Epidemic of Childhood Myopia – Global perspective and management strategies

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No Financial Interest
Epidemic of Childhood Myopia – Global perspective and management strategies

- Myopia - a global public health burden

- Increasing prevalence in both developing and developed countries.

- Recent publications and researches
This lecture will focus on treatment modalities with special emphasis on pharmacologic therapy of progressive myopia.

Highlights recent findings on preventive and early interventional measures to retard myopia, and novel treatments for progression of myopia.
POLL QUESTION 1

• What is your current position?

1. Pediatric Ophthalmologist
2. Comprehensive Ophthalmologist
3. Fellow/Resident
4. Medical Student
5. Optometrist
6. Myopia Consultant
Myopia – A 21st Century Public Health Issue
In 2010, an estimated 1.9 billion people (27% of the world’s population) -myopic, 70 million of them (2.8%) -high myopia.

These numbers are projected to rise to 52% and 10%, respectively, by 2050.
Vision impairment related to myopia –

- significant economic impact
- significant effect on quality of life regarding patients’ physical, emotional, and social functioning.

Globally, the economic burden is estimated to be $202 billion per year.
POLL QUESTION 2

- Do you think Pediatric Myopia needs consideration of an epidemic?

1. Yes
2. No
3. Not Sure
Myopia is a complex disease with a multitude of factors including:

- Genetic
- Environmental (external)
- Multifactorial
- Microenvironmental components
- Combination
Genome-wide association studies (GWAS)

- Involved in retinal cascade signalling (GWAS)
- loci that involved in -
  - neurotransmission (e.g., GRIA4),
  - Ion transport (e.g., KCNQ5, CD55, and CHN RG),
  - Retinoic acid metabolism (e.g., RDH5, RORB, and CYP26A1),
  - Extracellular matrix remodeling (e.g., LAMA2 and BMP2), and eye development (e.g., SIX4, PRSS56, and CHD7)

• Consortium for Refractive Error and Myopia (CREAM) genomic variations - associated with a 10-fold increase in the prevalence of myopia.

• 23 and Me


Genome-Wide Analysis Points to Roles for Extracellular Matrix Remodeling, the Visual Cycle, and Neuronal Development in Myopia” February 28, 2013 in PLOS Genetics
To date, almost 200 genetic loci have been identified for refractive error and myopia.
Prevalence of Myopia

Figure 1: Modelled prevalence of myopia by age for East Asian and White children and teenagers from a systematic review and quantitative meta-analysis fitted to the year 2005 (graph created from data in Table 3 of Rudnicka et al.37)
Risk Factors – Parental myopia

Table 1. Demographic Characteristics of Participants With Cycloplegic Refraction by Parental Myopia³

<table>
<thead>
<tr>
<th>Study characteristic</th>
<th>No. with parental myopia data</th>
<th>Maternal myopia No. (%)</th>
<th>P valueb</th>
<th>Paternal myopia No. (%)</th>
<th>P valueb</th>
<th>All parents with myopia, No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Study (location)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STARS (Singapore)</td>
<td>2500</td>
<td>1455 (59.0)</td>
<td>&lt;.001</td>
<td>1256 (51.3)</td>
<td></td>
<td>989 (39.6) 861 (34.4)</td>
</tr>
<tr>
<td>SPEDS (Sydney, Australia)</td>
<td>1069</td>
<td>371 (34.9)</td>
<td>&lt;.001</td>
<td>293 (27.9)</td>
<td>&lt;.001</td>
<td>416 (38.9) 124 (11.6)</td>
</tr>
<tr>
<td>MEPEDS (Los Angeles, California)</td>
<td>6224</td>
<td>1901 (30.6)</td>
<td></td>
<td>1227 (19.9)</td>
<td></td>
<td>1934 (31.1) 597 (9.6)</td>
</tr>
</tbody>
</table>

³ 2020 Mar 19;138(5):1-9
An individual has a 2.08 times greater chance of becoming myopic if he or she had one myopic parent and a 5.07 times greater chance with two myopic parents.
Sleep Duration, Bedtime, and Myopia Progression in a 4-Year Follow-up of Chinese Children: The Anyang Childhood Eye Study

Shi-Fei Wei,1 Shi-Ming Li,1 Luoru Liu,2 He Li,2 Meng-Tian Kang,1 Yun-Yun Sun,1 Yi-Peng Wang,2 Xiao-Yuan Yang,3 and Ningli Wang1

1Beijing Institute of Ophthalmology, Beijing Tongren Eye Center, Beijing Tongren Hospital, Capital Medical University
Height and Its Relationship to Refraction and Biometry Parameters in Singapore Chinese Children

Seang-Met Saw,¹,² Wei-Han Chua,² Ching-Ye Hong,¹ Hui-Min Wu,³ Kee-Seng Chia,¹ Richard A. Stone,⁴ and Donald Tan²
CHAMP Study

- The Childhood Health, Activity, and Motor Performance Eye Study - The prevalence of myopia at the final time-point was 17.9% and was not associated with physical activity.
POLL QUESTION 3

- Do you record parental myopia history, time spent on screen and exposure to sunlight when dealing with a myopic patient?

1. Always
2. Yes sometimes
3. Never
Near Work – Risk Factor

- The Sydney Myopia Study –
  near work such as close reading distance (<30 cm) and continuous reading (>30 minutes) independently increased the odds of having myopia.

- Sydney Adolescent Vascular and Eye Study (SAVES)
  children who became myopic performed significantly more near work (19.4 vs. 17.6 hours; \( p=0.02 \)) compared with children who remained nonmyopic.

“Near work can be a factor for inducing the earlier onset of myopia in smaller children.”

Screen myopia – Risk Factor

The Association Between Digital Screen Time and Myopia: A Systematic Review

Carla Lanca, Seang-Mei Saw
Less Time spent outdoors - Risk Factor

- ACES
  - Anyang Childhood Eye Study

- CLEERE
  - Collaborative Longitudinal Evaluation of Ethnicity and Refractive Error Study

- ORINDA
  - Orinda Longitudinal Study of Myopia

- ALSPAC - Avon Longitudinal Study of Parents and Children

STARS

SCORM

SAVES

OLSM
<table>
<thead>
<tr>
<th>Author (Year) Study Location, Study Design</th>
<th>Age at Baseline, Refraction</th>
<th>Main Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prevention</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jones et al. (2007)(^{154}) USA (OLSM), cohort study; (N = 514)</td>
<td>8–9 y, cycloplegic auto-refraction</td>
<td>Time outdoors (h/wk) and incident myopia (SER ≤ −0.75 D): OR = 0.91 (0.87 to 0.95); (P &lt; 0.0001)</td>
</tr>
<tr>
<td>Guggenheim et al. (2012)(^{172}) UK, cohort study (ALSPAC); (N = 7747)</td>
<td>7 y, noncycloplegic auto-refraction</td>
<td>Time outdoors (h/wk) and incident myopia (SER ≤ −1.00 D): HR = 0.76 (95% CI 0.60–0.96); (P = 0.02); Lost to follow-up: 37.6%</td>
</tr>
<tr>
<td>French et al. (2013)(^{164}) Australia, (SAVES), cohort study; (N = 2103); 5–6-y follow-up</td>
<td>6 and 12 y, cycloplegic auto-refraction</td>
<td>Time outdoors (h/wk) and incident myopia (SER ≤ −0.50 D): 12-y-olds: OR = 2.84 (95% CI 1.56–5.17) (P &lt; 0.0001); 17-y-olds: OR = 2.15 (95% CI 1.35–3.42); (P = 0.001); Lost to follow-up: 51.6%</td>
</tr>
<tr>
<td>Mutti et al. (2002)(^{152}) USA (OLSM), cross-sectional; (N = 336)</td>
<td>13–14 y, cycloplegic auto-refraction</td>
<td>Time outdoors (h/d) and myopia (SER ≤ −0.75D): OR = 0.92 (95% CI 0.86 to 0.97); (P = 0.005)</td>
</tr>
<tr>
<td>Rosc et al. (2008)(^{155}) Australia (SMS), cross-sectional; (N = 2339)</td>
<td>6 and 12 y, cycloplegic auto-refraction</td>
<td>Time outdoors (h/d) and SER: 6-y-olds: (\beta = 0.05); (P = 0.009); 12-y-olds: (\beta = 0.07); (P &lt; 0.0003)</td>
</tr>
<tr>
<td>Dirani et al. (2009)(^{167}) Singapore (SCORM), cross-sectional; (N = 1249)</td>
<td>11–20 y, cycloplegic auto-refraction</td>
<td>Time outdoors (h/d) and myopia (SER ≤ −0.50 D): OR = 0.90 (95% CI 0.84–0.96); (P = 0.004)</td>
</tr>
<tr>
<td>Low et al. (2010)(^{168}) Singapore (STARS), cross-sectional; (N = 3009)</td>
<td>6–72 mo, cycloplegic auto-refraction</td>
<td>Time outdoors (h/d) and myopia (SER ≤ −0.50 D): OR = 0.95 (95% CI 0.85–1.07); (P = 0.44)</td>
</tr>
<tr>
<td>Guo et al. (2013)(^{169}) China, cross-sectional; (N = 681)</td>
<td>5–13 y, noncycloplegic auto-refraction</td>
<td>Time outdoors (h/d) and myopia (SER ≤ −1.00 D): OR = 0.32 (95% CI 0.21–0.48); (P &lt; 0.001)</td>
</tr>
<tr>
<td>Progression</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jones-Jordan et al. (2012)(^{157}) USA, cohort study (CLEERE); (N = 835)</td>
<td>6–14 y, cycloplegic auto-refraction</td>
<td>Time outdoors (h/wk) and SER change: (\beta = 0.03) (99% CI −0.03 to 0.08); (P &gt; 0.01) for additional 10 h of outdoor time/wk</td>
</tr>
<tr>
<td>Li et al. (2015)(^{174}) China, cohort study; (ACES), (N = 2267)</td>
<td>10–15 y, cycloplegic auto-refraction</td>
<td>Time outdoors (h/d) and AL change: (\beta = −0.036) (99% CI −0.063 to −0.009); (P = 0.009); Lost to follow-up: 16.6%</td>
</tr>
</tbody>
</table>

ACES, Anyang Childhood Eye study; ALSPAC, Avon Longitudinal Study of Parents and Children; CLEERE, Collaborative Longitudinal Evaluation of Ethnicity and Refractive Error study; HR, hazard ratio; OLSM, Orinda Longitudinal Study of Myopia; OR, odds ratio; SAVES, Sydney Adolescent Vascular and Eye Study; SCORM, Singapore Cohort study of Risk Factors for Myopia; SMS, Sydney Myopia Study; STARS, Strabismus, Amblyopia and Refractive error study.
High Education – Risk factor

- Competitive and stressful education systems


Risk factors for myopia in school children included:

- Low outdoor time and near work,
- Dim light exposure,
- The use of LED lamps for homework,
- Low sleeping hours
- Reading distance less than 25 cm
- Living in an urban environment.

Table 2: Risk factors for the prevalence of myopia in the analyzed studies

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>Country where the study was conducted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female gender</td>
<td>China [10, 12, 14, 15], Colombia [37], India [17], Saudi Arabia [21, 35]</td>
</tr>
<tr>
<td>Low outdoor activity</td>
<td>Australia [27], China [1, 15], Netherlands [23]</td>
</tr>
<tr>
<td>Parental myopia</td>
<td>Australia (6-year-old cohort) [29], China [12, 14, 15], Finland [42], India [17], Japan [46]</td>
</tr>
<tr>
<td>Increasing age</td>
<td>Brazil [26], China [12, 14, 15], India [17], Poland [18, 19], Saudi Arabia [21, 35]</td>
</tr>
<tr>
<td>Time spent on near work/studying</td>
<td>Australia [29], China [12, 32], India (over 5 h daily) [17], Taiwan [47]</td>
</tr>
<tr>
<td>Higher socio-economic status</td>
<td>India [17], Netherlands [23], Saudi Arabia (only in girls) [21]</td>
</tr>
<tr>
<td>Low family income</td>
<td>China [14], Hong Kong [48], Indonesia [34]</td>
</tr>
<tr>
<td>Higher body mass index</td>
<td>China [32], Netherlands [23]</td>
</tr>
<tr>
<td>Use of LED lamps for homework (compared to incandescent or fluorescent lamps)</td>
<td>China [11]</td>
</tr>
<tr>
<td>Urban environment, high population density and small home size</td>
<td>China [14], Hong Kong [48], Indonesia [34]</td>
</tr>
<tr>
<td>Rural environment</td>
<td>Saudi Arabia (only in girls) [21]</td>
</tr>
<tr>
<td>Private schooling and watching TV over 2 h daily and playing mobile/video games</td>
<td>India [17]</td>
</tr>
<tr>
<td>Low sleeping hours</td>
<td>China [32], Netherlands [23]</td>
</tr>
<tr>
<td>Lower vitamin D levels, less participation in sports and foreign descent</td>
<td>China [32], Netherlands [23]</td>
</tr>
<tr>
<td>Westernized dietary habits</td>
<td>Japan [46]</td>
</tr>
</tbody>
</table>
Interaction between lifestyle and genetic susceptibility in myopia: the Generation R study

Abstract
Myopia is a refractive error of the eye caused by a complex interplay between nature and nurture. The aim of this study was to investigate whether environmental risk factors can influence the genetic effect in children developing myopia. A total of 3422 children participating in the birth-cohort study Generation R underwent an extensive eye examination at 9 years with measurements of refractive error and axial length corneal radius ratio (AL/CR). Environmental risk factors were evaluated using a questionnaire, and environmental risk scores (ERS) were calculated using backward regression analyses. Genetic risk scores (GRS) were calculated based on all currently known risk variants for myopia. Gene-environment interaction (GxE) was investigated using linear and logistic regression analyses. The predictive value of GxE and parental myopia was estimated using receiver operating characteristic curves. Myopia prevalence was 12%. Both GRS (P < 0.01) and ERS (P < 0.01) were significantly associated with myopia and AL/CR, as was GxE interaction (P < 0.01 for myopia; P = 0.07 for AL/CR). The predictive value of parental myopia was 0.67 (95% CI 0.65–0.70), similar to the values of GRS (0.67; 95% CI 0.64–0.70; P = 0.98) and ERS (0.69, 95% CI 0.66–0.72; P = 0.98). Adding GxE interaction significantly improved the predictive value to 0.73 (95% CI 0.70–0.75; P < 0.01). This study provides evidence that nature and nurture are equally important for myopia and AL/CR; however, the combination has the strongest influence. Since myopia genes are common in the population, adjustment of lifestyle should be a major focus in the prevention of myopia.
Vitamin D and Myopia

First, in a longitudinal study of European children, serum vitamin D no association between time outdoors and myopia.

Second, in a Mendelian randomization study by the CREAM consortium - no relationship.


Mutti D. O., Marks A. R. Blood levels of vitamin D in teens and young adults with myopia. Optometry and Vision Science. 2011;88(3):377–382
• Tang et al. reported that lower 25-hydroxyvitamin D (25(OH)D) concentration is associated with increased risk of myopia (AOR: 0.92; 95% CI 0.88–0.96; p < 0.0001)

• “light-dopamine theory” that increased light intensity during time spent outdoor protects against myopia by the increased release of dopamine.

• “vitamin D theory” - the increased ultraviolet light triggers the stimulation of vitamin D production,


Prevention of Axial elongation in myopia by trace element

- Zinc (Zn), copper (Cu), selenium (Se), manganese (Mn), α-tocopherol (vitamin E), ascorbic acid (vitamin C), glutathione (GSH), and β-carotene

- Play an important role in the antioxidative processes and in biochemical rebuilding of the sclera.

Is Dietary Vitamin A Associated with Myopia from Adolescence to Young Adulthood?

Fletcher J. Ng; David A. Mackey; Therese A. O'Sullivan; Wendy H. Oddy; Seyhan Yazar

Translational Vision Science & Technology May 2020, Vol.9, 29


What causes myopia?

- The signalling cascade from the retina to the sclera

- Amacrine cells - implicated in retinal processing of the signal.

- The choroid and the sclera show biochemical changes associated with ocular growth in the animal models.
STRUCTURE - Axial myopia

- The choroid - a source of scleral growth regulators

- Choroidal thickness - to understand the relationship between thin choroids and retinal complications of the elongated myopic eye.
Children with younger age and smaller β-PPA at baseline showed a faster myopia progression.

The width of β-PPA, regardless of SER, might be used as a quantitative parameter to predict the potential for further myopia progression associated with scleral stretching.
Complications of Myopia

- MYOPIC MACULAR DEGENERATION
- MYOPIC CHOROIDAL NEOVASCULARIZATION
- RETINAL DETACHMENT
- GLAUCOMA
- CATARACTS
Although high myopia carries the highest risk of complications and visual impairment, low and moderate myopia also have considerable risks.

These estimates should alert policy makers and health care professionals to make myopia a priority for prevention and treatment.

Annechien E. G. Haarman; Clair A. Enthoven; J. Willem L. Tideman; Milly S. Tedja; Virginie J. M. Verhoeven; Caroline C. W. Klaver
Treatment

- OPTICAL
  - SingleVision spectacles
  - PAL
  - ORTHOK
  - Soft CL/multifocal contact lenses

- PHARMACOLOGICAL
  - Atropine
  - Pirenzepine
  - Timolol

- BEHAVIORAL
  - Increase outdoor time
  - Decrease screen time

- COMBINATION
Orthokeratology and soft multifocal contact lenses are thought to slow myopia progression by optically decreasing peripheral hyperopic defocus or increasing peripheral myopic blur.
Peripheral Refraction and Eye Lengths in Myopic Children in the Bifocal Lenses In Nearsighted Kids (BLINK) Study

- Donald O. Mutti; Loraine T. Sinnott; Kathleen S. Reuter; Maria K. Walker; David A. Berntsen; Lisa A. Jones-Jordan; Jeffrey J. Walline; Bifocal Lenses In Nearsighted Kids (BLINK) Study Group
COMET STUDY

- Multicenter, randomized, controlled clinical trial

- Difference in the progression of myopia between children wearing progressive addition lenses (PALs) versus conventional single vision lenses (SVLs)

COMET STUDY

- Small, statistically significant amount - during the first year.
- The size of the treatment effect remained similar for the next 2 years.

*The small magnitude of the effect does not warrant a change in clinical practice.*

Children with larger accommodative lags (>0.43 D for a 33 cm target) wearing SVLs had the most progression at 3 years.

**PALs were effective in slowing progression in these children, with statistically significant 3-year treatment effects** (mean +/- SE) for those with larger lags in combination with near esophoria (PAL - SVL progression = -1.08 D - [-1.72 D] = 0.64 +/- 0.21 D), shorter reading distances (0.44 +/- 0.20 D), or lower baseline myopia (0.48 +/- 0.15 D).


US Trial
Hongkong Trial
Japenese Trial

So collectively, these three clinical trials show that PALs are a largely ineffectual modality for myopia progression.

Leung JT & Brown B. Progression of myopia in Hong Kong Chinese schoolchildren is slowed by wearing progressive lenses. Optom Vis Sci 1999; 76: 346

Greater success has been reported recently for executive bifocals.

Orthokeratology

- In the first trial, the Retardation of Myopia in Orthokeratology (ROMIO) study, axial elongation - slowed by an average of 43%, with treatment effects being proportionately larger in younger, more rapidly progressing myopic children.

- The Longitudinal Orthokeratology Research in Children (LORIC) study

- The High Myopia–Partial Reduction Orthokeratology (HM-PRO) study

- Toric Orthokeratology Slowing Eye Elongation (TO-SEE) study

Contact lenses

- Soft multifocal contact lenses and orthokeratology slowed myopia progression by 46% and 43%, respectively.

- Soft Contact lenses
- Rigid gas permeable contact lenses (RGPCCLs)
- Multifocal contact lenses

PHARMACOLOGICAL

- **Atropine** - broad-band muscarinic acetylcholine (mAChR) receptor antagonist.
- **Atropine prevents myopia via a non-accommodative mechanism.**

A neurochemical signalling cascade causing myopia begins at the retina level.
Landmark Study

- In the Atropine for Treatment of Childhood Myopia (ATOM1) study, eyes treated with atropine 1% experienced reductions in refractive error change (-0.28 ±0.92 D) and axial length.

The follow-up ATOM2 study - similarly effective dose-dependent results with lower concentrations of atropine (0.5%, 0.1%, and 0.01%) and reductions in the side effects of glare and discomfort.

- Phase 2 of ATOM2 - rapid rebound increase when atropine was stopped for 12 months after the 24 months of study treatment; the group receiving the lowest concentration of atropine, 0.01%, had the least rebound effect. (-0.02 ±0.35 mm) over a 2-year period.
In phase 3 of ATOM2, children who experienced a rebound effect and whose myopia continued to progress were restarted on atropine 0.01%.
Even lower

Low-Concentration Atropine for Myopia Progression (LAMP) Study, however, suggest that 0.05% atropine may be the most effective concentration for myopia control.

Guidelines – Atropine drops

Table 3. Clinical guidelines for children aged 6–10 years with myopia > 1.0 D and documented myopia progression > 0.5 D per year

<table>
<thead>
<tr>
<th>Good response: almost no myopic progression (&lt;0.5 D over second year)</th>
<th>Moderate response: myopic progression of 0.5 D to 1.0 D over second year</th>
<th>Poor response: myopic progression &gt;1.0 D over second year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treat children with Atropine 0.01% for 2 years</td>
<td>Continue Atropine 0.01% for a further 1–2 years, then taper and stop Atropine</td>
<td>May be a non-responder. Consider taper and stop Atropine</td>
</tr>
<tr>
<td>Taper and stop Atropine</td>
<td>Follow subject for a year post stopping Atropine</td>
<td>Recommence Atropine if significant rebound and continue review</td>
</tr>
</tbody>
</table>

Source: modified from the ATOM2 study (85).

1. Changes in Spherical Equivalent Refractive Error as an Outcome Measure
2. Changes in AL as an Outcome Measure

pre-myopic patient - ATOM3
Non Asian Perspective

Western Australia Atropine for the Treatment of Myopia (WA-ATOM) study: Rationale, methodology and participant baseline characteristics
February 2020 Clinical and Experimental Ophthalmology


There are number of ongoing placebo controlled trial of 0.01% atropine currently undergoing
Cochrane corner: Atropine: an ancient remedy for a twenty-first century problem?

John G. Lawrenson¹ · Rohit Dhakal¹,²

Received: 8 April 2020 / Revised: 27 April 2020 / Accepted: 28 April 2020
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A later meta-analysis in 2016 showed atropine was most effective at slowing myopia progression compared to all other interventions including refractive methods, however, a dose response effect was not shown.
When should myopia control be implemented and on which children?

- The average growth of the eye in childhood - 0.2 mm per year.

- ATOM studies recommended initiating treatment with atropine 0.01% if myopia progression exceeded 0.5D the preceding year, which corresponds to elongation greater than 0.2mm.

- Progression is faster in younger children, and possibly those of East Asian descent or geographic location and those with a parental history of myopia.
When should myopia control be discontinued? When to stop

- Assuming the myopia control is effective, it should be continued as long as the benefits outweigh potential risks or additional costs associated with treatment.
A recent survey reports that 345 out of 493 paediatric ophthalmologists managing myopia use pharmacological therapy with 277 prescribing 0.01% atropine (80%).

The next most frequently - 1% atropine, but only 44 do so (13%).

For optical therapies, 92 of 393 respondents prescribe PALs (23%) and 83 fit orthokeratology (21%).

Among those prescribing pharmacological treatments, European physicians offered the lowest rate of effective treatment (85% vs mean 97%).

Behavioural modifications (92%), between 87% (North America) and 100% (Central Asia).

Combinations of treatment modalities (95%).
Figure 1  Summary of some of the key studies that report the efficacy of various strategies for myopia control discussed at the 2018 WHO Western Pacific Region Meeting on Myopia.
THE FUTURE OF TREATMENT


Behavioral Treatment

- Decrease Screen time
- Increase outdoor time
- School efforts – Classes, recess outside

Not any light

- Children spending greater time exposed to bright outdoor light conditions (>1000 lux) each day at school, as measured by wearable sensors, also exhibited significantly slower myopia progression (0.14 D, \( P = 0.02 \)).
- Seasonal Fluctuations
- Light quality
Behavioral interventions

- Avoiding side effects - as atropine and orthokeratology.

Guideline

- Children should engage in outdoor activities for at least 2 to 3 hours per day and at least 14 to 21 hours per week.
- Less than 40 minutes per day of bright light exposure may predispose children to faster axial eye growth.

The Effects of Different Outdoor Environments, Sunglasses and Hats on Light Levels: Implications for Myopia Prevention
POLL QUESTION 4

- What myopia treatment do you prefer for your patients?

1. Single vision lens /spectacle
2. PAL
3. Atropine .01%
4. Orthokeratology
5. Combination therapy of pharmacological drops and behavioural treatment
6. Multifocal CL
7. Others
Initial consultation

• **History** (including family history, nearwork, outdoor time)
• **Age of onset, progression** (if myopic)
• **Visual acuity** (uncorrected, best corrected)
• **Binocular vision**
• **Corneal topography***
• **Anterior eye examination***
• **Intraocular pressure***
• **Objective/subjective cycloplegic refraction**
• **Fundus examination***

* Rule out secondary myopias – e.g. keratoconus, syndromic associations

Guidelines for Myopia Management

Assessment of risk

**Increased risk of onset**

- Parental myopia
  - One or both parents myopic

- Refractive error
  - More myopic than age normal or progression worse than 0.75D/yr

**Increased risk of progression**

- Age
  - 9 yrs or less

- Parental myopia
  - One or both parents myopic

- Ethnicity
  - East Asian

- Near work
  - Excessive

- Refractive error
  - More myopic than age normal or progression worse than 0.75D/yr

- Outdoor time
  - Limited

To estimate risk of progression in myopic eye, see [Myopia Calculator link below.](#)

Guidelines for Myopia Management

**Notes:**

Sankaridurg P¹, Tilia D¹, Morton M¹, Weng R¹, Jong M¹, Zhu F².
1 Brien Holden Vision Institute; 2 Shanghai Eye Disease Prevention and Treatment Center
Management

**No myopia**

- Reduce risk
  - Increase time outdoors
  - Frequent breaks from near work

**Myopia**

Choosing a myopia control strategy: consider

- Patient suitability
- Risk of progression *
- Patient/carer preference
- Effectiveness of strategy
- Access to strategy

**No control**

- Single vision spectacles
- Single vision contact lenses

**Myopia control**

- Contact lenses
  - Multifocal-like
  - Extended depth of focus
- Orthokeratology
- Progressive addition spectacles
- Executive bifocals
- Peripheral defocus spectacles
- Atropine (low-dose)
- Combination (e.g., low dose atropine with multifocal-like contact lenses)

*Fully correct based on cycloplegic refraction; myopia control should be a priority. Use Myopia Calculator link below to determine benefit with myopia control.*

Follow-up*

- 1 WEEK
- 1 MONTH
- 3 MONTHS
- 6 MONTHS
- 9 MONTHS
- 12 MONTHS

- Atropine (low-dose)
- Single vision contact lenses
- Contact lenses:
  - Multifocal-like
  - Extended depth of focus
  - Orthokeratology
- Single vision spectacles
- Executive bifocals
- Peripheral defocus spectacles
- Progressive addition spectacles

**Procedures**

- Updated history
- Best-corrected visual acuity
- Over-refraction
- Anterior eye examination (with lid eversion)
- Corneal topography (as needed for Ortho K)
- Pupil size/response to light (as needed for atropine)
- Intraocular pressure (as needed for atropine)
- Objective/subjective cycloplegic refraction (6 monthly)
- Fundus examination (annually)

1. If progression not slowed → check lens prescription/fit → Check compliance → Consider changing treatment power/design or treatment mode.
2. If myopia is stable for at least two years and if the individual is at age when risk for progression is minimal, can consider ceasing myopia control.

* For the first year especially for children and progressing myopes. Further follow up schedule may be modified based on patient progress, treatment modality and performance.
Biometry in Myopic eyes

BIOMETRY

Conventional Ultrasound biometry (AScan)
- Applanation A Scan
- Immersion A Scan

Optical biometry
- (PARTIAL COHERENCE INFEROMETRY)-IOL MASTER 500 (CarlZeiss Meditec AG)
- LENSTAR (Haag-Streit)
- SWEPT SOURCE IOL MASTER 700 (CarlZeiss Meditec AG)
POLL QUESTION 5

- Do you perform biometry, pupil size measurement & accommodation amplitudes in all pediatric patients who are taking myopia control treatment?

1. Yes most of the time
2. Not at all
Criteria

- Age 6-13 years
- SE -0.50 (-0.50 to -6.00D)
- Progression – 0.5D/year
- No history of atropine allergy

- Pathological myopia, Syndromic myopia, Pseudophakic myopia, Myopia in lasered ROP
**Baseline**

- NPC, NPA
- NRA, PRA (Relative Accomodation)
- Pupil size
- Axial length
- Keratometry, Orbscan
- Cycloplegic refraction

**Follow up**

- Check for side effects
- Need of PALS
  - pupillary response to light, ask about glare, and check near vision.
  - Regular education on how to instil drops,
  - lifestyle information regarding sunlight exposure and reduction of recreational near work.
Example - Rebound effect .01% Atropine
Myopia calculator

Myopia ‘calculators’ - useful to visualise the average potential outcome based on research.

Normal progression (the red line) is based on data on progression.

The data includes a cohort out of Singapore that includes some Indian children.

References Low dose atropine (0.01 - 0.05%)

CHIA, A., CHUA, W. H., CHEUNG, Y. B., WONG, W. L., LINGHAM, A., FONG, A. & TAN, D. 2012; Atropine for the treatment of childhood myopia: safety and efficacy of 0.05%, 0.1%, and 0.01% doses (Atropine for the Treatment of Myopia 2). Ophthalmology, 119, 347-54.
Low dose atropine (0.01 - 0.05%)

Percentage reduction in progression of myopia compared to standard correction e.g. single vision spectacles.

59%

If treated with Low dose (0.01 - 0.05%) atropine that provides 59% control, then the level of myopia at 17 may be:

-3.62D

If myopia control treatment is not commenced immediately, the final level of your child's myopia at 17 may be:

-6.68D
WSPOS Myopia Consensus Statement

**DOES NOT WORK**
- Undercorrection
- What Probably Does Not Work:
  - Bifocals
  - Contact Lenses

**DOES NOT WORK**

**THIS MIGHT WORK**
- What Might Work:
  - Orthokeratology
  - Peripheral retinal defocus

**THIS MIGHT WORK**
- What Does Work:
  - Atropine
  - Eye drops
Myopia Control 2020: where are we heading?
2020 – Researches Evidence

- Relationship between peripapillary atrophy and myopia progression in the eyes of young school children
  - Yoji Moon1, - Hyun Taek Lim2
  - Received: 11 July 2019 / Revised: 24 April 2020 / Accepted: 29 April 2020
  - © The Author(s), under exclusive licence to The Royal College of Ophthalmologists 2020

- Review: Myopia control strategies recommendations from the 2018 WHO/APB/BHVI Meeting on Myopia
  - Marcus Ang1,2,3, Judith L Flanagan4,5, Chee Wei Wong4,5, Andreas Müller1,4,6, Andreas Müller1,4,6, Andreas Müller1,4,6, Andreas Müller1,4,6
  - Amanda Davis1, Drew Keys1,2, Serge Resnikoff1,2, Monica Jong1,2,6,9, Tien Yin Wong1,2,3, Padmaja Sankaridurg1,2,3

- Editor's Spotlight | Jan 2020
  - What's Driving the Myopia Epidemic?
Macroscopic Thinking –
National Myopia Programme
Myopia Awareness week

School administrators
Ophthalmologist
Schools
Optometrist
Government and Non Governmental organization
Future lies in yours hand

Choose best myopic treatment for your pediatric patients

Future of your country.
A pandemic has taught us a lot.
Epidemic can be dealt
Simple but needs serious approach
Thank you
Minutes before leaving.........

• WELCOME TO QUESTIONS ????????