Report: OEPF Lecture • Myopia Control—Who to Target with Myopia Interventions

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The worldwide prevalence of myopia, by most accounts, is increasing. In some areas of the world, southeast Asia in particular, the percentage of the teen population that is myopic is significant. China's myopia has increased over 60% in the past 15 years to 95.5% of the teenage population. In the U.S., half of the teen population is now nearsighted.

The questions for myopia management are why and when do we need to manage myopic progression? Every diopter of myopia matters, but public awareness lags behind optometric research and concerns, which leads to a discussion of effective methods of myopia control. Control implies two parts: risk of myopia onset and risks for myopia progression. Will myopia happen? If it does start, can we slow it down? When will the progression stop?

Genetics plays a role, but low hyperopia in children is a key predictor for myopic progression. In the CLEERE study, a refraction close to emmetropia in North American children (7–13 years old) also has been shown to be the best single predictor of future myopia.[1] The exact threshold varies with age, from <+0.75 D at age 6, ≤+0.50 D at ages 7 to 8, ≤+0.25 D at ages 9 to 10, and ≤0 D at age 11 years. Recently, the International Myopia Institute has defined the condition of pre-myopia. Pre-myopia is a refractive state of an eye of ≤0.75 D and >0.50 D in children where a combination of baseline refraction, age, and other quantifiable risk factors provide a sufficient likelihood of the future development of myopia to merit preventative interventions. [2]

Heredity makes a difference, as does race/ethnicity. If both parents are myopic, the risk for children is at least three times higher. Asian children have a higher risk of developing myopia and an increased risk for high myopia (≤6.00 diopters) than other races.

Environment also plays a role, which echoes the behavioral optometric philosophy. Environmental risk factors for increasing myopia include reduced outdoor activities, reading distances that are 20 cm and closer, continuous near-work periods greater than 45 minutes at a time, and perhaps cell phone use. Remote learning during the pandemic and related educational activities have been shown to increase the risk of myopia progression.[3,4]

Binocular vision disorders, including accommodation and fusional dysfunction, are associated with myopic progression. Esophoria at near and a high AC/A ratio, as well as reduced accommodative facility and increased lag of accommodation, have been reported in myopic children. In sum, early-age refractive errors, family history of myopia, race/ethnicity, visual environment (especially at near), educational activities, outdoors time, and some aspects of binocular vision apparently have some role in or relationship to increased myopia.

Understanding risk factors allows us to target higher-risk children and offer active management of those patients. Parents' concerns and cultural backgrounds will come into play, but planting the seeds early with good patient (parent) education is key. Asian children progress at a higher rate than non-Asian children. At 9 years of age, Asian children on average progress at -0.82 D/year, while in non-Asians, that rate is -0.55 D/year.[5] Peak ages for progression are

6 to 14 years old, with myopic-trend refractive errors at a younger age being a big sign of myopia. The rates of progression in both axial length and refractive status at 7 years old are almost double the rates at 11 years old. Axial length in emmetropic children increases about 0.1 mm per year from 6 to 14 years old.[6] In Asian myopic children, the increase of axial length at 7 years old can be five times the rate in emmetropic children aged 6 to 14 years old.[7]

Myopia management starts with a comprehensive eye and vision examination, possibly with cycloplegic refraction. Binocular vision tests should always be performed, then collect and evaluate risk factor information: parental myopia, visual environment, and educational activities. If available, axial length measurements should be performed. If orthokeratology is a consideration, topography is needed.

If you are actively managing myopia, what is the stopping point? At what age? Fifty percent of childhood myopic progressions stop by age 15, and 75% stop by age 18. The peak progression years are 7 to 14 years old.[8] Perhaps when myopia progression is lower than 0.25 D/year and in an age zone when we would expect the myopia progression to stop, the conversation should be started with parents and children about when the myopia treatment should be considered to stop.

Online learning became a new normal during the COVID-19 pandemic. Although there is no study done to compare the effect of screen size on myopia progression (such as computer vs. cell phone), one would expect smaller screen size to be associated with closer working distance, which has been confirmed to be one of risk factors for myopia progression. In addition, smaller screens are associated with smaller fonts, which lead to increased accommodative demand. Thus, eye care practitioners may consider recommending that children use digital devices with relatively big screens and asking children to avoid using cell phones for educational activities. Furthermore, eye care practitioners should promote good visual hygiene, including the 20-20-20 rule: every 20 minutes, take a 20 second break, looking 20 feet away.

All of that risk analysis, history, and parental concern comes into play: which active myopia management should be chosen? If a parent is concerned, "wait and see" may not be an appropriate and well-accepted strategy. A clinical case: 9-year-old Sophia was a moderately myopic child (-2.75) at an early age, the Asian daughter of very nearsighted parents, and spent an hour in outdoor activities daily. She was on the swim team and did one hour of homework daily. Orthokeratology might be a good option for Sophia as active myopia management.

Six-year-old Andrew presented a different profile; a different regimen was recommended. Andrew had annual examinations since he was 3 years old. Over the last 3 years, his hyperopia decreased from +1.50 DS, to +1.25, to +0.75, and finally to +0.25 DS. His father, mother, and older sister were all myopic, and his sister had used 0.01% atropine for 3 years. With remote learning, Andrew's mother became very concerned about myopia. The ATOM 3 clinical trial (effect of 0.01% atropine on myopia onset) won't be completed until 2023. With good parent education, Andrew's parents understood that there was no research evidence about the effect of 0.01% on preventing myopia onset. Andrew was started on 0.01% atropine, was counseled on his visual environment (he currently was doing remote learning 8 hours a day, as well as some video gaming), and was encouraged to go outside to play for two hours (total) per day.

In contrast to Andrew, 16-year-old Rachel, a very myopic (-6.00 and -6.25 sph, although her current lenses were -7.25) African American girl, and her father (-3.50 sph) wanted to try atropine. Screen time, again, approached 8 hours per day for remote learning plus homework, and Rachel also had a 3-hour-per-day addiction to TikTok and YouTube. Rachel showed 2pd esophoria at near with the cover test. After adjusting her lens prescription to the current (lower) power, Rachel was scheduled to return in 6 months to evaluate whether her myopia had stopped or was progressing.

New technologies for myopia management include spectacle lenses to defocus the paramacular area (DIMS, Stellest, Diffusion Optics Technology) and IVMED-85 eyedrops that crosslink the sclera and induce a hyperopic shift. A myopia progression and treatment calculator can be found at https://bhvi.org/myopia-calculator-resources/.

Clinical pearls are that in the rapidly developing field of myopia management, treatment plans will be individualized, and parents need information planted early. Parents can be very knowledgeable, so be prepared.

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Pang Y, Hussey E. Myopia control—who to target with myopia interventions. Optom Vis Perf 2022;10(COVID):34-6.