LOS ANGELES EYECARE
OPTOMETRY GROUP
MEMBER Vision Source NETWORK

The Rising Prevalence of Myopia (Near-Sightedness) and The Importance of Myopia Control

Optometrists have been managing myopia for years, but the condition has recently become an emerging health issue. The prevalence of myopia is dramatically increasing in the United States. Over a 30-year period, the prevalence increased from 25% to 41.6%. It is 1 of 5 ocular conditions considered an immediate priority by the World Health Organization and it's expected that 1 in 2 people will be myopic by 2050.

Myopia is most commonly thought of as a near-sighted refractive error resulting in distance blur. In myopic children, the refractive error can potentially increase each year. And to satisfy the increasing myopic refractive error, a higher minus spectacle prescription is prescribed. While a new spectacle prescription clears the increasing distance blur, people forget the health ramifications that increasing myopia can have on the health of the eyes. Patients with moderate to high myopia are at an increased risk for vision-threatening conditions such as retinal tears and holes, retinal detachment, glaucoma, and myopic macular degeneration.

With the rising rates of myopia, an emerging goal of the optometric community is to prevent or delay the onset of myopia. Rather than passively allowing it to take its course and increase year by year, new developments have shown that we can reduce its progression. By keeping children and adolescents at lower amount of myopia, we can prevent their risk of developing vision-threatening conditions.

If my child is not myopic yet, what can be done to help delay the onset of myopia?

Currently, the best recommendation we have to delay the onset of myopia is to increase time spent outdoors. Indoor viewing is limited in range and objects in indoor space have variable focusing demands on the eye. Indoor lighting is also a predominantly long wavelength. It is theorized that these factors promote elongation of the eyeball and in turn higher myopia. In contrast, outdoor viewing presents higher ambient lighting levels with little to no focusing demands which may be why it has a protective effect for the onset of myopia. Therefore, increasing play time outdoors can be a treatment of choice to help delay the onset of myopia. Time spent outdoors has about a 10% protective effect for the onset of myopia. There is also data to support that each additional hour spent outside per week provides an additional 2% protective effect. So how much outdoor time is enough? The current recommendation is 8-15 hours/week, but the more the better. Remember, this can be broken up into smaller intervals so parents can take into account recess and lunch breaks at school in reaching these outdoor time goals. Once myopia develops, time spent outdoors becomes much less effective, so make sure to include outdoor playtime in your child's weekly schedule if he or she has yet to develop myopia.

Tips to prevent/delay the onset of myopia and help reduce myopia progression:

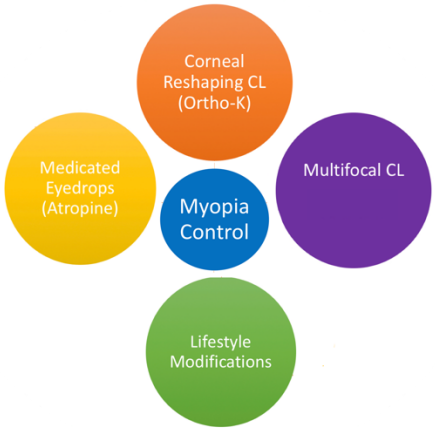
It is important to maintain a working distance of at least 40cm when reading or working on the computer. Studies show that reading at very close distances is significantly associated with myopia development and progression.

Taking short, frequent breaks when working on the computer or when reading a book is crucial. Take breaks every 20 minutes by looking across the room for 20 seconds. This is not specific to electronic device use, but includes any activity done at near range.

Increasing time spent outdoors can help delay the onset of myopia. Time spent outdoors has about a 10% protective effect for the onset of myopia. There is also data to support that each additional hour spent outside per week provides an additional 2% protective effect. 8-15 hours/week of outdoor time is recommended, but the more the better.

Well-lit indoor environments are important. Increase indoor lighting, especially natural lighting if possible.

Catching early signs of myopia before it fully develops can help slow onset and progression. Make sure to go in for annual eye exams. Talk to your optometrist about your child's risk of myopia development and options to reduce its progression.



Patients with increasing myopia are at an increased risk for vision-threatening conditions such as retinal tears and holes, retinal detachment, glaucoma, and myopic macular degeneration. If your child is near-sighted, a myopia control treatment option is strongly recommended, in addition to these lifestyle modifications. Talk to your optometrist today about options to reduce myopia progression.

Who Should Consider Myopia Control?

If your child is near-sighted, myopia control is an important conversation to have with your child's optometrist, no matter how mild their myopia. This is because higher degrees of myopia mean higher risk of blinding eye diseases. However, those children who have shown rapid progression or whom have particular risk of rapid progression should strongly consider myopia control. The following is a list of risk factors that can help assess whether a child is at particular risk of rapidly progressing myopia:

Summary of risk factors to consider:

1. **Myopic parents**

There is a strong genetic component to developing myopia. One and especially two myopic parents is the strongest predictor of becoming myopic. If a child has two myopic parents, they are three times more likely to develop myopia than a child who has no myopic parents.

2. **Lower far-sighted refractive error than expected for their age**

A patient's refractive error and how it compares to normative values is another indicator. Generally, we expect a 1-year old child to have a moderate to low-far-sighted (plus) refractive error that will eventually reduce with time towards plano and in some cases farther towards the myopic (minus) direction. The goal is for the child's far-sighted refractive error to reduce and stabilize to plano, where no refractive error correction is needed. Comparing a child's refractive error to the age-expected norms can be very helpful in determining how quickly they will become myopic. For example, we expect a 4-year-old child to have a low far-sighted refractive error. If this child is found to have a plano refractive error, we can expect him/her to become myopic because they are not as far-sighted as they should be for their age. The following guideline has been proposed to help assess this risk factor:

A child is at significant risk of developing myopia if their refractive error is:	
≤ +0.50 D	**at 7-8 years old**
≤ +0.25 D	**at 9-10 years old**
Plano	**at 11 years old**

3. **Reading at close distances (<20cm) and for continuous periods of time (>45mins)**

What we know currently is that reading at very close distances (<20cm) and for continuous periods of time (>45mins) is significantly associated with myopia development and progression (versus total time on near devices). This is not specific to electronic device use, but includes any activity done at near range. Therefore, our best current recommendation is to take regular breaks and use appropriate reading distances when doing near work. It is also important to increase indoor lighting, especially natural lighting if possible.

What are the myopia control options that are available for children with myopia?

The data shows that orthokeratology, multifocal soft contact lenses and atropine are the most effective. Low-dose atropine provides a similar control effect compared to orthokeratology and multifocal soft contact lenses and is well tolerated by kids. Other management options such as under-correction and RGP lenses actually cause a slight progression in myopia. While bifocal and progressive spectacles show some effect on slowing the progression of myopia, they are not as clinically significant as the above options. The optometrist will guide a patient towards the best option(s) for them. This decision is based on the child's refractive error, lifestyle, and cost of treatment.

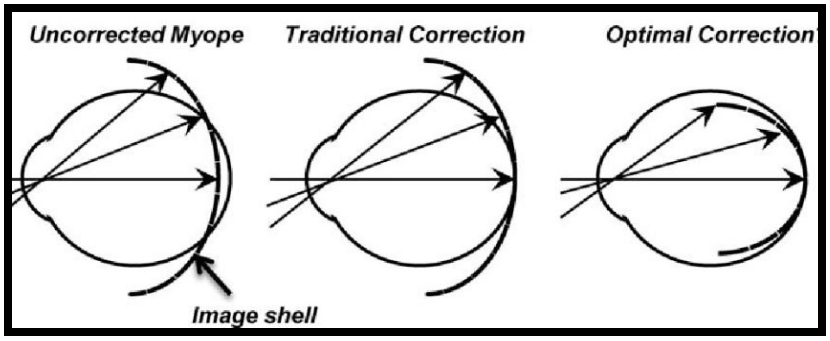
Myopia Control Treatment Options:

1. Orthokeratology

- Overnight lens wear that will allow the child to be contact lens and glasses-free during the day
- Myopia control achieved through hyperopic peripheral defocus
- Myopia must be under 6 diopters. Corneal astigmatism must be under 1 diopter.

2. Multifocal Soft Contact Lenses

- Soft multifocal contact lenses will be worn up to 8 hours per day, daily
- Can choose between a monthly lens modality (Aquaclear) or a daily lens modality (NaturalVue)
- Myopia control achieved through hyperopic peripheral defocus
- Myopia should be less than 10 diopters. Refractive Astigmatism should be less than 1 diopter.



3. Low-Dose Atropine

- Atropine 0.01% to be instilled 1 drop in both eyes before bed time
- Universally compatible with all degrees of myopia and astigmatism
- Ideal for children who are myopic but still very young. According to the FDA, 1% atropine is safe to use in children 3 months of age and older, making it an excellent option for parents who are reluctant to put their young kids in contact lenses

*Treatments can be combined for an additive myopia control effect. The best combinations are atropine with either multifocal soft contact lenses or orthokeratology. Sometimes, if one myopia control treatment is initiated without optimal results, the treatment can be changed or a second can be added.

FAQs

1. Between the above treatment options, which is the most effective for reducing myopia progression?

Orthokeratology, multifocal soft contact lenses and low-dose (0.01%) atropine have shown comparable effects (about 43-50% reduction) on myopia progression. Higher doses of atropine have shown even higher reductions in myopia progression, as high as up to 77% reduction. However, higher doses of atropine have shown more side effects and greater rebound myopia effects than lower concentrations of atropine.

2. Are these treatments FDA approved for myopia control?

All treatments for myopia control offered at this time are "off-label". Off-label is defined as "FDA approved drugs/medical devices used for non-approved indications". It is legal if there is sufficient evidence to support its safety and efficacy when used for the new purpose. In the case of myopia control, all three treatment options above meet this requirement. While these treatments are not FDA approved for the purpose of myopia control, they are FDA approved for other uses. Orthokeratology contact lenses are approved for correcting myopia. Multifocal soft contact lenses are approved to correct presbyopia. Atropine 1% is approved for the treatment of amblyopia (lazy eye). Recently in November 2019, the FDA approved a Coopervision multifocal contact lens called "MiSight" as the first contact lens approved to slow the progression of myopia in children between the ages of 8 and 12 years old in the US. This contact lens is expected to be available in March 2020. There are several other soft multifocal contact lenses that are approved for the purpose of myopia control in other countries (several European nations and Canada). Furthermore, there are ongoing studies in the United States to gain FDA approval for these medications/devices. Therefore, there is a good chance further FDA approval becomes a reality in the future.

3. What is the mechanism of atropine?

While there has been compelling evidence of Atropine's protective effects to reduce myopia progression, its exact mechanism of action has not been determined. It is believed that atropine acts directly or indirectly on the retina or sclera, inhibiting thinning or stretching of the sclera, and thereby eye growth.

4. How many years should a child be on atropine?

All myopia control treatments are intended to last for several years. The idea is to manage the patient while they are at the most risk (during school aged years). This could mean treatment for 5-10 years. Some doctors will discontinue treatment when the myopia appears to have stabilized over several visits. There is no clear guideline as to whether one approach is better than the other. The World Health Organization recommends limiting the use of atropine to two years. This is due to the preservative ingredient in the drop, not the atropine itself. There are also preservative-free formulations that can be made if longer use of the drop is indicated. At

our office, we comply with the recommendation by the World Health Organization and typically have the patient use the drop for two years. Studies have shown that atropine appeared more effective in the second year of use than the first year. We then discontinue the atropine for a period of 1 year. If the prescription appears to have stabilized or is progressing at a reduced rate (less than 0.50D per year), then we can continue to monitor without treatment. If there appears to be an increase in the rate of progression, atropine can then be restarted. It is important to note that follow-ups will be completed every 3-6 months to monitor for progression and to monitor the health of the eyes.

5. Is atropine safe?

Atropine 1% has been used for pupillary dilation and cycloplegia for over 100 years. Atropine 1% is FDA approved to be used in children 3 months of age and older, one drop per eye per day. While the use of atropine to arrest myopia progression has been studied for many years, the greatest research demonstrating its efficacy on myopia control was mainly performed during the last two decades. Therefore, the long-term side effects of the drop are still being researched. Atropine 1% is an eye drop that dilates the pupil. This can typically make light seem brighter and the near vision blurry because it reduces the ability of the eyes to focus while looking at near. Low concentration (0.01%) atropine has been shown to significantly slow the progression of nearsightedness without increasing pupil size or decreasing near vision dramatically. In a large study, only a very small percentage of children complained of blurred vision or light sensitivity with atropine 0.01%. Eye stinging may occur upon instillation with atropine 0.01% drops. Rarely, an allergic reaction may be experienced from the atropine drops and if so, should be discontinued. It is important to note that in a large study, no allergic reactions occurred in patients using atropine 0.01% eye drops, and only a very small percentage (≤3%) of participants experienced skin and/or ocular allergic reactions when using higher concentrations of atropine.

6. Will the myopia continue to progress once the atropine is stopped?

Studies show that cessation of atropine often resulted in a myopic rebound effect, which was more pronounced in eyes that received higher doses of atropine (1% to 0.1%), with a minimal rebound effect in eyes that received 0.01% atropine. In a large study of patients receiving atropine at different concentrations for 24 months, it was found that 0.01% atropine showed the lowest rebound effect and was the most effective concentration to reduce the progression of myopia after 3 years of discontinuing treatment. Patients who received 0.01% atropine had a five-year overall change of -1.38 D, compared with -1.83 D in the 0.1% group and -1.98 D in the 0.5% group. Based on these results, it can be concluded that low-dose 0.01% atropine for periods up to 5 years is a clinical viable treatment of myopia with the best sustained effect on reducing myopia progression. The mean myopia progression at 5 years (1.38 D) in children initially randomized to atropine 0.01% was similar to that in placebo eyes at 2.5 years (1.40 D), suggesting that atropine 0.01% can slowed myopia progression by 50%. It is important to note that there are no research studies evaluating the effects of any of the treatments beyond 5 years.

7. Do all children respond to atropine?

According to the ATOM2 study, anywhere from about 4-9% of children may not respond to atropine. This is important to note because if a child's myopia is continuing to progress even as the concentration of atropine increased, you may need to switch to another treatment.

8. Can treatments be combined (i.e. multifocal contacts with atropine simultaneously)?

Of course. We personally like to start with one treatment and then add another so we can evaluate the efficacy at each step. But, if the case is severe, two treatments can be initiated at the same time. The best combinations are atropine with either multifocal soft contact lenses or orthokeratology. Studies have shown that combining treatments can have an additive effect on reducing myopia progression.

9. How often does the child have to wear multifocal soft contact lenses?

There is evidence to support a dose response relationship between wear time and myopia control effect. Therefore, the current recommendation is a minimum of 5 hours/day and a maximum of 8 hours/day (to comply with healthy contact lens wearing practice).

10. Can progressive spectacle lenses help reduce the progression of myopia?

Progressives have a slight effect in controlling the progression of myopia, but it is not nearly as effective as the three options discussed above. Therefore, it is best to consider it a "2nd line treatment". It can be an option for a patient who is not a good candidate for the other options.