

# Ocular manifestations as the first symptom or manifestation of COVID-19: a literature review



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## HIGHLIGHTS

The literature review indicates a wide range of ocular complications related to COVID-19.

## ABSTRACT

The aim of this review is to analyze the available scientific literature on the impact of COVID-19 on eye health. A systematic literature review was conducted using medical databases. The focus was on publications regarding the ophthalmic manifestations of COVID-19, analyzing reported symptoms and pathophysiological mechanisms. The literature analysis revealed that COVID-19 can manifest as various eye conditions, such as conjunctivitis, keratopathy, uveitis, retinopathy, and optic neuropathy. Additionally, cases related to retinal microangiopathy and thrombosis have been described, which can lead to permanent vision loss. These findings suggest that SARS-CoV-2 may directly or indirectly affect various structures of the organ of vision through inflammatory and thrombotic mechanisms.

**Key words:** COVID-19, ocular manifestations, eye diseases, first symptoms, SARS-CoV-2

## INTRODUCTION

In recent years, the world was unexpectedly attacked by the COVID-19 pandemic, caused by the SARS-CoV-2 virus. Initially identified in December 2019 in Wuhan, China, the virus quickly spread globally, creating a wave of health, social, and economic challenges [1]. During the pandemic, the virus rapidly transmitted between people, becoming a global health concern [2]. The pandemic led to widespread infections, resulting in a surge of hospitalizations and increased pressure on healthcare systems worldwide. Patients' uncertainty about COVID-19 vaccinations exacerbated this issue [3]. The pandemic period not only affected public health but also had severe social, economic, and psychological consequences. Lockdowns, social restrictions, and economic losses impacted every area of life, leading to lifestyle changes, remote work, and increased psychological burden [4].

COVID-19 is characterized by a wide range of symptoms, including fever, cough, shortness of breath, loss of taste and smell, as well as serious complications such as pneumonia. The infection can lead to severe conditions, especially in the elderly and those with pre-existing conditions. In addition, reports have indicated the impact of COVID-19 on eye health. Some patients reported red eyes, photophobia, burning sensations, and a feeling of grit under the eyelids. Furthermore, cases of conjunctivitis have been identified in many infected individuals [5].

The purpose of this study is to analyse the impact of SARS-CoV-2 infection on ocular symptoms and diseases and to provide a comprehensive view of the new challenges related to the COVID-19 pandemic in the context of eye health. Additionally, the paper aims to highlight potential areas for intervention and directions for further research.

## METHODOLOGY

The initial steps involved a detailed definition of inclusion and exclusion criteria and the scope of the literature review. This process included defining the specific topics to be studied, the publication dates of articles, the types of studies, and the geographical areas to be included. The PubMed database was then searched using appropriately tailored combinations of keywords. The keywords included terms related to COVID-19, ocular symptoms, eye diseases, and medical terminology.

After the database search, a selection of publications followed. This process began with a review of article titles to assess their potential alignment with the established criteria. The next step was a review of abstracts to further refine which publications met the inclusion criteria. The final stage involved thoroughly reading the full texts of selected publications to assess their alignment with the inclusion criteria and the quality of the research. A key element of this process was the selection of the most

valuable content from all available publications. The selected articles were then carefully summarized. The summary included key research findings, their significance in the context of analysing the impact of SARS-CoV-2 infection on eye health, and the identification of areas that potentially require further research. This resulted in a comprehensive overview of the current state of knowledge on the impact of COVID-19 on eye health and highlighted the directions in which further research and interventions should be conducted.

## DISCUSSION

### Ocular symptoms of ongoing infection

Numerous medical reports suggest that ocular symptoms may be one of the clinical aspects associated with infection. These include red eyes, burning, dryness, as well as eye pain [5]. In adult patients, various ocular symptoms associated with COVID-19 can occur, with some reported symptoms being: conjunctivitis, episcleritis, corneal graft rejection, orbital cellulitis, dacryoadenitis, retinal vascular occlusion, retinopathy, maculopathy, endophthalmitis, cranial nerve palsy, optic neuritis, and uveitis with variable prognostic outcomes [6].

The phenomenon of ocular symptoms in COVID-19 infection is particularly intriguing as it may indicate potential eye damage associated with the virus. The mechanism of this impact is not yet fully understood, but studies suggest that SARS-CoV-2 may trigger inflammatory responses in the eye, affecting the mucous membranes and ocular structures. Ocular symptoms, though usually mild, may constitute a significant element of the clinical spectrum of COVID-19 infection. For instance, with Human Coronavirus NL63 (HCoV-NL63), conjunctivitis has been identified as a symptom of infection, highlighting the diverse nature of coronavirus manifestations [8]. The SARS-CoV-2 virus has been extracted from the tears of infected patients [9], which may be related to the susceptibility to ocular symptoms.

### Conjunctivitis

Conjunctivitis is the most common cause of red eye, and its background can be allergic, viral, or bacterial [10]. This condition is characterized by redness of the eye's mucous membrane, swelling, burning, and excessive tearing. Diagnosis is based on observing characteristic clinical symptoms, such as redness, pain, and photophobia. Treatment often includes eye drops to alleviate symptoms [11]. It is also recommended to avoid touching the eyes and frequently washing hands to reduce the risk of infection transmission. Approximately 9% of patients with SARS-CoV-2 infection have been observed to develop conjunctivitis [12]. A positive conjunctival swab result can persist for about 5 days, and symptoms most commonly appear in patients with

moderate COVID-19 disease [13]. Despite the passage of time and the emergence of a negative nasopharyngeal swab result, ocular symptoms may still persist [14]. This symptom affects not only adults but also children [15]. However, it is believed that in children and adolescents, this is a systemic inflammatory response and not directly caused by the infection [16]. A few cases of newborns with hemorrhagic conjunctivitis due to COVID-19 have also been described, where the mothers were infected with the virus during pregnancy [17].

## UVEITIS AND RETINITIS

COVID-19 infection affects not only the conjunctiva but also anatomical structures inside the eye. The virus can damage the retina and choroid through direct invasion or by triggering an indirect inflammatory response. Most retinal changes result from microcirculation damage, leading to cotton wool spots, intraretinal haemorrhages, acute macular neuroretinopathy, acute middle maculopathy, and retinal vein occlusion. Less commonly, retinitis, choroiditis, or reactivation of previously inactive uveitis can be observed [18]. Unilateral pathological retinal changes such as vascular changes, exudates, and perivascular infiltrates have been described. Other patients exhibited retinal changes, including vessel narrowing and cotton wool spots visible on OCT and angio-OCT examinations [19]. In children with multi-system inflammatory syndrome, subretinal haemorrhages, vitreous inflammation, and vascular changes have been noted. These symptoms may occur in the context of thrombotic risk associated with COVID-19 [20].

## Episcleritis

A case of episcleritis has been described as a possible early symptom of COVID-19. In a 29-year-old man with no prior medical conditions, episcleritis was the first symptom, and a few days later, systemic COVID-19 symptoms developed, confirmed by PCR testing. After treatment of the infection, the patient's symptoms significantly decreased [21]. Another study reported a case of a woman who developed episcleritis 7 days after initial symptoms of SARS-CoV-2 infection. Initially, she presented with a cough and muscle pain, which later subsided, replaced by anosmia and ageusia. A positive PCR test for COVID-19 prompted treatment, resulting in

the resolution of her eye symptoms, such as redness, foreign body sensation, and photophobia, with fluorometholone and artificial tears. 18 days later, after the resolution of ocular symptoms, a repeat PCR test was negative [22].

## Orbital inflammation

During the COVID-19 pandemic, unusual orbital symptoms in children were described. One child with confirmed COVID-19 infection developed orbital myositis, which was successfully treated with glucocorticosteroids. Another case involved a 6-month-old infant with active COVID-19 who developed bilateral orbital inflammation, confirmed by biopsy. Additionally, cases of infants with orbital swelling have been described, attributed to both COVID-19 and other factors such as prematurity [23].

## Dry eye syndrome

Among the potential ocular complications associated with COVID-19 is dry eye syndrome, which may be caused by the infection itself, as well as the frequent use of protective masks and the associated problems of eye dryness [24]. Furthermore, increased use of digital devices during the pandemic contributes to digital eye strain, which can be difficult to distinguish from dry eye syndrome symptoms [25]. Prospective studies have shown a significant impact of wearing protective masks on the development of dry eye syndrome or its symptoms. This correlation and the strongest symptoms were observed in the group wearing masks for more than 3 h per day [26]. Unfortunately, there are no studies that distinguish COVID-19 as a direct cause of dry eye syndrome.

## CONCLUSION

In the context of post-COVID-19 conditions, it is important to monitor the long-term impact of COVID-19 on eye health. The visual system plays a key role in everyday human functioning, making it essential to understand these aspects. This not only provides a better understanding of the scope of COVID-19 infection but also offers valuable information for planning healthcare for patients with post-COVID conditions. Identifying the causes of ocular symptoms and the correlation between various conditions is crucial for proper diagnosis, treatment, and prevention of complications.

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#### References

1. Khanna RC, Cicinelli MV, Gilbert SS et al. COVID-19 pandemic: Lessons learned and future directions. *Indian J Ophthalmol.* 2020; 68(5): 703-10.
2. Ulaszewska K, Jodczyk AM, Długołęcki P et al. Factors Associated with Willingness to Receive a COVID-19 Vaccine in Adult Polish Population – A Cross-Sectional Survey. *Vaccines.* 2022; 10(10): 1715.
3. Braczkowska B, Kowalska M, Braczkowski R et al. Determinants of vaccine hesitancy. *Przegl Epidemiol.* 2017; 71(2): 227-36.
4. Jodczyk AM, Kasiak PS, Adamczyk N et al. PaLS Study: Tobacco, Alcohol and Drugs Usage among Polish University Students in the Context of Stress Caused by the COVID-19 Pandemic. *Int J Environ Res Public Health.* 2022; 19(3): 1261.
5. Nasiri N, Sharifi H, Bazrafshan A et al. Ocular Manifestations of COVID-19: A Systematic Review and Meta-analysis. *J Ophthalmic Vis Res.* 2021; 16(1): 103-12.
6. Sen M, Honavar SG, Sharma N et al. COVID-19 and Eye: A Review of Ophthalmic Manifestations of COVID-19. *Indian J Ophthalmol.* 2021; 69(3): 488.
7. Shah KK, Venkatramani D, Majumder PD. A case series of presumed fungal endogenous endophthalmitis in post COVID-19 patients. *Indian J Ophthalmol.* 2021; 69(5): 1322.
8. Vabret A, Mourez T, Dina J et al. Human Coronavirus NL63, France. *Emerg Infect Dis.* 2005; 11(8): 1225-9.
9. Loon SC, Teoh SCB, Oon LLE et al. The severe acute respiratory syndrome coronavirus in tears. *Br J Ophthalmol.* 2004; 88(7): 861.
10. Alfonso SA, Fawley JD, Alexa Lu X. Conjunctivitis. *Prim Care.* 2015; 42(3): 325-45.
11. Azari AA, Barney NP. Conjunctivitis: a systematic review of diagnosis and treatment. *JAMA.* 2013; 310(16): 1721-9.
12. Sindhuja K, Lomi N, Asif MI et al. Clinical profile and prevalence of conjunctivitis in mild COVID-19 patients in a tertiary care COVID-19 hospital: A retrospective cross-sectional study. *Indian J Ophthalmol.* 2020; 68(8): 1546.
13. Chen L, Deng C, Chen X et al. Ocular manifestations and clinical characteristics of 535 cases of COVID-19 in Wuhan, China: a cross-sectional study. *Acta Ophthalmologica.* 2020; 98(8): e951.
14. Nayak B, Poddar C, Panigrahi MK et al. Late manifestation of follicular conjunctivitis in ventilated patient following COVID-19 positive severe pneumonia. *Indian J Ophthalmol.* 2020; 68(8): 1675.
15. Loffredo L, Pacella F, Pacella E et al. Conjunctivitis and COVID-19: A meta-analysis. *J Med Virol.* 2020; 92(9): 1413-4.
16. Fernández Alcalde C, Granados Fernández M, Nieves Moreno M et al. COVID-19 ocular findings in children: a case series. *World J Pediatr.* 2021; 17(3): 329-34.
17. Pérez-Chimal LG, Cuevas GG, Di-Luciano A et al. Ophthalmic manifestations associated with SARS-CoV-2 in newborn infants: a preliminary report. *J AAPOS.* 2021; 25(2): 102-4.
18. Zhang Y, Stewart JM. Retinal and choroidal manifestations of COVID-19. *Curr Opin Ophthalmol.* 2021; 32(6): 536-40.
19. Abbinante G, Plaitano C, Gallo FG et al. A case of retinal vascular involvement in a 6-year-old patient with Covid-19. *Eur J Ophthalmol.* 2022; 32(4): NP1-5.
20. Arkan İ, Demir ST, Livan EH et al. Ocular Manifestations of Multisystem Inflammatory Syndrome in Children with COVID-19. *Pediatr Infect Dis J.* 2021; 40(9): e356-8.
21. Otaif W, Al Somali AI, Al Habash A. Episcleritis as a possible presenting sign of the novel coronavirus disease: A case report. *Am J Ophthalmol Case Rep.* 2020; 20: 100917.
22. Méndez Mangana C, Barraquer Kargacin A, Barraquer RI. Episcleritis as an ocular manifestation in a patient with COVID-19. *Acta Ophthalmol.* 2020; 98(8): e1056-7.

23. Alnahdi MA, Alkharashi M. Ocular manifestations of COVID-19 in the pediatric age group. *Eur J Ophthalmol.* 2023; 33(1): 21-28.
24. Koh S, Rhee MK. COVID-19 and Dry Eye. *Eye Contact Lens.* 2021; 47(6): 317-22.
25. Kaur K, Gurnani B, Nayak S et al. Digital Eye Strain- A Comprehensive Review. *Ophthalmol Ther.* 2022; 11(5): 1655-80.
26. Krolo I, Blazeka M, Merdzo I et al. Mask-Associated Dry Eye During COVID-19 Pandemic-How Face Masks Contribute to Dry Eye Disease Symptoms. *Med Arch.* 2021; 75(2): 144-8.

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