Myopia Control

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Disclosures
- Bausch + Lomb: research materials

Myopia Control

Prevalence

Cost

$8,200,000,000

More Myopia = More Vision Loss

End of Lecture, You Will Be Able To...
- Talk to parents about myopia control options
- Understand how myopia progression slowed
- Understand how to maximize myopia control

What is Clinically Meaningful?
- Assume
  - -0.50 D per year progression
  - From 8 to 16 years
- Begin as -1.00 D, end as -5.00 D

<table>
<thead>
<tr>
<th>% Reduction</th>
<th>Final Refractive Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>-1.00</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>
Myopia Control Summary

Undercorrection

Gas Permeable CL

Bifocal/Multifocal Spectacles

Special Spectacles

Is It Commercially Available?

Myopia Control-Pirenzepine

Myopia Control Summary
Soft Bifocal Myopia Control


Sankardurg P, et al. IOVS 2011;52:9362-7

Walline JJ, et al. OVS 2013;90:1207-14

Orthokeratology Myopia Control


Charm J and Chu P. OVS 2013;80:539-9

Orthokeratology Myopia Control

Chen C, et al. IOVS 2013;54:6510-7

The Periphery Matters


How Do OK and SBCL Slow Myopia?
Eye Growth. Animal Models


Eye Growth. Humans

- Queiroz A, et al. IOVS 2020;87:323-9

Peripheral Optical Profile

Myopia corrected with specs, CL

Myopia corrected with corneal reshaping or soft bifocal

Eye Growth. Humans

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>SE</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average RBF</td>
<td>0.012</td>
<td>0.002</td>
<td>0.015</td>
</tr>
<tr>
<td>Average LBF</td>
<td>0.012</td>
<td>0.002</td>
<td>0.015</td>
</tr>
<tr>
<td>Average AML</td>
<td>0.012</td>
<td>0.002</td>
<td>0.015</td>
</tr>
<tr>
<td>Average YLML</td>
<td>0.012</td>
<td>0.002</td>
<td>0.015</td>
</tr>
</tbody>
</table>

Myopia Control-Soft Bifocal

Table 1. Moderate versus Lower Perimeter Optical Profile of Myopic Children Corrected with Soft Bifocal Spectacles, and Change in Myopia at 12 Months

<table>
<thead>
<tr>
<th>Perimeter Field Position</th>
<th>Change in Perimeter Optical Profile</th>
</tr>
</thead>
<tbody>
<tr>
<td>20°</td>
<td>0.01 (p = 0.02)</td>
</tr>
<tr>
<td>30°</td>
<td>0.01 (p = 0.02)</td>
</tr>
<tr>
<td>40°</td>
<td>0.01 (p = 0.02)</td>
</tr>
</tbody>
</table>

1% Atropine Myopia Control

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Duration (Years)</th>
<th>Subjects</th>
<th>Completion (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1% atropine</td>
<td>2</td>
<td>87</td>
<td>87</td>
</tr>
<tr>
<td>0.1% atropine</td>
<td>2</td>
<td>93</td>
<td>93</td>
</tr>
<tr>
<td>0.5% atropine</td>
<td>18 months</td>
<td>87</td>
<td>87</td>
</tr>
<tr>
<td>0.01% atropine</td>
<td>2</td>
<td>56</td>
<td>56</td>
</tr>
<tr>
<td>0.01% atropine</td>
<td>2</td>
<td>70</td>
<td>70</td>
</tr>
</tbody>
</table>

0.01% Atropine Myopia Control

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Duration (Years)</th>
<th>Subjects</th>
<th>Completion (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.01% atropine</td>
<td>2</td>
<td>70</td>
<td>70</td>
</tr>
</tbody>
</table>

What does this mean?
• Outdoor time prevents myopia, but does not slow progression.
Accrual of Treatment Effect

- What does this mean?
- Likely to be more effective because myopia control lasts for longer period of time

Soft Bifocal and Orthokeratology

Pupil Size

- What does this mean?
- More retina with myopic blur = stronger myopia control

Peripheral Myopic Blur

- Interaction, p < 0.001

- all p < 0.001
Peripheral Myopic Blur

- What does this mean?
- Greater myopic blur = greater myopia control
- Stronger add = better myopia control?

Bifocal Lenses in Nearsighted Kids (BLINK)

- Purpose: to determine the strongest add power that could be tolerated by kids

Eligibility

- 8-11 years old
- Spherical equivalent, non-cycloplegic subjective refraction
  - -1.00 D to -5.00 D
  - ≤ 1.00 DC
- 20/25 or better BCVA OD, OS
- No gas permeable contact lenses
- Condition affects vision, CL wear
  - Diabetes, Sjogren's, etc.

Randomization

- Proclear or Proclear Multifocal D OU
- Sphere
  - +2.00 D add
  - +3.00 D add
  - +4.00 D add
  - Random order

Protocol

- BLINK questionnaire
- Habitual visual acuity
  - High contrast at distance OU
  - Low contrast at distance OU
  - High contrast at near OU

BLINK Questionnaire

1. How clear was your vision when looking far away during the past week?

<table>
<thead>
<tr>
<th>Scale</th>
<th>Range</th>
<th>Frequency (% of Total)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good</td>
<td>1-2</td>
<td>10</td>
</tr>
<tr>
<td>Fair</td>
<td>3-4</td>
<td>20</td>
</tr>
<tr>
<td>Poor</td>
<td>5-6</td>
<td>30</td>
</tr>
<tr>
<td>Perfect</td>
<td>7-8</td>
<td>40</td>
</tr>
</tbody>
</table>

Subjects

- Age (years) | Gender (%) | J0 (D) | J45 (D) | Eye (OU) | Distance (logMAR) | Near (logMAR) | Add Power (D) | CL Wear Type |
<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>7-12</td>
<td>33.3</td>
<td>0.00</td>
<td>0.00</td>
<td>OD/OS</td>
<td>+0.00 ± 0.00</td>
<td>+0.10 ± 0.05</td>
<td>+0.00 ± 0.05</td>
<td>None</td>
</tr>
<tr>
<td>13-18</td>
<td>66.7</td>
<td>0.04</td>
<td>0.06</td>
<td>OD/OS</td>
<td>+0.00 ± 0.00</td>
<td>+0.10 ± 0.05</td>
<td>+0.00 ± 0.05</td>
<td>Ortho CLs</td>
</tr>
<tr>
<td>19-25</td>
<td>100</td>
<td>0.00</td>
<td>0.00</td>
<td>OD/OS</td>
<td>+0.00 ± 0.00</td>
<td>+0.10 ± 0.05</td>
<td>+0.00 ± 0.05</td>
<td>Silicone CLs</td>
</tr>
</tbody>
</table>

High Contrast Distance OU

- p = 0.32
BLINK Questionnaire

- No differences
- Distance vision
- Near vision
- Ghost images
- Computer
- Strain or tiredness
- Contact lens comfort
- Sporting activities

Blind Study Summary

- Objective vision
  - +3.00 and +4.00 worse low contrast
- Subjective vision
  - +3.00 and +4.00 worse
  - Glare and starbursts (+4.00)
  - Change fixation distance (+3.00 and +4.00)
  - Overall (+3.00)
- Primarily due to add power

Can We Combine Treatments?

- Contact lens myopia control
- Optical effect
- Atropine
- Receptors at the retinal or scleral level

Myopia Control Experience

- KIDS CONTACT LENS CLINIC
### Treatment

<table>
<thead>
<tr>
<th></th>
<th>Patients</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRT</td>
<td>14</td>
<td>44</td>
</tr>
<tr>
<td>Daily disposable</td>
<td>8</td>
<td>25</td>
</tr>
<tr>
<td>Soft bifocal</td>
<td>7</td>
<td>22</td>
</tr>
<tr>
<td>Toric</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Atropine</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>

% = myopia control

### Race

<table>
<thead>
<tr>
<th></th>
<th>Asian (n = 14)</th>
<th>White (n = 18)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRT</td>
<td>64</td>
<td>28</td>
</tr>
<tr>
<td>Soft bifocal</td>
<td>14</td>
<td>28</td>
</tr>
<tr>
<td>Daily disposable</td>
<td>7</td>
<td>10</td>
</tr>
<tr>
<td>Toric</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>GP</td>
<td>0</td>
<td>6</td>
</tr>
</tbody>
</table>

### No FDA Approved Myopia Control

- Consent

### Summary

- Bifocal specs, GP CLs, undercorrection, special spectacles don't work well enough
- Pirenzepine not available
- CLs provide best myopia control w/o side effects
  - Low concentration atropine needs more evidence
  - Don't know if we can combine to get stronger effect
- Use strongest tolerable add for soft bifocal
- Outdoor prevents myopia, not slow progression