Myopia and myopia control information

Myopia is a common eye condition where objects in the distance are blurred. Myopia in children is a concern as it can progress quickly throughout childhood, and high myopia increases the risks of other eye conditions in the future. The aim of myopia control treatments is to slow the rate of myopia progression during childhood and adolescence.

At Visique Peter Dick Optometrists we offer two types of myopia control; MiSight daily disposable soft contact lenses and low dose Atropine eye drops (both are expected to slow myopia progression by about 30% to 50-60%). Included below is information about: myopia, myopia control and the different methods available, the expected outcomes of the different methods, and risks/side effects of the different methods.

Costs involved for the different methods offered at Visique Peter Dick Optometrists;

MiSight contact lenses:

- $299 Contact Lens Fitting fee (includes initial appointment, corneal scan, contact lens fit and teach appointment, 1 week follow up appointment, 1 month follow up appointment)
- $90 ongoing monthly automatic payment (covers monthly cost of contact lenses and includes review eye appointments every 6 months). Any glasses required are not included in this cost.

Atropine drops:

- Low dose atropine drops need to be specially made from a compounding pharmacy in Auckland. It costs about $150.00 for a three month supply of drops, directly couriered to the patient.
- $186 Atropine Starter fee (includes initial appointment and follow up appointments at 1 week, 1 month and 3 months). Ongoing 6 monthly review appointments are not included in the cost, and the cost of glasses are also not included.

What is myopia?

Myopia (also called short-sightedness or near-sightedness) is a common condition of the eye where things in the distance (i.e. board at school, TV) appear blurred while things up close (i.e. book, iPad) are clear.[1] Childhood onset myopia is most commonly caused by the eyes growing too quickly, or continuing to grow after age 10-12 when eye growth should normally stop. In younger children, myopia progresses more quickly because their eyes are growing at a faster rate, leading to higher levels of myopia, stronger glasses and more eye health risks.

What causes myopia?

A combination of genetics and environment/lifestyle factors are thought to cause childhood myopia.

Genetics:

- Myopia can be hereditary, and a person's ethnicity and family background can increase the risk.
- While the exact link between family history and the development of childhood myopia is unknown, the risk of a child developing myopia is;[2]
    - 1 in 2 when <u>both</u> parents are myopic

  - 1 in 3 when one parent is myopic
  - 1 in 4 when neither parent is myopic

- Research suggests a link between Asian ethnicity and faster progression of myopia, with higher worldwide prevalence in this group of people.[3]

Environment:

- Spending more time on close work has been linked to development of myopia, such as reading, playing computer games, drawing or using smart phones and tablets.[4]
- Spending less time outdoors has been linked to myopia development.[5,6] Current research shows spending at least 2 hours outdoors a day (14 hours per week) beneficial in reducing the onset of myopia.

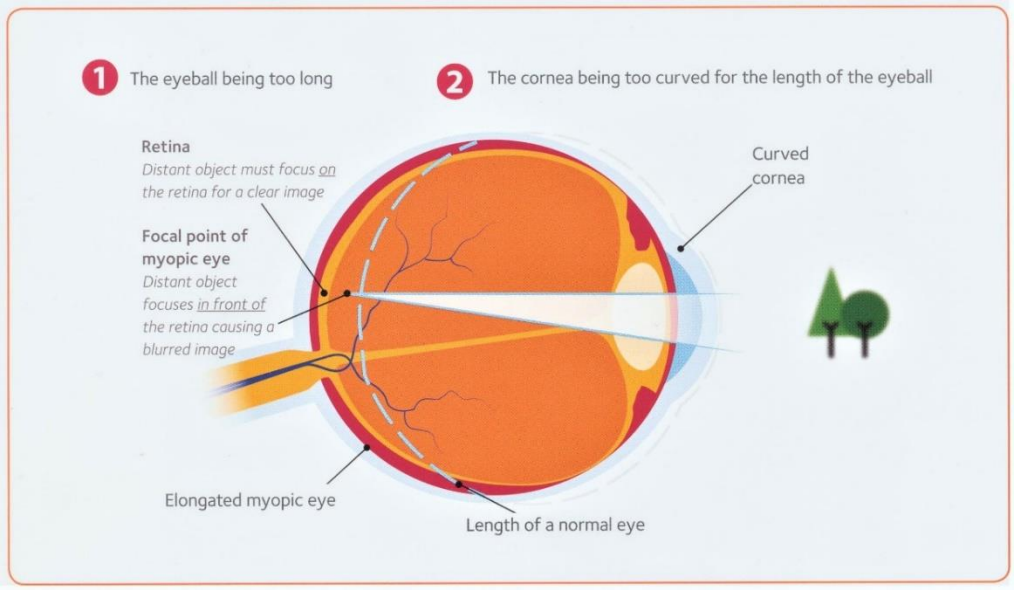


Figure 1: The Australia and New Zealand Child Myopia Report

Why is childhood myopia a concern?

Evidence is mounting that myopia is growing around the world; by 2050 it is estimated that more than 50% of the world's population will have myopia and 10% will have high myopia.[7,8] That is an increase from 2010 when 27% of the world's population were estimated to have myopia, and 2.8% had high myopia.[7,8]

This is of significant concern given that high myopia is also associated with comorbidities including retinal detachment, glaucoma, cataracts and myopic macula degeneration.[7] The risk of developing any of these conditions increases along with any increase in myopia.[7]

Myopia Control

The aim of myopia control is to try stop or reduce the natural progression of myopia through the childhood years.

No current myopia control treatment can permanently stop or reverse the progression of myopia. Generally, myopic children wearing traditional single vision glasses or contact lenses will continue to increase in myopia by approximately 0.50 to 1.00 D per year, as accelerated eye growth occurs.[3] The myopia control treatments discussed below are expected to slow the rate of progression; this means the average child would still have some progression in myopia. Measurements of the child's prescription (and measurement of the

length of eye if available) can provide more information about the effectiveness of various treatments.

The myopia control treatment effect for an individual child may be higher or lower than the average and is based on numerous factors, and the long-term effectiveness is not fully understood as the available data only extend to 1 to 5 years of treatment.[3]

Category	Strategy	Effect on slowing myopia progression
Contact Lenses	Multifocal soft lenses	30% to 50%
	Orthokeratology	30% to 60%
Pharmaceutical	0.02% atropine drops	30% to 60%
Spectacles	Executive bifocals Progressive addition lenses	10% to 50% in some groups of children

Contact Lens Options

Both multifocal soft contact lenses and orthokeratology have been proven to slow progression of myopia in children.[3] This is thought to be achieved by focusing light at the periphery of the eye in alignment or in front of the retina, a complex concept called peripheral hyperopic defocus control.[3] Standard soft contact lenses do not control myopia progression.

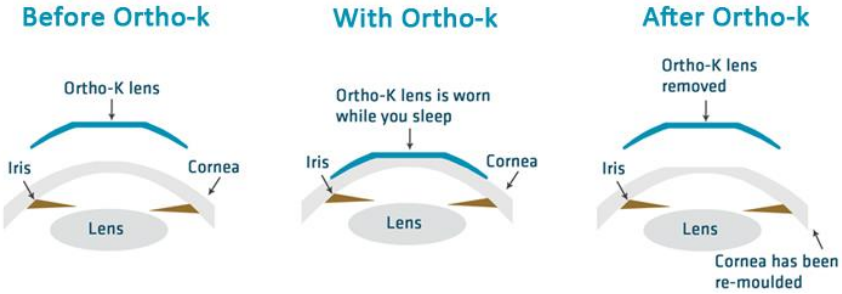
Multifocal Soft Contact Lenses (MFSCLs) (e.g. MiSight Soft Contact Lenses)

The daily disposable MiSight soft contact lens has been specifically designed as a myopia control contact lens for children and adolescents. The vision through the centre of the lens is corrected for distance but the power changes in the periphery of the lens, resulting in the peripheral vision through the lenses being clear for close work. This means that the child may notice some out-of-focus vision in the periphery with these lenses, but most children adapt very quickly to this. These lenses are daily disposable which means a new pair is put in each day. The child needs to wear these lenses at least 10 hours a day, 6 days a week for the myopia control to be effective.

How do multifocal soft contact lenses slow myopia?

The specially-designed multifocal contact lenses use unique optics to dampen triggers that encourage the eyeball to grow longer, therefore discouraging myopia progression. This is known as peripheral hyperopic defocus control. MFSCLs are expected to slow myopia progression by about 30% to 50%.[3]

Orthokeratology (Ortho-k)



Orthokeratology (ortho-k) is when a small hard contact lens is worn overnight, every night. The lens temporarily and reversibly flattens the cornea (the front surface of the eye). The way in which the lens flattens the cornea corrects the eye's myopia as well as providing myopia control. The lenses must be cleaned and disinfected each day.

How does orthokeratology slow myopia?

Like multifocal soft contact lenses, orthokeratology also works via controlling peripheral hyperopic defocus. This is achieved by reversibly reshaping the cornea in a specific pattern. Ortho-k lenses are expected to slow myopia progression by approximately 30% to 60%.[3] Additional benefits include not having to wear a vision correction during the day. Some parents also like that they can oversee contact lens wear since lenses are only worn at night.

At Visique Peter Dick Optometrists we do not currently offer Orthokeratology treatment. A referral to a local optometrist who offers orthokeratology can be made if required.

Contact Lens Risks

The risks involved with using contact lenses are low. However, the most significant risk associated with contact lenses is microbial keratitis (a bacterial infection of the cornea), which in a small percentage of cases can result in vision impairment. The rate of new cases of microbial keratitis in children wearing overnight ortho-k lenses is 13 in 10,000 per year.[3] For soft contact lenses, the rate of corneal infiltrative events is about 15 per 10,000 per year for children age 13 to 17 years.[3] The rate of microbial keratitis for children 8 to 12 years of age wearing soft contact lenses appears to be less than that of adults or teenagers, but cannot be accurately estimated with the data available.[3]

Other risks associated with the use of contact lenses include other types of infections or inflammation (swelling) or abrasions (scratches) of the eye. Most of these complications do not result in any long-term damage to the eye.[3]

Compared with glasses, children may notice mildly blurred vision or changes in their focusing with either ortho-k or MFSCLs.[3]

Atropine eye drops

Atropine drops have been used for many years to control myopia; however, until recently they have been prescribed at a much stronger concentration (0.5% - 1%).[10] Atropine at this level causes loss of focusing in young children for near tasks and dilates the pupil significantly, leading to light sensitivity.[10]

Studies over the last decade have found that much lower concentrations of atropine, such as 0.02%, have a comparable reduction in myopia progression,[10] without any noticeable effect on pupil size or near-focusing.[10] 0.01% atropine used to be used more routinely,[10] but current research has told us that a slightly stronger dose (such as 0.02%) is a more appropriate dosage to achieve myopia control and slow the growth of the eye,[10] while also causing no significant change to near focusing or pupil size in children.[10] Low dose atropine drops are expected to slow myopia progression by 30%-60%.[10]

How do atropine drops slow myopia?

It was initially thought that as atropine drops paralysed the focusing muscles of the eye, this was the reason for the myopia control. Our understanding now suggests that the atropine molecule affects a receptor in the tissue of the back of the eye, signalling the eye to stop growing excessively.[9] This mechanism is still being studied around the world.

How should atropine eye-drops be used?

- One drop of atropine eye drops should be instilled into each eye every night
- The child should close their eyes for 1 minute following instillation
- No other eye drop should be used for 5 minutes after instillation
- The drops sometimes sting a little but this should not last more than a minute. If the eye continues to sting beyond a minute advise your optometrist.
- The child should continue to use glasses or contact lenses during the day as atropine will not improve the vision. Uncorrected or under-corrected myopia has been shown to be a risk factor for myopia progression, so any glasses should be accurate and worn during the waking hours.

What are the side effects of atropine eye drops?

Eye-related side effects of high strength atropine eye drops can include: blurred near vision, sensitivity to sunlight, pupil dilation (the amount varies from patient to patient and concentration of medication used), stinging and burning, or swelling of the eyelids.[11] These side effects are rare at the low concentration prescribed for myopia control, however, may still occur to some degree.

General side effects of high-dose atropine eye drops include allergic reaction (difficulty breathing; closing of your throat; swelling of your lips, tongue, or face; or hives), an irregular or fast heart rate, hallucinations or unusual behaviour (especially in children). Other, less serious side effects may be more likely to occur.[11]

Low dose atropine drops are installed at night in case there are any minor side effects such as blurred near vision or light sensitivity. That way, the side effects will have resolved by the time the child wakes in the morning. Any general side effects are unlikely with low-dose atropine; however, if you notice anything unusual let your optometrist know.

How do I get my atropine eye drops?

Using atropine drops for myopia control is off-label in New Zealand. Atropine drops need to be specially prepared by a compounding pharmacy in Auckland as they are not readily available at concentrations below 0.5%. Drops will come in individual bottles, which should be used for 30 days, before discarding and starting a new bottle.

- Every 3 months, your optometrist will email the pharmacy a prescription for a 3-month supply of atropine eye drops. You will be copied on the email, so you are aware that the prescription is ready to be filled.
- You will then need to contact the pharmacy directly to arrange the payment and shipping of the drops. A 3-month supply (3 bottles) of compounded atropine is about $150.00. The drops are costly due to the need for each bottle to be individually diluted, and it is the only pharmacy in New Zealand is capable of doing this with the necessary accuracy and sterility.
- Pharmacy details: Optimus Healthcare, 4 Walls Rd, Penrose, Auckland, PO Box 99-467, Newmarket, Auckland, 1149. Tel 095800915, Fax 095800917, email: pharmacist@optimushealth.co.nz

Glasses

Wearing standard single vision glasses does not control myopia progression.[8] Undercorrection (not wearing glasses or wearing weaker glasses) is not effective for myopia control and can result in progression of myopia.[8]

Other spectacle lens options, such as progressive lenses, bifocals and specially designed myopia control lenses have some benefit for a group of children that have near focusing

difficulties.[8] Special lenses may slow myopia progression by 10% to 50%, in specific groups of children.[3] The evidence supporting specialty lenses for myopia control is less robust that other methods.[9] Generally, spectacle lenses for myopia control are used as a backup for other myopia control methods or if contact lenses or atropine drops are not suitable.

Treatment Duration

Regular appointments (every 6 months) and close monitoring for myopia progression is important to assess whether the treatment needs to be continued, modified, or stopped. Myopia generally progresses most rapidly during pre-teenage years (7–12 years), subsequently slowing through adolescence and adulthood.[3] When to stop treatment depends on the type of treatment and whether myopia progression has stopped. Current research indicates that atropine treatment should be stopped after 2 years and then may be tapered off while closely monitoring for progression.[3]

Other considerations

To date, no studies have examined children using myopia control treatments for more than 5 years, and not all the studies reported safety information, but data from clinical trials and record reviews do provide information on the major risks associated with myopia control treatments.

Environmental risk factors: environmental risk factors are unlikely to affect the management pathway, however, they are modifiable and should be considered in view of the overall myopia risk profile. Tips for modifying environmental risk;

- Spend time outside. Walk the dog, ride a bike, play in the backyard, sit outside in shade. It is the brightness of natural sunlight, which is beneficial rather than UV light– still take sun protection precautions.
- Take regular breaks from close work. Look away for a minute or so to change your focus, or change your task every 30-60 minutes to alter the demand on your visual efficiency (eye teaming) systems.
- Try to limit near tasks (after school/ work) to 2 hours per day. This also includes leisure time – ensure it is not primarily spent on handheld digital devices or other close vision tasks like reading and drawing. On the weekends, ensure a balance between inside and outside time, and increase natural lighting.

Resources

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4. Ip JM, Saw SM, Rose KA et al. Role of near work in myopia: findings in a sample of Australian school children. IOVS 2008 Jul; 49(7):2903-2910

5. He M, Xiang F, Zeng Y et al. Effect of time spent outdoors at school on the development of myopia among children in China: A randomized clinical trial. JAMA 2015; 314:1142-1148

6. Read SA, Collins MJ, Vincent SJ. Light exposure and eye growth in childhood. Investigative Ophthalmology and Visual Science 2015: 56(11): 6779-678

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10. Khanal S, Phillips JR. Which low-dose atropine for myopia control? Clinical and Experimental Optometry 2019. DOI:10.1111/cxo.12967

11. Medsafe: Atropt (Atropine sulfate 1% eye drops) New Zealand data sheet.