

Commentary: Exploring the transmission of COVID-19 through the ocular surface

The COVID-19 (also called SARS-CoV-2) pandemic has had a major strategic and operational impact on healthcare workers, due to its ease of interpersonal transmission.^[1] Like dentists and ENT surgeons, ophthalmologists and eye care providers are increased risk of getting infected due to the respiratory nature of transmission and patient proximity in ophthalmic examination. The role of the eye in the transmission of human CoVs is still under discussion. Amidst considerable controversy,^[2,3] what conclusion can one infer about occupational exposure through tears or conjunctival secretions? Is it to be considered a potential route of transmission? The explanation should be based on reliable scientific evidence and available anecdotal reports. Two studies from China have shown that in patients with conjunctivitis, the virus was detected in tears and conjunctival secretions, whereas it was absent in those who did not have conjunctivitis.^[3,4] In this issue, the authors of a study conducted by a single institute in South India report the presence of SARS-CoV-2 in 1 out of 45 conjunctival swabs of a COVID-19 patients having no evidence of conjunctival inflammation or ocular symptoms at the time of sample collection.^[5] This has also been reported earlier too.^[6] This suggests that a person could be infectious via tears even when there is lack of clinical eye signs of involvement. Although the detection of viral RNA does not always equate the presence of infectious virus and viral RNA shedding of SARS-CoV-2 does not equate with infectivity.^[7] Additionally, the single time point for conjunctival sampling compounded by the transient presence of virus, inadequate sampling or timing of sample collection may affect the low viral positivity.^[2] The important caveat, however, is that it highlights the rare presence of SARS-CoV-2 within the conjunctival sac/tears with important implications for public health.

SARS-CoV-2 is an encapsulated single-stranded RNA virus that has a spike glycoprotein, which interacts with a receptor-binding domain known as angiotensin-converting enzyme 2 (ACE-2).^[8] This receptor is expressed in the membranes of many cells in the body, including the respiratory, renal, and intestinal tracts. In the eye, this receptor is expressed in conjunctival epithelium, choroid, retina, and vascularised retinal pigment epithelium. So the discovery of SARS-CoV-2 in the tears or conjunctiva is not surprising. How does it appear into the conjunctival sac? Is it actively secreted by the lacrimal gland? Or is it possible that the obstruction of lacrimal drainage pathway plays a role in retaining the coronavirus on the ocular surface regardless of its presence in the nasal cavity, thus promoting periorcular/face skin contamination by means of epiphora.^[8] Could the positive pressure of ventilators push the virus retrograde up the nasolacrimal passage? Although, at the moment, it seems that there is a low risk of this virus spreading through ocular

discharge, in patients with conjunctivitis, it may survive or replicate in the conjunctiva even up to 21 days, after signs of conjunctivitis disappear.^[2] Also, conjunctival sampling does not provide any screening ability because the virus may not appear initially in the conjunctiva.^[9]

As scientific literature on presence of SARS-CoV-2 in ocular tissues accumulates, it will clarify the potential risk of transmission of COVID-19 by this route. Present findings suggest that the spectrum of those at risk of COVID-19 infection may be broader than previously recognized. It is prudent for healthcare workers to assume that ocular fluids are potentially infective. As suggested by the authors, precautionary measures are recommended when examining all patients (protective goggles or face shield) along with disinfection and sterilization of all contact equipment such as tonometers, occluders, vision cards, probes and contact lenses for laser procedures. Eventual investigations should determine if SARS-CoV-2 affects other structures of the eye, and determine the immunological responses that produce these clinical manifestations. Further data would throw more light on the role of novel coronaviruses in the eyes and we still have much to learn.

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