

Measures to Reduce Transmission Risk of Novel Corona Virus Disease (COVID-19) during the 2020 Pandemic - Corneal Service in a Tertiary Hospital in the UK

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Abstract

Purpose: SARS-CoV-2 pandemic is a rather challenging time for all worldwide. Purpose of this paper is to share our plan of actions to minimise the transmission risk of novel corona virus disease (COVID-19) among patients and health workers providing a comprehensive corneal service in a tertiary hospital in the UK.

Methods: After thorough risk assessment, measures have been taken to deal with the corona virus pandemic that required very close collaboration of all members of the corneal service, members of the infection control department and other associated colleagues.

Results: A systematic approach was devised, and significant changes were made in the administrative and clinical settings to minimise the transmission risk of SARS-CoV-2 within the corneal service at a tertiary hospital in the UK. Patient's clinical face-to-face appointments were significantly reduced, high risk corneal patients were identified and approached via a novel telephone consultation system, special urgent care corneal clinics were organised, and a new home delivery system of all medications was also introduced. Clinical room environment was optimised with patient education, thorough disinfection protocol, proper personal protective equipment (PPE) and a strict protocol of face-to-face appointments.

Conclusion: We believe that the development and setting up of all emergency measures that we introduced in the corneal service to deal with the COVID-19 pandemic aiming to protect both patients and health workers were well received by everyone, particularly the patients. However, gradual reopening the regular clinics, once this pandemic is controlled, will be a forthcoming challenge keeping in mind the possibility of a second wave of infection when the "social distancing" and isolation systems start to relax.

Keywords: SARS-CoV-2; COVID-19; Transmission Risk; Corneal Service; Ophthalmologist

Abbreviations

COVID-19: Corona Virus Disease; CDC: Centers for Disease Control and Prevention; CXL: Corneal Collagen Cross-Linking; UCCC: Urgent Care Corneal Clinics; PPE: Personal Protective Equipment

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Introduction

Corona virus disease (COVID-19) which is caused by SARS-CoV-2 was recognised as pandemic by the World Health Organisation (WHO) on 11th of March 2020 [1]. The novel corona virus emerged in Wuhan, China and has infected 3759967 confirmed cases and caused 259474 deaths worldwide till 8th of May 2020, according to the WHO [2]. COVID-19 is a highly contagious disease with person to person transmission, primarily via respiratory droplets produced when the infected person talks, coughs, or sneezes. When these droplets land on surfaces or if people touch an object or surface contaminated with this virus, and then touch their mouth, nose or eyes transmission can also happen as the virus can stay alive for many hours [3]. COVID-19 has a mean incubation period of 5.2 days (95% confidence interval, 4.1 - 7.0) [4]. Most common symptoms are fever, chills, myalgia, cough, sore throat, shortness of breath but less commonly it can cause headache, nausea, vomiting and diarrhoea. It generally starts with flu like symptoms but can advance rapidly. The median time to first hospital admission is 7.0 days (4.0 - 8.0), but the disease may progress to shortness of breath (~8 days), acute respiratory distress syndrome (ARDS; ~9 days), and to mechanical ventilation (~10.5 days) in about 39% patients [5].

The purpose of this paper is to share the experience of our specialised corneal service and course of actions that have been implemented in a tertiary hospital eye department in the UK to minimise the transmission of corona virus to patients and staff working in a hospital setting, utilising available resources in a most effective way and at the same time maintaining an effective and safe approach to patient's individual needs and a rather diverse corneal and ocular surface diseases clinical and surgical service that we provide to more than 1 million people. This has been a significant effort in a very short space of time, by all members of the corneal service to come up with a plan for the safety of all patients registered in the corneal service but at the same time to all key healthcare workers including ophthalmologists, nurses and healthcare assistants with the hope that this pandemic comes to an end soon, but keeping in our minds the risk of a potential second outbreak in the winter or when the "social distancing" and isolation systems are relaxed. We have developed a robust system which can easily be adapted to other viral pandemics.

Exposure risks of Covid-19 to ophthalmologist and patients

Healthcare workers are at the frontline in the "war against" COVID-19 that puts them at risk of contracting this deadly infection. Among 315,531 U.S. COVID-19 cases reported to Centers for Disease Control and prevention (CDC), during February 12-April 9, data on HCP (Health Care Personnel) occupational status were available for 49,370 (16%), among whom 9,282 (19%) were identified as HCP [6]. According to a report, healthcare workers made up 9% of Italy's COVID-19 cases [7]. As reported by Du Bin, director of the intensive care unit at Peking Union Medical College Hospital, in Wuhan, ear, nose and throat (ENT) and eye doctors (Ophthalmologist) were infected at higher rates than any other specialty doctor in the same hospitals [8]. We have limited evidence, but corona virus can exist in tears or conjunctival secretions. Zhou., *et al.* demonstrated that out of 67 patients enrolled in this study, SARS-CoV-2 was detected in the conjunctival sac of three COVID-19 patients without ocular symptoms [9]. Another study conducted by Zhang., *et al.* showed that out of 72 confirmed COVID-19 cases, two patients had conjunctivitis and one patient had SARS-CoV-2 RNA fragment in ocular discharge, however the low positive rate of conjunctival swabs could be because of the inefficient diagnostic method including sampling technique and also sampling time lag [10]. SARS-CoV-2 can cause severe but short-lived conjunctivitis which gets better after 21 days from onset of general symptoms of corona virus [11]. Close proximity between patient and ophthalmologist during an eye examination puts both in harm's way. Recent evidence suggests that even someone who is infected but remains non-symptomatic can spread COVID-19 with high efficiency, and conventional measures of protection, such as face masks, provide insufficient protection [12]. In the corneal clinic during face-to-face appointments, slit lamp examination, including tonometry, corneal staining, corneal scraping, eversion of lids and contact lens review, among other routine tasks, can significantly increase the risk of contracting SARS-CoV-2. With those concerns in mind we have setup a robust protective system to deal with the corona virus pandemic that required very close collaboration of all members of the corneal service, but also members of the infection control department and other associated colleagues.

Administrative measures

Creating separate excel spreadsheets of patients identified as high risk and all routine corneal and ocular surface diseases patients, cancelled during the lockdown period

Recent corneal grafts, stem cell transplant and keratoconus patients

We created separate spreadsheets specifically designed for each one of the designated diagnostic conditions identified at risk. Upload of patients to each spreadsheet was performed by a member of the clinical team and checked by one of the corneal consultants before we started calling individual patients to do a telephone consultation.

The following groups of high-risk patients who had their appointments cancelled during the pandemic lockdown period were duly identified from our electronic medical record (EMR), i.e. PowerChart Software (Cerner, UK) and Medisoft (Medisoft Limited, UK). Separate spreadsheets were setup and maintained for each high-risk group detailing the patient's clinical profile and telephone contacts, as follows:

- Patients who have undergone a corneal transplant over the last 6 months.
- Patients on the waiting list for a corneal transplant.
- Patients who have undergone or are on waiting list to have limbal stem cell transplants, including the ones enrolled in clinical trials.
- Keratoconus patients, including follow-up and new referrals.

All keratoconus patients had their individual medical notes checked including age, sex, recent history of progression and/or treatment with corneal collagen cross-linking (CXL), history of atopy, among other parameters to determine their individual risk of progression and then establish how soon to book their next review in clinic to minimise the risk of progression and maximise the identification process of patients in potential need of CXL.

Telephone consultation was done by one of the ophthalmologists, member of the corneal team including corneal consultants, their individual condition was assessed, medication checked and then advised accordingly. Each telephone consultation was documented on Medisoft and a consultation letter was generated addressed to the patient's GP to ensure that all patients get an uninterrupted supply of the needed medications. As expected, a few patients still required a face-to-face consultation based on their individual medical e-record assessment or after the telephone consultation. Face-to-face appointments were then booked accordingly in the urgent care clinics (see sub-section Urgent care corneal clinics (UCCC) below).

Routine patients

All corneal and ocular surface disease patients that had their appointments cancelled during the pandemic lockdown period were identified from our electronic medical record system, i.e. PowerChart and Medisoft, and were added to this specific spreadsheet.

Each individual patient had their electronic medical records fully reviewed to determine individual needs and assess priority, which would enable us to safely reschedule all appointments after the lockdown eases, accordingly. Patients identified as more at risk also had a telephone consultation similarly to high risk group of patients.

Patients on waiting list for corneal transplant also had a telephone consultation to make sure they were fine, and their individual needs were assessed, and medications were reviewed accordingly.

Cancellation of outpatient clinic appointments and elective surgeries

We significantly reduced the number of patients attending face-to-face consultations during the lockdown period by assessing the severity of their individual conditions by reviewing their electronic records that allowed us to cancel most face-to-face appointments. Cancellation letter was then sent to individual patients based on their medical record review and in some specific cases also based on their individual needs assessed during a telephone consultation. A new appointment was rescheduled accordingly. All patients were still provided with an emergency telephone number for contact and asked to phone us in case of any problem.

We also postponed all elective surgeries including cataract, pterygium, corneal transplantation, corneal collagen cross-linking and all other minor anterior segment procedures such as punctum occlusion, removal of suture, electrolysis, etc. to minimize COVID-19 infection risk.

Telephone consultation scheme

This was conducted for the following group of patients:

- Patients who had corneal graft and limbal stem cell transplant surgery within 6 months from beginning of the lockdown period or are currently on the corneal and stem cell transplantation waiting list.
- Patients who had their appointment cancelled or had an appointment booked later on in the year but contacted us with recent exacerbation of their corneal/ocular surface condition.
- Patients who had their appointments cancelled during the lockdown period but who were identified after review of their electronic records in need of a telephone consultation.

Urgent care corneal clinics (UCCC)

The routine and one weekly urgent care corneal clinics are organised for patients with acute problems along with corneal referrals from the eye emergency department (EED) who require face-to-face consultations. These clinics also include high-risk patients, as follows:

- The already established once weekly UCCC became twice weekly to deal with the increased demand for emergency face-to-face consultations during the lockdown period.
- Patients who had their appointment cancelled or had an appointment booked later on in the year but contacted us with recent exacerbation of their corneal/ocular surface condition and were deemed in need of a face-to-face consultation after a telephone consultation.
- Patients identified from the high-risk group (e.g. corneal graft and limbal stem cell transplant surgery within the last 6 months) with recent exacerbation of their corneal/ocular surface condition and were deemed in need of a face-to-face consultation after a telephone consultation.

- Patients referred from the Eye Emergency Service with acute corneal/ocular surface disease (e.g. corneal ulcers, recurrent herpetic keratitis and graft rejection, among others) that required an urgent face-to-face follow-up appointment by the Corneal Service.

Plan for corneal grafts, limbal cell deficiency and keratoconus new referrals

All new referrals of patients in need of corneal grafts, keratoconus and limbal stem cell deficiency and all new referrals that already had their booked new appointments cancelled during the lockdown period, were individually scrutinized by one of the corneal consultants to analyse the nature and severity of disease. So that appointments for initial consultations could be prioritised accordingly soon after the lockdown period.

Pharmacy service

Systems have been put in place to deliver new and repeat prescriptions to patient's home address to save and protect patients from unnecessary visit to the hospital pharmacy, but also to minimise patient's time spent at the hospital for those who attended a face-to-face consultation.

Patients currently using bandage contact lenses

Patients identified as wearing bandage contact lenses from the clinic list during the lockdown period also had a telephone consultation to make sure they were OK and had a separate consultation with the Optometry Service to have their bandage contact lenses replaced or permanently removed and a rescheduled appointment in the cornea clinic was booked accordingly soon after the lockdown period.

Measures taken to protect patients, nurses, healthcare assistants and ophthalmologist in the urgent care corneal clinics (UCCC)

Patient education

Specifically, designated check-in counter has been setup for the UCCC patients with clear instructions to maintain a 2 meters distance while queuing. Plastic barriers have been installed on the check-in counters aiming to protect the staff on duty for the check-in procedure.

All patients are specifically instructed on arrival to keep a minimum two-meter distance from other patients and healthcare workers while sitting in the waiting area awaiting their individual appointment in the urgent care corneal clinic (Figure 1). They are instructed to wear a surgical mask the whole-time while waiting and during their face-to-face consultation if they also report or manifest any COVID-19 symptoms.



Figure 1: Seating arrangement showing social distancing measures setup for patients in the waiting area.

Patients are encouraged to come alone for their appointments, however for those needing assistance only one accompanying person is allowed per patient. Only one parent and no accompanying siblings are allowed with paediatric patients barring few exceptions. The accompanying person with patients who can manage on their own are advised to wait elsewhere outside the hospital if possible. They are contacted to pick the patient up after completion of the consultation.

The hospital also provides assistance with transportation, i.e. taxi, ambulance or volunteer assistance for patients in need.

Examination room disinfection

The examination room is thoroughly cleaned by a dedicated and specifically trained staff member using a chlorine based disinfectant, in the form of a solution at a minimum strength of 1,000 ppm available chlorine, including slit lamp, tonometer, desk, patients and doctor's chair, prior to the first and after each patient's appointment. Special attention is given to areas of hand contact and particularly areas close to the patient and physician's face. In addition, Clinell universal wipes (Gama healthcare ltd, UK) are used to disinfect the visors, goggles and surfaces such as working desk, computer keyboards and mouse as needed.

Hand sanitiser gel 70% alcohol (Purell Advanced, Laboratories Prodene Kint, France) is also available in each examination room, waiting areas and corridor for both staff and patients use as needed.

Clinic settings and personal protective equipment (PPE)

Each patient appointment is booked 30 minutes apart to minimise the waiting time and the total number of patients sitting in the waiting area at any one time.

Each doctor uses 2 dedicated rooms, as follows:

- Room 1: Set up for the corneal team doctor to analyse patient's previous electronic records and to do all necessary administrative work, hand wash and fitting all personal protective equipment (PPE) such as disposable plastic aprons, gloves, surgical face masks, goggles, face visors before leaving the room to examine the patient and empty handed in order to prevent any possible cross contamination.
- Room 2: Next door, is solely dedicated for patient's face-to-face consultation and examination.

The consultation rooms have been specifically designed with two diametrically opposed separate doors, one for the patient opening to the waiting area and the other facing an internal staff corridor. The 2 meters distancing is also followed by all staff between themselves.

All diagnostic procedures which are deemed not essential are avoided.

Face-to-face consultation protocol in room 2

Patients with new or an acute exacerbation of a previous corneal/ocular surface problem that after full review of their electronic record or after a telephone consultation was deemed in need of a face-to-face appointment, that was booked via a phone call and confirmed by mail. One patient two rooms policy, as described above, is followed and a nurse outside the room makes sure that nobody enters the room during the examination. Slit lamp breath guards (Figure 2a and 2b) were fitted as recommended by the Royal College of Ophthalmologists, London, UK and doctors wear all necessary PPE as described above. No accompanying person is allowed in the examination room with an exception for the patients who are hard of hearing, require special needs and those with difficulty in retaining or comprehending instructions due to associated medical conditions. All patients are specifically instructed not to talk during the slit lamp examination and all conversation takes place either before or soon after the examination, respecting the minimum 2-meter distancing. As soon as the ex-

amination and the discussion with specific instructions about their condition, often including a prescription is completed, all patients are asked to leave the room. Then the doctor removes his/her PPE, according to a specific protocol and following a training provided by infection control department and comes out of room. This room is again cleaned by hospital staff for the next patient consultation. Meanwhile, the doctor uploads the consultation details on the electronic record system back in room 1 next door.



Figure 2A and 2B: Showing slit lamp with protective plastic breath guards.

All patients are encouraged to contact us in case of emergency via secretary’s office so that they can be prioritised for urgent attention by a corneal team member.

Ward admission

The Corneal Service protocol for emergency admission of patients with corneal and ocular surface disease (e.g. penetrating injuries, large corneal ulcers, etc.) has not changed. All patients admitted to the Eye ward for more than 24 hours get tested for COVID-19 on arrival. The ward has specifically been divided in different zones in order to separate the COVID negative, suspect and positive patients prompting the use of appropriate PPE for the attending nursing staff and doctors.

Medical team

Any team member who is identified as at high risk of getting infected is assigned no direct contact clinical duties rather tasks such as telephone consultations and other administrative duties are allocated. Primary roles of each team member has been identified and back-up plans are in place in case any of the team member needs to self-isolate in order to maintain the continuity of the services. Testing for COVID -19 is also available for symptomatic team members via occupational health department. Regular review of service provision and amendments take place with discussion amongst the team members. It is important for each member of the team to feel well supported in order to improve efficiency and safety.

Discussion

SARS-CoV-2 can infect any age group, but study shows that fatality rate is higher over the age of 60, those with associated health conditions, immunocompromised, obese and in Black-Asian community. NHS figures show 92% of coronavirus victims in England were over 60 [16]. Fatality ratio from international cases stratified by age were parametric estimate 1.4% [0.4 - 3.5] in those aged < 60 years [n = 360] and 4.5% [1.8 - 11.1] in those aged ≥ 60 years [n = 151] [17]. The UK population is ageing with significant pace. In 2018, 18% of the total UK population was aged 65 years and over [18]. The point being that UK health system, which was already stressed before corona virus, has taken a serious hit because of this pandemic and most of our patients in the cornea service belong to the vulnerable age group. Cancellation of regular clinic and surgery appointments have created a significant backlog of patients needing appointments in the near future.

First of all, we had to stratify our patients into groups categorised as high risk, medium risk and low risk. High risk patients like recent corneal grafts, stem cell transplants and young keratoconus with acute problems should be prioritised, medium risk and low risk patients should be given appointments accordingly. Obviously, taking into consideration the best way to accommodate stable patients in the clinics keeping in mind the capacity and impact of social distancing. We have specifically focused on corneal and ocular surface diseases rather than the broadly recommended and widely used “Risk stratification guidelines” developed by Moorfields Eye Hospital, in London [19].

Secondly, as part of the relaxing programme we will increase office time and organise extra clinics and theatre sessions that will also include the possibility of evening and weekend clinics and theatre lists. As this will be a relatively new process and rather high demanding for an already stressed staff with the pandemic, we are planning ahead taking into consideration all aspects and implications, including mental health to all members of the corneal team including clerk, secretaries, healthcare assistants, nurses and doctors.

Thirdly, we are also developing new protocols for follow ups for different diseases, but also planning ahead about patient education leaflet, ways to obtain feedback from patients and colleagues and monitor our schemes continuously to make any necessary changes at any time.

Fourthly, we certainly believe that the telephone consultation scheme should remain active and probably enhanced, as it has proved to be very efficient and give patient easy and swift access to ophthalmologists but will require dedicated time for it. This also goes for virtual clinics and video phone calls.

Finally, as we are currently working on a plan to gradually revive and reopen our regular clinics and theatres after resolution of this pandemic, accommodating maximum number of patients but still practicing infection preventative measures for the safety of both patients and healthcare workers, our reopening strategy takes into consideration all recommendations made by the Royal College of Ophthalmologists, London, UK that is clearly outlined on the recently published document “Reopening and redeveloping ophthalmology - interim guidelines” [20].

Conclusion

COVID-19 has spread around the world causing all healthcare systems to face a multitude of challenges at all stages of the pandemic, forcing all healthcare professionals, including ophthalmologists to quickly adapt accordingly. We have shown that we can be creative, cohesive, and rather efficient to develop and implement the necessary infection control measures and provide best possible and safe care to all our patients by making important and sometimes radical adjustments to administrative and clinical settings. It is indeed a significant amount of preparatory work at a rather stressful time. The priority is to keep patients safe and at home as much as possible aiming to significantly reduce patient's number in face-to-face clinics and shift most consultations to be delivered virtually using phone or video-based calls. This is a completely new approach with rather limited experience. We have to be vigilant and prioritise high risk corneal patients such as recent corneal grafts, limbal stem cell graft, young keratoconus, patients using bandage contact lens and acute corneal emergencies that could not be resolved through a telephone consultation. It is also important to reassure all patients and educate them to contact us through the phone if required. In clinics it is optimal to use separate rooms for patient examination and administrative work. All ophthalmologists must wear PPE, follow regional infection control guidelines and avoid unnecessary and extensive ocular examination during face-to-face appointments. Above all, it is important to continue auditing the new changes and implemented measures and be prepared to change as the pandemic evolves as required.

Conflict of Interest

None of the authors have any financial interest or any conflict of interest.

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