Myopia Management:

What is myopia?

Myopia is blurry long-distance vision, often called ‘short-sightedness’ or ‘near-sightedness’. A person with myopia can typically see clearly up close – when reading a book or looking at a laptop screen – but words and objects look fuzzy on a whiteboard, on television, across the room, when looking outdoors or when driving.

Why is myopia a concern?

The rate of myopia is growing across the world, increasing from 22% of the world’s population in 2000 to 33% in 2020 – half of the world’s population expected to be myopic by 2050.[1] Most myopia is caused by the eye length growing too quickly in childhood. The eyes are meant to grow from birth until the early teens and then cease, but in myopia the eyes grow too much and/or continue growing into the teenage years. Once a child becomes myopic, their vision typically deteriorates every 6-12 months, requiring stronger and stronger prescriptions. Most myopic children tend to stabilize by the late teens and early 20’s.[2] Excessive eye growth raises concern because even small amounts of stretching can lead to increased likelihood of vision threatening eye diseases in later life, such as myopic macular degeneration, retinal detachment, glaucoma, and cataract.[3,4]

Exactly why these changes are happening is not completely understood, but there are a number of risk factors that have been found. Genetics certainly plays a large role with high risk factors including having 2 myopic parents (or 1 highly myopic parent), a sibling with high myopia, family history of retinal detachment or being of Asian descent. It has been well documented that children who spend less time outside have a greater chance of becoming myopic, although the underlying reason for this is not yet known for certain. Theories include increased near work indoors (reading, tablets) and decreased sun exposure as possible contributing factors. There is some thought that since we tend to hold phones and other handheld electronic devices closer to our eyes than other near objects (like a book) that the extra focusing demand could be playing a role in myopia progression. Other factors can include socio-economic status and geography.

Why manage myopia in children?

Myopia progresses fastest in younger children, especially those under age 10.[5] This means that the most important opportunity to slow eye growth is when children are younger. Myopia management aims to apply specific treatments to slow the excessive eye growth to a lesser rate. Experts agree that myopia management should be commenced for all children under age 12,[6] and typically continue into the late teens.[7]

The short-term benefit of slowing myopia progression is that a child’s prescription will change less quickly, giving them clearer vision for longer between eye examinations. **The long-term benefit** is reducing the lifetime risk of eye disease and vision impairment. This risk increases as myopia does[3] with the good news being that reducing the final level of myopia by only 1 dioptre reduces the lifetime risk of myopic macular degeneration by 40% and the risk of vision impairment by 20%.[8]

Treatments for slowing myopia progression

Standard, single-focus long distance spectacles or contact lenses do not slow down the progression of childhood myopia.[6] Instead, specific types of spectacles, contact lenses and eye drops called atropine have been proven to slow myopia progression in children.[6]

The best option for your child will depend on their current prescription and other vision and eye health factors determined in their eye examination. Your eye care practitioner will discuss the options with you to determine the best option. Treatment options vary across the world due to availability, supply and regulatory reasons. **It is important to note that no treatment can promise the ability to stop myopia progression in children, only to slow it down.**

Spectacles

Standard single-focus spectacles do not slow the worsening of childhood myopia but specific designs do. Myopia controlling spectacles can both correct the blurred vision of myopia and work to slow down myopia progression. They are safe to wear and adaptation is typically easy, with the only side effects being related to the limitations spectacles pose for sport and active lifestyles.

1. Miyosmart (Hoya)

With the exclusive non-invasive D.I.M.S. Technology, the lens corrects the visual defect on its entire surface and has a ring-shaped treatment area to slow down myopia progression. The alternation of the focus area and defocus area provides clear vision and manages myopia simultaneously.

This lens was launched in 2020 and showed up to 60% reduction in progression in recent studies. If the child's prescription changes significantly within a year of purchasing these lenses, they will be replaced by the lens company with the updated prescription at no charge.

An analysis in the DIMS study showed that age was the only associated factor that exhibited a significant effect on myopia progression, and the effect of myopia control with DIMS lenses was greater in older children (aged 10–13). About 80% of the DIMS wearers who had considerable myopia progression were younger children aged 8–9 years.

https://www.hoyavision.com/en-ca/discover-products/for-eye-care-professionals/specialty-lenses/myopia-management/

Resource:

Defocus Incorporated Multiple Segments (DIMS) spectacle lenses slow myopia progression: a 2-year randomised clinical trial

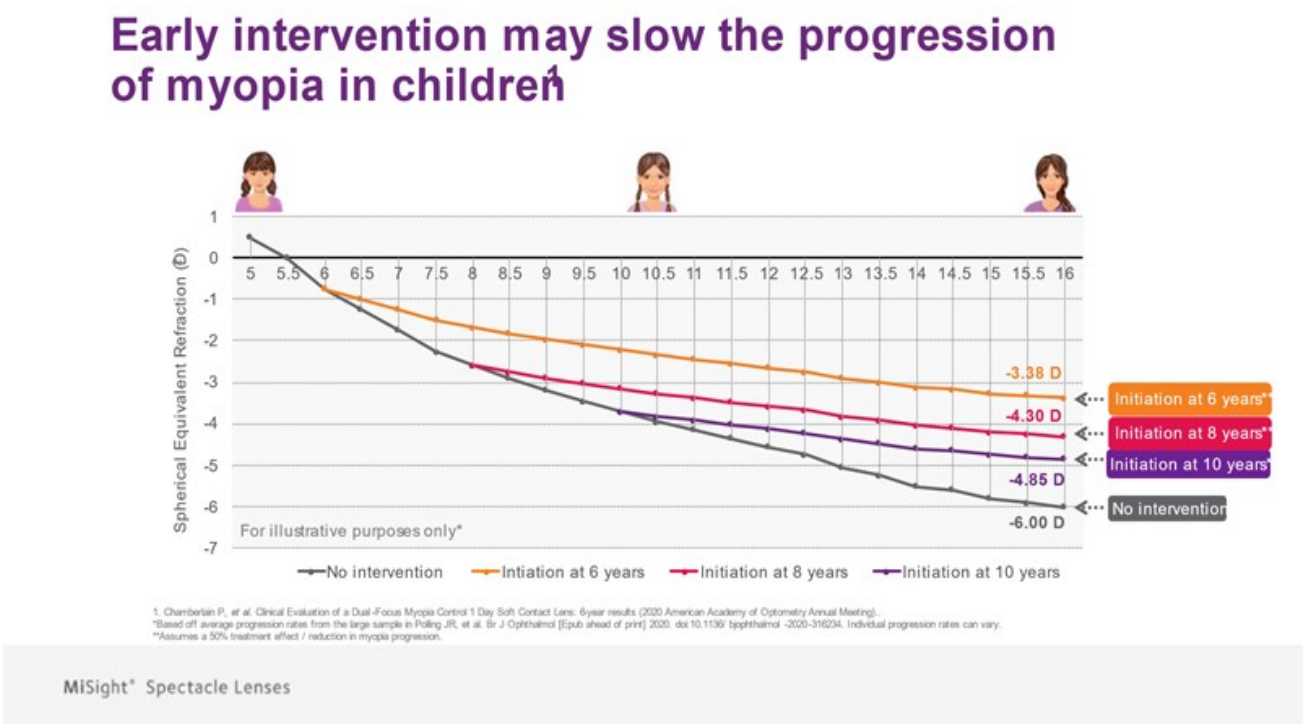
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7041503/

2. MiSight (Coopervision)

Suitable for children as young as 6 years old, MiSight® Spectacle Lenses with Diffusion Optics Technology™ slows progression of myopia by 59% on average, in children with full time wear over 2 years.

High-contrast light can interfere with the normal development of the eye by stimulating excessive eye growth. Over time, this excessive eye growth leads to worsening myopia. So, the sooner myopia is managed, the better the long-term eye health and vision outcomes are expected to be.

Your new MiSight® Spectacle Lenses have a special clear zone in the middle of each lens.



Contact lenses

Standard single-focus contact lenses do not slow the worsening of childhood myopia but specific designs do. These specific designs can both correct the blurred vision of myopia and work to slow down myopia progression. The options include soft myopia controlling contact lenses and orthokeratology.

Risks and safety

Contact lens wear increases the risk of eye infection compared to wearing spectacles, with the risks being:

- 1 per 1,000 wearers per year for reusable soft contact lenses or overnight orthokeratology lenses[9,10]
- 1 per 5,000 wearers per year for daily disposable soft contact lenses[9]

With proper hygiene and maintenance procedures, this risk can be well managed – especially by avoiding any contact of water with contact lenses or accessories.[11] Other side effects of contact lenses to control myopia can be temporary adaptation to the different experience of vision, which typically resolves in 1-2 weeks.

Benefits

There are many benefits to children wearing contact lenses:

1. Wearing contact lenses improves children's self confidence in school and sport, and their satisfaction with their vision – as much as it does for teens[12]

2. Children aged 8-12 years appear to be safer contact lens wearers than teens and adults, with a lower risk of eye infection[13]
3. Children only take 15 minutes more to learn how to handle contact lenses than teens[14]

1. Orthokeratology Contact Lenses

Orthokeratology (ortho-k) is the fitting of specially designed gas permeable contact lenses that you wear overnight. While you are asleep, the lenses gently reshape the front surface of your eye (cornea) so you can see clearly the following day after you remove the lenses when you wake up. No spectacles or contact lenses are required for clear vision during the day. They can require more appointments for fitting than other types of myopia control treatment. Adaptation to the lens-on-eye feeling can take 1-2 weeks but shouldn't affect sleep.[17] There are significant benefits for water sports and active lifestyles, and since the contact lenses are only worn at home there is low risk of them being lost or broken during wear.

2. MiSight Contact Lenses

These soft contact lenses are worn during waking hours and are daily disposable lenses. They typically require more appointments for fitting than spectacles but less than orthokeratology. Adaptation to the lens-on-eye feeling typically occurs in a few days. There are benefits in safety with daily disposables being the safest modality, and the number of lenses retained meaning loss or breakage is less of a practical issue.

The MiSight® 1 day lens is clinically proven to slow the progression of myopia by 59% over 3 years when prescribed for children 8-12 years old. The recommendations from this study are that the lenses should be worn a minimum of 6 days per week for at least 10 hours per day.

https://coopervision.ca/contact-lenses/misight1day

Atropine eye drops

Atropine eye drops in strong concentrations (typically 0.5% to 1%) are used to temporarily dilate the pupil of the eye and stop the focussing muscles working in a variety of clinical applications. Atropine eye drops for myopia control, though, are a low-concentration (0.01% to 0.05%) with much fewer such side effects. Spectacles or contact lenses are still needed to correct the blurred vision from myopia, as atropine only acts to slow myopia progression. They are dosed once a day before bed. Exactly how the drug achieves this is not well understood at this time and more research is being done. Results have varied across different studies, but it has shown up to 50% reduction in myopia progression in the higher concentration (0.05%).[15]

Risks and safety

The risks and side effects of atropine are as follows:

- Potential side effects of increased sensitivity to light due to larger pupil size, which is typically resolved with light-sensitive glasses or sunglasses. One study found around a third of children requested these types of glasses, but this was the case even in the placebo (untreated) group.[15]
- Problems with close-up focussing, which is typically resolved with glasses providing a stronger power for reading. One study found this only occurred in 1-2% of children treated with low-concentration atropine.[15]
- Eye irritation or mild allergy, which can occur in 2-7%,[15] although this can depend on the formulation of the atropine.

Atropine can be toxic and even fatal to small children if it is ingested in high quantities by mouth, but high quantity absorption via the eye is unlikely.[16] Medication safety in the home is extremely important.

Atropine eye drops are typically used at nighttime, before sleep, so are only utilized in the home environment. They are also ideal if the effective spectacle or contact lens options for myopia control are not suitable or not available for your child.

Combination Treatments

There is interesting evidence that atropine, when combined with orthokeratology, may have improved efficacy than either treatment used separately. A meta-analysis published in 2020 analyzed data from 341 children from two studies and three trials, and found a statistically significant reduction in myopia over one year in combination treatment compared to orthokeratology alone.

There are no other longitudinal studies published on atropine plus other optical treatments, but one is underway on atropine plus a soft contact lens treatment.

Summary

One or more of the myopia control options described may be appropriate for your child. If you would like more information, we encourage you to ask questions at your son or daughter's next appointment or to call our office and speak with their optometrist.

For more scientifically based, independent advice on childhood myopia and its management, go to mykidsvision.org.

Mykidsvision.org

Full Reference List

1. Holden BA, Fricke TR, Wilson DA, Jong M, Naidoo KS, Sankaridurg P, Wong TY, Naduvilath TJ, Resnikoff S. Global Prevalence of Myopia and High Myopia and Temporal Trends from 2000 through 2050. Ophthalmology. 2016 May;123(5):1036-42.

   https://pubmed.ncbi.nlm.nih.gov/26875007/

2. COMET Group. Myopia stabilization and associated factors among participants in the Correction of Myopia Evaluation Trial (COMET). Invest Ophthalmol Vis Sci. 2013 Dec 3;54(13):7871-84.

   https://pubmed.ncbi.nlm.nih.gov/24159085/

3. Flitcroft DI. The complex interactions of retinal, optical and environmental factors in myopia aetiology. Prog Retin Eye Res. 2012 Nov;31(6):622-60.

   https://pubmed.ncbi.nlm.nih.gov/22772022/

4. Tideman JW, Snabel MC, Tedja MS, van Rijn GA, Wong KT, Kuijpers RW, Vingerling JR, Hofman A, Buitendijk GH, Keunen JE, Boon CJ, Geerards AJ, Luyten GP, Verhoeven VJ, Klaver CC. Association of Axial Length With Risk of Uncorrectable Visual Impairment for Europeans With Myopia. JAMA Ophthalmol. 2016 Dec 1;134(12):1355-1363.

   https://pubmed.ncbi.nlm.nih.gov/27768171/

5. Chua SY, Sabanayagam C, Cheung YB, Chia A, Valenzuela RK, Tan D, Wong TY, Cheng CY, Saw SM. Age of onset of myopia predicts risk of high myopia in later childhood in myopic Singapore children. Ophthalmic Physiol Opt. 2016 Jul;36(4):388-94.

   https://pubmed.ncbi.nlm.nih.gov/27350183/

6. Brennan NA, Toubouti YM, Cheng X, Bullimore MA. Efficacy in myopia control. Prog Retin Eye Res. 2020 Nov 27:100923. doi: 10.1016/j.preteyeres.2020.100923.

   https://pubmed.ncbi.nlm.nih.gov/33253901/

7. Gifford KL, Richdale K, Kang P, Aller TA, Lam CS, Liu YM, Michaud L, Mulder J, Orr JB, Rose KA, Saunders KJ, Seidel D, Tideman JWL, Sankaridurg P. IMI - Clinical Management Guidelines Report. Invest Ophthalmol Vis Sci. 2019 Feb 28;60(3):M184-M203. doi: 10.1167/iovs.18-25977.

   https://pubmed.ncbi.nlm.nih.gov/30817832/

8. Bullimore MA, Brennan NA. Myopia Control: Why Each Diopter Matters. Optom Vis Sci. 2019 Jun;96(6):463-465.

   https://pubmed.ncbi.nlm.nih.gov/31116165/

9. Stapleton F, Keay L, Edwards K, Naduvilath T, Dart JKG, Brian G, Holden BA. The Incidence of Contact Lens Related Microbial Keratitis in Australia. Ophthalmol. 2008;115:1655-1662.

   https://pubmed.ncbi.nlm.nih.gov/18538404/

10. Bullimore MA, Sinnott LT, Jones-Jordan LA. The risk of microbial keratitis with overnight corneal reshaping lenses. Optom Vis Sci. 2013;90:937-944.

    https://pubmed.ncbi.nlm.nih.gov/23892491/

11. Arshad M, Carnt N, Tan J, Ekkeshis I, Stapleton F. Water Exposure and the Risk of Contact Lens-Related Disease. Cornea. 2019 Jun;38(6):791-797.

https://pubmed.ncbi.nlm.nih.gov/30789440/

12. Walline JJ, Gaume A, Jones LA, Rah MJ, Manny RE, Berntsen DA, Chitkara M, Kim A, Quinn N. Benefits of contact lens wear for children and teens. Eye Contact Lens. 2007;33(6 Pt 1):317-321.

https://pubmed.ncbi.nlm.nih.gov/17993828/

13. Bullimore MA. The Safety of Soft Contact Lenses in Children. Optom Vis Sci. 2017;94(6):638-646.

https://pubmed.ncbi.nlm.nih.gov/28514244/

14. Walline JJ, Jones LA, Rah MJ, Manny RE, Berntsen DA, Chitkara M, Gaume A, Kim A, Quinn N. Contact Lenses in Pediatrics (CLIP) Study: chair time and ocular health. Optom Vis Sci. 2007;84:896-902.

https://pubmed.ncbi.nlm.nih.gov/17873776/

15. Yam JC, Jiang Y, Tang SM, Law AKP, Chan JJ, Wong E, Ko ST, Young AL, Tham CC, Chen LJ, Pang CP. Low-Concentration Atropine for Myopia Progression (LAMP) Study: A Randomized, Double-Blinded, Placebo-Controlled Trial of 0.05%, 0.025%, and 0.01% Atropine Eye Drops in Myopia Control. Ophthalmology. 2019 Jan;126(1):113-124.

https://pubmed.ncbi.nlm.nih.gov/30514630/

16. North RV, Kelly ME. A review of the uses and adverse effects of topical administration of atropine. Ophthalmic Physiol Opt. 1987;7(2):109-14.

https://pubmed.ncbi.nlm.nih.gov/2958765/

17. Yang B, Ma X, Liu L, Cho P. Vision-related quality of life of Chinese children undergoing orthokeratology treatment compared to single vision spectacles. Cont Lens Anterior Eye. 2021 Aug;44(4):101350.

https://pubmed.ncbi.nlm.nih.gov/32674999/