Editorial

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Getting a clearer picture of myopia after the COVID-19 pandemic

Myopia is a complex disease with well-established genetic and environmental risk factors, particularly reduced time outdoors, increased near work, and increased education, that are all intertwined. The epidemic of myopia in Asia has led to interventions to increase the time schoolchildren spend outdoors and reduce the intensity of education and near work, which appear to be effective, with rates of myopia seeming to decline.[1] Other interventions such as low-concentration atropine eyedrops and orthokeratology also appear to slow progressions and are widely prescribed by eye care providers.[2]

The COVID-19 pandemic and associated lockdowns disrupted education worldwide, with children confined to home and undertaking increased learning online.[3] This was predicted to increase rates of myopia. However, only a small number of studies with full cycloplegic refractions on large numbers of children before and after the pandemic were available to thoroughly evaluate the pandemic's impact on myopia.[4]

In the current issue of this journal, Au Eong *et al*. report a systematic review on the impact of the COVID-19 pandemic on the progression, prevalence, and incidence of myopia.[5] Twenty-three studies, 17 cohort and 6 cross-sectional, were included. A large majority of these studies reported a greater myopic shift and increase in myopia prevalence during the COVID-19 pandemic compared to the pre-COVID-19 era. The three studies on myopia incidence showed increased incidence during the COVID-19 pandemic. Myopia progression accelerated during the COVID-19 pandemic, even in individuals using low-concentration atropine eyedrops in two studies. A similar systematic review and meta-analysis by Najafzadeh *et al*. found that, over the period of the pandemic, myopia prevalence increased, with spherical equivalent decreasing − 0.61diopter and axial length increasing by 0.42 mm.[6] The researchers also found mean screen time increased by 6.25 h/day, and that outdoor activity time decreased −1.52 h/day.

The COVID-19 pandemic disrupted many clinical trials underway, with participants unable or unwilling to attend follow-up trial assessments.[7] This was a major problem for some trials that were recording precise measurements. In addition, the pandemic also influenced participants' adherence with the trial intervention/medications. Several low-concentration atropine myopia intervention trials were underway at this time, including the PEDIG study,[8] which found no benefit of low-concentration atropine, and the MOSAIC study,[9] which noted a larger treatment effect in participants least affected by COVID-19 restrictions. In this issue, Lee *et al*. look at the impact of COVID-19 restrictions on the efficacy of atropine 0.01% eyedrops for myopia control in the Western Australia atropine for the treatment of myopia study.[10] This study found decreased efficacy of low-concentration atropine, even with relatively lenient restrictions lasting for a few months in Western Australia, where the last case of

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unknown community transmission of COVID-19 was on April 11 and WA schools resumed Term 2 as normal on April 28, while the state border remained closed for nearly 2 additional years.

What Have We Learnt from the Collision of Two Epidemics?

Notably, it appears that younger children might experience greater myopic progression due to COVID-19 lockdowns.[5] This is important for any future lockdown situations where this age group will need better interventions to increase outdoor time and reduce near-work/screen time. It also suggests that this age group should be the focus of any trials of interventions to prevent myopia.

Why did the COVID-19 lockdowns reduce the benefit of low-concentration atropine eyedrops and can this data help us understand how atropine works? Could the mild pupil dilation with low-concentration atropine[11] eyedrops allow more light into the eye in brighter outdoor settings but have minimal benefit in less illuminated environments indoors, when the pupil is more naturally dilated anyway. Genetic studies have highlighted the importance of light-induced signaling in the development of myopia.[12] The exact mechanism of light preventing myopia is unknown, with both red light and violet light felt to be protective. Furthermore, in this issue, Chen *et al*. review the impact of light properties on ocular growth and myopia development.[13] Future clinical research into factors such as light intensity, lighting cycles, spectral wavelengths, color contrast signals, and light source flicker status may elucidate the regulatory mechanisms of light on myopia and future treatment.

Researchers need to continue to take advantage of the timestamp the COVID-19 disruption has created and follow children into the future to see the long-term impact of reduced time outdoors and increased screen time at different ages.

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