البرتوكول العلاجي لمرض قصر النظر

Clinical Protocol for the Myopia Management

A descriptive review to manage and treat myopia progression

Prepared by	DR. AHMED IBRAHIM AL IBRAHIM	Consultant Optometrist	MOH, Prince Mohammed Bin Nasser Hospital – Jazan
	DR. MOHSEN NAIF AL-ENEZI	Senior Optometrist	MOH, King Fahad Specialist Hospital Buraydah – Qassim Health Cluster
	ABDULLAH DHAFER ALHALLAFI	Optometric Technician	Ministry of Health
	RASHED MUTLAQ M ALMUTAIRI	Doctor Of Optometry	MOH, King Khalid Majmaah Hospital – Riyadh Second Health Cluster
	SALEH ALI ALRIBI	Senior Optometrist	MOH, King Salman Hospital – Riyadh First Health Cluster
	RAYAN NASSER ALMUTAIRI	Senior Optometrist	MOH, King Saud Hospital Unayzah – Qassim Health Cluster.
	MOHAMMAD GHANNAM ALMUTIRI	Specialist-Health Administration.	MOH, King Khalid Majmaah Hospital – Riyadh Second Health Cluster.
	Dr. SALMAN AL SHAABAN	Doctor Of Optometry	Ministry of Defense, Armed Forces Hospital Al-Qassim.
Reviewed by	DR. AHMED IBRAHIM AL IBRAHIM	Consultant Optometrist	MOH, Prince Mohammed Bin Nasser Hospital – Jazan
	Dr. YOUSEF H ALDEBASI	Professor at Qassim University &Consultant Optometrist	Qassim University, Department of Optometry.
	Dr. Reena Patel	Doctor of Optometry	Marshall B Ketchum University, USA
	Dr. MANSOUR MOHAMMED AL-MUFARREJ	Consultant Optometrist	Ministry Of National Guard, King Abdulaziz Medical City – Riyadh.
	Dr. MOHAMMAD SHAKIL AHMAD	Associate Professor, Department of Family and Community Medicine, College of Medicine, Majmaah University.	College of Medicine, Majmaah University

	Dr. JAMEEL RIZWANA HUSSAINDEEN	M.Phil., PhD, FCOVD-I, FAAO, Clinical Diplomate & Chair – Written examination - Binocular vision, Perception &Pediatric Optometry Clinical Diplomate section	American Academy of Optometry (AAO)
	Dr. RIYAZ AHAMED SHAIK	Assistant Professor, Department of Family and Community Medicine, College of Medicine, Majmaah University	College of Medicine, Majmaah University

Contents

Introduction

Myopia, often known as near-sightedness, is a refractive error with negative power. It is due to elongation of the eyes and can be a chronic, progressive condition. The higher the myopia, the higher the likelihood for complications which may impair vision.

If no measures are done to prevent or cure myopia, the number of persons with the condition will increase from 2.6 billion in 2020 to 4.9 billion in 2050. Eye care practitioners must be on the cutting edge of this degenerative disorder to offer the best therapies to young patients. Myopia can be corrected with eyeglasses, contact lenses, or refractive surgery.

Myopia is the most prevalent refractive error in elementary school children in Alhassa, Saudi Arabia, with 65.7% of them having the condition, according to a screening study conducted by Fahad A. and his colleagues. Aldebasi observed in his research that among 5176 school age children, myopia and myopic astigmatism were more common than hyperopia and hyperopic astigmatism.

The types of myopia include pathological, axial, and physiological. Differences between the refractive components are caused by physiological myopia, also known as refractive or simple myopia. The crescent-shaped temporal region of the optic disc, which is enlarged in intermediate or axial myopia, causes the artery in the retina to appear straight when the thin retina is present. Clinically speaking, axial myopia is a complication of pathological myopia and is defined by the presence of staphyloma in the posterior pole along with chorioretinal degeneration.

Medical and optical therapies, and the ability to communicate with the patient and their parent or guardian about the risks and benefits of different myopia management strategies are important. The care of pre-, stable-, and progressive myopia is covered here in this protocol along with evidence-based best practices, which include identifying risk factors, investigating them, selecting treatment regimens, and giving recommendations for ongoing management.

The treatment of myopia progression is very variable in routine clinical practice since several factors need to be discussed and reviewed via evidence-based management. Nonetheless, the number of individuals with myopia is expected to reach 3361 million by 2030, according to Holden et al., who was cited in the Global Competitiveness Report on Vision that the World Health Organization (WHO) issued in October 2019. The prevalence numbers highlight the importance of myopia reduction initiatives since it is predicted that pathological myopia will become the most prevalent cause of blindness and irreversible visual impairment globally.

Myopia, a severe issue for public health throughout the world, is expected to become more common in future decades. Pathologies in very myopic eyes, such as optic neuropathy and myopic maculopathy, may cause blindness and irreversible vision loss. Other ocular conditions, such as glaucoma and retinal detachment (which may result in permanent blindness), are also more likely to occur because of myopia. Even mild and moderate myopia have definite disease associations.

A. Purpose

This protocol was created to provide eye care practitioners with information on treating myopia in clinical settings. This advice was developed with the notion that information is always evolving. The material provided here is thus based on the most

up-to-date and effective scientific standards and procedures, subject to periodic evaluation and revision. Due to the extensive role and abundance of literature on various therapy techniques, there is also a definite need for national protocols.

B. Aim and Scope

The guideline offers recommendations for managing myopia progression based on up-to-date data. Along with providing solutions for reducing the condition's incidence, this guideline also provides a detailed knowledge of the significance of halting the progression of myopia in children and adolescents. It also addresses increasing awareness of myopia and treatment.

C. Target population/Audience

The protocol is meant to serve as a useful and quick resource for eye care professionals, such as optometrists and ophthalmologists, who work in environments where they will care for patients with myopia progression, particularly children and adolescents.

D. Setting

1. General, central, and specialist hospitals in public and private sectors.

2. Optometry centers and Ophthalmology clinics centers in public and private sectors.

3. Optometry Clinics in Primary Healthcare Centers.

E. End Users

The protocol's goal is to serve as a user manual and quick reference for optometrists and ophthalmologists working in environments where they will be caring for young patients with myopia.

F. Methodology

The Saudi Protocol for Management of Myopia Progression is now available in its first practical iteration. Two steps were used to design this protocol:

Phase 1

The protocol for clinical treatment and control of myopia progression was derived from the International Myopia Institute clinical practice guidelines (2021) and the scientific literature. International Myopia Institute and the Recommendations Resource Center of My Myopia and Myopia Profile are partners with the European Society of Ophthalmology (János Németh et al., 2021).

Phase 2

A group of optometry specialists reviewed and provided feedback on the protocol. Their input was gathered over three months, followed by further sessions and committee evaluation for comments. The group was asked to review the material once again. Lastly, more suggestions for consensus-based policies and recommendations were asked from the members.

G. Updating

The first version of this protocol will be created in 2024. The guidelines will be reviewed frequently and changed periodically as needed based on updates in the literature.

H. Conflict of Interest

This protocol was created using current, comprehensive scientific research. There are no relevant financial pharmaceutical companies, medical devices, and biotechnology businesses have no financial ties to us.

I. Funding

No funding or grant is provided.

J. Disclaimer

Individually designed clinical practice recommendations are made to help practitioners determine the best medical treatment plan for controlling and managing myopia. This clinical protocol serves as a tool for evidence-based decision-making. It will be continually updated based on the most accurate facts available at the time of publishing. The following regimen is not meant to be strictly adhered to as a treatment plan. It is not meant to take the role of the clinical judgment of practicing clinicians, nor are they strict guidelines that must be followed, but rather to be a supporting aid in the management of patients with myopia. Doctors must tailor care and treatment plans to each patient's unique circumstances and medical history, and treatment choices must always be decided on an individual basis. While this document provides guidance for treatment and management, it is not meant to replace advice from a doctor or other trained healthcare expert.

1.1. Identifying the risk factors

Some of the associated risk factors have been discussed below:

1.1.1. Refractive errors and eye growth

Children who acquire myopia also exhibit significantly increased axial elongation up to 3 years before onset and up to 5 years after onset. The axial length of a myopic eye seems to expand most rapidly in the year before initiation. Refractive error is the key clinical sign for myopia. Individuals with hyperopia that is lower than expected for their age may be at risk for myopia development. As much as four years before the onset of myopia, future myopes show decreased hyperopic refractions relative to their age-matched emmetropic contemporaries.

1.1.2. Age

According to age, myopia may be divided into two types: early-onset or "school" myopia (between 9-11 years of age) and late-onset myopia (after 15 years of age). The primary factor for faster myopia progression in children is a younger age of onset for myopia.

1.1.3. Family history and ethnicity

Myopia is heritable. Compared to children without myopic parents, those with two myopic parents have a twofold or larger increased chance of developing the disease.

1.1.4. Visual environment

The visual environment seems to have a substantial impact on myopia in school-aged children. Children with myopia seem to spend less time outside than their non-myopic counterparts. More so than the total amount of time spent on near activities, reading at very close ranges for 45 minutes has a high association with the risk of myopia development and progression.

1.1.5. Binocular vision

Children with myopia are more likely to have esophoria at near and accommodative lag than their emmetropic counterparts. Children and young adults with myopia also have decreased accommodative facility and enhanced accommodative convergence (increased AC/A ratios) compared to age-matched emmetropes

1.2. Baseline exam for myopia progression

1.2.1. The standard procedure of examination (from IMI)

Below is a summary of standard practices for an examination for a patient with myopia.

1. The patient's general medical history, ocular history, family (parents/siblings) history of myopia, age of myopia onset, myopia progression history, and any previous myopia management procedures.
2. Refraction: Refraction with and without cycloplegia Two drops of 1% cyclopentolate and one drop of 1% tropicamide were recommended to be given five minutes apart for cycloplegic refraction. The cycloplegic refraction procedure should be performed 30 to 45 minutes after the first drop has been delivered.
3. Manifest refraction and best corrected VAs.
4. Cover test, accommodative accuracy (lag or lead), accommodative amplitude, accommodative facility, near fixation disparity, and AC/A ratio.
5. Test of corneal topography
6. Axial length (A.L.): Despite the lack of consensus on what constitutes normal or accelerated axial elongation in each person, axial length measurement is often employed in myopia control management to determine if it is changing over time. Myopia progresses faster in children between the ages of 6 and 10 due to axial

elongation than in children between the ages of 12 and 16. Myopia is typically associated with an A.L. of more than 25 mm, however, there is a broad range that may be seen. Emmetropes typically have an AL of 22 to 24.5 mm. Normal eye growth is associated with axial length elongation of around 0.1 mm/year, as opposed to myopia progression, which is associated with increases of 0.2 to 0.3 mm/year. It is important to note, however, that myopia can progress despite minimal changes in axial length.

7. Fundus examination and imaging: Annual dilated fundus examinations should be performed to properly assess the retina and posterior segment. Optical coherence tomography (OCT) scans and/or fundus pictures should be performed if there is any significant ocular pathology. Experts may also assess and grade any retinal flaws seen in fundus pictures (e.g., staphyloma, chorioretinal atrophy, titled disc, peripapillary atrophy, etc).
8. Early myopia control interventions should be implemented in children aged 8 years or less who have a refraction of +0.75 DS or less.

1.2.2. Environmental evaluation

Given the correlation between near work and outdoor time and myopia, it is advisable to collect and document the individual's visual habits, such as the average number of hours per day spent outside versus doing near work.

1.2.3. Binocular evaluation

To evaluate binocular vision, it is important to measure both the accommodation and vergence systems. The amount of lead or lag in accommodation gives insight into the accuracy of accommodation. Accommodative facility testing assesses a person's capacity to adjust to abrupt changes in accommodations. Near point of convergence, cover test and near vergence ranges should be examined to evaluate binocularity. (Table 1). There is currently no agreement on the "gold standard" procedures for measuring binocular visual function for patients undergoing myopia control treatment. Thus, it is up to the practitioner to perform the tests they feel are indicated based on the patient's specific findings and treatment.

Also, to monitor for changes, the same tests must be utilised in subsequent consultations. Recent research has shown that accommodative and binocular function may be impacted by not just atropine, but also multifocal soft contact lenses and orthokeratology as well.

TABLE 1. Accommodative Function Tests Used in Clinical Studies (adopted from IMI)

Accommodative assessment	Clinical tests
Accommodative accuracy (lag or lead)	Open-field autorefractors (Canon R-1, Grand Seiko WV-500, or Grand Seiko WR-5100). Aberrometers (Complete Ophthalmic analysis System [COAS] aberrometer). Monocular estimate method (MEM) retinoscopy**.** Nott dynamic retinoscopy**,** Photorefractor**.**
Accommodative amplitude	Minus lens technique (or Sheard's technique). Push-up (or in) test**.**
Accommodative facility	Near (+/- 2.00 D flippers).

TABLE 2 Vergence tests

Vergence assessment	Clinical tests
Distance and near heterophorias	Risley prism and Maddox rod. Von Graefe method. Alternating cover test. Howell near phoria card. Saladin near point balance card**.**
Near point of convergence	**Near point of convergence testing**
Near vergence ranges	Prism barRisley prism

1.2.4. Dry eye evaluation

Myopia management medications or environmental factors can cause or intensify the dry eye symptoms in individuals undergoing myopia control treatment. . Therefore, it is advised that practitioners properly assess the ocular surface in those undergoing myopia management therapy.

Wearing contact lenses has been connected to dry eyes, either as a cause of dry eyes or because pain and dropout are generally related to contact lens use. As a result, individuals wearing contact lenses need to have their ocular surface routinely assessed.

Teaching children how to properly handle and care for contact lenses is imperative to ensure their ocular surface remains healthy.

1.3. Treatment selection guides

1.3.1. Lifestyle advice

1.3.1.1. Interior or nearby place of employment

Excessive near visual demands may affect how myopia develops and advances. Increased probability of myopia development has been linked to closer near reading distances (20–25 cm), continuous reading (more than 45 minutes), head tilt, and closer nib–to–fingertip distance (which implies higher head tilt). According to a 23 year, follow up research study by Pärssinen, myopia progresses much more quickly in individuals who read while sitting as children and less quickly in adults who read while lying down Myopia in adult females was strongly predicted by reading distance in childhood. Myopia development in children throughout the first three years of life was connected to reading and close work time, but these factors did not predict development of myopia in adults.

1.3.1.2. Time spent outdoors and lighting.

The onset of myopia, but not its advancement, seems to be prevented by spending time outside. Spending more time outside throughout the week is associated with a 2% decrease in the incidence of myopia. The risk of acquiring myopia is reduced by around one-third if weekly time spent outside rises from 0-5 hours to 14 hours or more. It is recommended that school-aged children exercise outside for 8 to 15 hours a week to get clinically meaningful protection against myogenic stressors.

1.3.2. Refractive therapy

1.3.2.1. Optical therapy

It has long been standard practice to correct myopia using glasses. Under correction of myopia may not provide the best distance visual acuity and may also cause behavioral changes in certain children, such as a decrease in outdoor activities, which, as mentioned above, may encourage the advancement of myopia.

Optical lens designs for myopia control are becoming more prominent. Various designs such as peripheral defocus spectacle lenses (PDLs), diffusion optics technology (DOT) lenses, highly aspherical lenslet designs, and defocus incorporated multiple segments (DIMS) are currently being studied (refer to image below). The commercial availability of these designs across countries depends on the approval by the regulatory bodies. At present, there are no commercially available optical lenses or contact lenses for myopia control in the Saudi market.

	Bifocal/Progressive Addition lenses	Peripheral Defocus spectacles	Defocus incorporated multiple segments	Highly aspherical lenslet technology	Diffusion Technology
Rationale	Reduce accommodative lag.[11,12]	Reduce peripheral retinal defocus.[13,14]	Simultaneous myopic defocus.[7]	Induce a volume of myopic defocus at the retina.[9]	High contrast differential between neighbouring cones drives growth; reduce retinal contrast with diffusive dots.[15]
Lens design	Upper segment for distance viewing; near segment that is relatively positive compared to distance segment.	Clear asymmetric central zone designed to accommodate near viewing; surrounding peripheral zone is relatively positive. The positive power increases towards periphery.	Clear central zone; multiple discrete segments of +3.50D in mid peripheral zone.	Clear central zone; highly aspherical lenslets in a concentric ring formation; rings[11] separated by clear distance zone. Power of lenslets in each ring is similar but varies between rings.	Clear central zone; peripheral zone with diffuse dots that are non-refractive.
Schematic					

1.3.2.2. Contact lenses therapy.

Contact lenses are a useful tool for managing myopia. Orthokeratology (ortho-k) and soft multifocal contact lenses have both gained to be myopia control treatment. A meta-analysis found that ortho-k and soft multifocal lenses for myopia control provide similar axial length elongation. Orthokeratology lenses should be worn nightly for at least 8 hours to provide the best possible correction for clear, uncorrected vision during the day. According to a recent report published by the American Academy of Ophthalmology, ortho-k may be effective in slowing the progression of myopia in children and teenagers. Yet, there is still concern about safety because of the risk of blinding microbial keratitis from contact lens use. Some ways to reduce the relative peripheral myopia include modifying the designs of ortho-k lenses to boost the plus power inside the pupil. Nevertheless, randomized clinical trials are needed to assess the efficacy of such approaches.

If the full refractive error cannot be corrected with ortho-k, then single vision spectacle lenses for residual refractive error correction maybe required. This has been shown to be beneficial for myopia >6 D when only 4 D was corrected with ortho-k.

If tailoring the ortho-k lenses is not possible, soft multifocal lenses is another great option to consider. To prevent myopia from progressing, a recent overview recommended using soft multifocal contact lenses with the least minus power achievable that does not result in a blur at distance. Multifocal soft contact lens (MFSCL) effectiveness is predicted to increase with the duration of treatment. Continuous use of MFSCLs during school hours and at home is recommended for myopia management.

1.3.3. Atropine therapy

Atropine is an antimuscarinic eye drop that works through competitive inhibition of postganglionic acetylcholine receptors and direct vagolytic action, which leads to parasympathetic inhibition of the acetylcholine receptors in smooth muscle. Low dose atropine is less likely to impact accommodation and cause side effects of photosensitivity and blurry vision at near. Different low doses have been studied and 0.01% is widely administered across the globe as the first line management in managing myopia progression. Other low dose concentrations include 0.02%, 0.025%, 0.05% and the commercial availability depends on the approval by the country's health regulations. In children who are unresponsive to 0.01%, shifting to higher concentration should be considered. However

1.3.4. Therapies combinations

Combination treatment should be taken into consideration for individuals who are undergoing atropine, multifocal soft contact lenses ortho-k as monotherapy, but still have myopia or axial length elongation which is progressing more quickly than normal. Several studies have shown that ortho-k lenses and atropine therapy together have an additive effect in reducing myopia.

In a pilot investigation, children aged 8 to 12 showed slower axial elongation when treated with ortho-k in conjunction with atropine 0.01% than when treated with ortho-k alone. In the combination group, the increase in axial length after a year was 0.09–0.12 mm, but in the ortho-k monotherapy group, it was 0.19–0.15 mm. Atropine and ortho-k used in conjunction seem to reduce the development of myopia. Combination strategies are administered in children who progress rapidly or who do not respond as expected to a specific treatment.

Ideal candidates for myopia control

Based on cycloplegic refraction, the following factors indicate a significant risk for the development of high myopia.

- Age six: +0.75 DS or less
- Ages seven and eight: +0.50 DS or less
- Ages nine and 10: +0.25 DS or less
- Age 11: Planolano or any amount of myopia

Suggested myopia control treatment options based on age:

Age 4+: Atropine eye drops

Age 6+: Ortho-k contact lenses

Age 7+: Soft contact lenses.

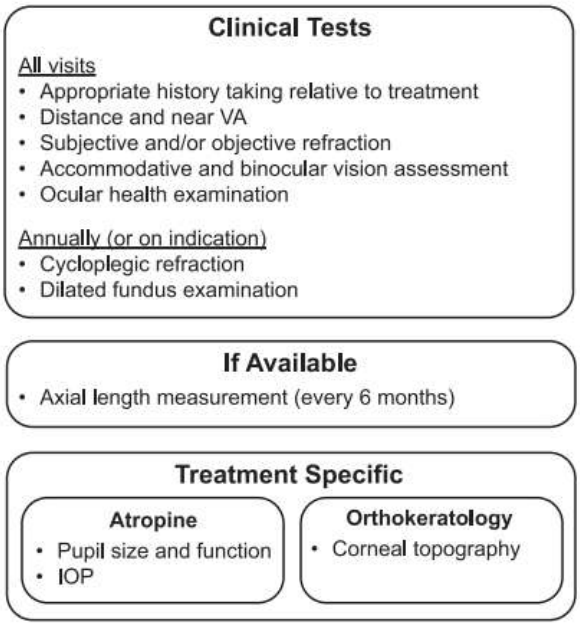
Age 8+: Myopia control spectacle lenses

Examination protocol

Baseline Evaluation

A thorough baseline myopia control evaluations necessary to identify risk factors for myopia progression, to determine the best treatment options, and to create a standard against which to compare the effectiveness of a certain course of treatment.

The key elements of a baseline myopia control evaluation are outlined below in figure 1:



Treatment Strategies

Treatment selection

There are many ways to delay the development of myopia, including multi-focal soft contacts (MFSCs), orthokeratology (Ortho-K), atropine.

MFSCL and Ortho-K are proven to be effective treatment options for myopia control, but neither option is suitable for children who have a substantial amount of astigmatism. Clinicians must assess if the child can safely administer, wear and remove contact lenses while appropriately caring for the lenses and properly using contact lens solutions.

Optical lens designs for myopia control are becoming more prominent. Various designs such as peripheral defocus spectacle lenses (PDLs), diffusion optics technology (DOT) lenses, highly aspherical lenslet designs, and defocus incorporated multiple segments (DIMS) are currently being studied (refer to image below). The commercial availability of these designs across countries depends on the approval by the regulatory bodies. **At present, there are no commercially available optical lenses or contact lenses for myopia control in the Saudi market.**

Atropine may not be suitable for children who are unable to tolerate eye drops or the side effects from atropine. Also, atropine may not always be readily available because it must be compounded by a pharmacy. Cost should also be considered when prescribing those specialized lenses mentioned above. The patient, parents and eye care professional should all work together to determine which modality is the most suitable for each specific patient.

Summary of myopia control treatment

Myopia control strategies tested	
Under Correction of Myopic Refractive Error	Ineffective
Gas-permeable Contact Lenses	Ineffective
Outdoor Time	Effective at reducing onset of myopia, ineffective for myopia control
Bifocal or Multifocal Spectacles	Statistically significant but not clinically significant
Orthokeratology	Approximately 45% reduction axial elongation
Multifocal Contact Lenses	50% to 81.25% effect on refractive error 29% to 55% effect on axial elongation
Anti-Muscarinic Agents (0.01% Atropine)	Approximately 59% slowing of refractive error and no effect on axial elongation
Combination strategies	Limited research

1.4. Treatment duration

Parents and patients should be informed that myopia progression may increase after stopping therapy. As the long-term negative effects of atropine usage have not been studied, the drug should be used with caution. To lessen the likelihood of unpleasant rebound effects, it may be best to gradually reduce the dosage or the frequency of doses at the end of the treatment period.

The results of the ATOM studies indicate some loss of treatment efficacy with time, at least with the higher concentrations of atropine, but a study using atropine concentrations between 0.05% and 0.1% by Wu and colleagues suggests that treatment effects with low-dose atropine can be maintained for up to 4.5 years.

It follows that ortho-K treatment should continue beyond the age of 14. Long-term usage of soft myopia control contact lenses or ortho-k can be done if the cornea and anterior segment remains healthy.

A soft contact lens for controlling myopia has not been associated with any rebound effect. Issues with compliance and safety may necessitate altering the mode of therapy or terminating it altogether. Myopia control treatment may also be discontinued or changed if the visual side effects are not tolerable.

1.5. When to change treatment (from IMI)

Treatment may be discontinued, changed, or combined with another modality if it has been determined that myopia development has not been satisfactorily controlled. Growth curves for children with myopia wearing single-vision glasses or contact lenses may be used as a guide to help determine the best treatment options, especially if the rate of progression for the individual patient is unknown. When myopia development is not being adequately controlled by the primary treatment, it may be required to resort to adjunct or combined treatments. Nevertheless, there are currently fewer trials demonstrating the benefit of combination therapy. Clinicians should proceed cautiously and not overstate the benefits of this combined treatment until further research has been conducted.

1.6. Treatment strategy conclusion, review schedule and clinical consideration (from IMI)

Clinical efforts to delay the onset and progression of myopia are expanding, with a focus on identifying risk factors early along with prescribing the appropriate treatment therapies.

For the initial visit, should get more information about the patient's history:

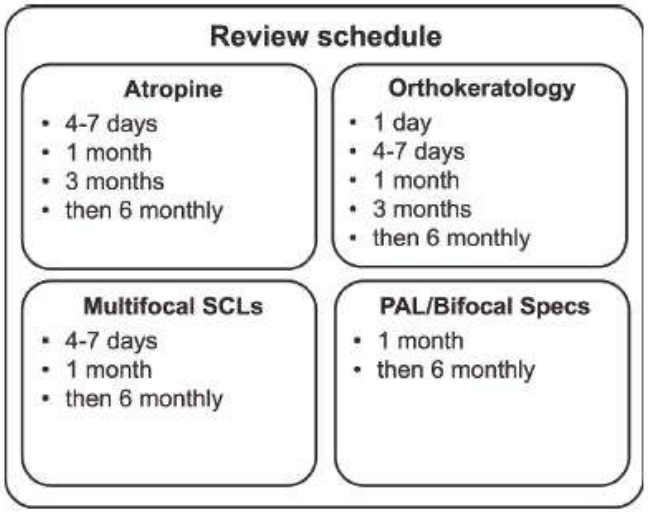
- Age of myopia onset
- Family (parents/siblings) history of myopia
- If any previous myopia control treatments
- History of previous prescriptions to show rate of progression.

Mild degrees of hyperopia are common in children less than 10 years of age. A higher chance of developing myopia is associated with hyperopia that is less than what is considered normal for one's age. Performing axial length measurements early on can be very helpful. It is important to properly assess the fundus because with pathological myopia are at a higher risk of having retinal tears or detachments, as well as myopia maculopathy, cataracts, and glaucoma.

Clinical care considerations

To monitor patient safety, compliance, and treatment effectiveness, it is recommended that patients receiving any therapy for myopia management be evaluated every six months.

The follow-up schedule specific to each treatment is outlined in Figure 2: (adopted from IMI)



- Those with substantial astigmatism may use Toric MFSCL or residual astigmatism-correcting eyeglasses in addition to myopia-control contact lenses. For those who use atropine, photochromic may be considered to lessen the drug's negative visual effects. While providing MFSCL, practitioners should choose the most suitable CL design.

<u>Commercially available myopia control options (Optical)*</u>

	Spectacle lens designs			
	Essilor Stellest	**Hoya MiYOSMART**	**SightGlass vision**	**Zeiss Myocare**
Technology	Highly Aspherical Lenslet Target (H.A.L.T.)	Defocus Incorporated Multiple Segments (DIMS)	Diffusion Optics Technology (DOT)	Cylindrical Annular Refractive Elements or C.A.R.E. Technology
Design	11 concentric rings of highly aspherical lenslets	The lenslets in this lens are all of the same power, and are not touching, instead in a honeycomb array	Microscopic diffusers of around 1/10th of a millimetre	Alternating defocus and correction zones in a ring-like pattern on the front surface, expanding towards the periphery of the lens

Power distribution	9mm clear central zone, and spaces between each ring, for sharp distance vision	Clear central zone of 9mm and there are spaces between each lenslet for sharp distance vision, relative positive power (+3.50 D)	Small central clear zone, this is different to the 'lenslet' spectacle designs, instead creating a diffusion or blur of light around the edges of the lens	Central clear zone of 7 mm (Myocare) with mean additional surface power of +4.6 D and 9 mm (Myocare S) with mean additional surface power of +3.8 D
Refractive index	One Index (Polycarbonate)	One Index (Polycarbonate)	One Index (Polycarbonate)	Fefractive index of 1.50, 1.60 and 1.67

In all lens designs, the lenslets or diffusers work to create a slow-down signal for eye growth to help control myopia progression. The clear central zones and spaces between lenslets provide clear distance vision.

MFSCL*

Center-distance Dual-focus Lenses for Myopia

	MiSight	NaturalVue MF	Biofinity MF	Proclear MF
Power	-0.25D to -6.00D	+4.00D to-12.25D	+6.00D to -10.00D	+6.00D to -8.00D
Base Curve	8.7	8.3	8.6	8.7
Diameter	14.2	14.5	14.0	14.4
Add	one single design	one single design	+2.50/+2.00 recommended	
Design	concentric ring	extended depth-of-focus		
Tint	visitint			
UV	none	class 2	none	none
Material	omafilcon A	etafilcon A	comfilcon A	omafilcon B
Water Content	60%	58%	48%	62%
Dk	27	20	128	21
Replacement	daily	daily	monthly	monthly
Fitting	minimum minus	duochrome first green; use manufacturer calculator for starting lens	studies show -0.50 to -0.75sph over-minus as needed	

***. At present, there are no commercially available optical lenses or contact lenses for myopia control in the Saudi market.**

Clinical assessment

Visual acuity (with correction) Distance and near	OD: OS:
Spectacle prescription Subjective refraction Dry retinoscope Cycloplegic retinoscope	 OD: OS:
Open field auto refraction – distance refraction (WAM 5500)	OD: OS:
WAM 5500 Accommodative response @ 40 cm	OD: OS:
Near point of convergence (NPC) in cm Vergence ranges	Break/Recovery values
Near point of accommodation (NPA) in cm & Amplitude of Accommodation (AA) in Diopters MEM TESTING	OD: AA : OS: AA : OU: AA:
Accommodative facility (Near) (+2.00/-2.00 DS accommodative flippers) (cycles/min)	OD: OS: OU:
Keratometry	OD: OS:
Ocular Biometry	OD: AXL: ACD: LT: VCD: CD: CCT: PS: OS: AXL: ACD: LT: VCD : CD: CCT: PS:
Cycloplegic auto refraction (OPEN FIELD)	OD: OS:
Pupil Size New SRx finalized	Mesopic OD: OS: Photopic OD: OS:
Myopia Management recommendations	

List of Equipment

- A-scan Biometer
- Retinoscope
- WAM-5500 Open field autorefractor
- Binocular vision testing kit (Maddox rod, Muscle imbalance measure card, Astron International rule, Prism bar, Accommodative flippers +2.00/-2.00 DS

List of Abbreviations

1. WHO: World Health Organization
2. AGREE II: Appraisal of Research and Evaluation II
3. UV: Ultraviolet
4. AC/A ratios: accommodative convergence to accommodation ratios
5. IMI: International Myopia Institute
6. AL: Axial Length
7. IOL: Intraocular lens
8. OCT: Optical Coherence Tomography
9. D: DIOPTRIC POWER
10. OK: Orthokeratology.
11. Ortho-K: Orthokeratology.
12. LDLs: light data loggers
13. MFSCLs: Multifocal Soft Contact Lens
14. IOP: Intraocular pressure
15. MMD: Myopic macular degeneration.
16. ATOM: Atropine Treatment Of Myopia.

References

- International Myopia Institute guidelines: https://myopiainstitute.org/wp-content/uploads/2020/09/Clinical-Management-Guidelines-IMI.pdf.
- Protocol for clinical management and control of myopia in children quoted from Update and guidance on the management of myopia. European Society of Ophthalmology in cooperation with International Myopia Institute (János Németh et al., 2021) (https://journals.sagepub.com/doi/full/10.1177/1120672121998960).
- https://www.myopiaprofile.com/articles/connect-the-dots-understanding-sightglass-dot-lens#:~:text=The%20SightGlass%20Vision%20DOT%20lenses,rather%20than%20optical%20defocus%20theory.
- https://reviewofmm.com/when-to-initiate-myopia-management-intervention-and-when-to-stop/
- Drugs and Lactation Database (LactMed®) [Internet]. National Institute of Child Health and Human Development; Bethesda (MD): May 17, 2021. Belladonna. https://pubmed.ncbi.nlm.nih.gov/30000920/
- https://www.mykidsvision.org/knowledge-centre/when-should-we-start-myopia-control-and-when-should-we-stop#:~:text=There%20is%20lots%20of%20evidence,be%20continued%20throughout%20this%20time.
- https://www.myopiaprofile.com/articles/myopia-control-when-to-start