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## Facing COVID-19 in Ophthalmology Department

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### ABSTRACT

**Purpose:** To provide useful guidelines, targeted at ophthalmology professionals, to minimize COVID-19 infection of both health-care workers and patients.

**Methods:** In this review we present updated literature merged with our experience from hospitals in Bergamo, the epicenter of the COVID-19 European outbreak.

**Results:** Non-pharmaceutical interventions, hygienic recommendations and personal protective equipment to contain viral spread as well as a suggested risk assessment for postponement of non-urgent cases should be applied in ophthalmologist activity. A triage for ophthalmic outpatient clinic is mandatory.

**Conclusion:** Ophthalmology practice should be reorganized in order to face COVID-19.

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## Introduction

Coronavirus disease 2019 (COVID-19) is a new illness that can affect lungs and airways. It is potentially fatal if it escalates to severe acute respiratory syndrome (SARS). The cause is a newly discovered virus called severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).<sup>1</sup>

The genesis of the virus was most probably due to an interspecies jump from bats to intermediate hosts and from animal hosts to humans.<sup>1</sup> The COVID-19 is a single positive-sense RNA virus; mutation rates of RNA viruses are greater than DNA viruses, which provides a more efficient adaptation process for survival.<sup>2</sup>

At the present moment, SARS-CoV-2 appears to be less virulent than the SARS-CoV and MERS-CoV, with a currently estimated mortality of 3.4%. SARS had a death rate of 9.6% and MERS had a rate around 35%.<sup>3</sup> COVID-19 is highly contagious in humans; its basic reproduction number, known as the R<sub>0</sub>, was calculated to be between 2.24 and 3.58.<sup>1</sup> R<sub>0</sub> represents the average number of people who will catch the disease from one infected person, for example, the R<sub>0</sub> for the seasonal flu typically ranges from 1.2 to 1.4.<sup>1</sup>

Ophthalmologists are a high-risk category, not only because they have close contact with patients during the examination (conjunctival, tear secretions and aerosol secretions), but also because their daily outpatient clinic and emergency lists have a high patient volume, an outbreak in the ophthalmology department is already reported.<sup>4</sup> It is in fact risky for all health-care workers in the ophthalmology service and patients alike. It needs to be taken into account that on a daily basis, an outpatient clinic waiting room is overcrowded, especially with elderly people who may have other underlying health issues.

In response to this SARS-CoV-2 pandemic, most of the national ophthalmology societies are recommending avoiding any treatment other than urgent or emergent care, in order to reduce virus transmission from human-to-human, to reduce the rate of new case development and to conserve needed disposable medical supplies for emergency departments facing the infection. It becomes crucial to risk assess and postpone outpatient visits and elective surgical procedures that can be delayed, especially in older patients and those with comorbidities, taking into account individual patient medical and social circumstances.

In this review of literature merged with our experience from hospitals in Bergamo, the epicenter of the COVID-19 European outbreak, we propose the measures that should be taken in order to reduce the spread of the virus and the risk assessment that should be used to determine which patients should still attend clinics.

## Recommended protocols in outpatient clinic

COVID-19 is a highly contagious pathogen and is mainly transmitted through direct or indirect contact of infected people or contaminated surfaces. Respiratory droplets (>5 µm) produced by breathing, talking, sneezing, coughing can reach the mucous membranes (eye, nose and mouth) of people who are nearby and can be then inhaled into the lungs.<sup>5</sup> The distance for droplets transmission has not been definitively determined, a distance of approximately at least 1 meter (3 feet) has been established in the literature as an area of risk.<sup>6,7</sup>

The possibility of fecal-oral or airborne (≤5 µm), i.e. aerosol, transmission remains controversial and studies are still in

progress to better understand virus transmission mechanisms. The World Health Organization (WHO) claims COVID-19 can be transmitted by symptomatic and asymptomatic people (carriers). Carriers may never become symptomatic representing a serious obstacle to containment of viral spread.<sup>8</sup> Case reports have been published that suggest infectivity during the asymptomatic period, with one patient found to be shedding virus before the onset of symptoms.<sup>9–11</sup> There are studies reporting that the coronavirus can be detected in the conjunctival secretions of positive patients with conjunctivitis.<sup>12</sup> Ophthalmologists, along with dentists and ear, nose and throat specialists, have been infected during routine visits.<sup>12,13</sup> For all these reasons and mainly to contain viral spread, non-pharmaceutical interventions (NPI), hygiene recommendations and personal protective equipment (PPE) are essential.

### Patient triage

Patients in need of an ophthalmic consultation should be asked triage questions before entering the waiting room. The COVID-19 symptoms are not specific and vary from asymptomatic to fever, cough, dyspnea, myalgia, anosmia or fatigue.<sup>14,15</sup> Also reported less frequently sputum, headache, hemoptysis and diarrhea. Some of these patients will come to the ophthalmology emergency department because of conjunctival congestion.

For anyone who enters the hospital, at the main entrance or in a tent, this procedure should be followed: temperature measured, hands disinfected, gloves given to the patient along with a surgical face mask (SM) that meets a minimal protection level of 1 according to the American Society for Testing and Materials (ASTM) classification.<sup>16</sup> If the patient is positive for symptoms or has fever, he/she is instructed to go home and call the numbers provided so that trained health-care personnel can visit their home to test for COVID-19 positivity (Table 1).

### Instruction in waiting area

Instruct seated patients to keep a distance of at least 2 meters from one another with masks on.

### Reduce health care assistant

Staff reorganization is a necessity. With the reduction in elective visits and surgery, it is important to assess how many ophthalmologists and non-medical staff are needed for

outpatient clinical care and then reallocate all the other members into different wards, following refresher training. We recommend splitting the staff into two segregated teams: the first working with COVID-19+ patients and the second with COVID-19- patients, keeping them separated in order to minimize contagion risk. In particular, colleagues that outside of work are in contact with people at increased risk (including pregnant women, immunosuppressed people and those with underlying health conditions) should be allocated to a lower risk area or provided with measures (such as a hotel room) to avoid contact with those people.

### Environmental sanitation

Survival time and conditions of SARS-CoV-2 outside hosts are not yet determined.<sup>17</sup> Based on data from other viruses from the same virus family, it can be assumed it can survive a few days.<sup>18,19</sup> A recent study compared the survival of SARS-CoV-2 and SARS-CoV-1 and did not find significant differences, for both viruses the half-life was less than 3 hours for aerosol, around 3.5 hours on copper, less than 9 hours on cardboard, 13 on steel and 16 on plastic.<sup>20</sup> Therefore, it is crucial to perform an appropriate sanitation of the potentially contaminated environment. Effective agents against this family of virus are summarized in Table 2. In health-care settings, if specific formulations are lacking, the European Centre for Disease Prevention and Control (ECDC) recommendation would be to clean with a neutral soap and sodium hypochlorite at 0.1%, which proved effective on SARS-CoV-1.<sup>21</sup> For surfaces that can potentially be damaged by sodium hypochlorite, ethanol (70% concentration) can be used.

In particular, tonometer tips must be cleaned with alcohol as 70% alcohol solutions appear to be effective at disinfecting tonometer tips from SARS-CoV-2. However, alcohol will not effectively sterilize the tip against adenoviruses. If available, use single-use disposable tonometer tip. Tips cleaned with diluted bleach remain a safe and acceptable practice.<sup>22</sup> If available, the best option is a no contact tonometer to check the pressure.

### Hand hygiene

Hand hygiene is a fundamental for patients and doctors. The WHO encourages the use of alcoholic gel and solutions,<sup>23</sup> although there is limited evidence that these are superior to hand wash with water and soap in reducing viral load.<sup>24</sup>

**Table 1.** Triage procedure.

-In the last 14 days have you travelled internationally or to an area with widespread geographic spread or been in close contact with a person known or suspected to have coronavirus? (Suspect if his/her answer is affirmative)
-Do you have a cough or shortness of breath? (Suspect if symptomatic)
-Measure temperature (Suspect if temperature > 37.8 C°)
If no to the above: mask the patient and hand hygiene
If suspect: mask the patient, isolate and
a) If symptoms are severe >> inform clinical staff immediately
b) If symptoms are minor >> consider home care or E-visit with close monitoring. Direct to home care guidance and inform local county health department

**Table 2.** Antimicrobial agents for surface sanitation in non-health-care settings<sup>17</sup>.

Antimicrobial Agent	Concentration (%)	Coronaviruses Tested
Ethanol	70	HCoV-229E, MHV-2, MHV-N, CCV, TGEV
Sodium hypochlorite	0.05–0.5	HCoV-229E SARS-CoV-1
Sodium chlorite	0.23	MHV-2, MHV-N, CCV
Povidone-iodine	10	HCoV-229E
Glutaraldehyde	2	HCoV-229E
Isopropanol	50	MHV-2, MHV-N, CCV
Benzalkonium chloride	0.05	MHV-2, MHV-N, CCV
Formaldehyde	0.7	MHV-2, MHV-N, CCV

### Breath shield

The use of slit lamp barriers or breath shields is important, as they can provide a measure of added protection for health-care workers and patients. However, these barriers do not prevent the contamination on the patient's side of the barrier, which may then be a source of infection transmission. In general, barriers are not a replacement for all other hygienic recommendations or NPI and PPE during the examination.

-Re-think how to visit

- Study the background before the patient attends to minimize history taking time.
- Ask the patient to enter without accompanying adults, if possible.
- Keep the examination limited to that required to make a clinical decision and try avoiding close contact at the slit lamp.
- Request special tests (visual field, optical coherence tomography, corneal topography, ultrasound) only when critical to making a clinical decision.
- When testing for visual acuity, try beginning with the lowest expected achievable line
- Try using indirect ophthalmoscopy rather than slit lamp fundus examination.
- Consider treatment changes when an alternative is available that might result in less attendance over the proceeding months (e.g. AntiVEGF intravitreal protocol).
- For prolonged laser procedures, consider using an indirect ophthalmoscope delivery system for patients who cannot reasonably be deferred.

### Respiratory protection

Respiratory protection is classified in three grades based on filter efficacy and face adhesion: filtering face piece (FFP) 1, 2 and 3<sup>25</sup> (filter efficacy 80%, 94%, and 99%, respectively).

- to attend to patients not suspected to be infected by coronavirus: surgical mask for patients and doctors is recommended. Surgical masks were designed to prevent patient exposure to surgeon's droplets and, therefore, have a modest filtration efficacy. Surgical masks are recommended for patients and health-care workers in outpatient clinics in order to reduce the viral load and to prevent a potential viral spread by asymptomatic COVID-19 carriers. Minimal protection level recommended is ASTM 1.
- to attend to patients with suspected or confirmed cases of coronavirus: ophthalmologists need to wear at least FFP2, while FFP3 is necessary during slit-lamp examination.

A 2016 study on FFP respirators indicates that FFP respirators may not achieve the expected protection level, as there is a strong association between fit factors and protection factors.<sup>18</sup>

### Eye protection

To prevent mucous membrane exposure, ophthalmologists must use goggles with good adhesion to the face, that can be

reused after proper disinfection. Alternatively, it is possible to use disposable face shields, although these may prove to be uncomfortable for ophthalmologists. Regular corrective spectacles are not considered adequate eye protection.

### Body protection

Long sleeved gowns should be used if exposed to COVID-19 positive patients: there is no need for them to be sterile, but they absolutely have to be waterproof. It is also appropriate to use disposable plastic aprons on top of non-waterproof gowns. Disposable aprons and gowns must be changed between patients and immediately after the completion of a procedure/task.

### Hands protection

Glove usage is crucial, and it is highly recommended the usage of long gloves that cover up to the cuff. Gloves must be changed immediately following the care episode or the task undertaken.

### Test for health-care providers

Consider urgent staff testing for symptomatic (i.e. fever, cough, dyspnea, anosmia) staff who would otherwise need to self-isolate for 7 days.

### Risk assessment for clinic attendance

In response to the pandemic outbreak of SARS-CoV-2 authorities suggest hospitals need to rapidly draw up plans to reduce all non-urgent elective activities as well as finding a viable solution to undertake urgent care safely. This will free up staff for training, beds for COVID-19 patients and theatres/recovery facilities to be adapted to deal with COVID-19 patients and is essential to avoid any preventable exposure. Optometrists should limit their clinic to urgent cases and should not spend an excessive amount of time measuring deviations, it is acceptable to use a temporary form of occlusion when a prism cannot be promptly determined. Clinicians should reschedule outpatient appointments and surgical procedures that can be safely deferred, particularly in elderly patients and those with comorbidities, following a risk stratification for each subspecialty taking into account a 12-week delay for our patients.<sup>22</sup> This number is derived after analyzing the timeline of the Chinese contagion but is subtle to variations according to the preventive measures that each country is willing to take. Clinicians should also consider setting up a dedicated screening program for COVID-19+ patients that underwent treatments with high dosage of drugs with a recognized macular toxicity, such as hydroxychloroquine and ritonavir.<sup>3,26-28</sup>

A stratification of our patients in a three-color escalation plan based on their severity condition is reported in [Table 3](#). *Green* is for patients that can be deferred, *amber* is for patients whose condition can be handled through a phone or video review and *red* is for sight or life-threatening conditions requiring a face-to-face visit. The red group conditions often require prompt clinical or surgical management that must be performed in order to ensure the best possible outcome. It is necessary to minimize the post-operative care for the surgeries performed before

**Table 3.** Outline of patient stratification based on risk assessment and condition severity.

	Low Risk (Green) Rebooked 4–6 Months Ahead	Medium Risk (Amber) Phone Consultation with Visit Rebooked 3 Months Ahead	High Risk (Red) Face to Face Visit
Cornea Clinic	Blepharitis, dry eye and other minor conditions KC patients who have already done CXL	Minor trauma, abrasions or foreign bodies KC patient under 20 years of age not yet cross-linked Patients on topical steroids not seen within 3 months Therapeutic Contact Lens patients	Microbial keratitis, major trauma Corneal transplant within 1 month Corneal graft rejection
Surgery	Graft surgery can be deferred if no risk of perforation, cross-linking can be deferred if patient is older than 20 years old		Corneal perforation or corneal thinning at risk of perforation, severe postop complications from previous graft (eg. fully detached DMEK/DSEAK)
Glaucoma Clinic	Routine visual field/pressure check to monitor progression	Peripheral iridotomy in the fellow eye of an acute angle closure	Acute Intraocular pressure (IOP) >30 mmHg, including uveitis and neovascular glaucoma Acute Angle-Closure Glaucoma High risk avoidable vision loss within 2 months Post-op patients with surgery <3 months Emergency high pressure uncontrolled medically High risk vision loss in only eyes
Surgery	Defer all MIGS and non-urgent trabeculectomy. Cataract surgery in glaucoma patients could be deferred		Complex post-op or complications
Cataract Clinic	Likely can be delayed	Routine 1-month follow-up	
Surgery	Defer nearly all cataract and YAG lasers capsulotomy		
Medical Clinic	Background and severe diabetic retinopathy (NPDR), Stable treated PDR, Stable BRVO/CRVO, chronic CSCR	Severe non-proliferative macular edema, postop macula edema and any other macular edema	Active proliferative diabetic retinopathy (PDR), wet AMD, new onset Central Retinal Vein Occlusion (CRVO)
Surgery	Cataract surgery in medical retina patients can be delayed		Intravitreal injections to continue for wet age-related macular degeneration (AMD), active secondary CNVMs, diabetic macular edema (DME)/retinal vein occlusion (RVO) PRP laser treatment
Vitreoretinal Surgery Clinic	ERM, Macular Hole, uncomplicated PVD follow up	Routine postop (peeling, PPV for vitreous hemorrhage, routine retinal detachment)	Clinical suspicion of retinal break and other sight threatening conditions
Surgery	Routine surgery could be delayed with minimal risk but must be reviewed on a case by case basis		Complex Surgery post-ops Barrage laser for retinal tear. Treatment of retinal detachment, intraocular foreign bodies, penetrating injuries.
Ocular Oncology Clinic	Routine follow up of choroidal nevus	Patients on greater 12-month follow-up interval Patients with no issues on telephone triage could be delayed further	All new referrals Patients on less than 12-month follow-up interval Continue all oncology surgery
Surgery Uveitis Clinic		Anterior Uveitis patients given the standard 6 week tapering course of steroid. If symptoms not resolved, clinical review is needed Stable patients on prolonged drops regimen	Every form of new potential uveitis
Surgery General Ophthalmology Clinic	Cataract surgery for uveitis patients could be delayed All screening check-up	Triage consultation for routine referrals via phone/video. All patients triaged via phone/video consultation	Intermediate Uveitis with vision loss, posterior uveitis, retinal vasculitis, panuveitis.
Pediatrics Clinic	Annual checkup visit	Patients having amblyopia treatment Pediatric oculoalabastic/adnexal cases	Sight or potential life (systemic) threatening conditions Cataracts causing amblyopia or under 4 months old Reduced vision in both eyes, or in one eye in under age 6 Children on medication for glaucoma, uveitis, corneal disease Post-ops within last 2 months Cataract surgery in under 4-month-old or where causing amblyopia
Surgery			

(Continued)

Table 3. (Continued).

	Low Risk (Green) Rebooked 4–6 Months Ahead	Medium Risk (Amber) Phone Consultation with Visit Rebooked 3 Months Ahead	High Risk (Red) Face to Face Visit
Strabismus Clinic	Majority of new cases can be deferred		Acute onset strabismus indicating serious overlying condition (e.g. acute 3rd nerve paralysis)
Surgery	Routine follow up visit		
Neuro-Ophthalmology Clinic	All strabismus surgery can be delayed	Neuromuscular disorders	Acute condition with potentially underlying severe condition. Patient by patient triage is needed. Patient by patient triage needed
	Stable follow-up on a patient by patient basis		

restrictive measures came into place. Lastly, it is important to create a healthy and safe environment for patients who need to be seen in order to protect them from exposure. It is also advisable to reduce on-site waiting times (booking patients 45 minutes apart), avoiding closely packed waiting areas, minimizing staff–patient contact time and articulating an action plan to protect vulnerable patients (immunosuppressed, pregnant, old and frail, serious systemic co-morbidities) that cannot be deferred, creating dedicated clinics in an attempt to isolate them from other patients.

## Conclusion

It is necessary and urgent to rearrange ophthalmologist and optometrist routine appointments in order to control viral spread and try to maximize patient and health-care provider's safety. Current evidence suggests deferring all the elective activity and providing assistance for only acute and chronic sight or life-threatening conditions. Further, clinical and surgical activity should be reorganized into different levels of dedicated precautions based on risk assessment and severity conditions.

## Method of literature search

Articles providing data on COVID-19 were found by searching PubMed with the following MESH terms: “SARS-CoV-2, COVID-19”. Additional research terms included “personal protective equipment AND COVID-19”. Given the paucity of available updated material, research was extended to current guidelines available on websites of major disease control authorities and ophthalmology societies. Publications cited in articles selected by searchers were retrieved and reviewed.

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