



# Comparison of Ocular Findings between SARS and Covid-19

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## Abstract

In December 2019, the novel coronavirus 2019-nCoV emerged from Wuhan, China and rapidly spread worldwide, causing thousands of deaths due to severe acute respiratory syndrome. In the past, another SARS coronavirus, the SARS-CoV, caused severe and even fatal respiratory illness as well. Ocular involvement has been reported for both these viruses. This review aims to highlight similarities and differences between these coronaviruses, focusing mainly on ocular findings. We wish that this article will lead to further analysis of the continuously emerging new data.

## Introduction

During the past 2 decades the World Health Organization (WHO) has twice declared a global health emergency over the SARS-CoV and the 2019-nCoV outbreak [1,2]. Both these Coronaviruses (CoVs) are highly contagious, with high fatality rate due to severe acute respiratory syndrome. CoVs are known pathogens for birds and mammals and in humans generally cause mild upper respiratory tract infections [3]. This article will introduce the knowledge about these two coronaviruses; will highlight the currently available evidence for ocular involvement and the similarities and differences between them.

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## Epidemiology

According to WHO the SARS-CoV outbreak in 2003 affected more than 8000 cases in 26 countries. The virus is primarily transmitted through infected respiratory secretions and it could be identified in stool and other secretions like tears, as well [4-6].

As far as the 2019-nCoV is considered, WHO officially declared COVID-19 a pandemic on March 11<sup>th</sup>, 2020. The disease was initially diagnosed in Wuhan, China, in December 2019 followed by a rapid world wide spread [7]. Viral transmission occurs mainly through infective respiratory droplets and indirect contact with infected surfaces and objects. Although the virus can be found in feces, currently there is no proof of oro-fecal transmission. Airborne transmission and spread through infected secretions like tears are also considered as possible ways of human-to-human infection [5,7-9].

## Pathophysiology

Hoffmann et al. [10] suggested that 2019-nCoV-S and SARS-CoV present similar pathogenic mechanisms. Researchers found that SARS-S and 2019-nCoV-S share about 76% amino acid identity and they concluded that both these coronaviruses use the Angiotensin-Converting Enzyme 2 (ACE2) receptor for target cells entry. In 2006, Sun et al. [11] identified ACE2 receptors in human eye and conjunctiva and concluded that these cells could slightly bind to the spike proteins of SARS-CoV. Ocular tropism of respiratory viruses could also be explained by the anatomical proximity and connection, through the nasolacrimal system, between the eye and the respiratory tissues [12]. Despite these commonalities between 2019-nCoV and SARS-CoV, ocular involvement is more frequently reported for COVID-19 [8-9,13].

## Symptoms - Diagnosis

Typically, coronaviruses cause self-limiting upper respiratory infections, with a wide spectrum of clinical manifestations. Indeed, the clinical appearance of both 2019-nCoV, SARS-CoV may vary from completely asymptomatic cases to severe acute respiratory failure and death. Fever of 38°C or more, dyspnea and malaise were more frequently reported by symptomatic patients. In cases of immunocompromised patients or patients with severe underlying conditions, life-threatening pneumonia can occur [3]. Occasionally, non-respiratory symptoms could be present. Ocular tropism of respiratory viruses, coronaviruses included, is proven in animal models, producing a broad spectrum of ocular manifestations from conjunctivitis and anterior uveitis to optic neuritis and retinitis [3]. On the contrary, humans rarely present ocular complications [12] and only selected cases are described in literature [14-17]. Ocular involvement could be suspected based on the ophthalmic examination and it is confirmed by the presence of viral RNA in conjunctival swabs on Reverse Transcription Polymerase Chain Reaction RT-PCR [5,6].

During the SARS-CoV outbreak in 2003 conjunctivitis was rarely described and viral RNA was detected in tears samples of only a small number of patients [5,6]. As far as 2019-nCoV is regarded, it could be associated to viral conjunctivitis [8,9,18]. Wu et al. concluded that ocular involvement is more common and could be correlated to the severity of the disease. In these studies viral conjunctivitis, epiphora and increased secretions were the main ocular complications and no sight-threatening conditions were described. [8,18].

We assume that the conjunctivitis associated to SARS-CoV and 2019-nCoV was self-limiting, with no permanent vision impairment as in all cases present in the literature for these coronaviruses, no special treatment and intervention was described.

Thus, ocular involvement for both coronaviruses is important mainly for the risk of transmission through infected tears and secretions. Indeed, different studies concluded that SARS-CoV is transmitted primarily by direct or indirect contact with mucous membranes of the eyes, nose, or mouth [19,20]. This seems to be valid for COVID-19 as well [8,18]. Therefore, it is essential for health care professionals to adopt adequate precautions such as face mask, frequent hand washing, avoid unnecessary eye touching, use of slit-lamp protective shields [21].

## Discussion

In the SARS epidemic, general public health interventions included case finding and isolation, quarantine of close contacts and enhanced measures were applied only in healthcare facilities and homes. Regarding travelling, there was extended information about SARS, health declarations were requested, and thermal scanning was performed at international borders. Overall, these measures have successfully contained the SARS-CoV outbreak in 2003 [22]. Initially the same strategy was used for the COVID-19, but soon it became evident that more restrictive measures were needed. Indeed, the WHO on March 11<sup>th</sup>, 2020 has declared COVID-19 pandemic [23]. Gradually most governments have applied more rigorous measures leading even to general lockdown, in an effort to contain the 2019-nCoV outbreak.

The consequences of these measures on the economy are enormous. The SARS-CoV outbreak affected mainly the economies of China and Hong Kong, with smaller impact in other countries

[24]. The predictions for covid-19 are by far larger due to the simultaneously lock down, as all sectors of the economy are affected globally and there are fears of new recession and financial collapse [24,25].

As far as the healthcare system is regarded, the 2019-nCoV pandemic represents a unique challenge. Ophthalmologists, along with all healthcare providers, ophthalmic clinics and practices, should adapt to this new reality in order to protect both patients and healthcare workers [21,25]. Patients should be examined only after scheduled appointment, whenever possible telemedicine is should be implied, the use of surgical mask and eye protection are recommended as well along with general hygienic measures [21,25].

## Conclusion

Ocular tropism of Respiratory Viruses, coronavirus included, is well known from the current scientific literature and is also documented in numerous animal models studies [12]. Although ocular complications are not a frequent manifestation of coronavirus infections in humans, the presence of both SARS-CoV and 2019-nCoV RNA in tears was confirmed, indicating that ocular exposure may represent a route of entry for this virus [3,12,18]. Thus, ophthalmologists and other healthcare professionals should adopt appropriate measures in order to prevent virus spread. In conclusion, further research is necessary in order fully understand the coronavirus infectivity within ocular tissues.

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