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Ten-Year Follow-Up: Collagenase Injection Versus Open Surgery for Dupuytren's Disease

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Abstract

Background: Dupuytren's disease (DD) is a fibroproliferative disorder of the palmar fascia that results in progressive digital flexion contractures. Various treatment strategies have been developed to restore extension, ranging from minimally invasive collagenase clostridium histolyticum (CCH) injection to more invasive surgical procedures such as open selective aponeurectomy. While CCH has gained widespread adoption due to its limited invasiveness and rapid recovery, questions remain about its long-term durability compared with open surgery (OS). This study aims to compare long-term outcomes of CCH injection and OS in patients with stage 2 or higher single-digit DD, focusing on recurrence, patient satisfaction, complications, and return to work at least 10 years after treatment. Methods: A retrospective cohort study was conducted on patients treated in 2012 with either CCH injection or OS. All patients had at least stage 2 DD and at least 10 years of follow-up. The primary outcome was to compare recurrence rates between the two patient cohorts. Secondary outcomes included visual analogue scale (VAS) satisfaction, Michigan Hand Questionnaire (MHQ) scores, complications, and time to return to work. Results: A total of 97 patients completed 10-year follow-up (60 OS, 37 CCH). Recurrence at 7 years was relatively similar between groups. However, a pronounced divergence emerged between 7 and 10 years. At 10 years, recurrence occurred in 10 patients in the OS group versus 15 in the CCH group, with statistically significant differences overall (p = 0.0175) and particularly in the PIP subgroup (p = 0.0041). VAS satisfaction at 10 years was higher after OS (7.9 $\pm$ 1.5) than after CCH (6.4 $\pm$ 1.6), and return to work was significantly faster after CCH. MHQ scores were comparable. Conclusion: Both treatments provided acceptable patient satisfaction at 10 years; however, OS yielded better long-term recurrence rates and fewer complications. Although CCH offers rapid recovery, its durability beyond 7 years appears markedly inferior. These findings reinforce the need for careful patient selection and long-term counseling when considering minimally invasive treatment.

Keywords: Dupuytren's disease; collagenase clostridium histolyticum; open selective aponeurectomy; recurrence; long-term outcomes; hand surgery

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1. Introduction

Dupuytren's disease (DD), or palmar fibromatosis, is a chronic fibroproliferative disorder of the palmar and digital fascia. It results from the pathological proliferation of myofibroblasts and the excessive deposition of type III collagen within the pretendinous bands, leading to the progressive formation of nodules and cords. As these cords shorten and thicken, affected digits develop flexion contractures that may impair hand function and compromise activities of daily living. Although its precise pathogenesis remains incompletely understood, DD is strongly associated with genetic predisposition and is more common in men. Environmental and behavioral factors such as diabetes mellitus, manual labor, smoking, and alcohol consumption have also been implicated [1].

Multiple treatment modalities exist, each with unique advantages and limitations [2]. Open surgery (OS), such as open selective aponeurectomy, remains the benchmark surgical approach, offering the potential to excise diseased fascia and achieve durable contracture correction. However, OS requires an operative setting, carries risks of wound-related complications, and necessitates a longer recovery compared with minimally invasive alternatives [3]. Among these alternatives, collagenase clostridium histolyticum (CCH) injection has gained prominence since its introduction in the early 21st century. CCH enzymatically disrupts the pathological collagen within Dupuytren cords, allowing passive extension the following day to rupture the weakened cord. This technique offers minimal invasiveness and rapid functional recovery [4–8]. Despite these advantages, concerns persist about the long-term efficacy of CCH, particularly regarding relatively high recurrence rates at the proximal interphalangeal (PIP) joint [9].

Although the collagenase formulation previously used in Europe for Dupuytren's disease is no longer commercially available for therapeutic use [10], numerous research initiatives are actively exploring new enzymatic options that can replicate or improve upon its effects [11,12]. As a result, the role of collagenase in the minimally invasive management of Dupuytren's disease remains a highly relevant clinical issue.

Therefore, the present study aims to provide a direct 10-year comparison between CCH and OS in a homogeneous cohort of stage 2 or higher single-digit DD. Using the standardized recurrence definition proposed by Felici et al. [13], this study evaluates recurrence, patient satisfaction, complications, return-to-work times, and functional outcomes. Of particular interest is the evolution of recurrence between 7 and 10 years, an interval rarely examined in the literature but potentially critical for understanding the relative durability of minimally invasive versus surgical treatment.

2. Materials and Methods

This retrospective cohort study included all patients treated in 2012 for single-digit DD with either CCH injection or OS in our department, the techniques routinely used to treat single-digit Dupuytren's disease, with a minimum follow-up of 10 years. All patients fulfilled the inclusion criteria of stage 2 or higher disease, involvement of a single digit, and completion of long-term follow-up evaluations at 7 years [14] and 10 years [15]. Patients were excluded if they were pregnant or breastfeeding, undergoing treatment for other conditions of the affected hand, receiving antiplatelet or anticoagulant therapy, or presenting psychiatric disorders affecting compliance. The study was approved by the local Ethics Committee (Protocol number P/488-857-872-1041-1113/CE/2012).

The surgeon decided to treat the patient with OS or CCH after a thorough discussion of the available options with the patient, including a clear explanation of the respective advantages and disadvantages of each technique. The decision-making process primarily took into account the patient's age, occupational demands and need for an early return to work, as well as the aggressiveness of the disease. Needle fasciotomy was not proposed

as a treatment option, as it is not routinely performed by all surgeons within our unit. All procedures in both groups were performed by senior hand surgeons within the same unit following standardized institutional protocols. The surgical technique for open selective aponeurectomy was consistent across surgeons and adhered to the same principles of limited fasciectomy, with preservation of neurovascular bundles. Similarly, CCH injections were performed according to the same standardized protocol regarding injection site, dosage, manipulation technique, and splinting regimen. No relevant variations in technique occurred during the study period.

Post-treatment management was standardized for both groups. All patients followed the same rehabilitation protocol consisting of hand therapy as indicated without any thermoplastic splinting. No additional adjuvant treatments (e.g., steroid injections, repeat collagenase injections, or secondary surgical procedures) were performed before recurrence was detected.

The primary outcome was recurrence, defined according to the Felici consensus: a >20° increase in passive extension deficit between the 12-week and long-term assessments, combined with a palpable cord. Secondary outcomes included satisfaction measured with a VAS (0–10), clinical outcomes measured with the Michigan Hand Questionnaire (MHQ) [16], documented complications, and time to return to work as self-reported by patients.

Baseline characteristics between the OS and CCH groups were compared to assess potential selection bias related to the retrospective design. Age, sex, disease stage, joint involvement (MCP vs. PIP), baseline contracture severity, presence of Hueston diathesis, and dominant hand involvement were analyzed. Given the known influence of joint involvement and baseline severity on recurrence, all outcome analyses were predefined to be stratified by MCP and PIP joints and interpreted in light of baseline disease stage and contracture degree.

Statistical analyses were performed using Student's *t*-test for continuous variables and chi-square test for categorical variables and the relation between complications and recurrences, with significance set at $\alpha = 0.05$.

3. Results

3.1. Demographic Characteristics

In 2012, a total of 109 patients met the inclusion criteria and were treated in our unit: 64 with open surgery (OS) and 45 with collagenase clostridium histolyticum (CCH). During follow-up, 4 patients in the OS group and 8 in the CCH group were lost to follow-up before the 7-year evaluation. No patients were lost between the 7-year and the 10-year assessments. Therefore, the final cohort analyzed at 10 years consisted of 60 OS patients and 37 CCH patients who completed the entire follow-up protocol.

Baseline characteristics of the two cohorts are summarized in Table 1. No statistically significant differences were observed between patients treated with OS and those treated with CCH in terms of age, sex distribution, joint involvement, baseline contracture severity, Hueston diathesis, or dominant hand involvement.

Although a higher proportion of stage 2 disease was present in the CCH group and stage 3–4 disease in the OS group, these differences did not reach statistical significance. Importantly, baseline MCP and PIP contracture degrees were comparable between groups.

These findings indicate that the two cohorts were broadly comparable at baseline, allowing meaningful long-term comparison of outcomes while accounting for joint involvement and disease severity.

Table 1. Baseline characteristics of patients treated with OS and CCH in 2012.

Variable	OS (*n* = 60)	CCH (*n* = 37)	*p*-Value
Mean age, years (SD)	64.8 (8.1)	65.8 (7.1)	0.54
Male sex, *n* (%)	50 (83%)	33 (89%)	0.48
Stage 2 DD, *n* (%)	44 (73%)	33 (89%)	0.06
Stage 3 DD, *n* (%)	13 (22%)	4 (11%)	0.18
Stage 4 DD, *n* (%)	3 (5%)	0	0.27
MCP involvement, *n* (%)	49 (82%)	31 (84%)	0.81
PIP involvement, *n* (%)	11 (18%)	6 (16%)	0.81
Mean baseline MCP contracture ° (SD)	73 (18)	72 (14)	0.79
Mean baseline PIP contracture ° (SD)	119 (22)	110 (16)	0.29
Hueston diathesis, *n* (%)	5 (8%)	3 (8%)	0.99
Dominant hand affected, *n* (%)	41 (68%)	23 (62%)	0.53

3.2. Recurrence at 7 Years

At the 7-year evaluation, recurrence occurred in 8 of the 60 OS-treated patients, including 5 in MCP joints and 3 in PIP joints. In contrast, recurrence occurred in only 2 of the 37 CCH-treated patients, one at an MCP joint and one at a PIP joint. Statistical analysis revealed no significant difference in recurrence between the two groups overall ($p = 0.1724$). Similarly, subgroup analyses showed no significant differences between treatments for either MCP ($p = 0.3683$) or PIP joints ($p = 1.0$). These findings indicate that recurrence rates in the medium term were broadly comparable across both treatment modalities (Figure 1).

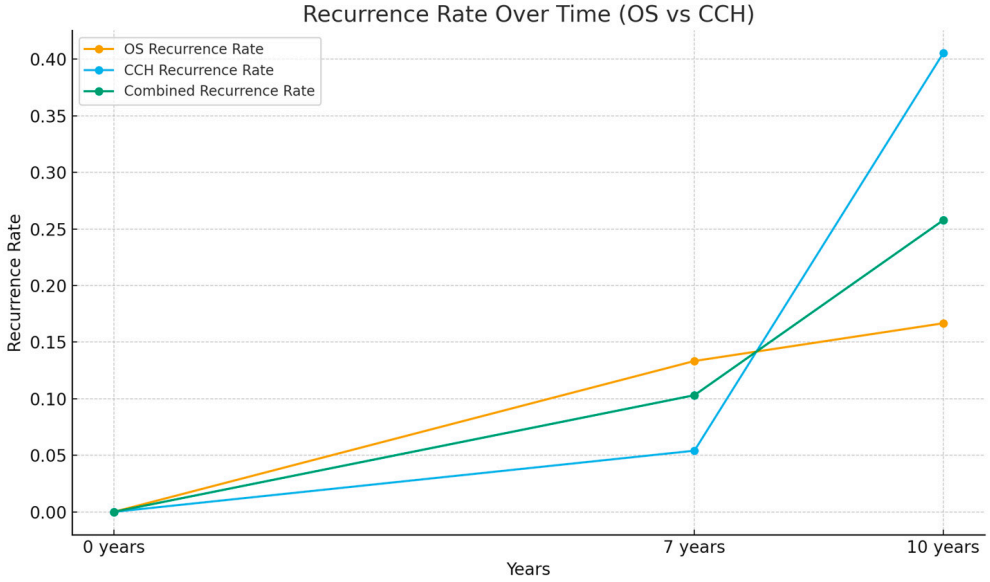

Figure 1. Recurrence rate over time.

3.3. Recurrence at 10 Years

Between the 7-year and 10-year assessments, recurrence increased markedly in the CCH group. By 10 years, recurrence had occurred in 10 OS-treated patients, evenly divided between MCP and PIP joints (5 in each). In contrast, 15 recurrences were observed in the CCH group, including 9 at MCP joints and 6 at PIP joints. Overall recurrence at 10 years differed significantly between treatment groups ($p = 0.0175$). This corresponds to a 17% recurrence rate in the OS group versus 41% in the CCH group, representing an absolute difference of 24%.

When broken down by joint, recurrence in MCP joints approached statistical significance ($p = 0.0721$), whereas recurrence in PIP joints was significantly higher in the CCH

cohort ($p = 0.0041$). These findings highlight a substantial divergence in recurrence rates between 7 and 10 years, driven largely by late recurrence in the CCH group (Figure 1).

3.4. Patient Satisfaction

Patient satisfaction, measured at 7 years, showed similar results across treatment types. The mean VAS score was 8.1 (SD 1.3) for OS and 8.3 (SD 1.2) for CCH. However, at 10 years, a clear difference emerged. OS patients reported a mean satisfaction of 7.9 (SD 1.5), whereas the mean satisfaction for CCH patients declined to 6.4 (SD 1.6). In patients treated for MCP joint contracture, satisfaction at 10 years averaged 8.2 (SD 1.4) in the OS group and 6.7 (SD 1.7) in the CCH group. The disparity was even more pronounced when PIP joints were treated, as OS patients reported an average satisfaction of 7.1 (SD 1.5) compared with 5.0 (SD 0.6) in the CCH cohort. Statistical analysis confirmed significant differences overall ($p < 0.0001$), as well as in MCP ($p < 0.0001$) and PIP joints ($p = 0.0001$) (Figure 2).

Figure 2. Patient satisfaction.

3.5. Functional Outcomes

At 10 years, the MHQ scores showed no statistically significant difference between treatment groups. The OS cohort had a mean score of 75 and a standard deviation of 18, while the CCH cohort had a mean of 78 and a standard deviation of 20. When examined separately, MCP joints showed scores of 75 (SD 18) in the OS group and 80 (SD 21) in the CCH group, whereas PIP joints demonstrated scores of 74 (SD 21) and 70 (SD 15), respectively. None of these comparisons reached statistical significance, with overall p-values of 0.4235, 0.3410 for MCP joints, and 0.6795 for PIP joints (Figure 3).

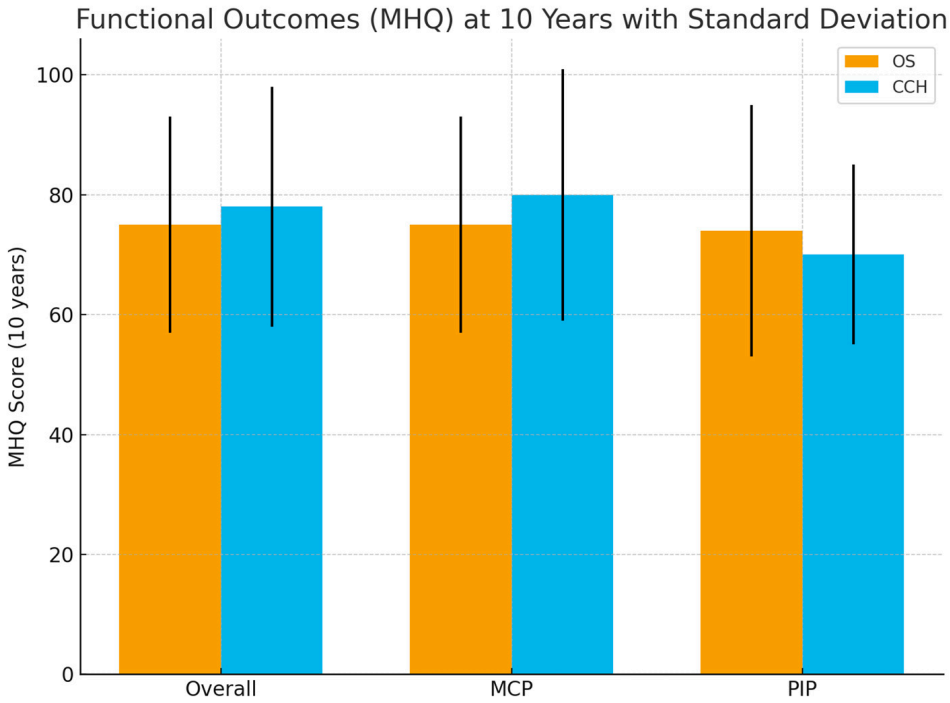

Figure 3. Functional outcomes.

3.6. Return to Work

Time to return to work differed significantly between the two treatment modalities. The OS group required a mean of 27 days (range: 15–40) and a standard deviation of 6. In contrast, the CCH group returned to work in a mean of 11 days with a range of 4 to 20 days and a standard deviation of 4. This corresponds to a mean difference of 16 days between treatments. This difference was highly significant (p-value < 0.0001), confirming the considerably shorter recovery time associated with CCH injection.

3.7. Complications

Complications were more frequent in the CCH group. These predominantly consisted of early, transient local reactions, such as ecchymosis, edema, pain, and occasional skin tears, associated with the forced extension procedure. The majority were resolved within 4 weeks, and all were resolved within 3 months. No cases of tendon rupture, no neurovascular injury, or severe adverse events were recorded. In the OS group, complications were less common and mostly related to postoperative stiffness or mild wound irritation, which resolved without permanent functional deficit (Table 2). Although OS involves a surgical incision and longer recovery, its complication profile over the long term was not worse than CCH.

Table 2. Complications.

Type of Complication	CCH	OS
Bruising and/or Ecchymosis	32 (86%)	2 (3%)
Edema	23 (62%)	6 (10%)
Skin tears	9 (24%)	2 (3%)
Stiffness	0	11 (18%)
Wound irritation	0	9 (15%)

The relationship between complications (both overall and by subtype) and recurrence was assessed, and no statistical correlation was found.

4. Discussion

This study provides a comprehensive 10-year comparison of two widely used interventions for Dupuytren's disease: open selective aponeurectomy and collagenase Clostridium histolyticum injection. Although the specific collagenase formulation used in this study is no longer commercially available in Europe, the long-term data remain highly relevant to current practice. Interest in enzymatic fasciotomy persists, and new collagenase formulations are under active investigation. Understanding the long-term durability limitations observed with previous collagenase treatment is therefore essential for informing the development, evaluation, and clinical expectations of future minimally invasive enzymatic therapies.

The most striking finding is the divergence in recurrence rates between the 7-year and 10-year evaluations. Up to the 7-year mark, recurrence rates did not differ significantly between the two groups, suggesting that in the medium term, both treatments perform comparably. However, by the 10-year follow-up, recurrence in the CCH group increased sharply, whereas it remained relatively stable in the OS group. This late divergence was particularly pronounced in PIP joints. These findings indicate that CCH offers reasonable stability for 5–7 years, but its durability beyond this period is substantially inferior to that of OS.

Comparing those results to the literature is difficult because of the wide variation in how recurrence of Dupuytren disease is defined across studies [17]. Anyhow, the results align closely with the emerging body of long-term literature on CCH. Recent long-term evaluation of CCH injection reported recurrence rates of approximately 50% for MCP joints and 100% for PIP joints [18,19]. This corresponds remarkably well to the recurrence observed in the present series, reinforcing the generalizability of these findings. Older studies with medium-term follow-up also support the limited durability of CCH. Zhang et al. [20] reported recurrence rates approaching 80% at five years, while Göransson et al. [21] noted a 50% recurrence rate at five years with substantially reduced outcomes at PIP joints. These studies suggest a consistent pattern of adequate short-term correction followed by progressive relapse, especially with PIP involvement.

In contrast, long-term results after OS have consistently demonstrated greater durability. Although recurrence is still observed, particularly for PIP joints and in patients with severe disease or strong diathesis factors, the rates are significantly lower than those observed after CCH. This difference likely reflects fundamental differences in the mechanisms of treatment. OS physically removes diseased fascia, allowing the surgeon to address multiple pathologic components of the cord. CCH, by contrast, enzymatically weakens collagen structures but does not remove pathological tissue, leaving the potential for residual disease proliferation. The higher recurrence after CCH between years 7 and 10 may therefore reflect disease progression within incompletely disrupted fascial segments [22].

Another important observation from this study is that patient satisfaction remained relatively high at long-term follow-up for OS patients, whereas it declined markedly for CCH patients. This pattern is consistent with the recurrence data and with broader clinical experience. Many patients treated with CCH experience excellent early results, which likely explains the near-equivalent satisfaction at seven years. However, as recurrence progresses, satisfaction progressively diminishes. The lower satisfaction reported by patients with PIP involvement in the CCH group highlights the particular vulnerability of this joint to relapse. It aligns with several published investigations that consistently identify PIP joints as the least responsive to minimally invasive treatment.

Functional outcomes measured by the MHQ at 10 years, however, showed no significant difference between groups. This may reflect the subjective nature of functional adaptation, whereby patients adjust to mild residual contracture, or may indicate that mild-to-moderate recurrence does not necessarily translate into substantial dysfunction at long-term follow-up. Nonetheless, satisfaction scores, which more directly capture patients' perceptions, clearly favored OS.

One of the major advantages of CCH highlighted in this analysis is the markedly shorter time to return to work. Patients treated with CCH returned to work in less than half the time required after OS. This rapid return to function is particularly valuable for individuals engaged in manual labor or for those without the luxury of extended work absence. When considered alongside the main acceptable medium-term outcomes, CCH is an attractive option for selected patients despite its inferior long-term durability.

The complication profile further distinguishes the two treatments [23]. Although complications were more frequent in the CCH group, they were mild and self-limiting. However, recurrence itself may be considered a late complication, especially in patients who anticipated a longer-lasting correction. OS, despite being more invasive, demonstrated a lower overall complication rate in this cohort, consistent with reports from high-volume surgical centers.

This study has several limitations. Although the retrospective design may introduce selection bias—related to the individual surgeon's choice of surgical technique following shared decision-making with the patient—the detailed baseline comparison demonstrates substantial comparability between groups in disease severity, joint involvement, and demographic characteristics. Furthermore, outcomes were consistently analyzed with stratification by MCP and PIP joints, which are recognized as major determinants of recurrence in Dupuytren's disease. Differences in surgical technique among operating surgeons may influence recurrence rates, reflecting real-world practice. Using VAS rather than disease-specific PROMs for satisfaction assessment may limit sensitivity to subtle differences. Nonetheless, the strengths of this study include its long follow-up period, the use of standardized recurrence criteria, and the direct comparison of two widely employed treatment modalities within a single center. Further studies, including other surgical techniques, can surely increase knowledge on Dupuytren treatment recurrence.

5. Conclusions

After confirming baseline comparability and stratifying outcomes by joint involvement and disease severity, open selective aponeurectomy was associated with lower long-term recurrence compared with collagenase Clostridium histolyticum injection. Although recurrence rates were similar at seven years, a marked divergence emerged by ten years, driven by significant late recurrence in the CCH group, especially at PIP joints. Despite this, CCH retains an important role in clinical practice because of its rapid recovery, minimal invasiveness, and acceptable medium-term outcomes. For patients prioritizing long-term durability, OS remains the preferred option. Treatment decisions should therefore be individualized, taking into account disease stage, joint involvement, patient expectations, occupational constraints, and the observed divergent long-term recurrence trajectories.

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Data Availability Statement: Data are available on reasonable request to the corresponding author.

Conflicts of Interest: The authors declare no conflicts of interest.

Abbreviations

The following abbreviations are used in this manuscript:

DD	Dupuytren's disease
CCH	Collagenase clostridium histolyticum
OS	Open surgery
VAS	Visual analogue scale
MHQ	Michigan Hand Questionnaire
PIP	Proximal interphlangeal
MCP	Metacarpophalangeal
SD	Standard deviation

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