

Non-contact tonometer use during the COVID-19 pandemic

Dear Editor:

The COVID-19 era has forced upon us changes in the way we approach and manage our patients. One of the changes that have been suggested in the routine workup of patients is

to avoid non-contact tonometer (NCT) for the assessment of intraocular pressure (IOP).^[1] Use of Tonopen with a disposable tip or Goldmann applanation tonometry (with the cleaning of applanation cone after every patient) is recommended for IOP measurement, if necessary.^[1]

The origin of this decision seems to stem from the concern that viral dissemination may occur via NCT due to micro-aerosols formed with the pulse of pressurized air

blown towards the eyes and previous evidence of severe acute respiratory syndrome coronavirus (SARS-CoV) particles in tears of infected patients.^[2-4] However, recent studies showed inconsistent results regarding the presence of SARS-CoV-2 particles in tears and the risk of infection from ocular secretions is still uncertain.^[5-10]

In their study, Zhou *et al.* investigated the possible transmission of SARS-CoV-2 through aerosol contact with the conjunctiva. They detected SARS-CoV-2 in the conjunctival sac of three patients out of 67 cases with COVID-19 but were unable to prove that virus can be transmitted via conjunctival route.^[5] Another study by Kumar *et al.* detected SARS-CoV-2 in the conjunctival swab of only one patient among 45 COVID-19 patients.^[6] However, the detection of viral RNA does not always represent the presence of the infectious virus, and viral RNA shedding of SARS-CoV-2 does not correspond to infectivity.^[7]

Seah *et al.*, in their study, compared viral shedding in tears with nasopharyngeal swab sample results during COVID-19 infection. They found no evidence of virus shedding in tears through the course of the disease, even when nasopharyngeal swab samples continued to show positive results. They also suggested that the hypothesis of the lacrimal duct as a viral conduit may not be true as patients with symptoms of upper respiratory tract infections did not demonstrate any viral shedding in tears and the likelihood of transmission through tears is low regardless of the phase of infection.^[8]

Xia *et al.*, in their study, assessed the tears and conjunctival secretions in thirty SARS-CoV-2-infected patients. They found that the virus existed in the tears and conjunctival secretions of only one patient with conjunctivitis and there was no virus in the conjunctival sac of patients without conjunctivitis. However, the virus was not successfully isolated and cultured in the conjunctival secretion of the patient.^[9] Another study by Zhang *et al.* detected SARS-CoV-2 RNA fragments in the ocular discharge of one patient with conjunctivitis out of 72 cases with COVID-19.^[10] These findings substantiate the low risk of virus transmission from tears and conjunctival sac, especially in patients without conjunctivitis.

SARS-CoV-2 is assumed to use angiotensin-converting enzyme 2 (ACE2) to recognize and bind receptors to spike protein on its surface to enter into host cells as SARS-CoV.^[11] It is not clearly known whether conjunctival epithelia can express ACE2. According to Sun *et al.*, the expression and the binding capability of ACE2 were found to be much lower in conjunctiva and cornea than in lung and kidney tissues.^[12] However, in a recent study by Choudhary *et al.*, it is shown that ACE2 was not distributed in conjunctiva and cornea, though it was expressed in the posterior tissues such as the retina.^[13]

Regarding the use of NCT during the COVID-19 pandemic, we want to point out the overemphasis given to micro-aerosol formation without considering the volume of fluid in question. The volume of the tear film is 7 μ L and the possible amount of aerosolization is negligible if no topical drops are used. It is unlikely to contain more than one or two copies of the virus in tears, and the risk of infection from tears is a mere theoretical possibility based on the findings of the recent studies.^[5-10,13] Though it is reported that NCT produced micro-aerosols, it was also found that the aerosol particles disappeared quickly as the air circulated.^[3]

Only a small proportion of the COVID-19 patients had conjunctivitis,^[14] but it is unknown whether the conjunctival congestion was the initial or coexisting symptom. It has been initially reported that a member of the national expert panel on pneumonia, who wore an N95 mask but with no eye protection, was infected with SARS-CoV-2. However, wearing an N95 mask cannot completely prevent transmission. Also, he developed conjunctivitis just 2 to 3 hours before the development of fever and catarrhal symptoms rather than several days before the onset of pneumonia.^[15] It is unlikely that the onset of pneumonia occurred within 2 to 3 hours following the development of conjunctivitis.^[16] Another reported case of an anesthesiologist with COVID-19 who presented with conjunctivitis as the initial symptom had a negative conjunctival sac test for SARS-CoV-2. She developed ocular symptoms followed by fever and cough after performing intubation anesthesia for a confirmed COVID-19 patient, wearing an ordinary surgical mask and no other protective devices. The ocular symptoms were mild and relieved without any medication.^[5] These observations corroborate that no case has conclusively been demonstrated to be of viral transmission to a healthy person from the conjunctiva or tears.

It is thus highly unlikely that micro-aerosolization that occurs during NCT would cause transmission of infection to a healthy person. We believe that performing IOP check using NCT is not a risk, and the minimal theoretical risk can be further extenuated by placing the NCT in a relatively well-ventilated room with sufficient circulation of ambient air and airflow exchange, increasing the interval between tests, and following the 'one doctor, one patient, one consultation room' method, which can in turn further reduce the generation and accumulation of aerosol particles that may occur.^[3]

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Conflicts of interest

There are no conflicts of interest.

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