Refractive error changes and associated asthenopia observed after COVID-19 infection: Case reports from two continents

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COVID-19 infection has been linked to various ocular complications and complaints, but not to refractive errors. In this case report, we present ethnically diverse patients who reported asthenopic symptoms shortly after recovering from COVID-19 infection. The hyperopic shift in the refractive error, post-COVID could indicate the ciliary body muscle's inability to sustain accommodation, resulting in asthenopia. Hence, refractive errors should also be considered as a post-COVID complication, even if the magnitude is small, especially when patients have a headache and other asthenopic symptoms. Performing dynamic retinoscopy and cycloplegic refraction will also aid in the better management of these patients.

Keywords: Asthenopia, binocular vision, COVID-19, hyperopia

The common eye symptoms reported by patients with COVID-19 infection during a clinical examination included persistent dry eyes, itching, redness, watering, foreign body sensation, intolerance to light, and in some cases subtle retinal changes.[1,2] Here we report patients with asthenopia and headache during/after the COVID-19 infection, who were examined in two different clinical settings (an institutional-based clinic [India] and a private practice clinic [Botswana]), who demonstrated a change in refractive error post-COVID. Informed consent was received from the patients in order to report clinical details for this case report.

Case I

A 31-year-old female patient, of Asian–Indian ethnicity, reported in August 2021 complaints of seeing near objects with distortion after recovering from COVID-19, 3 months ago. These symptoms were not present during her earlier visit to our institute 3 years ago (refractive error: 0.00/-0.50DC X 90, each eye). In the present visit, her distance visual acuity (VA) was −0.1 logMAR (COMPlog VA chart) in each eye and N6 for near. The non-cycloplegic and cycloplegic refraction revealed hyperopia [Table 1]. A lag of +1.50 Diopter sphere (DS) was also observed in both eyes (monocular estimation method). The patient also had 16 Prism diopter (PD) and 20 PD intermittent exotropia for distance and near, respectively. This deviation was not observed in the earlier visit. She was prescribed hyperopic correction. Over teleconsultation after 6 months, the patient reported her symptoms were not present and she was comfortable with her spectacles.

Case 2

A 25-year-old male patient and an optometry trainee, of Asian–Indian ethnicity, reported in July 2021 complaints of blurred vision for near in both eyes over the past week. He also complained of generalized headaches after recovering from a COVID-19 infection 2 months ago. On examination, his VA was 0.0 logMAR for distance in each eye and N6 for near. The non-cycloplegic and cycloplegic refractions indicated hyperopic refractive error [Table 1]. There was a lag of +1.75 DS in the right eye and +1.50 DS in the left eye. His near point of convergence (NPC) was receded. The accommodation findings were also on the borderline toward having a lower near point of accommodation (NPA) when compared to an age-appropriate level.[3] The accommodative facility also revealed difficulty with the minus lens to clear the target and with a lower facility. Taken together, there was an indication of accommodative dysfunction. Spectacles were advised for this patient for constant use. The patient reported a reduction in symptoms and was comfortable with his spectacles in the 6-month follow-up.

Case 3

A 22-year-old African-ethnic male student reported in July 2021 to a clinic in Botswana with symptoms of near vision difficulty, particularly after looking at distant objects, ever since he had a COVID-19 infection, 3 months ago. He also reported of pulling sensation and difficulty looking at light. His VA was 0.0 logMAR (Snellen's vision projector) for distance and N6 for near, in each eye. Both the non-cycloplegic and cycloplegic refractions revealed a hyperopic refractive error [Table 1]. Following the refractive correction, the patient reported an improvement in symptoms and comfort during a 6-month follow-up.

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Table 1: Refraction and binocular vision parameters measured in the three reported cases

Case	Age/ gender	Objective refraction			Subjective acceptance (logMAR visual acuity)	Diagnosis	Binocular vision parameters	
			Non-cycloplegic	Cycloplegic			Accommodation	Vergence
I	31/F	RE	+1.00 DS/−0.50 DCX100	+1.50 DS/−0.75 DCX100	+1.25 DS/−0.50 DCX110 (−0.1)	Compound hyperopic astigmatism	NPA (cm): RE/ LE/BE10/11/14	NA
		LE	+1.50 DS/−0.75 DCX80	+1.25 DS/−0.75 DCX80	+1.25 DS/−0.50 DCX70 (−0.1)			
II	25/M	RE	+0.50 DS/−0.75 DC X180	+0.50 DS/−0.50 DC X180	+0.50 DS/−0.25 DC X180 (0.0)	Compound hyperopic astigmatism	NPA (cm): 12/16/14 NRA: +2.75 DS PRA: -2.00 DS AF (cpm): RE/ LE/BE10/8.5/8	NPC: 12 cm NFV (PD): Break/Recovery Distance: 8/6; Near: 20/18 PFV (PD): Break/ Recovery Distance: 20/18; Near: 25/20
		LE	+0.50 DS/−0.75 DC X180	+0.50 DS/−0.50 DC X180	+0.50 DS/−0.25 DC X180 (0.0)			
III	22/M	RE	+0.75 DS	+1.25 DS	+0.75 DS (0.0)	Simple hypermetropia	NPA (cm): 12/12.5/13	NA
		LE	+0.75 DS	+1.25 DS	+0.75 DS (0.0)			

F: Female, M: Male, RE: Right eye, LE: Left eye, BE: Both eyes, DS: Diopter sphere, DC: Diopter cylinder, cm: Centimeter, cpm: Cycles per minute, NPC: Near point of convergence, NPA: Near point of accommodation, NFV: Negative fusional vergence, PFV: Positive fusional vergence, NRA: Negative relative accommodation, PRA: Positive relative accommodation, PD: Prism Diopter, AF: Accommodative Facility, NA: Not available

Discussion

The emergence of asthenopic symptoms and changes in refractive error in individuals with a history of COVID-19 infection is highlighted in these case reports. These symptoms occurred only after/during COVID-19 infection and were not present before. Although these patients visited different clinical settings, the treatment outcomes of these individuals were comparable. These cases suggest that post-COVID fatigue can affect the eyes regardless of race and that even a low magnitude of refractive error, particularly hyperopia, might exacerbate the symptoms.

All patients in this report showed facultative hyperopia, which they were able to compensate for with accommodative effort. In general, mild to moderate hyperopic refractive error goes undiagnosed because this optical defect may be adequately compensated for by ciliary muscle contraction.[4] This is particularly true when the accommodative amplitude exceeds the amount of hyperopia. In the absence of symptoms, such small refractive errors are hardly corrected. Prescribing patterns for hyperopia vary greatly.[5] Hyperopic blur can lead to asthenopic symptoms and headaches.[6] Hyperopes usually have high tonic accommodation due to strong parasympathetic innervation.[7] It is possible that as a sequel to COVID-19 infection, there could be a decrease in parasympathetic innervation,[8]which in turn decreases the ciliary muscle tonicity.

The observation of intermittent exodeviation (Case I) and receded NPC (Case II) indicates a reduction in the fusion ability. Accommodative convergence can control the exodeviation.[9] Hence, it is possible that with the reduction in accommodative ability, the exodeviation increases in these patients. Reduced accommodation or convergence, along with visual discomfort, has been documented in individuals with post-viral syndrome.[10,11] Age is commonly associated with a reduction in tonic accommodation and the manifestation of hyperopia.[12] However, the reduction in tonic accommodation and acceptance of a low hyperopic refractive correction in young adults reported here cannot be attributed to aging.

Cases I and II were evaluated at a binocular vision and orthoptics clinic. These patients were found to have a significant lag of accommodation and a borderline reduction in the amplitude of accommodation. These values suggested that the accommodative system was perhaps dysfunctional. The first line of management in such cases is to give the appropriate refractive error correction. The uncorrected refractive error causes additional demand on the vergence and accommodation systems, resulting in asthenopia. Although these patients had a low refractive error, spectacle correction was recommended primarily to maintain clear retinal images without effort. Clear retinal images in both eyes will maintain fusion and binocularity. It has been shown that considerable improvement in binocular vision can be observed within a month of refractive correction.[13] All patients reported a decrease in symptoms following their refractive correction. A longer follow-up will be necessary to determine if accommodation improves for these patients; at least within 6 months of follow-up, no such improvement was observed in our cases.

Conclusion

In conclusion, COVID-19 infection can cause asthenopic symptoms involving the visual system. In these individuals, a comprehensive eye examination to rule out any underlying refractive error is essential. Even though the amount of refractive error is minimal, with normal VA, the refractive correction should be considered to alleviate the symptoms.

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Conflicts of interest

There are no conflicts of interest.

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