



Eye versus COVID-19 Pandemic: The Hidden Link

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ABSTRACT

Severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) belongs to the family of new viruses that emerged in 2019 causing coronavirus disease (CoVid-19) which was first reported from Wuhan China. The virus found to be viable on the plastic materials for 72 hours and on metal surface for about 48 hours. The virus spreads through droplet secretions and the evidence suggests the possibilities of transmission through tears by the lacrimal-pump mechanism. This article aims to demonstrate the eye-related safety measures to be taken by health care professionals and by the general population at the community level during the COVID-19 outbreak. The search for the relevant journal was carried out through the use of the PubMed, PubMed Central (PMC), Daily situations reports, IPC (Invention Prevention Control) guidelines, WHO (World health organization), and from other Internet Sources. Due to transmission possibilities through tears, there is a need for stringent barrier methods among eye-care workers, Ophthalmologist/Optomist, and health care workers regarding safety measures, personal protective equipment (compulsory during general/suspect/or probable cases), workplace disinfection, equipment sterilizations, frames and sunglasses disinfection in eye care settings during COVID-19 pandemic. To prevent the risk of transmission at the community level, the general population also needs to take precautionary measures regarding COVID-19 pandemic.

Keywords: COVID-19, Lacrimal pump mechanism, Eye safety measures.

INTRODUCTION

Severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) belongs to the family of new viruses that emerged in 2019 and causes coronavirus disease

(COVID-19) which was reported from Wuhan, China and then spread around the world.¹ The disease is highly contagious and is transferred from person to

person by means of respiratory secretions (Droplet from coughing, sneezing, or rhinorrhea) within 1meter distance from the infected person. Following its rapid spread, the WHO declared Covid-19 as a health emergency and pandemic. ² The virus found more viable and stable up to 72 hours on plastic and stainless steel, although a great reduction was found from $10^{3.7}$ to $10^{0.6}$ tissue-culture infectious doses TCID₅₀ per milliliter of the medium after 72 hours on plastic and from 48 hours on stainless steel.³ Most of the spectacles, frames, and lenses are manufactured in plastic material or steel, so safety measures concern must be opted prior application. The search for the relevant journal was carried out through the use of the PubMed, PubMed Central (PMC), Daily situations reports, IPC (Invention prevention control) guidelines, WHO (World health organization), and from other Internet sources.

This article aims to demonstrate the eye-related safety measures to be taken by health care professionals and by the general population at the community level during the COVID-19 outbreak.

I) MODE OF TRANSMISSION OF COVID-19

The respiratory infection can be transmitted through different sized droplets ranging from $>5-10 \mu\text{m}$ in diameter (respiratory droplets), and $<5\mu\text{m}$ in diameter (droplet nuclei). The current evidence reported COVID-19 virus is primarily transmitted between people through respiratory droplets and contact routes. The droplet transmission occurs within 1-meter close contact with an infected person who is coughing or sneezing or through fomites in an immediate environment around the infected person; therefore, the transmission of the COVID-19 occurs through

- Direct contact with an infected person.
- Indirect surface contact in the immediate environment or with objects used by the infected person (e.g. stethoscope, thermometer, etc).

Airborne transmission occurs if the particles (presence of microbes within droplet nuclei) of size $<5 \mu\text{m}$ in diameter remain in the air for longer periods and transmitted over distances greater than 1meter. The airway transmission may be possible under circumstances and settings in which procedures or support treatments that generate aerosols are

performed (e.g. endotracheal intubation, open suctioning, etc).^{4, 5}

II) COVID-19 TRANSMISSION IN EYE

The tears are secreted from the lacrimal and accessory lacrimal glands. It contains pre-corneal tear film, which covers the anterior surface of cornea and conjunctiva. It has 3 layers aqueous, mucous, and lipid which protect the ocular surface from potential pathogenic microbes. With the help of the lacrimal pump mechanism, the tears enter into the puncta, canaliculi, lacrimal sac, and nasolacrimal duct that lead into the nasopharynx. The tears come from the lacrimal gland, enter through the lacrimal drainage system and gravity assist in moving these tears down through the throat and into the body.⁶

There is a probability that patients affected by COVID-19 can transfer the droplet infection through coughing, sneezing, or by talking to another person by breathing through mouth and nose. Another probable mode of transmission of COVID-19 is by ocular tissues.

Loon SC (2004) examine and analyzed by PCR using WHO laboratory protocol on 36 patients suspected of SARS in Singapore over a period of 12 days in the month of April 2003 and found a positive result from the tear samples of SARS coronavirus from eyes.⁷ According to one study about one-third of patients suffering from COVID-19 reported ocular abnormalities with low prevalence or the possibility of transmitting the SARS-CoV-2 in tears (Ping Wu; March 2020).⁸ One report reveals that the severity of COVID-19 is associated with conjunctivitis.⁹ Salducci M (May 2020) report revealed that severe viral conjunctivitis may be detected in patients with COVID-19 through tears with symptoms of red-eye, irritation, swelling with transparent serous secretion, conjunctival chemosis, tarsal conjunctiva inflammation accompanied by enlarged submaxillary lymph nodes.¹⁰

III) SAFETY MEASURES DURING COVID-19 OUTBREAK

1) Measures at Community Level

At present no vaccine is officially announced to cure COVID-19, so the best way is to avoid being exposed to the virus. Many public health organizations have

established guidelines to slow down COVID-19 transmission by case-isolation, identification, and follow-ups of contact environmental disinfection and use of Personnel Protective Equipment.¹¹ According to Infection preventive and control (IPC) measures, the risk of exposure can be reduced by¹² the use of face mask by the community and for health care workers [N₉₅ or FFP₂ (filtering Face Piece)].

- Disposal of the tissues used during coughing and sneezing.
- Regular hand-washing with soap or disinfection with 0.5–1.0% chlorhexidine gluconate in 80% ethyl alcohol¹³.
- Avoidance of contact with an infected person.
- Eye-protective wear or goggles (Visor). Anti-fog features improve clarity.¹³
- Water repellent or water-resistant gown, gloves (handling of any body fluid of infected patient), change gloves between each contact with different patients during outpatient procedures.
- Maintaining an appropriate distance/ Social distancing (1-meter).
- Avoid touching eyes, nose, or mouth with unwashed hands.

2) Measures in Eye-Care Settings

To protect the entire community/ general population from the unintentional spread of disease, patients should first be screened (**Table-1**) and then grouped on the basis of triage system by WHO 2003; Gavidia 2020 into general, suspect, and probable categories. (**Table-2**).¹³

a) PPE (Personnel Protective Equipment)

According to WHO (March 2020), donning the personnel protective equipment (PPE) is the only proficient measures for epidemic-pandemic-prone acute respiratory infections among health care professionals. These are enclosed here:

1) **Administrative Policies** like appropriate infrastructure facilitated access to laboratory testing, appropriate triage, and placement of patients, adequate staff-to-patient ratios, and training of staff, etc.

2) **Environmental and Engineering Control Policies** like social distancing, maintenance of 1meter distance between the patient and health care workers, well-ventilated isolation rooms for COVID-19 suspected/confirmed patients, etc.

The package includes gloves, medical masks, visor goggles or a face shield covering the forehead, extend below the chin and wrap-around side of the face (**Fig-1**), surgical gowns, shoe leggings, head mask as well as for specific procedures, respirators (i.e. N₉₅ or FFP₂ standard or equivalent).¹⁴ Concern should also be given on doffing procedures of PPE in such a way that its outer surface should not touch any part of the skin while removing it.



Fig 1: Face Shield

b) Equipment Sterilization

The diagnostic tools used during eye-examination must be disinfected using diluted bleach or by covering them with protective shields for e.g. slit lamp with breath shield (**Fig-2**), Autorefractor with a protective breath shield, microscope with shield, Prism tip to be sterilized after each case, Lensometer, Tonometer disposable sleeve (**Fig-3**) etc. The non-contact equipment such as chin-rest, forehead, etc needs to be disinfected by wiping with cotton ball soaked in 60-70% of isopropyl alcohol.

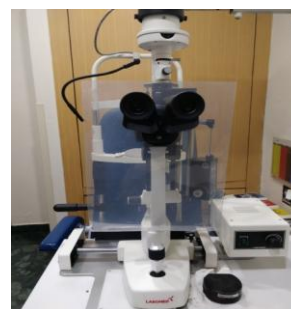


Fig 2: Slit Lamp with Breath Shield.



Fig.3: Tonometer Disposable Sleeve

c) Work-Place Hygiene and Disinfection

1. Restrict the visit of caregivers visiting the eye care settings/ hospitals with patients except for exceptional cases (Disabilities, or handicapped, etc).
2. The work-place should be sanitized with 1% of sodium hypochlorite (bleach) (Recommended by the ministry of health and family welfare).
3. Periodic mopping of the floor using good quality floor disinfectant and leave the solution before wiping it off for 10-15 minutes.
4. All possible touch points must be disinfected (door handles, table with accessories on it, chairs, desk, board switches, instruments, patient files between contacts, etc) on a daily basis using good quality sanitizers.

d) Preparation of 1% Sodium Hypochlorite (Bleach) 15

To make a dilute solution of 1% from 5% concentrated solution of sodium hypochlorite; calculate with the following formula

$$\text{Total Parts (TP) (H}^2\text{O)} = [\text{Percentage of concentrate} / \text{Percentage of dilute}] - 1$$

$$\text{TP (H}^2\text{O)} = [5.0\% / 1.0 \%] - 1$$

$$\text{TP (H}^2\text{O)} = 5 - 1 = 4$$

To make a desired 1% solution, dilute one part of sodium hypochlorite to 4 parts of water.

e) Sterilization of Frames and Sunglasses

Caitlenn B. Lineback (2018) reported that sodium hypochlorite, hydrogen peroxide, and diluted isopropanol alcohol have significantly higher bactericidal efficacies than other experimented disinfectants.¹⁶ Frames in this context are disinfected with 0.5% of hydrogen peroxide solution. Sunglasses need to be rinsed with water using liquid soap solutions and lenses by isopropyl alcohol commonly known as isopropanol or 2-propanol is a colourless, flammable chemical compound that evaporates quickly and is non-toxic. The isopropyl 60-70% solution is diluted with water as the water is capable of open up the pores of the bacteria.¹⁷

CONCLUSION

Finding suggests that COVID-19 virus may transmit through the tears by lacrimal pump mechanism and infect the person. Evidence are minimal on COVID-19 transmission through ocular tissues/eyes. More clinical studies need to be carried to validate its occurrence and its pathogenic mechanism.

There is a probability that SARS-CoV-2 can follow the tear pathway through the lacrimal apparatus into the throat. The importance must also be given to the safety of eye diagnostic tool for future patients and tear samplings as the investigative reports from various data sources reveal the transmission of COVID-19 in such scenarios of direct contact to the patient (close proximity), asymptomatic contacts, or by the use of an eye-diagnostic tool e.g. slit lamp examination, direct and indirect fundus examinations, tonometry, etc.¹³ There is a need for stringent barrier methods among eye-care workers, Ophthalmologist/Optomestrist, and health care workers regarding safety measures, personal protective equipment (compulsory during general/suspect/or probable cases), workplace disinfection, equipment sterilizations, frames and sunglasses disinfection in eye care settings during COVID-19 pandemic. The general population also needs to be conscious regarding the prevention and control of COVID-19 to avoid the risk of exposure and to prevent spreading the virus at the community level by also considering protective goggles along with other personnel protections.

Table 1: Steps for Primary Screening in Eye-Care Setting /Hospitals

S. No	Primary Screening
1	Symptoms of cold cough or fever.
2	Travel history within the last 2-3 weeks in any hotspot areas of COVID-19 infections.
3	Any contact with the identified COVID-19 patient or suspect.

Table 2: Patient Categorization According to Triage System in Eye- Care Setting / Hospitals

Group	Description	Categorization	Evaluation and Treatment
Group-1	or else, healthy patient with no travel/contact history in the last 2-3 weeks	General patients	Eye-care OPD with PPE.
Group-2	Patient with travel/contact history, self quarantine, and declared unaffected.		
Group-3	Patient with recent travel/contact history with no isolation and quarantined.	Suspect/ Probable cases	Only case with eye urgency needs to be treated in isolation ward but with full PPE protection

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