Myopia Control

What can be done?

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What is Myopia?

- aka: short sighted
  near sighted

- Inability to see clearly in the distance
  - Light focuses in front of the retina
    - Eyeball “too long”
Prevalence of Myopia

2010
Nearly 28% affected by Myopia

2050
Nearly 50% affected by Myopia

Estimated 4.7 billion myopes

Source: Ian Morgan, Australian Natl Univ.
Change Over Time

- The onset of myopia is shifting to a younger age in Taiwanese school children\(^1\)

  \[ \text{n} \sim 10,000 \text{ each year} \]

  - 11 year-olds in 1983
  - 10 year-olds in 1986
  - 9 year-olds in 1990
  - 8 year-olds in 2000

18% of Singaporean children at the age of 7 are at least -6.00D myopic\(^2\)

Risk Factors

- Genetic
- Parental myopia
- Near work
  - More near work = higher risk
- Time outdoors
  - Less time = higher risk
- Ethnicity
What about Canada?
Myopia prevalence in Canada

- CCLR Study in 2014 completed in Waterloo
  - CNIB
  - Essilor funding
- First Canadian study looking at general population
## Results

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Incidence of Myopia</th>
<th>Mean Refractive error</th>
</tr>
</thead>
<tbody>
<tr>
<td>6-8</td>
<td>6.0%</td>
<td>-1.10D</td>
</tr>
<tr>
<td>11-13</td>
<td>28.9%</td>
<td>-2.44D</td>
</tr>
<tr>
<td>Overall</td>
<td>17.5%</td>
<td></td>
</tr>
</tbody>
</table>

NOTE: Out of the 29 children who were myopic, **34.5%** (10 children) were uncorrected
What’s changed?
- Time spent on homework per week (15 year old)
  - Shanghai 14 hours
  - UK 5 hours
  - US 6 hours

So What?
<table>
<thead>
<tr>
<th>Emmetropia = 1x</th>
<th>Cataract (PSCC)</th>
<th>Retinal Detachment</th>
<th>Myopic Maculopathy</th>
</tr>
</thead>
<tbody>
<tr>
<td>-1.00 to -3.00</td>
<td>2.1</td>
<td>3.1</td>
<td>2.2</td>
</tr>
<tr>
<td>-3.00 to -6.00</td>
<td>3.1</td>
<td>9.0</td>
<td>9.7</td>
</tr>
<tr>
<td>-6.00 or greater</td>
<td>5.5</td>
<td>21.5</td>
<td>40.6</td>
</tr>
</tbody>
</table>
Myopic retinopathy
## Visual Impairment - myopic macular degeneration

<table>
<thead>
<tr>
<th></th>
<th>Visual Impairment</th>
<th>Blindness</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>10.0 million</td>
<td>3.3 million</td>
</tr>
<tr>
<td>2015</td>
<td>55.7 million</td>
<td>18.5 million</td>
</tr>
</tbody>
</table>

Prevention of Myopia?

Myopia prevention/Myopia control - fact or fiction?

Can we do anything?
Unusual Attempts...
What does myopia control mean?

- Assume -0.50 progression per year, aged 8-16
- Begins at -1.00D ends at -5.00D

<table>
<thead>
<tr>
<th>% reduction</th>
<th>Final refractive error</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>-4.00</td>
</tr>
<tr>
<td>50</td>
<td>-3.00</td>
</tr>
<tr>
<td>75</td>
<td>-2.00</td>
</tr>
<tr>
<td>100</td>
<td>-1.00</td>
</tr>
</tbody>
</table>
OPTIONS

- Spectacles
- Drops
- Contact Lenses
Myopia progression - prevention

- Outside time (increased light exposure) can help prevent onset
- 90 minutes per day
  - Hat and shades is fine
  - Sitting by the window isn’t!
Myopia progression - prevention

- Dopamine theory - light stimulates release of dopamine which blocks axial elongation

- FALCON study (CORE)
  - 1 extra hour per week lowered odds by 14.3%
Options for Myopia Control

- **Pharmaceuticals**
  - Atropine

- **Spectacles**
  - Single vision correction (*Under-correction*)
  - Bifocals
  - Progressive addition lenses (PALs)
  - Myopia control spectacles

- **Contact lenses**
  - OrthoKeratology
  - Correction of peripheral defocus
    - *Multifocals*
    - *Dual focus myopia control lenses*
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Figure 2. Mean change in spherical equivalent for groups from baseline, 2 weeks, and 4 to 24 months with atropine 0.01%, 0.1%, and 0.5% from the ATOM2 study, and placebo and atropine 1.0% from the ATOM1 study. A = atropine; ATOM = Atropine for the Treatment of Myopia; D = diopter; m = month; w = week.
Is 0.01% Atropine All Its Made Out to Be?

- Mismatch between refractive error and axial length
- 0.05% much better than 0.01%

<table>
<thead>
<tr>
<th>Atropine dosage:</th>
<th>0.5%</th>
<th>0.1%</th>
<th>0.01%</th>
<th>0.01%</th>
<th>0.025%</th>
<th>0.05%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mydriasis (mm)</td>
<td>+3</td>
<td>+3</td>
<td>+1</td>
<td>+0.5</td>
<td>+0.8</td>
<td>+1</td>
</tr>
<tr>
<td>Amps baseline (D)</td>
<td>15.8</td>
<td>16.7</td>
<td>16.2</td>
<td>-0.3D</td>
<td>-2D</td>
<td>-1.6D</td>
</tr>
<tr>
<td>Amps 2 weeks</td>
<td>2.2</td>
<td>3.8</td>
<td>11.3</td>
<td>11.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amps 2 years</td>
<td>4.0</td>
<td>6.8</td>
<td>11.8</td>
<td></td>
<td>-2D</td>
<td>-1.6D</td>
</tr>
<tr>
<td>Refractive efficacy (%)</td>
<td>75</td>
<td>68</td>
<td>59</td>
<td>27</td>
<td>43</td>
<td>66</td>
</tr>
<tr>
<td>Axial efficacy (%)</td>
<td>29</td>
<td>25</td>
<td>-8</td>
<td>12</td>
<td>29</td>
<td>51</td>
</tr>
</tbody>
</table>

1. Chia et al.: Atropine for the treatment of childhood myopia: safety and efficacy of 0.5%, 0.1%, and 0.01% doses (Atropine for the Treatment of Myopia 2). Ophthalmology 2012; 119;2: 347-54.
2. Yam et al.: Low-Concentration Atropine for Myopia Progression (LAMP) Study: A Randomized, Double-Blinded, Placebo-Controlled Trial of 0.03%, 0.025%, and 0.01% Atropine Eye Drops in Myopia Control. Ophthalmology 2019; 126;1: 113-124.
LAMP study
Options for Myopia Control

• **Pharmaceuticals**
  – Atropine

• **Spectacles**
  – Bifocals
  – Progressive addition lenses (PALs)
  – Myopia control spectacles

• **Contact lenses**
  – OrthoKeratology
  – Correction of peripheral defocus
  – Myopia control lenses
Spectacles: Novel designs

- Zeiss Myovision Pro
  - Central clear zone
  - Peripheral defocus
  - Zeiss data – 30% treatment effect
    - More effective on young patients
    - More effective if parental history of myopia
    - Further validation required
      » Long term study data
Spectacles: Novel designs

- Essilor Myopilux
  - Short corridor PAL
  - Essilor data – 62% treatment effect
Spectacles: Novel designs

- **Essilor Myopilux Plus and Myopilux Max**
  - **Plus** – progressive lens
  - **Max** – Bifocal lens with 3 base-in each eye
    - Specifically for children with eso/low lag of accommodation
    - CYL to -4.00D
  - Limited data available – promising results 60% myopia control

Spectacles: Novel designs

- HOYA MyoSmart
  - DIMS technology HK PolyU

- Slows progression by 60%
- Halts progression in 21.5%

- Not available in Canada
Options for Myopia Control

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Peripheral Defocus

Eye stretches to match peripheral retina to image shell

Figure modified from Smith, E.: Visual Experience & Myopia (ppt available at: http://www.icee.org/events/congress_video/day3/Session%209%20-%20Research%20and%20Collaborations/Earl%20Smith%20-%20Myopia%20Research.ppt)
Peripheral Defocus

New strategies

- Development of new spectacle and contact lens designs that correct ametropia at BOTH fovea and periphery

Image shell and ocular shape closely match
Myopia progression with Orthokeratology

Current theory:

Ortho-K Lenses?

- Orthokeratology CL slow the growth of the eye by about 50%

The Longitudinal Orthokeratology Research in Children (LORIC) in Hong Kong: A Pilot Study on Refractive Changes and Myopic Control

**Soft lens options**

- Distance Centre Multifocals
  - Biofinity D multifocal*
  - Proclear D multifocal*
  - Acuvue Oasys for presbyopia*
  - NaturalVue Multifocal* (VTI) – 1-day lens

- Dual Focus
  - MiSight
    - Health Canada authorized as a myopia control product

* Off label use
MiSight 3 year data - Change in SERE (Diopters)

Δ = 0.40D
69%

Δ = 0.54D
59%

Δ = 0.73D
59%
MiSight 4 year data - Change in SERE (Diopters)

![Graph showing change in cycloplegic SE over time for MiSight and Proclear 1-Day lenses. The graph displays the change in diopters over study time in months. The number of participants (n) for each data point is indicated.]

- Change in Cycloplegic SE (D)
- Study Time (Months)

Key:
- MiSight
- Proclear 1-Day

Data points include:
- n=96 at 0 months
- n=100 at 6 months
- n=98 at 12 months
- n=98 at 18 months
- n=102 at 24 months
- n=102 at 30 months
- n=102 at 36 months
- n=102 at 42 months
- n=102 at 48 months
When to intervene?

• Biggest impact on younger myopes
  ▪ In particular fast progressors – greater than 0.50D per year

• Consider options/compliance
  ▪ Contact lenses
  ▪ Spectacles
  ▪ Pharmaceuticals

• Manage expectations
Managing expectations

<table>
<thead>
<tr>
<th>Age</th>
<th>Progression</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No treatment</td>
</tr>
<tr>
<td>≤7</td>
<td>-1.00</td>
</tr>
<tr>
<td>8</td>
<td>-1.00</td>
</tr>
<tr>
<td>9</td>
<td>-0.75</td>
</tr>
<tr>
<td>10</td>
<td>-0.50</td>
</tr>
<tr>
<td>≥11</td>
<td>-0.50</td>
</tr>
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</table>
The Future

- Prevalence of myopia increasing
- Options to manage myopia
  - Readily available
  - Successful
- Resources available
  - Parents
  - Clinicians
- Parents will/are asking for myopia control
Information readily available regarding myopia

www.allaboutvision.com
www.mykidsvision.org
www.myopiaprofile.com
www.myopiaprevention.org
www.myopiainstitute.org
THANK YOU

QUESTIONS?