

CLINICAL SUMMARY

IMI Clinical Myopia Management Guidelines Report

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INTRODUCTION

This report details evidence-based best practice for myopia management, including risk factor identification, the examination process, selection of treatment strategies and guidelines for ongoing management. Practitioner considerations such as gaining informed consent and patient and parent communication are detailed.

KEY FINDINGS

Risk factor identification

Myopia has been traditionally viewed as a consequence of interplay between genetic, ethnic and environmental risk factors. The following section highlights these risk factors:

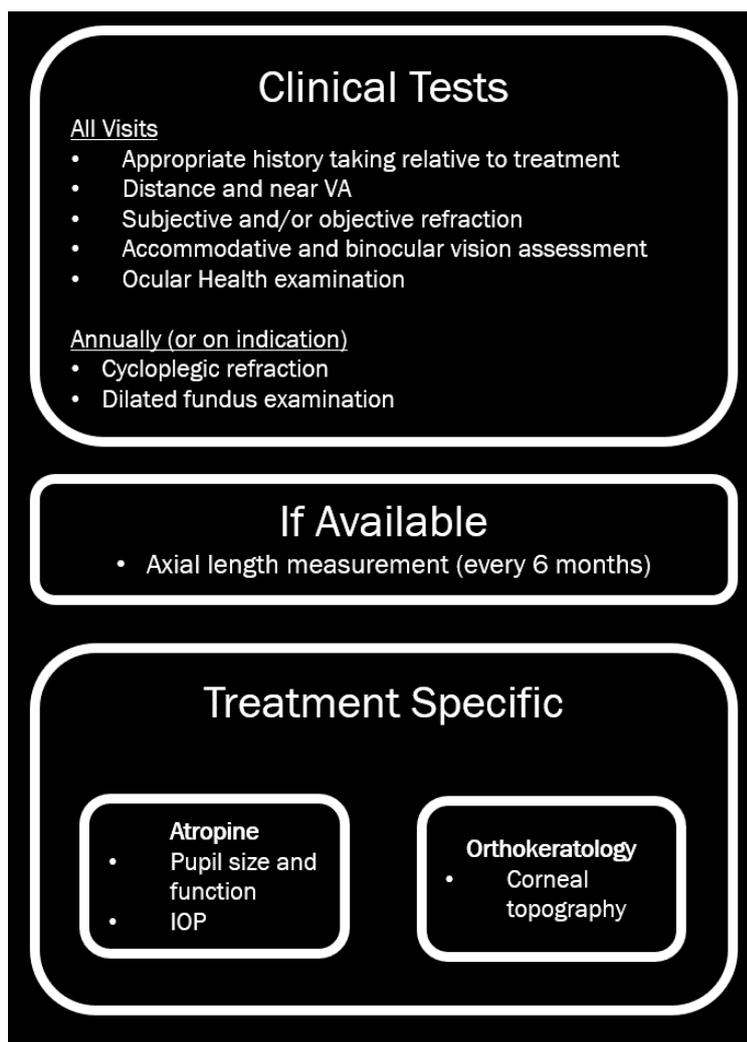
1. **Younger age at myopia onset:** The child at risk of developing myopia can be identified by comparing their refractive error to the age-normal (Table 1). Lower hyperopia than age-normal can indicate risk of myopia development; future myopes show less hyperopic refractions for up to 4 years before onset of myopia, compared to age matched counterparts who remained emmetropic. The major factor contributing to faster childhood myopia progression is younger age at myopia onset, with this factor being independent of gender, ethnicity, school, time spent reading and parental myopia.
2. **Age normal cut-offs based on an ethnically diverse US study of more than 4,500 children.**

Age (years)	Refraction
6	+0.75 D or less
7 to 8	+0.50 or less
9 to 10	+0.25 D or less
11	emmetropia

3. **Myopic parents:** Having one or two myopic parents increases risk, along with less time spent outdoors and more time spent reading.
4. **Asian ethnicity:** Ethnic background also plays a role in myopia susceptibility, with a greater prevalence in those with Asian ethnicity.
5. **Binocular vision disorders:** The pre-myope may show specific binocular vision disorders, including reduced accommodative responses, increased accommodative lag and higher AC/A ratios. The effect of managing these disorders on myopia development has not yet been defined.
6. After myopia onset, conjecture exists as to whether accommodative errors are a feature rather than a cause of myopia.
7. **Visual environment:** Children who become myopic appear to spend less time outdoors as compared to their non-myopic counterparts. Additionally, the risk of myopia development and progression is significantly associated with reading at very close distances (<20cm) and for continuous periods of time (>45 min), rather than being associated with total time spent on all near activities.

Examination

Figure 1. Clinical tests for myopia management.



1. **History taking:** Age, gender, history of ocular and general health, ocular surgery, parental history of myopia, age of onset of myopia, past history of myopia progression (if available), previous myopia control treatments, and visual habits such as daily average hours of time spent on near work and time outdoors.
2. **Refraction:** Non-cycloplegic and/or cycloplegic refraction as indicated. The recommended dosage for cycloplegic refraction is 2 drops of 1% tropicamide or cyclopentolate given 5 minutes apart. Cycloplegic refraction should be performed 30 to 45 minutes after.
3. Best-corrected visual acuity
4. **Binocular vision and accommodative tests:** Evaluation of both the accommodative and vergence systems. The two primary tests of accommodation are accommodative accuracy, clinically measured as lead or lag of accommodation, and accommodative amplitude or the maximum accommodative ability. In addition, accommodative facility is often measured to assess an individual's ability to adapt to rapid changes in accommodation.
5. **Anterior eye health evaluation:** slit-lamp assessment and intraocular pressure measurement.
6. **Corneal topography:** if indicated (for example, for contact lens fitting) and preferably measured with corneal topographer.
7. **Axial length:** Measurement of axial length is not widespread in clinical practice, and currently there are no established criteria for normal or accelerated axial elongation in a given individual. It is well known that during emmetropization, axial elongation is more rapid in younger (6-10 years) than older (12-16 years) children. However, there is a broad range observable, with emmetropes typically showing an axial length of 22-24.5mm, and myopia typically associated with axial lengths greater than 25mm. Increases of about 0.1 mm/year have been shown to be associated with normal eye growth, while 0.2 to 0.3 mm/year is associated with increasing myopia, but not limited to this. Where available, measurement with anon-contact device, for example, IOL Master (Zeiss) or LENSTAR (Haag-Streit) is ideal.
8. **Fundus examination and imaging:** Examination of both the central and peripheral retina under dilation, annually in high myopes and in others as indicated with documentation of any changes done using OCT and/or fundus photography.

Selection of treatment strategies

1. **Determine rate of progression:** In attempting to control progression of myopia, an understanding or estimation of the rate at which myopia progresses for a given individual may help identify an appropriate strategy to control the rate of progression.
2. **Select a treatment:** Children who possess multiple risk factors may require more strategic management and frequent review, compared to those with little or no associated risk factors. Other patient and treatment factors will also influence treatment selection:
 - a. Baseline refractive error and age (younger age generally leads to faster progression)
 - b. Binocular vision status (for example, greater myopia control effects with progressive spectacles were reported in children with larger lags of accommodation and near esophoria)
 - c. Ethnicity (for example, a recent meta-analysis suggested greater myopia control with atropine treatment in children of Asian compared to European ethnicity)
 - d. Safety, compliance and cost considerations.

3. Specific guidelines:
 - a. **Multifocal soft contact lenses:** As currently available multifocal soft contact lenses can reduce quality of vision, it is essential that visual acuity and quality of vision are monitored. In cases where the patient experiences significant reduction in visual acuity and/or subjective quality of vision with the selected lens, an over-refraction should be conducted and incorporated into the lens power. Alternatively, the add power may be reduced until acceptable vision is achieved, or a different lens design may be trialed. The impact of the add power on binocular vision function should also be evaluated.
 - b. **Spectacles:** In clinical practice, it may be more practical to prescribe the near addition required to manage any evident accommodation or vergence disorder to ensure visual comfort. While there is indication from one study that bifocal spectacle lenses show better efficacy than progressive addition spectacles, the practitioner should consider any aesthetic issue with bifocal lenses, or compliance and frame fitting issues with progressives in the prescribing choice.
 - i. **Bifocals:** The fitting seg line of bifocals should be higher than that for presbyopic correction to ensure the add is easily accessed, and that enough myopic defocus is imposed on the superior retina.
 - ii. **The frame** should be regularly adjusted to ensure that is appropriately fitted.
 - iii. **Progressives:** Selecting progressive lens designs with shorter corridors will similarly ensure the child is looking through the near addition.

Patient communication

1. **Education on risk factors:** Patients and parents must be informed on the probable causes and risk factors for myopia in order to enable them to understand their child's risk profile; and reduce their exposure to avoidable risk. Written lay education is important to consolidate in-office verbal education and serves as a reference between visits and discussion with parents of children at risk as well as those who are already myopic should occur.
2. **Informed consent:** Parents should be provided information on expected efficacy and other potential benefits of treatments.
 - a. **Prognosis:** No current myopia control treatment can permanently stop or reverse the progression of nearsightedness. Generally, myopic children wearing traditional single vision glasses or contact lenses will continue to increase in myopia by about 0.50 to 1.00 diopters per year. Myopia control treatments are expected to slow the rate of progression. The myopia control treatment effect for an individual child may be higher or lower than the average. The long-term effectiveness is not fully understood as the available data is from 1 to 5 years of treatment.
 - b. **Potential risks and side effects:** Parents should be informed of potential risks and side effects associated with myopia control treatments:
 - i. **Contact lenses:** the most significant risk associated with contact lenses is microbial keratitis, which in a small percentage of cases can result in vision impairment. The rate of new cases of microbial keratitis in children wearing overnight OK lenses is 13 in 10,000 per year. For soft contact lenses, the rate of microbial keratitis (MK) in adult daily disposable wearers is 2 per 10,000 per year; and 12 per 10,000

per year in reusable soft lenses. These rates of MK have not been specifically studied in children; however the rate of corneal infiltrative events is about 15 per 10,000 per year for children age 13-17 years. The rate of microbial keratitis for children 8-12 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.

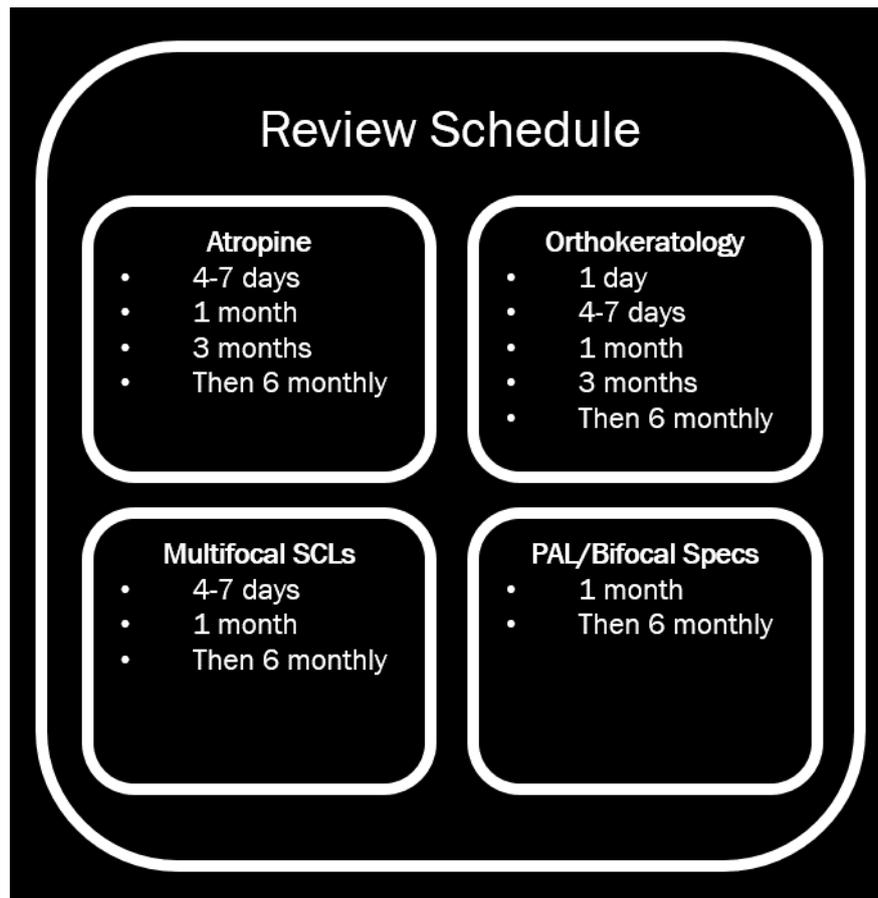
- ii. **OK and Multifocal soft contact lenses:** Compared to glasses, children may notice mildly blurred vision or changes in their focusing with either orthokeratology or multifocal soft contact lenses.
- iii. **Atropine:** The most common side effects associated with the use of atropine eye drops are a temporary stinging or burning, blurred vision and sensitivity to lights. Lower strength doses may cause less of these side effects. Effects of long term use are unknown.
- iv. **Spectacles:** While generally showing lower efficacy than other options, the risks of side effects with spectacle lens corrections is minimal.

3. Advice and clinical care

- a. Children should be encouraged to wear their myopic correction full time, as undercorrection of myopia has been shown in some studies to increase myopia progression.
- b. OK wear should be encouraged daily a minimum of 8 hours overnight.
- c. MFSCs should be worn at minimum during school hours and for school work at home, with a back up spectacle option.
- d. Parents should be informed that greater near work (hard copy or digital) may influence the development and progression of myopia. Close reading distance (<20cm) and continuous reading (>45 min) have been associated with greater odds of myopia. Outdoor activity is associated with reduced incidence of myopia in children, including those who usually perform large amounts of near work. This suggests that children should not be prevented from participating in near work activity, but rather that regular breaks, appropriate reading distances and near fixation changes whilst reading and spending time on screens are taken, with sufficient time outdoors also encouraged.
- e. Maximising both indoor and natural lighting, and increasing outdoor time.
- f. Contact Lens Wear:
 - i. Wash your hands before applying or removing contact lenses
 - ii. Never swim or shower with contact lenses or expose the contact lenses or lens case to water.
 - iii. Don't wear your contact lenses if you have a cold or flu.
 - iv. Daily disposable lenses are strongly encouraged. If you wear reusable contact lenses, use new lens cleaning solution each day and use non-preserved care cleaning regimen such as hydrogen peroxide, if possible. Replace your lens case at least every 3-6 months. Rinse with contact lens cleaning solution, rub, tissue-wipe and air-dry casing facing down. Unless directed by your doctor (for OK), don't sleep or nap in your lenses.
- g. Atropine Use: Where available, unit dose atropine preparations are preferable.

4. **Review schedule (Figure 2):** Treatment may be stopped, switched to another form of therapy or augmented by combining with another treatment modality when myopia progression is considered to not be sufficiently controlled. Close monitoring by the clinician is important on treatment cessation, so that any apparent acceleration in progression can be quickly addressed by reinstating treatment. Furthermore, there are legal and ethical issues related to treatment intervention that might need to be considered.

Figure 2. Review schedule for myopia management based on treatment type.



Reference: Gifford KL, Richdale K, Kang P, Aller TA, Lam CS, Liu YM, et al. IMI - Clinical Management Guidelines Report. Invest Ophthalmol Vis Sci. 2019;60(3):M184-M203. <https://iovs.arvojournals.org/article.aspx?articleid=2727312>

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