regards to mean latency.

A-0633 STT arthrodesis by radial vascularized bone graft (Zaidemberg graft): the solution for nonunion

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Arthrodesis is the gold standard for the STT OA, but it is complicated by 5 - 25% nonunion, according to studies; however, in case of consolidation, the return of strength, being pain-free, and mobility is excellent, and usually superior to other techniques. We describe a new method to significantly reduce the nonunion rates. Eight STT arthrodeses were performed using a radial graft vascularised in block by the artery supra-retinacular, described by Zaidemberg for scaphoide nonunion treatment. The incision was centered with the axial straight styloid. Two 2.5 mm cannulated screws in compression ensured osteosynthesis. A wrist brace was maintained 6 weeks. All of our patients had consolidated in the first 2 months. We describe the techniques with accurate, educational illustrations.

A-0636 Long-term results of vascularized radial bone graft for advanced Kienbock's disease

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Objective: Since 1999, we have treated staged Kienbock's disease with vascularized pedicle bone graft (VBG) from the 4th and 5th distal radius, and temporary internal fixation of the scapho-trapezio-trapezoidal joint (STT), and analysed the long-term results.
Methods: We reviewed 13 patients (10 male and 3 female) whom were followed-up more than 10 years (two wrists were Lichtman Stage 3a, 11 were 3b). The average age at surgery was 26.5 years (range:18 - 58). All K-wires were removed at 8 weeks. The mean follow-up period after surgery was11 years (range: 10.8 - 13.2 years). All cases were evaluated with clinical score and X-P assessments by Nakamura et al. Postoperative T1 and T2 changes on lunate magnetic resonance imaging (MRI) were compared with preoperative values.
Results: Pain relief and improvement of range of motion (ROM) were obtained: the clinical score increased in all cases, and was excellent for 10 cases and good for three cases. CHR increased in all cases immediately after operation, but decreased after removal of the K-wires. S-L angle decreased in all cases immediately after operation, and increased after removal of the K-wires. MRI examination showed that only T2-weighted MRI intensity shows the change from low to patchy mixed with high and low signals in nine cases, but a slight change of T1-weighted MRI intensity was seen in four cases. There were no progressions of OA change around the radio-carpal joint and mid-carpal joint.

Conclusion: These current results (VBG + temporary STT fusion) would indicate a good treatment option for Kienbock's disease, Stage 3.

A-0637 Results of arthroscopic attachment for DRUJ instability due to TFCC injury

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Objective: The aim of this current study was to evaluate the results about the arthroscopic attachment of TFCC for DRUJ instability, due to TFCC detachment at the fovea.
Methods: We treated 150 patients surgically for DRUJ instability. Our own criteria of DRUJ indicated apprehension or a painful click with forearm rotation, confirmation of detachment of the TFCC at the fovea with magnetic resonance imaging (MRI) and arthrogram, and instability. The 150 patients included 92 men and 58 women (mean age 33.5). All patients were operated on under an arthroscope, with the inside-out method, using our special guide. Two 2-0 PDS sutures were penetrated TFCC and Ulnar styroid, and stitched at ulnar cortex. Plaster fixation with the arm neutral was applied for 3 weeks. All patients were evaluated with modified Green and O'Brien scoring system. Patients were evaluated at a mean follow-up time of 424 days.
Results: All cases except for six patients had disappeared wrist pain, and returned to their previous work or sports. Grip strength averaged 94.1% of the contralateral side. Clinical score with modified Green and O'Brien scoring system averaged 93.1 points. There were five cases of superficial ulnar nerve irritation, and that disappeared within 3 months.
Conclusion: Recent reports suggest the TFCC at fovea had a great role in DRUJ stability. Our current results encourage the repair of the TFCC at the fovea, arthroscopically. In spite of the good results, whether a factor of age (traumatic or degenerative), and the duration from injury to surgical repair do have an effect on the results was considered as a future problem.

A-0638 Scapholunate instability stabilization with bone graft: arthroscopic technique

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Introduction: Chronic dynamic scapholunate (SL) instability causes clinical problems in common activities. Extensive, open procedures like SL ligament reconstruction (Brunnelli technique, capsulodesis, etc.) quite significantly limit the movement of the wrist, and their long-term results are suboptimal. The goal of the minimally invasive techniques is to stabilise (provide sufficiently firm stabilisation) the joint between the scaphoid and lunate; and minimise reduction of the range of movement (ROM) of the wrist.
Material and methods: We reviewed 25 patients (average age 32 years) with chronic dynamic scapholunata instability (Geissler classification II and III) with persistent post-traumatic pain and weakness to the wrist, were indicated for the stabilization of the SL joint with the arthroscopic technique. The authors had developed the methodology of arthroscopic stabilization of SL joint with bone graft, which was inserted into the resected bone of the SL joint, by a bone cutter, to the level of the cancellous bone. The stabilisation of the joint was ensured by three K-wires for 6 weeks, followed by gradual rehabilitation. ROM, grip strength, radiographic measurements and the Mayo wrist score were used to evaluate the results.
Results: The average follow-up period was 16 months (range, 12 - 26 months). One patient underwent repeated surgery after 6 months, where re-stabilisation was performed, using the same technique. Out of the 24 remaining patients, there were 10 excellent, 13 good, and one fair result, based on the Mayo wrist score.
Conclusion: Arthroscopic stabilisation of the SL joint with the bone graft gives the possibility of a sufficiently firm connection between the scaphoid and lunate, which can even ensure power sports load without significant restriction of movement. The results of this technique were better than plain arthroscopic debridement and close pinning.

A-0639 How to save the necrotic proximal pole of the carpal scaphoid

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Objective: The aim of the study was to investigate the effectiveness of the use of a bone flap of radius for nonunions of the carpal scaphoid with osteonecrosis.
Methods: We treated 38 patients (36M; 2F) with a mean age of 32 years (17 - 43), suffering of unilateral

nonunion of the carpal scaphoid in 18 right and 20 left wrists, over a period of 12 years, with a bone pedicled flap of the distal radius, as described by Zaidemberg et al. (1991). Post-operative management consisted in splinting with a below-elbow thumb-included plaster cast for 30 days; and then active and passive kinesiotherapy-rehabilitation. All patients were investigated preoperatively with clinical history taking, physical examination, X-rays, basal and angiographic MRI. Of the 38 patients elected for the surgical treatment, 35 presented a scaphoid nonunion associated with osteonecrosis of the proximal pole. The 30 patients were followed up for a mean time of 71 months (24 -168). They were checked at 30 days, and 3 and 6 months post-operation and at the maximal follow-up time by clinical examination and X-rays. In particular, the clinical parameters we considered were: pain, passive and active range of movement (ROM), grip and pinch strength, Disabilities-of-the-Arm,-Shoulder-and-Hand (DASH) questionnaire score, time of return to work. At the X-rays and MRIs that we evaluated gave a graft level of consolidation vs signs of nonunion and/or osteonecrosis, scapholunate angle and carpal hight ratio.

Results: We considered that two of 30 (6.6%) patients had not healed, because they showed a lack of bone consolidation at X-ray, and clinically still complained about pain at the wrist. All the other 28 out of 30 (or 93.3%) patients healed, with a good rescue of the force and movement of the wrist without pain and with a good consolidation of the bone flap, as demonstrated also by the MRI control. We found that 24/30 (80%) of the patients didn't complain of any pain, while 6/30 (20%) of patients did so only under heavy activity. ROM was > 80% of the contralateral side in 19/30 (63%) of patients, 60 - 80% in 4/30 (14%), 40 - 60% in 5/30 (16%) and < 40% in 2/30 (7%). Grip and pinch strength resulted in being > 80% of the contralateral side in 22/30 (73%) of the patients, 60 - 80% in 5/30 (16%), 40 - 60% in 3/30 (10%). The DASH score was < 10 in 14/30 (47%) of patients, 10 - 20 in 11/30 (37%), 20 - 40 in 5/30 (16%). Average time of return to work was 85 (60 -180) days. Mean scapho-lunate angle at X-ray (normal = 30°- 60°) was of 50° (35°- 75°) in the preoperative, and 50° (40°- 75°) in the postoperative measurement. Mean Carpal Height Ratio (normal = 0.54 +/- 0.03) remained 0.52 in the preoperative time (0.47 - 0.54) and postoperatively (0.49 - 0.54).

Conclusions: Zaidemberg's vascularised bone flap can be considered a useful tool for the treatment of carpal scaphoid nonunions with osteonecosis of the proximal pole, a valid alternative to the resection and substitution by biological or prosthetic spacers. Additional advantages consist of the preservation of global morphology of the navicular bone and in the possibility to convert anytime into a demolitive or substitutive procedure.

A-0640 Single portal endoscopic treatment for chronic exertional compartment syndrome of the forearm

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Chronic exertional compartment syndrome of the forearm is an unusual disease, not commonly found in the daily practice of a hand surgeon. This condition is quite rare in the general population, but occurs more frequently among musicians and athletes, with the highest incidence found in professional motorcycle drivers. It is mainly because of a critical augmentation of the extracellular pressure of the forearm compartments. The diagnosis is mainly clinical, based on stress dynamic tests and intracompartmental pressure measurements. Traditionally, the treatment of this disease has revolved around suspension of trigger activity. In the case of professional athletes, this solution cannot be considered; and thus, the standard surgical treatment consists of an open forearm fasciotomy. This procedure usually requires a lengthy operation period and has a long recovery time before patients can resume their regular activity. Different surgical endoscopic solutions with mini-open techniques have been proposed, to shorten this time and reduce the incision size. The aim of this study was to present a new technique for endoscopic-assisted fasciotomy of the forearm in chronic exertional compartment syndrome, using a single mini-incision. Four of these surgical procedures were performed in three patients. They were all treated at our center for this condition, and in one case, the disease was found on both sides.

A-0647 A trend analysis of levels of evidence in hand surgery research

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Objective: The application of evidence-based medicine (EBM) to the practice of hand surgery has been limited. Production of high-quality research is an

integral component of EBM and essential for the global progression of hand surgery. With considerable improvements in the quality of published evidence in both orthopaedic and plastic and reconstructive surgery, it is imperative that evidence in hand surgery research emulate this trend.

Methods: A systematic review was performed on all hand surgery articles published in six journals, over a 20-year period, involving the years 1993, 1998, 2003, 2008 and 2013. The journals included: *Plastic and Reconstruction Surgery*; *Journal of Plastic, Reconstructive and Aesthetic surgery*; *Journal of Hand Surgery European Volume*; *Journal of Hand Surgery American Volume*; *Journal of Bone and Joint Surgery* and *The Bone and Joint Journal*. Articles were allocated to levels of evidence, as per Oxford CEMB Levels of Evidence guidelines. The average level of evidence per article, per year was calculated and compared between journals and hand surgery topics. Study type, number of participants and use of statistical analyses were also solicited. Additionally, the methodology of the randomised controlled trials (RCT) was assessed using the Jadad scale. Statistical analysis involved the chi square and student t-test, using a 2-sided alpha error of 0.05 for statistical significance.

Results: We included 1221 original hand surgery research articles in the final review. Trend analysis demonstrated a significant improvement in the mean level of evidence, from 4.26 in 1993 to 3.91 in 2013 ($p < 0.001$). High-quality evidence (level I and level II) only accounted for 9.2% of the evidence published, with a significant increase over the study period, from 4.5% to 12.8% ($p = 0.008$). Case series was the most prevalent study type (32.7%), with carpus (28.4%) and tendons (21.3%) the most researched topics. Quantitative evaluation of the 26 published RCTs, using Jadad scale, revealed a progressive improvement in study design, from 0.3 in 1998 to 3.33 in 2013.

Conclusions: Hand surgery research has mirrored trends seen in other surgical specialties, with a significant increase in quality of evidence over time. Yet high-quality evidence still remains rare. Multiple barriers for performing these studies must be assessed, in order to improve the quality of evidence.

A-0648 Injectable collagenase of *Clostridium histolyticum*: A 2-year experience

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Background: Dupuytren's disease (DD) is a fibroproliferative pathology that affects the palmar aponeurosis, causing the development of nodules and collagen cords and the progressive loss of flexion of the fingers. The standard procedure is surgical fasciectomy, which is followed by high recurrence rates. Collagenase from *Clostridium histolyticum* (CCH) injection represents an innovative noninvasive approach to the treatment of DD. This prospective study was designed to examine the efficacy and safety of CCH injection performed in the outpatient, using local anesthesia.

Materials and methods: We included 85 patients (64 metacarpophalangeal (MP), 21 proximal interphalangeal (PIP)) with a Dupuytren's contracture of at least 20° for MP joint and any degree for PIP joint. Their mean age was 66. All joints were treated with a single vial of the collagenase injection and manual breaking of the cord, 24 h after. All adverse effects (AEs) were monitored. Patients were checked regularly after the injection, with an average follow-up of 22 (6 - 54) months. Primary endpoint was a reduction in digit contracture, within 0° - 5° of normal extension. Secondary endpoints were the improvement of range of motion (ROM), the evaluation of AEs incidence, and cost-effectiveness of collagenase treatment.

Results: About 67.5 % of patients obtained clinical success. At 24 months, 97.5% attained the same result. The mean contracture of treated joints was 5.3° for MP and 6.8° for PIP joints. We found that 41% of the study group had one or more mild-to-moderate side effects.

Conclusions: The use of collagenase appears to be an effective and safe method for the treatment of Dupuytren's contracture. Therapeutic success was achieved in a significant percentage of patients. The incidence of side effects was higher, but they were self-resolving local reactions. The use of a single collagenase vial in patients treated in day of surgery appeared more cost-effective than surgery.

A-0649 Long-term effects of toe transfers on the donor feet

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The objective of this study was to evaluate the long-term donor site defect caused by the microvascular transfer of toe or toes. We evaluated the patient charts of a cohort of 98 patients who had had one to three toes

transferred, for post-traumatic grip reconstruction. Three of the major transfer groups were identified: great-toe (5 patients), second-toe (64), and double en-block second-third toes (5). The primary outcome measure was function, measured with an ADL questionnaire and with an AOFAS scale for the hallux-metatarsophalangeal disorders. Secondary outcome measures were patient-reported symptoms, measurements from weight-bearing radiographs, rate of complications and secondary operations. The ADL questionnaire allocates patients into four groups, according to the level of complaint. For the purposes of this study, a limit for good function according to the AOFAS scale was set at > 78 (out of 100) points. Osteoarthritis of the first MTP joint, hallux valgus angle (HVA°), and the width of the forefoot were evaluated from the radiographs.

The median follow-up for the 74 patients (80 feet, 85 transferred toes) participating in the study was 16 years 7 months (range 31 - 358 months). According to the ADL score, 73 feet (92%) had no or minor complaints; and six had moderate or major complaints, of the donor feet. We had 62 (83%) of the 75 feet receive a good result in the AOFAS scale. The primary outcome measures had a positive correlation (Spearman´s rho = 0.561, $p < 0.001$). Fifteen of the 16 patients with no complaints concerning the donor feet, had had a single, second-toe transfer. Complaint s over cold intolerance were rated major in four patients and moderate in 12 feet/patients. HVA° was at least 4° greater in the donor (25 patients) than in the control feet, which seemed to be related to the worsening score on the AOFAS scale (median 78 vs. 93, respectively, Mann-Whitney test $p = 0.069$). There was no widening of the forefoot of the donor, compared to the control feet. Moderate or severe first MTP osteoarthritis was related to older age, first ray malalignment and seemed to be related to a worse score in the AOFAS scale, compared to those with no or mild osteoarthritis. Primary wound healing problems in 16 (22%) patients resulted in a worse value in the AOFAS scale (median 78 vs. 93, Mann-Whitney test $p = 0.004$, respectively) and more problems with walking, compared to those without. One patient suffered a deep venous thrombosis, and another a transient peroneal palsy. In total, 21 secondary operations were performed on the donor feet of our patients. Transferring a toe or toes has a definitive effect on the donor site, and functional and patient-reported complaints should be expected; however, the donor site defects were in most cases of minor inconvenience, and patient satisfaction is high. With this in mind, the decision to transfer a toe should be balanced between achievable gain and the anticipated defect.

A-0650 'All inside knotless' arthroscopic scapholunate reinsertion with a 2.5 mm Bio-PushLock® (Arthrex): a new and innovative procedure, study of feasibility with preliminary results at 9 months follow-up (series of 10 patients)

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Introduction: Scapholunate interosseous ligament (SIOL) is the keystone of the dynamic stability of the carpe. Its reattachment, especially during recent injuries, remains consequently a fundamental step. Wrist arthroscopy has become the gold standard in ligament injury assessment and treatment, and joins the mini-invasive approach which prevails in modern surgery. To our knowledge, no publication has shown the feasibility and results of an all-arthroscopic SIOL reinsertion.

Material and methods: We present our new procedure of arthroscopic SIOL reinsertion using a Bio-PushLock® of 2.5 mm (Arthrex) absorbable suture anchor, as we have previously described it for foveal TFCC injuries. After a feasibility anatomical study (four fresh cadavers), we report the different key points of our procedure, using classical wrist arthroscopic portals (radiocarpal and midcarpal). No additional stabilization was done with K-wires. The wrist was immobilized in a short arm splint, for 4 weeks after beginning rehabilitation.

Results: Concerning the 10 patients: after a mean follow up of 9 months, preliminary results were good and the pain decreased in all cases. The range of motion (ROM) was around 80% of the contralateral side, and grip strength of the affected side was 70% of the opposite side. The mean DASH score was improved, after surgery.

Conclusions: As what we can see in other joints, the arthroscopic approach seemed to provide a better quality of management for severe SIOL injuries, with improved results over open surgery.

The preliminary results of our original technique predict interesting perspectives, but they demand a long-term follow-up and a larger cohort of patients, to validate definitively its acuteness.

A-0652 A MRI study of the ECU tendon disorder in traumatic and degenerative TFCC tears

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Purpose: The purpose of this case control study was to investigate the incidence of tendon and joint disorders associated with chronic triangular fibrocartilage (TFCC) tears with the use of magnetic resonance imaging (MRI). We hypothesized that the ECU tenosynovitis would be highly associated with chronic TFCC tears.
Materials and methods: From 2006 - 2013, we consecutively enrolled 71 patients whom had chronic ulnar wrist pain, in which the symptom duration was > 3 months. Clinical diagnosis of these patients included traumatic or degenerative TFCC tears, and the diagnosis was confirmed by open or arthroscopic surgery. Degenerative tears were associated with ulnocarpal abutment syndrome. Twenty-four wrists had degenerative TFCC tears, 44 had traumatic tears, and three were these combinations. All of these patients preoperatively underwent 1.5/3.0 Tesla wrist MRI with microscopy coil. We excluded patients with acute injury and rheumatoid arthritis. There were 49 female and 22 male patients, with an average age of 42 years. As a control group, we enrolled 72 age and gender matched patients whom underwent wrist MRI, due to radial wrist ganglion, carpal tunnel syndrome without any ulnar wrist pain. We examined the ECU and DRUJ disorders based on T2-weighted coronal and axial MRI images. Regarding the ECU disorder, we focused on ECU tenosynovitis and longitudinal rupture of the ECU tendon. ECU tenosynovitis was positive when > 1 mm of a peri-tendinous high-intensity area was observed at the center of the ECU groove. We defined longitudinal ECU tendon rupture as a splitting, high-intensity area within the ECU tendon. DRUJ arthritis was defined as > 1 mm width of intra-articular high-intensity area in the DRUJ. We compared the incidence of associated tendon or joint disorders between the case and control group. Statistical analyses were performed using student *t*-tests and chi-square tests.
Results: There were no significant differences in age and gender, between the case and control group. In the 71 cases of chronic TFCC tears, there were 29 wrists (41%) with DRUJ arthritis, 30 wrists (42%) with ECU tenosynovitis, and 22 wrists (31%) with longitudinal rupture of the ECU tendon. Meanwhile, in the 72 cases of the control group, we found nine wrists (13%) with DRUJ arthritis, six wrists (8%) with ECU tenosynovitis, and 14 (19%) with longitudinal ECU rupture. There were significant differences in the incidence of DRUJ arthritis, ECU tenosynovitis, and longitudinal ECU rupture between the two groups.
Discussion: We found a higher incidence of accompanying ECU tendon and DRUJ disorders in patients with chronic TFCC tears, as compared to the control group. Instability of the DRUJ in patients with TFCC lesion may have contributed to the higher rate of associated DRUJ and ECU disorders. Because the floor of ECU tendon sheath consists of a part of the structure of the TFCC, a finding of ECU tenosynovitis may indicate possible injury of the ECU floor. Higher incidence of these associated lesions may be one of the causes making a diagnosis of TFCC injury difficult.

A-0653 Proximal interphalangeal joint dislocation: monocentric retrospective study of 102 consecutive cases

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Introduction: Proximal interphalangeal joint dislocation (PIP) is a frequent trauma. The purpose of this study was to evaluate our management of PIP dislocation, to define its natural history and to determinate prognostic factors. Our hypothesis was that patients undergoing clinical monitoring recover better hand function.
Materials and methods: Between 2010 and 2013, we had 137 patients present with a PIP joint dislocation at our emergency department, of which 102 were contacted for evaluation. Mean age was 42 years. Sports trauma was found in 34% of cases and a simple fall, in 49%. The fifth finger was concerned in 44 cases. Once the diagnosis was confirmed, the dislocation was reduced. Post-reduction clinical examination and radiographs were made. Patients were immobilized in 90% of the cases, had syndactilie (59 cases) or PIP extension splint (38 cases) for a mean duration of 18 days. There were 50% of patients who received clinical monitoring by an orthopedist hand surgeon, 24% by their general practitioner, and 26% had no monitoring.
Results: Mean follow-up at the time of the study was 19 months. Quick-DASH averaged 3.6 points, with 84% showing no hand function impairment. A swollen joint was present in 70% of cases. Pain was present in 35% of cases, with an average Visual Analogue Scale (VAS) at 1. Range of movement (ROM) was - 5°/100°. Patients were evaluated according to follow-up: an increase in flexion range and hand function, and decrease in pain, were statistically correlated to the follow-up. Prognostic factors' analysis found an influence for the

type of dislocation, with volar dislocation associated with a more frequent and more important extension deficit. The type of immobilization or the type of monitoring did not influence the final clinical results.
Conclusions: Extension deficit or swollen joint are the usual sequelae of PIP joint dislocations. Flexion range increases with time, with usually functional ROM recovery. Climatic pains can persist up to 2 years after the initial trauma, with slight functional impairment. After conservative management of the PIP joint dislocation by a trained practitioner, this study demonstrated that patients monitored by an orthopedic hand surgeon, a general practitioner or not monitored at all, show no differences based on clinical results.

A-0655 New method of phalangeal fracture treatment with percutaneous retrograde intramedullary headless screw

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Closed two-level finger fractures are uncommon, highly unstable and have a significant risk for postoperative finger stiffness. We present such a case for which stable fixation was achieved with a new technique of percutaneous longitudinal compression screw fixation at two levels, allowing for immediate, active mobilization and loading. A 25-year-old male body builder suffered closed transverse shaft fractures of the proximal and at the neck level of the middle phalanx of his left little finger. Training weights fell on his hand. Conservative fracture treatment for 4 weeks failed and surgery was then performed. After closed reduction, a 0.8 mm K-wire was inserted percutaneously. Thereafter, cannulated screws (Speed Tip CCS 2.2. Medartis, Basel, Switzerland) were inserted in intramedullary retrograde and also percutaneously. Exercises with a full range of motion (ROM) and normal weight-bearing were allowed on the first postoperative day. During all follow-up visits, the patient showed a full and pain-free ROM. At his 3.5 year follow-up, the patient had normal full ROM, is free of pain and has no signs of osteoarthritis. The screws remain in-situ, without any sign of complications.
For two-level finger fractures (floating PIP joint), various methods of fixation can be applied. Closed two-level shaft fractures are challenging, since open fixation with plating or crossed K-wires lead to stiffness, due to soft tissue scarring or prolonged immobilisation. The described method of intramedullary fixation causes minimal soft tissue disruption, creates stable fixation and allows for immediate mobilisation and loading. Potential complications, such as extensor mechanism injury, extensor lag or osteoarthritis due to intra-articular screw insertion were not seen, even after longterm follow-up. We have applied this fixation method in a series of 67 patients with closed and open single-level extraarticular fractures (from shaft to the neck level) of the proximal and middle phalanges; however, even in a series, we have not observed any of the mentioned potential complications. We think that the small diameter and strength of the compression headless screw are crucial to limiting of complications. A larger diameter may disrupt the central slip or cause damage on the weight-bearing cartilage, instead of only violating the non-weight bearing intercondylar fossa. Thus, we recommend this method of stable percutaneous compression screw fixation, especially for 2-level phalangeal shaft fractures.

A-0657 Actual indications of continuous extension technique (TEC) for severe Dupuytren's disease

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Introduction: The treatment and knowledge of Dupuytren's disease has evolved in the last few years and has become widely known. Treatment at earlier and earlier stages has been performed surgically or with the use of collagenase. Nevertheless, still some cases at a severe stage or severe/multiple recurrence cases are seen in specialised hand surgery centres. Amputation of the digits is still performed by some surgeons, but this should be avoided. The continous extension technique (TEC) is an external, fixed system that can be used in severe uni-multidigital cases of DD, as an alternative to amputation.
Materials and methods: The TEC device is an external fixator, able to extend the retracted digito-palmar aponeurosis, finger or fingers at the initial stage of the disease. The continuous atraumatic lengthening of fascia produces a regenerative action on retracted skin and ligaments of the digital joints, so that articular procedures such as ligament release and skin plastic flaps are completely avoided. After its positioning, the extension is perfomed for two mm. a day by the patient himself, for 3 weeks. At the end of the treatment, the finger and its structures are completely extended and the device is removed; and then a simple aponeurectomy is perfomed. We have treated 130 patients, and in this study 86 were reviewed, with a mean follow-up time of 4 years (8 months - 10 years).

Results: Excellent and good results in 85% of cases (finger/s extended up to the initial stage of the disease), fair in 15%, but no poor results. All fingers avoided amputation. In 16% of patients, stiffness was reported in the hand and in 18% there were reports of recurrence or extension (8% recurrence and 10% extension) of the disease. The residual joint stiffness was restored in up to 6 months by the hand therapy; so no secondary surgery was performed and no plastic dermal operations were necessary. At the end of the atraumatic continuous extension, all of the treated fingers acquired a greater microvascularity of the skin and of the fingers, together with a better trophic and discriminative sensibility.
Conclusions: Nowadays, these indications are rare, as patients are sent early on to the surgeon. But in some cases where dyatesis exists and there is a severe and progressive contracture of one or several digits, when surgery is risky, the Tec device is an alternative to a proposed amputation or if a multiple operation plan is needed, as it occurs in severe recurrences with collateral vasculo-nervous damage of the finger, risk of necrosis, severe skin loss, severe stiffness, evolutive contracture with difficult palmar surgical access. This procedure is simple and can also be used for any retracted finger, as an alternative to amputation (DD or burns). The gradual extension leads to tissue regeneration, as in the Ilizarov method, is atraumatic for the patient, and then the subsequent aponevrectomy becomes an easy procedure.

A-0660 Outcome of patients with arthroscopically treated ulnotriquetral ligament split tears

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Objective: Ulnotriquetral ligament (UT) split tear is a cause of ulnar-sided wrist pain that can be managed conservatively or surgically. Our objective was to assess the surgical outcome of patients with UT split tear whom underwent wrist arthroscopy.
Methods: We retrospectively reviewed all patients whom had undergone wrist arthroscopy for fovea positive ulnar-sided wrist pain, between January 2009 and January 2014, performed by a single surgeon. We identified patients with intra-operative findings of UT split tear. We analysed the patient demographics, presenting features, pre- and post-operative examination findings, and pain score.
Results: A total of 24 patients underwent wrist arthroscopy for fovea-positive ulnar-sided wrist pain. Of these,14 patients had arthroscopic findings of UT split tear (11 male and three female patients). Mean age was 25 years (16 - 33 years). Seven patients (50%) underwent a trial of conservative treatment with splinting, prior to surgery. Twelve patients (86%) underwent UT ligament repair, using the 'outside to inside' technique, while two patients (14%) had small UT tears that were debrided, but did not require repair. Thirteen patients (93%) achieved a satisfactory outcome, in terms of complete resolution or improvement of symptoms. Their mean pain score (scale 0 - 10) improved from 1.5 (CI 1.13 - 1.87) pre-operatively, to 0.5 (CI 0.13 - 0.87), post-operatively. The mean Jamar grip for the affected wrist was 16.5 kg (CI 15.39 - 17.61) pre-operatively and 34.3 kg (CI 29.89 - 38.77) post-operatively. There was no significant difference between the pre- and postoperative mean range of motion (ROM). There were no post-operative complications.
Conclusions: Wrist arthroscopy was a reliable and effective method of diagnosing and treating UT split tears, with good surgical outcomes.

A-0663 Comparison of vascularized and nonvascularized bone graft in treatment of long-lasting humeral nonunion

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We investigated 65 cases of post-traumatic humeral non-union, treated surgically in the years 2005 - 2013. Average time between the trauma and operation was 2.5 years (1 - 13). All of the patients were operated before, on average 2.2 times (1 – 8 times), with use of different types of internal and external fixation. Vascularised bone grafts were done in 24 patients and nonvascularized ones in 41 patients. All bones were fixed by locking plates. We used 20 free vascularised fibula grafts and four medial femur epicondyle grafts. In all nonvascularised grafting cases, we used ileac crest bone. Among the vascularised cases, union was achieved in 21 (87.5%) cases, within 4 months. There were two deep infections (8.3%) in the vascularised group; and one delay in healing requiring additional successful grafting. In the conventional group, union was reached in 30 (73%) patients, but there were three (7.3%) deep infections. For long-lasting, humeral non-union, vascularised bone grafting is overall more effective in achieving union, in a short time.

A-0667 Review of five cases of angioleiomyoma in fingers and hands

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Objective: We experienced five cases of angioleiomyoma in fingers or hands. We report our review of the clinical features, medical imaging and histopathological characteristics of five surgically-treated cases.
Patients and results: All patients were men, presenting at an average age of 56.4 years (range, 33 - 80 years). The location of tumours were: 3 fingers, 1 hand and 1 wrist. The man whose location was the left thumb had complained of sharp pain, and the man who had angioleiomyoma located on the ulnopalmar surface in his wrist, was associated with ulnar nerve palsy; however, the other three cases had an asymptomatically-palpable mass and the tumours were present for an average of 29.7 months (range, 5 mo to 5 years), before the first medical evaluation. No patients had abnormalities upon X-ray. On the magnetic resonance imaging (MRI) scan, all tumours were mainly low-intense to muscle on T1 and heterogeneous (4 cases) or iso-intense (1 case) on T2. We treated all patients surgically and made the definitive diagnosis of angioleiomyoma via pathological analysis. Tumours presented as lesions with an average size of 24.4 mm (range, 10 - 50 mm). Histologically, two cases were classified as a solid type, one case was classified as a venous type, one case was classified into cavernous type and one case was classified into the mixed solid and cavernous type. After the surgery, no recurrence was seen, and all patients reported an improvement in their symptoms, including the disappearance of preoperative sharp pain and the neurologic symptom disappearance as well, in all cases.
Conclusions: Angioleiomyoma classified as a benign soft tissue tumour is a painful mass. It is a tumour appearing most commonly on the lower leg of a woman. About 22% of all these tumours exist in the upper extremity. Angioleiomyoma is composed of bundles of smooth muscle and vascular channels, which lack cytological atypia and mitotic activity. Angioleiomyoma is classified into three histological groups by Morimoto et al.: solid, venous and cavernous. It is said that pain was caused by local ischemia from the mass effect of feeding by blood vessels. Therefore, the solid tumour is typically painful and venous, and the cavernous tumour, typically painless; however, only for angioleiomyoma in the finger or hands, there is no report referring to the relationship between pain and the histologic form. In our case, only one case presented with pain, though there were two cases that were classified into being a solid type tumour. The accumulation of further case studies of angioleiomyoma in fingers or hands is needed.

A-0669 Long-term results of a cross finger flap in finger tip amputations

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Objectives: The finger tip amputation (FTA) is a severe trauma of the hand. Pulp reconstruction should lead to the restoration of a sensitive, trophic and painless pulp, which are the conditions for the restoration of the digital function. The cross finger flap (CFF) provides this restoration. The aim of this study was to present the functional and sensory long-term results of this flap.
Materials and methods: This was a retrospective study of 28 patients treated from 1992 to 1995 for a finger tip amputation without conserved fragment (16 were Stage 3, 8 Stage 2 and 4 were Stage 4). CFF was taken from an adjacent finger on the dorsal surface of the mid phalanx, carrying the skin and subcutaneous tissue. A dorsopalmar hinge was respected, to ensure the viability of the flap. Pulp reconstruction was then performed and the flap was weaned at an average of 18.7 days (14 - 22). Patients were reviewed at 19.7 years, for a follow-up. We evaluated: the pulp volume (compared with the contralateral fingertip by lateral X-ray), the presence or absence of neuroma, the occurrence of complications (necrosis, infection or donor site), the presence of cold-related troubles, the static discriminative (Weber) and tactile sensitivity (filaments Semmes and Weinstein), the digital range of motion (ROM) and the patient satisfaction (VAS 0 - 10).
Results: At the last follow-up, 22 patients (53%) were reviewed or contacted by phone, three patients were dead and three were lost in follow-up. The mean age at revision was 59 years (27 – 82; 20 men and two women). The pulp average trophicity finger injured was 9 mm (8 - 12), and was 9.66 mm (8 - 13.2) for the contralateral finger. Neuroma was not found. No postoperative complications were noted. Cold sensitivity was present in 11 patients, without associated functional troubles. The average static discriminative sensitivity was 7.3 mm (6 mm in 8 cases, 8 mm in 7 cases, and 10 mm in 2 cases), and the average tactile sensitivity was 3.98 (3.61 in 8 cases; 4.31 in 9 cases). The digital (ROM) was complete in 14 patients, a flexion contracture of 10° from the distal interphalangeal joint was noted in three patients. Subjective patient satisfaction was a 9 (8 - 10).
Conclusions: The CFF provided very satisfactory reconstruction of the finger tip. The results showed a long-term trophicity that was almost comparable to

the contralateral pulp, and finger sensitivity reappears. It is a reliable reconstruction technique, simple and sustainable; however, it requires a 2-stage surgery.

A-0672 Salvage procedures for advanced carpal collapse, 4-corner fusion vs. proximal row carpectomy: No difference?

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Objective: Salvage procedures for advanced carpal collapse (SLAC, SNAC) include mainly the four-corner fusion (4-CF) and the proximal row carpectomy (PRC). To facilitate the decision-making procedure between the two operations, we initiated a follow-up study of our salvage procedures.
Methods: Between 2008 and 2013, we performed 179 salvage procedures in our hand surgery department: 122 4-CFs and 57 PRCs were carried out, of which we were able to follow up retrospectively n = 58 of people from the 4-CF group (mean follow-up, 38 months) and N = 25 of the PRC group (mean follow-up, 37 months). We evaluated the pain score (VAS 1 - 10) in rest and on exertion. The DASH scores were routinely recorded preoperatively, at 6 months and upon follow-up exam. Grip strength (Jamar) and ROM were examined on the operated and on the opposite hands.
Results: The 4-CF group showed a mean DASH score of 19.3 (preoperative 44.7), the PRC group 28.1 (preoperative 47.0). Pain was reduced for the 4-CF group to 0.87 VAS (during rest: R) and 3.16 VAS (on exertion: E) for the 4CF (2.78 (R) and 7.52 (E), preoperatively). The PRC group claimed a pain score of 1.36 VAS (R) and 3.92 VAS (E) (1.0 (R) and 7.0(E), pre-operatively). Jamar Grip was 84.4%, compared to the non-treated hand in the 4-CF group and 86.9% in the PRC group. We found that 75% of these patients would choose the same treatment again and that they were satisfied, in both groups.
Conclusions: In our patients, 4-CF and PRC proved to be reliable procedures for examining advanced carpal collapse. Although there was no significant difference in the outcome, we tend to suggest the 4-CF to younger patients, due to the anatomic reconstruction and due to the tendency of a (not significant) better DASH and a lower pain score upon exertion. Due to the possibility of osteoarthritis of the lunate fossa, we tend to promote the PRC procedure for patients with less demand or higher age, if they have not yet progressed to a Stage III carpal collapse.

A-0673 The bullet anchor-like Redeemer for S-L dislocation

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Introduction: Scapholunate instability is a common cause of wrist instability, pain and loss of working strength for most patients. We know that a great majority of the patients with conservative therapy or arthroscopic shaving and K-wire fixation offer indeed poor results. Many other surgical techniques have been used, from anchor refixation of the acute SL ligament tear to chronic dorsal intercarpal capsulodesis or the tenodesis procedure, and rarely scapholunate fusion (e.g. RASL) and bone-spacer-bone interpositions. But there is no surgical technique that gives us long-term, favourable outcomes. In chronic S-L instability, a SLAM technique using a palmaris longus tendon transplant, anchored with a bullet into the lunate, shows us a salvation for long-term satisfactory results.
Methods: In our study of arthroscopically confirmed scapholunar rupture, we made a modified SLAM technique. Previously all patients were arthroscopically examined, shaved and/or made by vaporisation (VAPR® System), and not successfully treated by closed reduction and percutaneous pinning proximal row of carpal bones. In all our cases, we used only a radial approach to the scaphoid, so we did not expose the S-L gap via a dorsal approach. In the first place, we inserted two joysticks in the scaphoid and lunate, reduced the SL gap with a retractor and checked the S-L position under X-ray intensifier. After that, we inserted K-wire over the C-guide, followed by the bullet anchor with the tendon graft insertion into the lunate bone. Once again, the position was checked with flouro. Then we inserted the interference screw in the bone tunnel, in the scaphoid, followed by capsuloplasty over the scaphoid with braided, non-absorbable sutures. We observed patients for 1, 3, 6 and 9 months postoperatively, to measure their progress with X-ray control and Mayo and Krimmer wrist scores. Their age range was 23 - 44 years (mean 31.4 years).
Results: We analysed 10 patients in our study. Follow-up data were available for six patients with Stage III and four patients with Stage IV Geissler arthroscopic classification. Wrist X-ray control after 3 and 6 - 9 months after surgery revealed that the average SL distance of 4.89 mm preoperatively, was reduced to 2.84 mm. Range of motion (ROM) of the wrist was exellent in 76% and good in 24%. Results of the Visual Analogue Scale (VAS) evaluation were

excellent, good and satisfactory in 31%, 47% and 22% of patients, respectively. Hand grip after 9 months was excellent in 24%, good in 45% and satisfactory in 31% of patients. Pre- and post-operatively, we performed Mayo wrist score and the average measures were 60 before, and 81after, the operation. The Krimmer wrist score improved from 58 to 77, respectively.
Conclusion: Use of this modified SLAM technique with a minimally invasive method and the reconstructed ligament position, almost in primary anatomic place, offered promising results. This simplified technique is a new challenge in S-L ligament rupture treatement, with a low complication rate, early mobilisation, excellent/good ROM and a good clinical outcome.

A-0675 Role of CT in the evaluation of children with obstetric brachial plexus palsy

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Introduction: Most patients with obstetric brachial plexus palsy (OBPP) recover spontaneously within the first months of life; however, in some cases, the glenohumeral joint can develop into posterior subluxation, some deformities of the humeral head, and changes in the glenoid cavity. There are few studies demonstrating the moment that such deterioration occurs in the shoulder of these patients with obstetrical palsy.
Objective: This study evaluated children with impaired glenohumeral joint, divided into three age groups, and compared the clinical features and imaging findings between these groups, seeking to identify differences between them.
Methods: A retrospective study was conducted by consulting the medical records of 76 patients with OBPP. They were divided into three groups: age < 12 months, 13 - 24 months and > 25 months. They were classified according to gender, affected side, type of paralysis, and by computed tomography (CT) according to the scale of Waters and Peljovich.
Results: The correlation between the groups of patients and type of paralysis presented no statistical significance ($p = 0.117$), but the association of age to the classification of Waters was statistically significant ($p = 0.006$), demonstrating that the patients under 12 months, and between 12 and 24 months, compared to the older group over 25 months, showed a statistically significant correlation between the physical examination and serious deterioration of the shoulder.
Conclusions: This study showed a statistically significant correlation between the cited findings of physical examination and serious deterioration of the shoulder in children under 24 months, justifying the realization of imaging studies, aimed at a better way of monitoring them and allowing a sooner and better approach to OBPP children.

A-0677 Wide awake approach in hand tendon surgery: our experience

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'Wide awake' hand surgery means no sedation, no tourniquet, and no general anesthesia for hand surgery. The only medications given to the patient are lidocaine with epinephrine. Lidocaine is for anesthesia and epinephrine provides hemostasis, which deletes the need for a tourniquet.The rich literature to confirm proper employment of the epinephrine in the fingers, has afforded us to be able to use this 'Canadian' technique that allows us to execute 90% of our surgery of the hand, with the exception of children, patients with pathologies such as hypoperfusion, psychic problems or insufficient collaboration and in greater traumas. The wide awake approach to the tendinous lesions of the hand allows the possibility of active intraoperatorial mobilisation of the structures repaired, that it affords us to test, in real time, the corrected regulation of the tensions (in the tendinous transfers) and the free sliding, in absence of yieldings in tendons sutures. In tenolysis, the wide awake approach affords us to control the real range of active movement of the patient, before the cutaneous suture. Till now, we have dealt with this technique in 30 patients, with a meaningful improvement of outcomes, as patient satisfaction, quality of the functional results, control of the risks, of the costs and reduction of the inconveniences due to other types of anaesthesia.

A-0678 Intra-articular fracture of the first metacarpal base: treatment through a volar approach

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Objective: Management of fractures of the carpo-metacarpal joint of the thumb has been controversial, since described by Bennett (1882). Many methods have been suggested in order to achieve satisfactory joint

congruity. Early reports supported closed reduction and casting, with or without percutaneous pinning. Later the exact anatomic restoration of articular surfaces was advocated through open reduction and internal fixation. Different surgical approaches were commonly used. The purpose of this article was to assess surgical treatment using a direct volar approach.

Methods: Between March of 2008 and December of 2012, we operated on 18 patients with intra-articular first metacarpal fractures presenting two or three fragments, displaced > 1mm, by using a direct volar approach. The fixation was done with micro-screws or K-wires, always placed from ulnar to radial, during thumb supination. The articular step-off, secondary displacement incidence and consolidation rate/time were measured, analysing it by pre- and post-operative X-rays. At the final follow-up, we assessed the thumbs for range of motion (ROM), residual pain and grip strength. Sensitive areas around the scar were evaluated. Mean follow-up was 8 months after surgery.

Results: The articular step off was anatomically re-established in all cases. One secondary displacement was registered. The mean distance between the tip of the thumb and the fifth metacarpophalangeal joint was 3 mm, and all patients could flatten their hand on a table top. Mean palmar abduction was 60°. The grip strength 6 months after surgery averaged 80% of the opposite side. There were neither sensory disturbances in sensitive areas around the scar, nor thenar muscle atrophy.

Conclusions: The complete visualisation of the first metacarpal articular surface was hard to accomplish from the dorso-radial aspect of the hand. Bennett fractures' surgical treatment through a volar approach was first described by Guedda and Moberg (1953), but seldom used. It offers an excellent fracture exposure. It is possible to place the osteosynthesis in ulna-radial fashion from the smaller fragment, achieving correct reduction and stabilisation. In spite of the proximity to the radial and median sensitive nerve branches, and the necessity of thenar muscles shifts, we had no complications. A direct volar approach was a reliable and effective procedure for treating intra-articular fractures of the first metacarpal base.

A-0683 Pre-surgical assessment for pediatric ulnar coronoid fractures using CT

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Introduction: In the treatment for fractures of the ulnar coronoid process in pediatric patients, it is radiographically difficult to diagnose or evaluate the morphologic condition of the fragment, due to invisibility of a chondral lesion. A large fragment should be also fixed, to avoid the instability or malalignment in pediatric cases. We report the successful treatment using MDCT as the preoperative imaging examination for five young patients with ulnar coronoid fractures.

Methods: All five patients were boys with an average age of 10 years (7 - 17). Injury mechanisms were three falls and two sports-related accidents. The associated injuries were four simultaneous humeral lateral epicondyle fractures, and one radial neck fracture. X-ray and computed tomography (CT) examinations were taken for all cases, in addition a magnetic resonance imaging (MRI) was done, only for the 7-year-old case. According to Regan's classification, there were three Type1, one Type 2 and one undefined. When classifying into O'Driscoll's criteria, we set the window-function of axially reconstructed CT as WW/WL (100:45) on the CT application (Aquarius Net Viewer, Fuji-film, Japan) to visualise the chondral portion of the fragment. Next, according to its information, the height (%) of the fragment was measured in Type1 - 2 on the sagittal image of the preset CT. The surgical indication was determined following the updated consensus in adults, i.e. Type 2 - 3 anteromedial facet fragment (AMF) and Type 3 (fragment height > 50%), with no other instability. Clinical outcome was also reviewed, including range of motion (ROM), radiographs and JOA score.

Results: There were: one Type1-1, 2 Type1-2, 2 Type2-3. In two cases of Type 1 - 2, the height (%) of the fragment was measured on the sagittal image of the preset CT. The fragment height percentage of two O'Driscoll Type 1 - 2 were 39% and 44%. ORIF in 2AMF, combination of leaving unexplored and resection of the incarcerated fragment in one, and only unexplored in two were performed for coronoid fractures. While, against the lateral epicondyle fracture, we performed ORIF in three due to PLRI and it was unexplored in one. At an average 9-month follow-up time, bone union was recognised in all besides the 7-year-old case. The average ROM was 137/10 (flexion/extension). JOA was 98. There was no elbow instability.

Conclusion: Fractures of the ulnar coronoid process in children are rare injuries. Because the size of cartilageous coronoid tip is harder to interpret than in adults, understanding the morphology is crucial in the decision-making process to treat these paediatric cases. Window function processed CT enabled us to visualise the chondral portion of the fragment. Considering that two of the coronoid tips of O'Driscoll's Type 1 - 2 were left unfixed with satisfactory results, it may support that 50% of transverse coronoid fractures are borderline, whether it is fixed or not. Further study, with an increasing number of cases, is necessary.

A-0685 Minimally invasive technique to stabilise lax and painful thumb CMC joint

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The painful thumb carpometacarpal (CMC) joint without arthritic changes with joint laxity is a common condition mainly affecting the female population in their early decades. Two surgical methods have been mostly used to treat this condition: ligament reconstruction and extension osteotomy. In these methods, the surgical trauma is quite extensive. In this case series, we would like to present a new, minimally-invasive procedure for the treatment of so-called 'pre-arthritic' but painful thumb CMC joints. The procedure was used for patients with lax and painful thumb CMC joints, which have failed to improve after conservative treatment during 3 months. The main indications for surgery were clinical findings, which included persistent pain and laxity of the thumb CMC joint. All 14 patients who had been operated were female gender and with a mean age of 38 years: 10 of them on the right side and four on the left side thumb. The integrity of the cartilage was checked arthroscopically and it was considered an absolute indication to perform the technique, consisting of stabilizing the space between the first and second metacarpal base with a suture button device (Artrex Mini TightRope). A standard postoperative protocol was followed. No major complications occurred. Our preliminary experience and the short-term follow-up results of this less invasive technique were encouraging.

A-0686 Distal biceps tendon injury

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Introduction: Rupture of distal biceps tendon is a relatively rare injury that occurs mainly in middle-aged men. Most of a distal biceps tendon rupture consists in its avulsion from the radial tuberosity. Once torn, the biceps tendon at the elbow will not grow back to the bone and heal. Other arm muscles make it possible to bend the elbow fairly well, without the biceps; however, they cannot fulfill all the functions, especially supination. Significant, permanent weakness during supination will occur if this tendon is not surgically repaired.
Materials and methods: The authors analysed and evaluated 55 cases treated in the Hospital San Martino of Genoa and in the Hospital San Paolo of Savona, between 2010 and 2014. The diagnosis was based on the patient's medical history and a physical exam, and supported by an echography or magnetic resonance imaging (MRI). In all cases, surgical treatment was the reinsertion of the distal biceps tendon at the radial tuberosity by two suture-anchors that were inserted into the bone as an anchorage for the tendon. An anterior approach and loco-regional anesthesia was used. After surgery, a splint was applied, with the elbow blocked at 90° flexion and neutral prono-supination for 4 weeks. After this time, the patient started a physiotherapy program, removing the splint only during the physical therapy for the following 2 weeks. By 6 weeks, they were allowed to remove the splint. The follow-up proceeded with a clinical exam, 2 and 6 months after surgery. We evaluated all patients by echography and a physical exam. Elbow range of motion (ROM), subjective and objective strength recovery, time to return to work and sports activities were recorded. The Disability of the Arm, Shoulder and Hand Score (DASH), the Oxford Elbow Score (OES) and the Mayo Elbow Performance Score (MEPS) were obtained for all patients.
Results: No cases of radial nerve lesion nor palsy were reported. All of the patients showed a complete functional recovery and got back to their sport and working activities. The DASH, OES and MEPS scores were good. One patient had a partial re-tear after 4 months, without functional limitation, two patients had a superficial infection treated successfully by antibiotics; and echograpy showed there were two cases of heterotopic ossification without functional limitation .
Conclusion: In the authors' opinion, the reinsertion of the distal biceps tendon at its orthotopical site, the radial tuberosity, is the surgical solution that guarantees the best functional results and the use of the suture-anchors realizes a strong fixation.

A-0688 Do we see enough? Visual perception and acuity of hand surgeons using loupes

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Purpose: Most surgeons lack knowledge of the fundamentals of optical magnification. To obtain information on the use of magnification devices of hand

surgeons, a self-assessment of their visual performance and their near visual acuity was tested in a simulated setting; and then analysed with respect to ageing.

Methods: We tested 63 hand surgeons between 29 - 68 years of age, with their habitual loupes. A questionnaire evaluated the self-assessment of their visual performance, as surgeons during their daily work, on a modified Visual Analogue Scale (VAS 0-5). The objective near visual acuity was measured in a simulated clinical setting, using miniaturised visual tests with E-optotypes. The influence of the surgeons' age was analysed by comparing the subgroups A (< 40 years) and B (> 40 years). The influence of the optical device used was evaluated by comparing the Galilean and Keplerian loupes.

Results: Seven surgeons out of 63 routinely used two different loupes, according to different indications, meaning that a total of 70 loupes were tested (Galilei magnification < 2.5 x n = 35, Kepler magnification 3.0 - 4.5 x n = 35). The Spearman's rank correlation coefficient of 0.25 (Galilei loupes: 0.15; and Kepler loupes: 0.27) revealed only a weak correlation between the self-assessed values and the objective visual performance. We found that 21% of the participating hand surgeons overestimated their visual performance. The difference between the two age groups was more important in Galilean ($p = 0.008$) than in Keplerian loupes ($p = 0.04$). The difference between the two loupe systems was more important in the older group ($p < 0.0001$), compared to the younger group ($p = 0.01$).

Conclusions: A Galilean loupe might be sufficient for surgeons with good vision, while a Keplerian loupe for the same microsurgical procedure must be recommended to surgeons with presbyopia or a lower visual performance. The loss of near sight vision during age is only realised if daily activities are affected. Without objective standards, it is not possible to know if or what magnification is required for an individual surgeon.

A-0693 Clinical features of ulnar tunnel syndrome

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Introduction: Ulnar tunnel syndrome (UTS) is defined as a compressive neuropathy of the ulnar nerve at the level of the wrist. Numerous factors may precipitate the onset of UTS, including space-occupying lesions, vascular lesions and repetitive trauma. Patient presentation depends on the anatomic zone of ulnar nerve compression and therefore may be purely motor, purely sensory, or a combination of both. The purpose of this study was to determine the clinical features of UTS.

Materials: Data was retrospectively collected from 1997 to 2013. Ten hands in 10 patients (5 men, 5 women) with UTS were treated by needle puncture or surgery. The average age at the time of surgery was 43 years (range 17 - 83 years). The average period from onset to treatment was 25 months (range 2 - 60 months). Nine patients were available for this study.

Results: The causes of UTS included a ganglion in three, a tumor in one, a volar carpal ligament in one, a pisohamate ligament in one, an aberrant muscle in one, a repetitive fibrosis in one and unknown in one. Symptoms included pure motor disturbance in six, pure sensory disturbance in one and a combination of both in two. Three hands showed a claw deformity and three hands had a positive Tinel sign. Surgical exploration was performed in eight hands. Three hands had compression in Zone 1, five in Zone 2 and one in Zone 3, according to Gross and Gelberman classification. Decompression of the ulnar tunnel or removal of space-occupying lesion was performed by the standard surgical technique. One patient was successfully treated by ganglion aspiration, assisted with ultrasonography. The clinical symptoms of UTS improved in all patients after surgery. Magnetic resonance imaging (MRI) was suitable for localizing a ganglion or a tumor. An aberrant muscle could be detected by ultrasonography.

Conclusion: Ulnar tunnel syndrome is rare and presents various features. Clinical features are important for diagnosis of UTS, as well as use of MRI or ultrasonography.

A-0694 Functional and aesthetic results in the treatment of Madelung's deformity in young women

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Objective: Madelung's deformity is a complex congenital disease that leads to an abnormal growth of the distal radius, forearm and carpus. It becomes symptomatic at adolescent age, with pain and loss of grip strength. The aim of the study was to evaluate functional and aesthetic results of the treatment with corrective open wedge radial osteotomy with bone graft or radial corrective closed wedge osteotomy with ulnar shortening.

Methods: Thirteen wrists in nine patients were treated. Mean age was 20 years (16 - 28, all female patients). In 11 wrists, patients complained of pain and all of insufficient grip strength. In five cases there were paraesthesias preoperatively. Seven wrists were treated with a radial corrective open wedge osteotomy with graft (Group 1), six wrists with radial corrective closed wedge osteotomy with ulnar shortening (Group 2). Two wrist had a previous treatment with the Ilizarov technique first, and then corrective radial and ulnar osteotomy, subsequently. Osteotomies were internally fixed with AO plate and screws. All patients were reviewed (13 wrists); mean follow-up was 5 years (2 - 14).
Results: Mean grip obtained in Group 1 was 17.5 Kg (10 - 24 Kg), and 16.6 (7.5 - 23) in Group 2. There was absence of pain in all cases. All patients returned to their previous work or activities, with slight limitations in two cases. Mayo wrist score in Group 1 was excellent in 2 cases, good in 4 cases and fair in 1 case. Mayo wrist score in Group 2 was excellent in 1 case, good in 4 cases, fair in 1 case, with no bad results. Paraesthesia disappeared in all cases. Better cosmetic appearance was obtained in Group 1, as radial length was restored.
Conclusions: The treatment of this complex deformity was not always straightforward. Radial corrective osteotomy gives good functional results with or without ulnar shortening. Results were slightly better in Group 1, but these results were not statistically significant. It was also difficult to have a great number of cases, as this pathology is rare. From the aesthetic point of view, radial open wedge osteotomy gives better results than radial corrective osteotomy with ulnar shortening. It has been necessary to remove metal work successively in some patients, in both groups. Grip strength was generally increased and pain disappears, but rarely a completely normal wrist morphology is obtained.

A-0696 The operative management of chronic scapholunate instability with a minimally invasive extra-articular tenodesis technique: the carpal sling

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Objective: The operative management of chronic scapholunate (SL) instability without osteoarthritis remains controversial in the literature. Dissappointing results in our own patients using a modified Brunelli tenodesis SL reconstruction over years, persuaded us to develop a new operative technique to reconstruct the SL ligament.

Methods: Since reposition of the scaphoid bone can be usually well achieved by the established methods, we set our target on gaining a reliable reconstruction of the SL ligament, a reduction of DISI deformity with reposition of the lunate and an improvement of the postoperative range of motion (ROM). We developed a carpal interosseus sling technique, which was first tested in cadaver trials. Since the interosseus SL ligament repair with final fixation at the capitate bone needed a strong tenodesis anchor, we evaluated the tensile strength of a tenodesis screw versus alternative methods, in animal cadavers. After definition of an operative algorithm, we proposed the operation in selected cases with a reducible SL instability (Garcia-Elias Stages 2, 3 and 4). All of the so far 20 patients were preoperatively thoroughly evaluated by clinical examination, standard X-rays, magnetic resonance imaging (MRI) and wrist arthroscopy. Though we started our series with an open technique using a dorsal wrist approach in the first three patients, we performed the operation in the following 17 patients as a minimally-invasive, extraarticular tenodesis procedure.
Results: We were able to evaluate 18 of our 20 patients postoperatively (mean time of examination was 9.5 months; range 4 - 18 months). We found unaltered X-ray results in all patients, compared to the status immediately postoperative and 6 weeks postoperatively. The range of motion (ROM) was noticeably better in patients with the extra-articular technique (55° of extension, 40° of flexion (70%, 71% of the uninvolved wrists)). The mean strength of grip was about 80%, compared to the opposite side. No patient had to be reoperated. We had 14 patients go back to their previous job or level of activity.
Conclusions: The minimally invasive, extra-articular tenodesis technique for the treatment of chronic scapholunate (SL) instability without osteoarthritis was, after our first evaluation, a successful alternative to the conventional operative treatment options like the modified Brunelli or Garcia - Ellis. We achieved our goals in a reliable reconstruction of the SL ligament, the reduction of the DISI deformity and a postoperatively-improved ROM. In further use of this technique, we expect long-term data to support our first evaluation.

A-0697 Recognition of carpometacarpal dislocation fractures in a Dutch emergency department

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Objectives: Carpometacarpal joint dislocation fractures of the 4th and 5th metacarpal, in combination with fractures of the hamatum are often overlooked on initial examination. The aim of this study was to provide a systematic approach for the assessment of this specific type of carpometacarpal joint dislocation fracture, to minimize the number of cases missed. The guidelines will be based on current available literature, as identified by a systematic review.
Methods: A series of 15 patients with carpometacarpal joint dislocation fractures was reviewed to identify recurring pitfalls in the initial assessment. A systematic review was then conducted. With the recommendations provided in the reviewed literature, guidelines for the assessment of carpometacarpal joint dislocation fractures were composed. Selection criteria: Articles specific on carpometacarpal joint dislocation fractures were included. Inclusion criteria: original publication between January 1990 and November 2014, studies written in Dutch or English. Exclusion criteria: studies with incomplete data, case reports, letters or editorials, studies solely on carpometacarpal dislocations or fractures, studies on carpometacarpal dislocation fractures other than the 4th or 5th metacarpal.
Results: We identified 299 articles, after removing duplicates and screening of the title and abstract, and 14 studies were found eligible for inclusion. The quality of the included articles was considered moderate: the majority of articles had been published over 10 years ago.
Conclusion: The presence of an apparently isolated metacarpal fracture due to an indirect force should raise the suspicion of an associated carpometacarpal dislocation. Recognition of these injuries can be improved by using a systematic approach during the initial assessment of a patient with trauma of the hand. Data on the recognition of carpometacarpal joint dislocation fractures when using the heretofore presented guidelines should follow.

A-0698 The reverse flow superficial branch of the radial artery (SUPBRA) flap for digital reconstruction: our experience

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Objective: The ideal flap for volar defects of the digits should provide glabrous skin, maintain length, be sensate and supple enough to allow unimpeded motion of the joints. We describe our experience with the use of a reverse flow flap based on the superficial palmar branch of the radial artery for digital (volar) reconstruction.
Materials and methods: Between May 2006 and November 2014, we used this flap on nine patients, with defects secondary to trauma (3), resurfacing for old skin graft scar (1) and infection (1). Pulp reconstruction after neurolysis (1), after skin cancer excision (1) and Dupuytren's fasciectomy (2). The majority of patients were women (5) and the mean age of the sample was 55 years old (range 21 - 80). Data on demographics, range of motion (ROM), and complications were obtained. Complications such as infections or failure of the flap were also recorded. To assess functional outcomes, we reviewed hand therapy and case notes. The donor site was closed directly in all cases.
Results: There were no flap failures. One case suffered distal superficial epidermolysis, but went on to heal satisfactorily. All wounds healed with good functional outcomes relating to length, movement and use of the hand.
Conclusion: This flap brings like for like skin from an adjacent area to the site of the volar defect.
It does not sacrifice a major pedicle in the hand and it does not require microsurgical anastamaoses.
The flap is from the same hand, therefore limiting the area of trauma and scars to the same region. Donor site morbidity was minimal. The reach of the flap made it a good alternative for pulp reconstruction in the index finger and thumb. We believe that the reverse flow SUPBRA is a very reliable and useful local option in the armoury of the reconstructive hand surgeon, for coverage of digits in the palm and volar aspect of digits, especially the index finger and thumb.

A-0699 Interphalangeal joint fractures of the thumb: correlation of range of motion to thumb function

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Objective: Due to the unique position of the thumb in relation to the other digits, we hypothesised that restoration of excellent range of motion (ROM) in the interphalangeal joint (IPJ) of the thumb bears poor correlation to hand function.
Methods: We did a retrospective review of fractures of the IPJ of the thumb fractures treated in our institution over a 2-year period (2011 - 2012). The case notes, hand physiotherapy notes and X-rays were examined. Data on demographics, ROM, and complications were

obtained. A Michigan Hand Questionnaire (MHQ) was used as an additional outcome measure. Correlation between the MHQ score obtained in patients and ROM was analysed.
Results: Three patients (2 children and one adult with no follow up) were excluded. Eighteen patients (5 women and 13 men) with a mean age of 45 years (range 18 - 91) were reviewed. The non-dominant hand was more commonly injured (66%). The most frequently injured phalanx was the distal one. The majority of the fractures were considered unstable and immobilised for 4 - 6 weeks. In 60% of patients, ROM was good or excellent, and fair or poor in 40%. The mean score on the MHQ obtained was 90 (R 60 - 100). There is poor correlation between the MHQ scores and ROM ($p > 0.38$).
Conclusion: Restoration of ROM of the IPJ in the thumb is a poor determinant of restoration of hand function, following these fractures.

A-0700 Validation of measurement of joint motion in the interphalangeal joint of the thumb in the hand with photography

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Objective: Due to the difficulty in getting some hand patients to return for assessment in clinic, we hypothesised that the range of motion (ROM) assessed in a photograph taken by the patient with the commonly available smartphone will not be dissimilar to that obtained in person in the clinic. Therefore, we sought to test /validate this assumption.
Methods: We randomly selected 60 people in our unit: 30 of them were selected within people that had some condition/injury/disease that promoted decrease of ROM over the interphalangeal joint of the thumb (IPJ thumb). Ethical approval of the committee was obtained. A consent form was obtained from each participant. In the study was measured the maximum active extension of the IPJ of the thumb clinically and in a true lateral picture of the thumb, fully extended. Also, the maximum active flexion of the thumb was measured clinically and in true lateral picture of the thumb, fully flexed. A student *t*-test for paired samples was done to analyse if there were statistical differences between both samples, in measures obtained clinically and measures obtained through photography.
Results: P values for student *t*-test were 0.61, when comparing extension values measured in photography and clinically; and 0.8, when comparing flexion values measured in photography and clinically. There were not statistical differences between both measures.
Conclusion: The range of motion (ROM) of the interphalangeal joint of the thumb obtained by measuring the angles in a photograph taken with a smartphone is similar to values obtained physically on the patient. The potential benefits include the assessment of hand patients whom cannot make it to the clinic, whether due to distance or compliance issues, and enabling completeness of data collection in studies, as hand patients are notorious for not attending clinics once they feel better. It can therefore form part of the tele-assessment of hand patients.

A-0702 Comparison between tendon interposition arthroplasty and pyrocarbon implant in thumb carpometacarpal joint arthritis at Stage III

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Thumb carpometacarpal (T-CMC) joint osteoarthritis (OA) is a well-known pathology. Many different kinds of surgical procedures were proposed, but the literature is poor in comparison outcomes between two or more of them. We did a retrospective comparative study based on two surgical options for the treatment of the Stage 3 T-CMC OA, according to Eaton-Littler staging: a modified Weilby arthroplasty and a partial hemitrapeziectomy with the implant of a pyrocarbon spacer (Pyrodisk©). From April 2007 - April 2013, our Operative Unit operated 74 patients at Stage 3 for 80 T-CMC joints: 40 of them underwent to the trapeziectomy with an APL tendon interposition arthroplasty (Group A) and 40 to implant a pyrocarbon spacer (Group B). We reviewed 35 patients of Group A and 32 of Group B. We measured pain, range of motion (ROM), strength, physical function and patient global assessment (valuated by Disabilities of the Arm, Shoulder and Hand (DASH) and MAYO wrist scores) as the outcome, according to the international review over the thumb carpometacarpal joint arthritis. Group A was composed of 34 women and 6 men with a mean age of 66 years old and a mean follow-up of 3 and one-half years; Group B by 35 women and 5 men with a mean age of 60 years and a mean follow-up of 2 years, 8 months. We statistically analysed all data applying the Student's *t*-test and the chi-squared distribution. All patients referred a relief of pain. Both groups equally preserved ROM. Group B achieved a statistically significant pinch strength recovery (p

<0.05). The DASH score was 16.9 for Group A and 14.9 for Group B. The Mayo wrist score was better for Group B (14 patients had an excellent result, 8 patients a good result and 10 patients a satisfactory result); in comparison with the Group A (7 Patients had an excellent result, 12 patients a good result, 14 patients a satisfactory result and 2 patients a poor result) and the excellent results present a statistically significant difference ($p < 0.01$). We have had few patients unsatisfied in both groups and some complications (3 FCR tendon disruptions and 1 complex regional pain syndrome in Group A; 2 spacer intolerances, 1 nerve injury and 1 spontaneous subluxation of the spacer without any related problem, in Group B). The spacer implant required a longer time of recovery. As found by Wajon et al. (2009) in a systematic review of the T-CMC OA surgical management, no procedure demonstrated a statistically significant superiority over the other in terms of pain, patient global assessment and ROM. Nevertheless, our data outlined a statistically significant superiority of the pyrocarbon spacer in pinch strength and global physical function. In our daily practice, these two elements are relevant to decide the more befitting surgical option for each patient, according to his age, need and expectations. A more complete and larger study should be done, to find out the best surgical technique for the treatment of the T-CMC OA at Stage III.

A-0703 Giant cell tumour of the trapezoid: a case report and review of the literature

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Giant cell tumour (GCT) of bone is a rare, benign tumour with some aggressive characteristics such as a high local recurrence rate. Histologically it is composed by mononucleated cells and osteoclast-like multinucleated giant cells. It has a specific predilection for age (young-adult females) and location (the meta-epiphysis of the long bones). It infrequently occurs in the hand and the few cases seen usually affect the phalanges or metacarpals. We report a rare case of GCT of the trapezoid in a young woman. Only after a long and difficult diagnostic examination of her left hand (X-rays, ultrasound scan, MRI and CT scan), the tumoral nature of the lesion was clear. We made a first intervention: curettage, phenol used as local adjuvant and autogenous bone graft, but after 5 months, a multicentric local recurrence was found. So an en bloc resection with carpal reconstruction was made. At 5 years' follow-up, the patient is disease-free and clinical function and radiographic findings remain very good. Even if the first unspecific symptoms, wrist dorsal swelling and pain, and the first imaging studies did not highlight the tumoral nature of the lesion, the operation allowed the patient to preserve her wrist and hand function. We reviewed the literature of GCTs of bone, and especially the GCTs of the hand, and investigated an adequate surgical procedure to treat this lesion.

A-0704 Arthroscopy in distal radius fractures. Do we really need it?

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Objective: The development of wrist arthroscopy has allowed the visualisation of radiocarpal joint with a minimally invasive approach and the reduction of articular fracture fragments, as well as the identification of associated intracarpal lesions. Aim of this study was to evaluate the arthroscopic findings, associated lesions (ligament and TFCC injuries) and the results of the treatment.
Methods: Twenty patients affected by distal radius fracture were treated. Arthroscopic evaluation associated to open reduction and internal fixation with volar plate in 17 cases was perfomed, while in three cases, arthroscopy was associated to percutaneous screw of pin fixation. Mean age of patients was 43 years old (range 16 - 59). All patients were reviewed at a mean follow-up of 26 months (6 - 63 months). ROM, grip, DASH and Mayo score were evaluated. Associated injuries were subdivided in two groups. Minor injuries (ligament injuries Stage I and II, TFCC tears without instability of DRUJ, minor cartilage damage), which did not need immediate surgical treatment and major injuries (ligament injuires Stages III and IV, wide chondral damage, TFCC damage with instability) which were treated simultaneously. In complex fractures, extra-articular reduction was performed first in order to reduce the main fragments and restore the normal anatomical parameters (frontal and sagittal inclination of radius, radial length, DRUJ congruity). Then the joint was assessed by arthroscopy and further intrarticular reduction of step-off and joint incongruity was performed, with associated injury identification and treatment. Surgical time was also evaluated.
Results: Arthroscopic evalutation showed a good extra-articular reduction or articular surface in 60% of cases, while arthroscopic intra-articular reduction manoevres were necessary in the remaining 40% of

patients. According to the Mayo Wrist Score, all patients had excellent results. Different types of minor injuries were found in all the patients, while major associated injuries found were SL injury in 30% of cases, treated by pinning. TFCC tears (60%) were minor tears without instability of DRUJ and were left alone.

Conclusions: Arthroscopic assistance provided a direct visualisation of the joint and thus, allowed an excellent reduction of the articular surface of the distal radius and an evaluation of associated injuries, and an immediate treatment of the most important of them. It is always necessary, in complex fractures, to associate internal fixation by plating, in order to stabilise the fracture in an optimal way and allow early mobilisation. Arthroscopy gives the opportunity of an additional evaluation of the wrist joint and to address associated lesions, but a longer operating time is needed to perform the procedure.

A-0705 Scaphoidectomy and midcarpal tenodesis (Heras-Palau Technique) in SLAC/SNAC II wrist: our experience

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In the management of advanced arthritis of the wrist, SNAC (scaphoid nonunion advanced collapse) / SLAC (scapholunate advanced collapse) II, the cartilage of the radio-scaphoid joint is damaged with integrity of the radial lunate and capitate lunate joints. The typical treatment of SLAC/SNAC II arthritis involves scaphoid excision with midcarpal fusion (four-corner arthrodesis) or proximal row carpectomy. In both, a valid joint is removed, the radial-lunate or the capitate lunate joint. Scaphoidectomy and midcarpal tenodesis (Heras-Palau tecnique) is a technique that allows to preserve unchanged the midcarpal joint, after scaphoid excision. The procedure is performed with dorsal and volar approach. Through the dorsal approach, the wrist capsule is exposed and a radial capsular flap is developed, after posterior interosseous nerve resection. A volar approach allows to remove scaphoid. A portion on flexor carpi radialis of about 10 cm is taken at the myotendinous junction. The tendon flap is passed through the space of the scaphoid and transferred dorsally. The tendon flap is passed around the capitate neck and fixed with an anchor. The flap is then passed around dorsal radiotriquetral ligament and pulled to correct DISI deformity. Postoperatively, the patients were immobilised in a splint for 6 weeks, and after 6 weeks, range of motion and strengthening exercises were started under physiotherapy supervision. From 2011 to 2014, a cohort of 24 patients was treated with this technique for SNAC /SLAC II wrist and failure of treated scaphoid nonunion. Patient were preoperatively submitted to tests and wrist diagnostic arthroscopy, to assess the condition of the radio-carpal joint and medium-carpal joint cartilage. The results showed a significant decrease in pain on exertion, according to VAS score and pain at rest was absent. Flexion /extension and pronation /supination of the wrist were unchanged, while the gripping force was increased. In cases of SLAC/SNAC II wrist and failure of treated scaphoid nonunion, the only scaphoidectomy causes a collapse of the carpal bones with the capitate that moves radially and the lunate rotates dorsally (DISI deformity). Scaphoidectomy and midcarpal tenodesis (Heras-Palau tecnique) allows to stabilise the proximal and distal carpal row after scaphoidectomy, preserving the lunate and the triquetrum and maintaining a midcarpal functional joint. The DISI deformity is corrected. This technique does not exclude the proximal row carpectomy or arthrodesis midcarpal on failure.

A-0706 Stability and pain relief after arthroscopic transosseous repair of the triangular fibrocartilage complex (TFCC)

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The TFCC stabilizes not only the ulno-carpal joint, but also the distal radio-ulnar joint (DRUJ). Injuries of the TFCC normally lead to pain and depending on the type of the lesion, to instability of the DRUJ. One important aspect of this instability is the foveal detachment of the TFCC at the base of the processus styloideus ulnae (PSU). Foveal ruptures of the TFCC are detectable during arthroscopic treatment (positive hook probe). Nakamura established one arthroscopic assisted transosseous refixation of the TFCC. From 2007 to 2013, we treated 50 patients in the manner described by Nakamura. In opposite to the common recommendation, we treated chronic (> 6 month) ruptures of the TFCC as well. We examined 40 patients with the modified Mayo-Wrist and DASH-scores and checked clinically the stability of the DRUJ. The minimal postoperative time range was 12 months. The questionnaire revealed no obvious differences between acute and chronic TFCC lesions after surgery. Almost every patient showed good stability of

the DRUJ and satisfying to good pain relief after the treatment. Regarding our results, we can recommend the arthroscopic assisted transosseous refixation of the TFCC (Nakamura's technic) as a good option in the operative treatment of acute, as well as in chronic lesions of the TFCC, and DRUJ instability.

A-0707 Barbed sutures vs. conventional tenorrhaphies in flexor tendon repair: a biomechanical study in an animal model and first results in vivo

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Objective: Recently barbed sutures have gained popularity due to the improvement in biomaterial and US Food and Drug Administration (FDA) approval. The advantages of barbed suture for tendon repair could be the elimination of the knot and the better distribution of the load throughout the tendon, reducing the bunching at the repair site.
Methods: Before starting an in vivo clinical trial, we performed a biomechanical analysis on an porcine model, to evaluate the breaking force and the repair site characteristics of a new barbed tenorrhaphy technique, compared with the conventional 4-strand technique. Sixty porcine flexor tendons were divided randomly into three groups and, after been transected, repaired with one of the following techniques: A) a new 4-strand barbed technique using 2-0 polypropylene QuillTM SRS; B) the same new 4-strand barbed technique using 2-0 PDO QuillTM SRS; and C) the conventional 4-strand technique using 3-0 non-barbed polypropylene (control group). All tendons underwent mechanical testing to assess the 2-mm gap formation force and the breaking force.
Results: No significant difference was registered in 2-mm gap formation force among the three groups (A: 42.2 N ± 12.6; B: 38.2 N ± 9.3; C: 41 N ± 11.4) neither in ultimate strength between barbed sutures with PDO (61.5 N ± 11) and the control (54.12N ± 10.9; p = 0.04), and barbed suture with polypropylene (50.3N +/- 9.9) and the control (p = 0.25). Concerning the repair-site profile, less bunching in the repair-site in the two barbed groups, compared with the control group, was recorded.
Conclusions: This study confirmed the promising results achieved in previous ex-vivo studies [1,2] concerning the use of barbed suture in flexor tendon repair. In our animal model, the tenorrhaphy with Quill TM SRS suture guarantees a tensile strength of repair that exceed 40 to 50 N suggested by Amadio [3] as sufficient to initiate early active motion, but a smoother profile of the repair site essential to reduce gliding resistance. We began a clinical trial, authorized by the ethical committee of our hospital, and the first results will be shown.

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A-0708 Thumb duplication with atypical flexor tendon insertion: Is the tendon transfer a working technique?

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Frequently we find atypical tendon insertions when we correct duplicated thumbs. Tendon realignment is mandatory to gain an upright position. The insertion of the flexor tendon can be centralised by transposing it ulnarly. But tendon sheath cannot be centralised perfectly /totally. Recurrence of radial tilt at the IP-joint level in growth is possible. We want to investigate if the upright position persists and how often a recurrence can be expected.
Patient and method: We retrospectively analysed our patients operated from 2000 to 2010, with a minimum follow-up of 3 years post-operation. They were analysed for gender, age at operation, type of duplication, position, active and passive range of motion (ROM).
Result: Over a period of 11 years, we had operated 36 children with a double thumb, showing an atypical flexor tendon insertion which was corrected by tendon transposition: 22 patients came to a follow-up, 3 - 12 years post-operation (mean 5.6 years). Mostly (n = 17) they suffered a Wassel IV duplication. Ten patients received a perfect result (straight thumb without deviation), 5 children a light deviation of 10°; 8 patients developed a clearly visible radial deviation

of 20° radial deviation or functional disturbing 30° flexion position of the IP-joint. The malposition developed between 3 - 12 years, mainly 6 years postoperation. Three patients of these underwent IP-arthrodesis for secondary correction and one is scheduled for this. The IP-joint was always stable and had mostly no, and in some cases up to 40°, of active mobility.
Conclusion: As far as our experience goes, the transposition of the flexor tendon insertion is a technique which works for straightening up the IP-joint of a doubled thumb. The impediment in growth occurred mostly around 6 years after the transposition, and it can be corrected by a straightening IP-arthrodesis.

A-0710 Investigation of relationship between activity participation and quantitative assessment methods in median and ulnar nerve repairs

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Objective: The aim of this study was to investigate the relationship between quantitative measurements and hand usage, activity and participation levels after median and ulnar nerve repairs at the forearm level.
Methods: Forty-four patients (35 male and 9 female) with median and combined median and ulnar nerve repairs were included in this study. The mean age of the patients was 34.27 ± 11.20 years. Time elapsed after the injury was 38.18 ± 18.81 months. Rosen Score was used to evaluate peripheral nerve functions. Hand usage in daily living activities and participation level were evaluated by Michigan Hand Questionnaire (MHQ).
Results: The mean RS of patients was 1.99 ± 0.44. The mean total score of MHQ was 72.33 ± 17.99. Ultrasonographic (USG) evaluation revealed a fusiform thickening in all nerves at the repair site. Also, no gap and neuroma formation were observed. There was a significant correlation between total and subdomain scores of RS and MHQ total score ($p \leqslant 0.05$).
Conclusions: Relationship between MHQ and RS found in this study supports the fact that the evaluation of peripheral nerves functions reveals information about the activity and participation of patients. Evaluation results were informative on hand usage, activity and participation level, even at the late phase of the injury, and essential occupational practices should be given to patients in light of these results.

A-0711 Comparison of static and dynamic splinting regimens for extensor tendon repairs in Zone III

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Objective: The aim of this prospective, randomised, controlled trial was to compare two methods of rehabilitating extensor tendon repairs in Zone III.
Methods: Patients who incurred simple and complete lacerations of their extensor tendons in Zone III were enrolled in the study and underwent either static splinting (n = 25) or dynamic splinting (n = 27) after primary acute repair of tendons. Extension lag, flexion deficit, total active motion (TAM), grip strength, and functional status of upper extremities were measured.
Results: TAM was improved in the dynamic group, when compared with the static group, in the injured digits at 4 weeks (p = 0.001), at 12 weeks (p = 0.05), and at 6 months (p = 0.001). Grip strength outcomes demonstrated improved grip force for the dynamic group, when compared with the static group, at 12 weeks (p = 0.001). There were no ruptures in either group. Also, a better functional level was found in the dynamic splinting group at 6 months (p = 0.001).
Conclusions: The findings of the current study suggested that dynamic splinting of complex lacerations of the extensor tendons in zone III provide improved functional outcomes at 4 and 12 weeks, and 6 months, when compared with static splinting.

A-0713 Arthroscopic ligament plication for palmar midcarpal instability

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Objective: Palmar midcarpal instability (PMCI) is a painful condition characterized by a kinematic dysfunction of the proximal carpal row (PCR). Most symptomatic PMCI patients benefit from non-operative management, which is based on splinting and proprioceptive neuromuscular rehabilitation. However, patients that do not respond to non-operative management are candidates for surgical treatment. Cases with mild to moderate symptoms may be treated with soft-tissue procedures, such as dorsal capsular reefing (Lichtman, 2006), or arthroscopic shrinkage (Mason, 2007; Lichtman, 2003). The purpose of this study was to present our results with a personal technique of arthroscopic ligament plication (ALP) for PMCI.

Methods: The technique consists of dorsal and palmar ligament plication at the radiocarpal joint. The dorsal ALP is a modification of Lichtman's dorsal capsular reefing, in which DRT and dorsal intercarpal (DIC) ligament are tightened with two stitches of strong non-resorbable sutures, instead of being divided and re-sutured as originally described. In cases showing evident carpal pronation and ulnar sag, ALP of the proximal part of the ulnar arm of the palmar arcuate ligament, i.e. palmar ulno-carpal ligaments, is also performed (an all-inside modification of the technique described by Savoie). The patient is placed in a short arm cast for 3 - 4 weeks, then an intensive proprioceptive rehabilitation program is started, including use of dynamic splinting that restricts mobility of the PCR to the plane of dart-throwing motion only, for a further 4 weeks.
Results: Seven patients (4 male and 3 female patients; aged 20 – 29 years), complaining from painful PMCI non-respondent to conservative treatment, were operated since 2008. At an average follow-up of 1.7 years, Mayo Modified Wrist score was excellent in 2 cases, good in 4 and fair in 1. Clinical complaints were relieved in all patients. All but one patient returned to heavy work. None of the patients required further surgical treatment.
Conclusions: Our results suggested that ALP may be an effective option of treatment for PMCI. On a medium term follow-up, ALP showed it can restore stability of the PCR, with the advantages of a minimally invasive procedure resulting in slight loss of motion and patient satisfaction. We suppose that restoration of stability of the PCR is due not only to the direct mechanical effect of ligament tightening, but also to a concurrent dynamic effect produced by the stimulation of the mechanoreceptors located in the DRT and DIC. The DRT and DIC are among the most innervated ligaments of the wrist, with an abundance of mechanoreceptors, including Ruffini receptors and the so-called Golgi-tendon-like organs. Both types of mechanoreceptor react to changes in tensile strain, rather than compressive forces; thus, they are in need of ligaments with normal tensile characteristics in order to function properly. In joints with increased ligament laxity, such as in PCMI wrists, the proprioceptive function is disturbed. The ALP increases mechanical stability of the PCR and is effective in reducing symptoms of PMCI also by enhancing the conscious neuromuscular control of the wrist, therefore facilitating proprioceptive re-education of the wrist.

A-0716 Scaphoidectomy and double column midcarpal arthrodesis for SLAC and SNAC Stage III

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Introduction: Midcarpal arthrodesis with scaphoidectomy is an option for the surgical treatment of SLAC and SNAC Stage III. Several methods for carpal bone arthrodesis are used, from simple K-wires to headless screws and intercarpal plates. We present our experience of this technique, according with the procedure of the two columns arthrodesis (lunocapitate and triquetrumhamate) by using the Herbert screws introduced in a proximo-distal direction.
Materials and methods: From 2001 - 2012, we treated 93 cases of SLAC and SNAC wrist Stage III°: 61 of them had midcarpal arthrodesis, according with the two-columns technique. All cases were submitted to preoperative and postoperative X-rays, clinical evaluation according with the Mayo score, and DASH and PRWE questionnaires. Arthroscopy was done in all cases, in order to obtain precise information about the condition of the joint before the open surgery.
Results: At a mean follow-up of 9 months, 34 cases (30 male and 4 female patients with a mean age of 50 years) were controlled. No complications or failures occurred. SLAC and SNAC had an equal distribution in this series (16 and 15 cases, respectively). Pain showed an important decrease from 8 to 3 (VAS scale), wrist ROM globally reduced (flexion-extension from 83 ° to 54°, while radio-ulnar deviation went from 24° to 20°); grip strength slightly improved. Mayo score showed an increase from 34 to 55. All cases showed a radiographically complete consolidation, and almost all the patients returned to their previous work in 3 months.
Conclusions: The technique of double-column midcarpal arthrodesis for SLAC, SNAC and SCAC Stage III° provided good results in term of clinical recovery, fusion of the arthrodesis, patient satisfaction and return to work.

A-0719 Preliminary results of the TACTYS implant: a new PIP prosthesis

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Introduction: Tactys implant is a new anatomic gliding articular prosthesis for PIP joint destruction.
It is a modular prosthesis with variable sizes of its four components (2 medullar stems and 2 articular surfaces). We report the preliminary results of this prosthesis, with a minimum follow-up of 2 years.

Material and methods: We operated 22 patients (17 female and 5 male patients) with a mean age of 63 years in a single centre, by two senior hand surgeons. Indications were painful and stiff PIP joint of the third finger (9 cases), fourth finger (7 cases), index (2 cases) and fifth finger (2 cases). The etiologies of joint destruction were: osteoathritis (18 cases), post-traumatic (2 cases), rheumatoid arthritis (1 case) and postinfection (1 case). All prostheses were implanted with a dorsal median transtendinous approach, with detachment of the central slip of the extensor tendon. At the end of the intervention, the central slips were reattached to the base of the second phalanx, in 2 cases. Active and passive mobilisation in flexion and extension were performed immediately postoperation, with a protective splint, for 2 weeks. All patients were evaluated (pain, motion, strength, function and X-rays), with a mean follow-up of 34 months (24 - 50 months).
Results: Pain decreased from 6.5 preoperatively, to 1.9 postoperatively, on a VAS scale. Flexion-extension range of motion (ROM) increased from 39° in preop to 58° in postop. Ulnar clinodactylia was 14° in 14 cases in preop. In postop, clinodactylia remained in 2 patients, respectively, at 2° and 4°. Grip strength was 21 kilos in preop and 26 kilos in postop. Pinch strength was 3 kilos in preop and 5 kilos in postop. Functional autoquestionaire scores, QuickDash and PRWE (hand), were 52.15 and 51.33. These were, respectively, 22.52 and 18.20 at the last follow-up. Patient satisfaction was: 8 high, 9 good and 4 fair. Four patients were reoperated on. In three cases for dorsal tenoarthrolysis and in one case, for a palmar osteophyte removal. Swan neck deformity was seen in 4 cases in postop. There were no infections, no instability. All implants remained in place at the last follow-up.
On X-rays, there were no migrations and no loosening of the implants.
Discussion: The modularity of the prosthesis seemed to be the great advantage of this implant. It helped to match the anatomy of the phalanx to the surfaces of the joint for each patient. More importantly, balance of the periarticular soft tissues can be restored properly with this prosthesis.
Conclusion: The Tactys prosthesis was a reliable alternative to other conventional PIP implants.

A-0720 Improving elbow flexion after upper brachial plexus injuries, using the Oberlin nerve transfer: results from Norway

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Introduction: Upper brachial plexus injuries involves the motor axons of the musculocutaneous nerve. The result is a loss of active elbow flexion. Earlier our only treatment option was primary exploration and reconstruction of the upper plexus, by means of resection and nerve grafting from viable nerve roots. If the patients didn't regain elbow flexion after reconstruction of the upper plexus, the treatment option was limited to secondary procedures, like the Steindler procedure. In the last 20 years, nerve transfers have become more and more common, and the results are shown to be good. Oberlin described the nerve transfer of the FCU fascicle (the ulnar nerve) to the biceps motor branch (the musculocutaneous nerve), in 1994. Later the method was modified to include the FCR fascicle (the median nerve) to the brachialis motor branch (the musculocutaneous nerve). This is now a good option, as a primary or secondary procedure, to regain active elbow flexion. In our department, we started to use this procedure in 2008, and we want to present the results of our first 9 patients.
Materials and methods: We retrospectively identified all patients treated with Oberlin or modified Oberlin nerve transfer at our department. We identified 9 patients. Seven were treated with modified Oberlin, and two were treated with the original Oberlin procedure (three female patients and six male). Four patients had brachial plexus birth palsy, and five, traumatic brachial plexus injuries. Age when operated: 19 years (range, 11 months - 55 years). Delay from injury to surgery was 13 months (6 - 27 months). Follow-up was a minimum of 16 months.
Results: Eight patients achieved 90˚ or more active elbow flexion against gravity. One patient has not yet had any recovery of elbow flexion. All patients are planned for re-examination in the spring of 2015, to re-evaluate the results after a longer follow-up, and to register accurate AROM and BMRC grade.
Conclusion: Our results using the Oberlin/modified Oberlin procedure seems to be comparable with results from other plexus centres around the world.

A-0721 Minimally-invasive plate osteosynthesis (MIPO) and the lesions found in the sparing technique pronator quadratus muscle: a study in cadaver distal forearms

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Objective: Regarding the MIPO (minimally invasive plate osteosynthesis) for distal radius fractures, few

studies show the possible injuries that can occur during the surgical approach of sparing the pronator quadratus muscle (PQ): the objective of this research was to identify these injuries and incidents involving the vascular structures, neural and pronator quadratus muscle, to better assess the safety of the technique. The importance of preserving this muscle is due to the fact that this is considered the primary engine for forearm pronation movement, and a dynamic stabilizer of the distal radioulnar joint, and it isolates the implant flexor tendon adhesions and avoids injuries.
Methods: The use of MIPO technique with the volar distal radio fixation and to preserve PQ muscle was performed in 28 forearms of 28 specimens of fresh cadaveric; 19 were male and 9 female bodies. The surgical technique was described by Imatani (2005), during the plate insertion procedure used a device (guide) specifically developed to direct the positioning of the same in the absence of fluoroscopy. After the fixation of the plate and its removal, a macroscopic analysis of the structures involved was made and documented by photographs.
Results: The neurovascular bundle anterior interosseous and its branches remained intact. In 13 of 28 cases, validated specimens were observed PQ muscle injury. This consisted of partial detachment lesions of the radial side edge by 28%, and laceration of the muscle belly at 34%. The PQ muscle was found under the plate part 10 specimens (36%). The plate was considered well placed in 22 cases (79%), poorly so in 5 cases (18%) and in one case, it was not possible to determine its position. Muscle lesions found were not statistically correlated with gender.
Conclusions: The study demonstrated that the technique was safe for preservation of anatomical structures of the neurovascular bundle, anterior interosseous and its branches.

A-0725 A case of SCAC wrist with severe median nerve compression

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Objective: This case presentation illustrates SCAC and the well-recognised complication of median nerve compression. The treatment options for SCAC are discussed and the rationale for each explored. The treatment chosen in this patient is justified, based on functional requirements and personal demands.
Methods: A literature review of SCAC was conducted and is presented. A single patient's history, examination, radiology and treatment was outlined and short-term follow-up is presented.
Results: A proximal row carpectomy (PRC) and radiocapitate pyrocarbon implant (RCPI) were employed. The neurological improvement, increased range of motion (ROM) and other parameters are presented. Improvement was evident in the short term.
Conclusion: SCAC wrist is a well-defined entity. Operative intervention is warranted in cases of neurological compromise and for other reasons such as pain. Numerous treatment options are available, including PRC and RCPI, which this patient had. PRC and RCPI was a valid option to relieve nerve compression and improve ROM. Short term results are favourable.

A-0726 Post-traumatic sequelae after operative treatment of distal radius fracture

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Objective: Complex post-traumatic sequelae of the wrist often affect different joints at the wrist with additional neurovegetative dysfunction. Which procedures, in what order and in how many surgical interventions should the different problems be addressed to restore an acceptable wrist function? Is a 'simple procedure' or a 'surgically challenging procedure' superior, concerning the outcome?
Methods: Case report: A 38 year old man presented 4 months after operative treatment of a distal radius fracture. Symptoms were limited wrist movement with loss of pronosupination, clinical signs of CRPS with neuropathic pain of the superficial branch of the radial nerve at a former pin site. Radiographs and computed tomography (CT) revealed radiocarpal destruction with intraarticular screw placement, radial shortening with resulting ulnocarpal impaction, and distal radioulnar joint incongruency. After discussion with different experts, most agreed on an arthrodesis of the radiocarpal joint, whereas the treatment options concerning the distal radioulnar and ulnocarpal joint were more at issue. Our plan was to address the expected radial nerve neuroma with removal of the metal, performing a shortened radioscapholulnate arthrodesis with bone graft, and decide intraoperatively based on the findings, how to

address the distal radial ulnar joint: with a partial head replacement, total head replacement or a Sauvé Kapandji procedure, in a second step. The intraoperative findings were a low-grade infection with melted distal radius and proximal scaphoid and lunate. As expected, the superficial radial nerve was lacerated with a neuroma in continuity. The neuroma was excised and the gap bridged with an avance nerve graft. After extensive debridement, a gentamycin cement spacer was implanted at the radiocarpal joint. The infection was treated according to the specialists for infectious diseases, with a high dose intravenous antibiotics for 2 weeks. In a second step, we performed a radioscapholunate arthrodesis with a free vascularized bone graft from the medial femoral condyle and an ulnar head replacement. After immobilisation for 4 weeks, pronosupination was trained with a static supination brace and intensive hand therapy.

Results: At 1 year after the final surgery, the patient had subjectively and objectively good hand function, with an acceptable ROM and grip strength of the wrist, that allowed him to return to his former work as a postman. The radioscapholunate arthrodesis was consolidated. He had no neuropathic pain nor persisting CRPS symptoms.

Conclusions: It is necessary to discuss the treatment of complex posttraumatic sequelae of the wrist with different experienced surgeons, to broaden the mind for surgical options and alternatives. Intraoperative findings may require changes concerning the planned procedure. Our patient benefitted from the interdisciplinary treatment and by keeping the number of surgical interventions to the wrist to the minimum. The more challenging vascularised bone led to consolidation; however, it remained unclear if a classic iliac crest bone graft had provided the same result. Early rehabilitation is essential.

A-0731 Arthroscopic resection arthroplasty of CMC-1 arthritis

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Objective: While arthroscopic resection arthroplasty (ARA) for thumb basal joint arthritis (BJA) is gaining popularity, comprehensive use for all cases has not been generally adopted. The authors present a series of patients with BJA, whereby all patients presenting with primary disease were treated with ARA. The purpose of this study was to document the utility and long-term results of ARA for thumb BJA.

Methods: The senior author developed a data registry system to prospectively enroll consenting patients scheduled to undergo ARA for BJA of the thumb. IRB approval and signed consents were obtained. Thus, 178 cases underwent ARA for thumb carpometacarpal (CMC) osteoarthritis (OA), between 2004 - 2011. Patients were excluded if they had $\leqslant$ 1 year of follow-up or underwent significant concomitant surgeries that would obscure evaluating the variables of interest. This left 136 cases: 12 of these had significant instability and underwent arthroscopic stabilisation, using tendon graft or a suture button implant (CMC Cable FIX™, Instratek, Houston, TX) at the time of ARA, 84 patients had isolated CMC ARA and 41 underwent ARA of both CMC and the scaphotrapezeotrapezoid (STT), for pantrapezial disease. Subjective and objective data were collected preoperatively and at postoperative intervals of 1, 3, 6 and 12 months, and annually thereafter, by an occupational hand therapist. Pain, rated 0 to 0 (0 = none, 10 = worst imaginable), and satisfaction, rated 1 to 5 (1 = very dissatisfied, 5 = very satisfied), were recorded at each postoperative visit. Surgical Technique: Thumb fingertrap traction was used. The 1R and 1U portals were used for CMC arthroscopy. A 2.7 mm 30° arthroscope is preferentially used. When indicated, STT arthroscopy was performed through portals placed 1 cm proximal to the portals described for CMC arthroscopy. The portals were localised with hypodermic needles, under fluoroscopy. There was 2 - 3 mm of bone resected from both sides of the joint. Arthroscopic denervation was performed using an ablater (SERFAS Energy Probe, Stryker, Kalamazoo, MI), as previously described.

Results: Mean follow-up was 6.5 years (range 4 - 10). There were 106 (78%) women and 30 (22%) men. Their mean age was 60 years (range 35 - 83). The dominant side was involved in 71 (52%) cases. Pain improved from a mean of 6.41 (range 2 - 10) preoperatively, to 1.03 (0 - 6) postoperatively. Key pinch improved from 4.64 kg (0 - 17) preoperatively to 6.36 kg (0 - 12) postoperatively. Grip improved from 20.50 kg (0 - 39) to 24.39 kg (3 - 52). Mean final satisfaction was 4.52 (range 1 - 5). There were 6 (4.4%) failures.

Conclusions:

- All patients presenting to our hand practice with thumb BJA were effectively treated using arthroscopic means; and
- The results of this study demonstrated that ARA for thumb BJA yields excellent results that were sustained at long-term follow-up.

Reference:

1. Cobb et al. Am J Hand Surg. 2011; 36: 413-9.

A-0732 Arthroscopic partial scafoid resection for STT arthritis

L Pegoli

A-0733 Arthroscopic trapezio-trapezoidal resection for STT arthritis

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Objective: The most common treatment for scaphotrapeziotrapezoid joint (STT) arthritis is scaphoid resection arthroplasty, with or without prosthetic interposition; however, even the arthroscopic approach, though being a technically demanding procedure, still shows a considerable amount of unsatisfactory results related to the progression of DISI carpal malalignment. In order to overcome these drawbacks and reduce ligamentous damage around the STT joint, we developed an arthroscopic technique of distal STT resection arthroplasty (d-STT/RA) that consists of resection of the trapezium and trapezoid at the STT joint.
Methods: The d-STT/RA technique was used in 12 cases (1 bilateral), from 2009 to 2013. Average age was 62 years (range 32 - 73). There were two male and nine female patients. The technique was performed using MCR and STT portals, with standard setup for midcarpal arthroscopy. After extensive synovectomy and osteophyte resection, a 3 - 4 mm resection was performed using a motorized burr, to expose the subchondral, still sparing the ligamentous attachments on the distal aspect of the STT. Patients were evaluated for wrist range of motion (ROM), pain (10-point Visual Analogue Scale (VAS) score), grip and pinch strength, MMWS, and DISI evolution. Subjective outcome was investigated with Quick Disabilities of the Arm, Shoulder and Hand (QuickDASH) and PRWHE.
Results: After a mean follow-up of 2.7 yrs, all patients reported a functional improvement of their hand. ROM was 96% of the contralateral side. Mean pain VAS score was 3 (occasional pain in 3 cases). Grip and pinch strength accounted for 85% and 90% of the contralateral side, respectively. MMWS was excellent in10 patients (including bilateral) and fair in one patient. DISI increased in nine patients, though less than 10°, and was not related to any clinical impairement. The Q-DASH and PRWHE scored 27.8% and 5 %, respectively. Transient irritation of the dorsal branch of the radialis was observed in two cases.
Conclusions: The d-STT/RA technique was shown to be a valuable option to relieve symptoms and restore normal hand function in STT arthritis. The arthroscopy overcomes the difficulties of an open approach, so that the resection of the trapezium and trapezoid is an easier and faster procedure, compared to distal scaphoid resection. Early results are encouraging, though larger series with longer long-term follow-up are needed.

A-0734 Arthroscopic resection of wrist ganglion

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Introduction: Dorsal and volar wrist ganglia can be resected by arthroscopic surgery.
Recent works show this technique produces better results than traditional surgery, also conferring a great aesthetic appearance. Our experience on dorsal and volar wrist ganglia resection is reported.
Materials and methods: From 1995 to today, 103 cases (87 dorsal and 16 volar ganglia, respectively) were operated by a single surgeon. The mere presence of a ganglion was not considered sufficient for the surgical treatment. Indication for arthroscopic surgery was given on the basis of the presence of pain. Bulky ganglion has not been operated in arthroscopy. Patients were evaluated pre- and post-operatively, with an objective method (Mayo wrist score) and by the use of Disabilities of the Arm, Shoulder and Hand (DASH) and PRWE questionnaires. All patients carried out an instrumental investigation before surgery: ultrasound or magnetic resonance imaging (MRI) of the wrist, always confirming the presence of the ganglia. Radio-carpal (1-2, 3-4, 6R) and mid-carpal (MCR and MCU) portals were used. The palmar radio-carpal portal was used specifically for the volar ganglia. Dry arthroscopy was always used and duration of the surgery was almost 30 minutes. The resection of the stalk has been the major objective in the dorsal ganglia, followed by the posterior capsular wall and the ganglia. In order to completely remove the origin of the ganglion stalk, part of the reflection of the capsule to the scapho-lunate (SL) ligamentous complex was excised and a minimal debridment of the SL ligament was performed. Rarely, a direct access to the cysts was used. Volar ganglia were resected by direct access, using the 1-2, 3-4 and volar radio carpal portal. Particular attention was paid in the evaluation of the volar capsular reflexion and volar part of the SL ligament, in order to visualise and resect the ganglia stalks. Moderate pressure dressing over the seat of the cyst removed was adopted, with immobilisation of the wrist for 15 - 20

days, in relation to the size of the cyst. The rehabilitation of the wrist began after 20 days and ended with the complete recovery of the motility of the wrist and the disappearance of scar disturbances.
Results: We have had no major complications. Patients were followed directly for almost 3 months. Recurrences were 8% for the dorsal ganglia and only eight patients were reoperated: four had arthroscopy and eight, open surgery. Recurrences for the volar ganglia were two. Painful sensation to the dorsal wrist was reported in most patients: it reduced the wrist flexion for > 2 months. Specific rehabilitation treatment of the painfull deep scar, allowing to reduce the discomfort, and wrist motility recovered in a short time.
Conclusions: The arthroscopy allows removal of the dorsal and volar wrist ganglia in a rational and efficient manner. Our patients were satisfied with the results in 92% of cases for the dorsal and in 99% for the volar wrist ganglia.

A-0736 Role of DCSS and arthroscopic capsulodesis for SL instability

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Objective: The carpal interosseus ligaments are important stabilizers in the wrist; however, their load bearing is not sufficient to sustain all forces. Therefore, several secondary stabilizers are needed to avoid a dissociation of these carpal bones. Regarding the stability of the scapholunate joint, several structures beside the interosseus ligaments were hypothesized to play a role in that mechanism. The first group of ligaments were the palmar STT ligaments, which may avoid flexion of the scaphoid. In the second group, the dorsal ligaments were implied. The most important ones are the dorsal intercarpal ligament (DIC) and the dorsal radiocapitate ligament (DRCL). Short et al. (2007) and Elsaidi et al. (2004) showed that the palmar ligaments, such as RCS, LRL and SRL have only minor stabilising effects for the whole complex, but may be important for anterior stability.
Methods: In parallel to these studies, several surgeons have tried by open or arthroscopic techniques to suture interosseus ligaments or perform capsuloplasties. As the interosseus ligaments are little vascularised, their healing potential is low. Once approximated correctly, the two ruptured ligaments stump, and they may heal as we have learned, from simple pinning. Unfortunately, this procedure has not given stable results. Others have tried by open surgery to repair the dorsal capsule or perform capsulodesis, which should act as a secondary stabilizer. The operative technique consists generally in opening the dorsal capsule, in realigning the bones, and then refixing the dorsal capsule to stabilise the whole situation. Unfortunately, even these procedures have not given stable results. Other surgeons have tried, mostly by arthroscopic means, to suture mostly the dorsal remnants of the ruptured interosseus ligament. Knowing the failure of the classical open procedures, this technique didn't seem very promising at the beginning. Astonishingly, the results were quite stable and at least as good as those produced by former surgeries.
Results: The explanation for the stabilising effect of this arthroscopic procedure lies mainly in the effect, that the authors have recognized, of the importance of the dorsal capsuloscapholunate septum (DCSS). This septum, in fact, is the dorsal attachment of the wrist capsule to the global dorsal wrist bones, forming the division of the radiocarpal and midcarpal joint. This septum than is continued into the intercarpal ligaments. By suturing together these septal attachments, the realignment of the bones can be performed, the remnants of the ligaments can be brought together and the dorsal capsule can be reattached. Therefore, the 3-dimensional structure can scar, heal and restore its function, at least partially.
Conclusions: If this hypothesis would be true, there is no real need to suture the interosseus ligament, but it would be sufficient to suture the remnant attachments of the DCSS. To us, this seemed a more logical explanation for the success of this arthroscopic procedure, rather than the suture of those remnants. This is especially true when the scapholunate ligament disruptures from the bone, instead of rupturing in the middle of the interosseus ligament. This hypothesis is also maybe supported by the fact that in open surgery, capsulodesis in the past has almost ever foreseen to detach completely the dorsal capsule from the scaphoid and from the lunate, and so potentially augmented the instability of the situation.

A-0739 Arthroscopic Bone-ligament-bone for SL instability

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Objective: The treatment of scapholunate (S-L) dissociation is a challenging problem. The surgical strategy depends on chronologic and anatomical

factors. The trophic condition of the S-L ligament is strictly correlated to the time between the trauma and diagnosis. The wrist's condition (presence of arthrosis and anatomical congruence) and the characteristic of the instability (possible reduction of the DISI and the rotatory subluxation of the scaphoid), must be evaluated before performing any surgical procedures. In the literature, there are different and various techniques of reconstruction of the S-L ligament to perform, but all techniques have some complications where the stiffness is often present, despite a perfect reconstruction of the ligament. From the experiences of open surgery of the wrist, a new idea formed to convert the bone-ligament-bone reconstruction of the S-L ligament in the arthroscopic method.
Methods: The concept of a biologic surgery and mini-invasive surgery thrust us into finding a new method of the reconstruction of S-L ligament, with the conviction that the preservation of the vascularisation and the proprioceptive innervation of the wrist would improve outcomes. We present the new, personal and reproducibile technique using bone-ligament-bone graft by arthroscopic method.
Results: On the basis of our preliminary experience, with 20 cases treated and with a minimum folluw-up of 1 year, the advantages are undeniable. The results were assessed with the use of pre- and post-operative clinical and radiographic studies, and measurements of active and passive range of motion (preoperative average extension 59.9; postoperative, 61.7; preoperative average flexion 63.2; postoperative, 55.4), grip strength, pulp and key pinch strength (preoperative 13.95 Kg; postoperative 19.98) and a validated functional test (PHWRL preoperative score 56.25; postoperative score 22.6).
Conclusions: These results thrust us into an optimistic judgement of this new technical possibility.

A-0741 Comparison of arthroscopic and vascularized medial femoral condyle bone graft for nonunions of the scaphoid with 'humpback deformity'

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Objective: To compare the outcome of arthroscopic bone graft (ABF) and vascularised medial femoral bone graft (VMFBG) in the treatment of nonunion of the scaphoid, with a 'humpback deformity'.
Methods: Retrospective study recording age, range of motion (ROM), operation time and time to scaphoid union. Scaphoid union was determined by the presence of trabecular bridging on computed tomography (CT) imaging at the bone graft site. Surgical Technique: In both ABG and VMFBG, the scaphoid nonunion was excised to trabecular bone, the DISI deformity corrected, the flexion deformity of the scaphoid corrected and internally fixed. Different fixation techniques were used and included K-wires, screws, K-wires and screws, and K-wires with an 'exchange screw'.
Results: There were eight VMFBG, with a follow-up of 2 years and 7 months; and 18 ABG, with a follow-up of 2 years and 2 months. There were additionally four ABG cases, which had united but were excluded, because they could not return the range of motion (ROM) measurements. All VMFBG united. One ABG of a nonunion of the proximal pole did not unite. This united with double screw open fixation and cancellous bone graft, performed with a dorsal approach. The mean time to union for both ABG and VMFBG was 4 months. There was a slightly greater ROM for the ABG, but this was not statistically significant. (ABG 57° palmar flexion and 61° dorsiflexion; VMFBG 46° palmar flexion and 56° dorsiflexion). ABG had a shorter operating time. The mean tourniquet time for ABG was 45 minutes and for VMFBG, 1 hour 30 minutes.
Conclusion: ABG had a shorter operating time, same time to scaphoid bone graft union and same post-operative ROM, when compared to VMFBG.

A-0742 Arthroscopic management of scaphoid nonunion without bone graft

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Introduction: The management of scaphoid nonunion still remains controversial, with a reported failure rate up to 40% and absence of a gold standard of treatment. Based on the new concepts of the potential osteogenic capacity of the nonunion cells, the encouraging results generated by increasing vascularisation within the metaphyseal radius and ulna decompression used in the treatment of Kienbock's disease, as well as the advantages of minimal surgical trauma using percutaneous and arthroscopic techniques, we proposed to do an arthroscopic-assisted reduction and internal fixation (AASSIF) without bone grafting, and core decompression of the distal radius to treat scaphoid nonunions, in advanced stages and significant bone loss.
Material and methods: We evaluated retrospectively 38 patients with scaphoid nonunions treated prospectively by AASSIF without bone graft. Their average age

was 30.81 years. The right side was affected in 24 patients, and 78.9% corresponded to the dominant extremity. The mean time from injury to surgery was 21.43 months. The nonunions were grouped according to the Slade-Dodds classification.

Results: Scaphoid union was obtained in 35 patients. Three patients, who failed to heal, required a new surgical procedure 8 months later. In cystic nonunions, the bone defect was filled with neighboring new bone formation at the non-union site, even in cases where the cyst exceeded 10 mm. The biological effect of the metaphyseal decompression characterised by an increased hyperemia over the radial column was demonstrated with the SPECT studies. The visual analog scale (VAS) score showed an average of 1.04 (0 - 2) for postoperative pain. The average postoperative range of function was 65.3° extension (range 46 - 88) 69.2° flexion (range 55 - 88) 10.7° radial deviation (range 5 - 20) and 26° ulnar deviation (range 20 - 37°). The average Mayo score was 95.

Conclusion: We recommend arthroscopic assisted internal fixation treatment, without bone grafting and core decompression of the distal radius, for young or middle-aged non-smoking patients, without prior wrist surgeries, in the case of scaphoid nonunions, including if in a cystic stage or with humpback deformity. The method is not recommended for nonunions with significant sclerosis of the edge at the nonunion site nor in those with a very small proximal fragment, in which a solid screw fixation would be questionable.

A-0743 Arthroscopic management of radioscaphoid osteoarthritis

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Objective: Arthroscopy of the wrist takes a greater place in the arsenal of treatment of wrist disorders. The authors asked the question: Is it possible to manage radioscaphoid osteoarthritis (RSOA) with an arthroscopic approach? And what kind of procedure can be 'translated' from classic treatment to arthroscopic management?

Methods: Wrist arthroscopy is now a well-described and accepted method for the treatment of several disorders of the wrist joints. The management of RSOA associates total wrist arthrodesis, total wrist denervation, partial wrist arthrodesis, proximal row carpectomy, styloidectomy and interposition arthroplasty. For instance, the partial wrist arthrodesis, the styloidectomy, and the interposition arthroplasty can be considered as the only solution which can be managed under arthroscopy for the treatment of RSOA. The authors present the method of treatment and the first results of these nonconventional methods of management of RSOA. Between 2010 and February 2015, we operated 60 patients for RSOA with an arthroscopic procedure. The follow-up was 13 months (1 - 50 months). The treatment was managed under outpatient surgery; tourniquet and loco-regional anesthesia. The entire patient set had a SLAC or a SNAC Stage I, II or III before surgery; and 40 were male. Large scaphoidectomy with interposition arthroplasty was use in 35 cases, partial intra-carpal arthrodesis in 15 cases and there were 10 cases of patients receiving styloidectomy.

Results: The functional result was at least as good as with a classic procedure. The pain relief was comparable, too. Styloidectomy was the easiest solution, with less important morbidity. The number of complication was very low: one CRPS, one radial nerve partial palsy, one de Qervain tendinitis. The interposition arthroplasty had a simpler follow-up than the partial arthrodesis. The strength recovery is faster with arthroscopy, but the final result is the same.

Conclusion: The arthroscopic management of RSOA is possible and well-described now. Three types of management are possible: styloidectomy, large styloidectomy with interposition arthroplasty, and partial arthrodesis. A fast recovery period is the most important advantage of this kind of management. A low rate of post-operative complications is another advantage.