MYOPIA: IS IT A PROBLEM? AND HOW TO CONTROL PROGRESSION

The Myopia Epidemic: Magnitude of the condition

It is estimated that 1.4 billion people worldwide (22.9% of world population) are myopic and 163 million are categorized as having high myopia.[1] Myopia has become an epidemic in certain East Asian cities; i.e. Singapore, Hong Kong and Guangzhou (China); with around 1 in 2 people being affected.[2] The prevalence is highest among young adults where 80-90% of those aged 17-18 years suffer from myopia. Published reports on myopia prevalence in Malaysia shows a relatively lower rate at 9.8% in children 7 years of age which increases to 34.4% by the age of 15 years.[3]

Why is it a problem?

Myopia, particularly high myopia (defined as spherical equivalent of greater or equal to -6.00D or axial length >26.5mm) is associated with vision-threatening conditions, of which some are irreversible, leading to pathological myopia. These include myopic macular degeneration, myopic choroidal neovascularization, rhegmatogenous retinal detachment, glaucoma and cataract.

What are the risk factors for myopia?

Overwhelming evidence has shown that sustained, intense near-work is significantly linked to the onset of myopia in children and possibly progression of myopia, particularly in young adult-onset myopia. These activities include continuous long durations of intense studying or reading, as well as prolonged screen-time with mobile gadgets, TV and videogames.

Outdoor time is a protective factor

Light-induced release of dopamine has now been confirmed to inhibit axial elongation and is generally accepted as the mechanism of myopia protection. Numerous studies have consistently shown that children who spend more time outdoors are less likely to be or become myopic.[5] Causal association has been proven by 2 large randomized clinical trials,[6,7] where increased time outdoors had significantly reduced myopia incidence in children aged between 6 and 11 years old.

How to diagnose myopia?

Cycloplegic refraction should be performed for children below the age of 6 years old, as accommodation overestimates myopia. Older children who can perform subjective refraction reliably may not require cycloplegic agents. However, in cases where over-accommodation is suspected, cycloplegia is advised to prevent overcorrection.

How to manage myopia?

Glasses should be prescribed for full-time wear in children who are symptomatic or when clear distance viewing is desirable, e.g. school-going children. Low isometropic myopia is usually not amblyogenic in very young children as they are still able to see well at near. Prescribing glasses may not be required at the outset however close monitoring is advisable as myopia is likely to progress with age. There is also a known association between higher levels of accommodative lag and enhanced AC/A ratios in myopic children compared to emmetropes.[8] Thus, evaluation of accommodative lag by dynamic retinoscopy and AC/A ratio measurement should be considered in identifying children at risk of developing myopia.

Myopic children on treatment should be monitored every 6 months with repeat refraction and axial length recorded where possible. Dilated fundus examination should be performed annually or as indicated.

Myopia prevention and control of progression

In view of the public health concerns of a global myopia epidemic, approaches to prevent myopic pathology must include both early preventive interventions as well as rescue treatments to retard progression.

Intervention for prevention includes increasing outdoor play for young children at risk of myopia to 2 hours per day or 14 hours per week.[8]

Screen-time with mobile devices should be discouraged in young children. Children below the age of 2 should not be exposed to mobile gadgets, 2-6 year olds should have a limit of 1 hour per day

whereas a maximum of 2 hours per day only for children above 6 years. Reducing study time may be unrealistic in a culture where academic excellence is highly regarded. Alternatively, educational policies encouraging outdoor classes, maximizing outdoor physical education and teaching healthy eye habits such as taking regular breaks and adopting appropriate reading distance during intense near-work may provide more practical solutions.

Myopia control treatment should be considered when there is an increase of 1.00D or more within 1 year in children at risk of developing high myopia. There have been several treatment approaches including pharmacological and optical.

There is high-level evidence that suggests topical atropine is effective for myopia control.[9,10,11] Low dose topical atropine (0.01%) has been shown to have good efficacy and is safe. Instilled to both eyes at night, it has been shown to reduce myopia progression by up to 58%. However, the mechanism by which atropine slows down myopia is still unclear and there is a group of patients who are non-responders. Currently, there is no standard guideline on management of myopia control with topical atropine. Most experts in the field advocate its use in children aged 5 years or older and therapeutic effect is expected by 6 months of treatment. Wu et al[11] had proposed an algorithm for atropine treatment in myopia control as shown in Figure 1. An increment of 0.5D or more over a 6-month period is considered uncontrolled progression and step-up treatment may be considered. The optimal duration of treatment is still unknown and there is a risk for rebound after stopping treatment.

Orthokeratology (Ortho-K) is a rigid, gas-permeable contact lens that flattens the central cornea while steepening the peripheral cornea. It is worn overnight and provides spectacle-free vision during daytime. It causes peripheral myopic defocus which has been shown to slow down eyeball growth. Ortho-K is reported to retard axial elongation by an average of 43%.[10] However, there are concerns in the use of Ortho-K due to the risk of microbial keratitis which causes significant visual morbidity and there has been a few reports of patients needing surgical treatment.[9] In addition, cessation of Ortho-K causes rebound myopia as the cornea returns to its original shape. Thus, questions remain regarding the duration of treatment required to achieve stabilization as well as the long-term effect on the ocular surface health of the cornea.

Recently, novel optical treatment that induces peripheral myopic defocus has been studied. Multifocal soft contact lens (MFSCL) is designed to impose myopic defocus at all distances, hence decelerating myopia progression. It is reported that MFSCL slows down myopia progression as well as axial elongation by an average of 38.0% and 37.9% respectively.[10] MFSCL demonstrate lower risk for microbial keratitis compared to Ortho-K. However, the issue of cost and handling of contact lenses in children versus its benefit is still debatable.

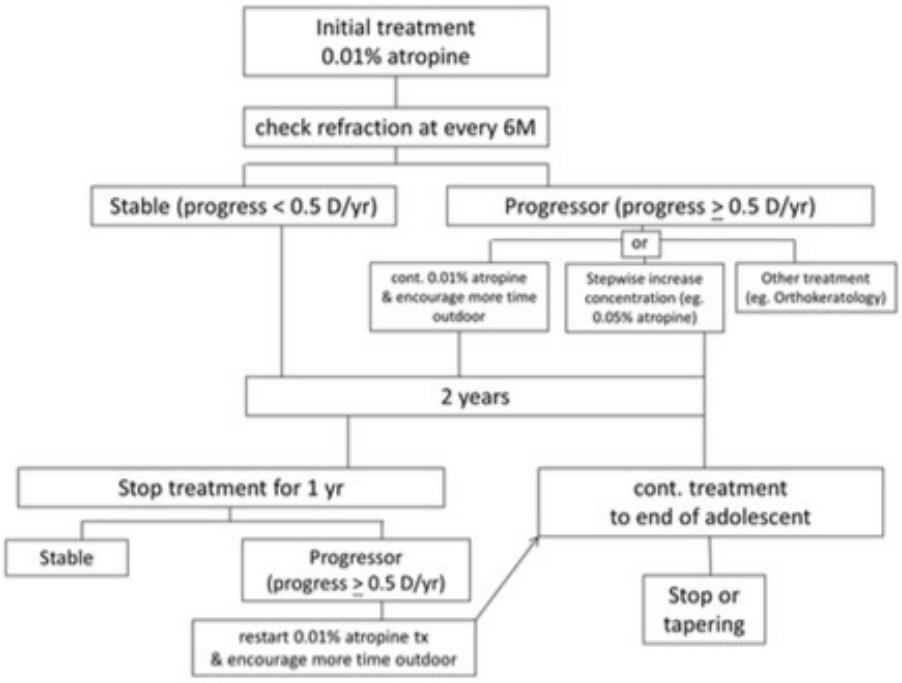

Figure 1. "The proposed strategy of atropine treatment for myopia control in clinical implementation" (taken from Wu et al. Update in myopia and treatment strategy of atropine use in myopia control. Eye 2019; 33:10)

It is clear that myopia is no longer seen simply as a form of refractive error but has become a major public health issue in view of its increasing prevalence and link to potential irreversible blindness. Prevention campaigns should not be overlooked in promoting good eye-care habits, increasing time outdoors and limiting near-work in children.

Reference

1. Holden BA, Fricke TR, Wilson DA, et al. Global prevalence of myopia and high myopia and temporal trends from 2000 through 2050. Ophthalmology. 2016;123:1036-1042
2. Saw SM, Matsumura S, Hoang QV. Prevention and management of myopia and myopic pathology. Invest Ophthalmol Vis Sci. 2019; 60:488-499
3. Goh PP, Abqariyah Y, Pokharel GP, Ellwein LB. Refractive error and visual impairment in school-age children in Gombak District, Malaysia. Ophthalmology 2005; 112(4): 678-685
4. Chung KM, Mohidin N, Yeow PT, Tan LL, O'Leary D. Prevalence of visual disorders in Chinese schoolchildren. Optom Vis Sci. 1996; 73(11): 695-700
5. Morgan IG, French AN, Ashby RS et al. The epidemics of myopia: Aetiology and prevention. Prog Retin Eye Res 2018; 62:134-149
6. He M, Xiang F, Zeng Y et al. Effect of time spent outdoors at school in development of myopia among children in China: A randomized clinical trial. JAMA 2015; 314: 1142-1148
7. Wu PC, Tsai CL, Wu HL, Yang YH, Kuo HK. Outdoor activity during class recess reduces myopia onset and progression in school children. Ophthalmology 2013; 120(5): 1080-1085
8. Gifford KL, Richdale K, Kang P et al. International Myopia Institute (IMI) – Clinical management guidelines report. Invest Ophthalmol Vis Sci. 2019; 60:M184-M203
9. Prousali E, Haidich AB, Fontalis A et al. Efficacy and safety interventions to control myopia progression in children: an overview of systematic reviews and meta-analyses. BMC Ophthalmol 2019; 19:106
10. Wildsoet CF, Chia A, Cho P, et al. IMI – Interventions for controlling myopia onset and progression report. Invest Ophthalmol Vis Sci. 2019; 60:M106-M131
11. Wu PC, Chuang MN, Choi J et al. Update in myopia and treatment strategy of atropine use in myopia control. Eye 2019; 33:3-13

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