Evaluation and Treatment of Myopia in Childhood

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Myopia
• Prevalence 3-84% in children 5-15 years old (defined as spherical equivalent of -0.5D or more)
• Important systemic associations
• Significant ocular complications
• Direct economic and social burden
• Wide interest in understanding the pathophysiology, prevention and treatment

Talk objectives:
• To provide a systematic approach for the evaluation of myopia in children
• To provide guidelines for the management of myopia in children
• To discuss potential therapeutic approaches for progressive myopia in children

Prevalence Rates of Myopia
Guidelines for prescribing glasses

Case 1

- 5 yo Egyptian obese boy with autism
- “squints left eye in bright light”

- VA OD 20/60 +1.00+1.50x90
  OS 20/400 - 6.50+1.50x90

- XT 45°

Unilateral myopia

Unusual → Always look for underlying cause!

<table>
<thead>
<tr>
<th>Condition</th>
<th>Diopters</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Age 0-1 year</td>
</tr>
<tr>
<td>Isometropia (similar refractive error in both eyes)</td>
<td></td>
</tr>
<tr>
<td>Myopia</td>
<td>≥ -5.00</td>
</tr>
<tr>
<td>Hyperopia (no manifest deviation)*</td>
<td>≥ +5.00</td>
</tr>
<tr>
<td>Hyperopia with esotropia</td>
<td>≥ +3.00</td>
</tr>
<tr>
<td>Astigmatism</td>
<td>≥ 3.00</td>
</tr>
<tr>
<td>Anisometropia</td>
<td></td>
</tr>
<tr>
<td>Myopia</td>
<td>≥ -2.50</td>
</tr>
<tr>
<td>Hyperopia</td>
<td>≥ +2.50</td>
</tr>
<tr>
<td>Astigmatism</td>
<td>≥ 2.50</td>
</tr>
</tbody>
</table>

Preferred Practice Patterns AAO- September 2007

Weiss AH. Br J Ophthalmol 2003;87:1025-1031

Table 1 Factors associated with development of unilateral high myopia

<table>
<thead>
<tr>
<th>Associated factor</th>
<th>Number of patients (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optic nerve disorder</td>
<td>15 (31.3)</td>
</tr>
<tr>
<td>Lens abnormality</td>
<td>10 (20.8)</td>
</tr>
<tr>
<td>Retinopathy of prematurity</td>
<td>5 (10.4)</td>
</tr>
<tr>
<td>Family history of high myopia</td>
<td>3 (6.3)</td>
</tr>
<tr>
<td>Bilharziasis</td>
<td>3 (6.3)</td>
</tr>
<tr>
<td>Macular scar/chorioretinal coloboma</td>
<td>2 (4.1)</td>
</tr>
<tr>
<td>Congenital ptosis</td>
<td>1 (2.0)</td>
</tr>
<tr>
<td>N=48</td>
<td></td>
</tr>
</tbody>
</table>

Optic nerve hypoplasia
Case 1: unilateral high myopia

- PERRL, no APD
- IOP 15 OD, 12 OS (iCare)
- c/d 0.3 OD
  0.5 OS, tilted
- Failed patching
- Atropine

Follow-up

- “since we started using atropine, he can’t see at night; he has trouble finding his shoes”
- VA OD 20/60
  OS 20/80 (improved from 20/400)
- XT 18°

Questions

- 1) Amblyopia?
  Unusual for level of myopia
  Strabismic
- 2) Unilateral high myopia
  Normal IOP, no APD, normal fundus
- 3) Nyctalopia
  Atropine?
Case 2

- 4 ½ year old girl with poor vision in the left eye
- VA
  - OD 20/25  +1.25 +0.25 x 88
  - OS 20/600 -7.25 +2.25 x 90
- PERRL, no APD

Diseases associated with myopia

<table>
<thead>
<tr>
<th>Ocular</th>
<th>Systemic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Congenital Stationary Night Blindness (CSNB)</td>
<td>Stickler syndrome*</td>
</tr>
<tr>
<td>Marshall syndrome</td>
<td></td>
</tr>
<tr>
<td>congenital/non-progressive</td>
<td></td>
</tr>
<tr>
<td>Gyrate atrophy</td>
<td>Weill-Marchesani syndrome</td>
</tr>
<tr>
<td>Prematurity</td>
<td>Cornelia de Lange</td>
</tr>
<tr>
<td>Glaucoma</td>
<td>Marfan syndrome</td>
</tr>
<tr>
<td></td>
<td>Homocystinuria</td>
</tr>
</tbody>
</table>


Anisometric myopia

<table>
<thead>
<tr>
<th>Ptosis</th>
<th>Cataract</th>
</tr>
</thead>
<tbody>
<tr>
<td>Congenital/infantile glaucoma</td>
<td>Vitreous hemorrhage</td>
</tr>
<tr>
<td>Myelinated nerve fiber layer</td>
<td>Optic nerve hypoplasia</td>
</tr>
</tbody>
</table>
Case 2

Exam

Case 3

- 7 month old premature girl s/p bilateral cataract extraction
- Ex- 26 weeks
- Family history of AD cataracts
- Aphakic CLs:
  
  OD +23.00
  OS +32.00

Partial opacification of entrance pupil by cortical material
Exam under anesthesia

- IOP 18.5 OD  14.5 OS
- CCT 495µ  480µ
- K Ø 10.5 mm  10.6 mm
- C/D 0.6 x 0.5  0.2 x 0.2
- Axial length

Axial elongation-myopia

- Stimulus deprivation
- Prematurity
- Aphakic glaucoma

- Large myopic shift in infant →
  Always rule out GLAUCOMA

Case 4

- 4 year old Hispanic girl with a right eye that is “intermittently crossed”
- Sister wears glasses since age 7

- VA
  OD  20/200  -9.50 + 2.00 x 90
  OS  20/80  -2.50 + 0.25 x 90

- IOP 14 OD, 13 OS
- RXT 14^Δ=RXT’ 8^Δ
Follow-up

- 3 months wearing Rx full time
- VA
  - OD 20/40
  - OS 20/30
- Orthotropic at distance- X 14° =X'8°

Anisometropic Amblyopia

TAKE HOME PEARL!

Spectacles ALONE improve best corrected amblyopic eye visual acuity by about 3 lines, so many patients do not need additional treatment with patching or penalization.

Amblyopia Treatment Study 5

Case 5

- Intelligent 6 year old Asian American boy
- Both parents wear glasses since elementary school
- VA
  - OD 20/20 -4.00 + 1.00 x 90
  - OS 20/20 -4.50 + 1.50 x 90

- Parents want to know what they can do to retard or stop the progression of nearsightedness in their child?
Myopia Risk factors

- Near work activity
- Outdoor activity
- Family history and genetics
- Other environmental factors

Interventions to retard myopic progression

- Atropine
- Pirenzepine
- Undercorrection
- Progressive addition lenses (PALs)
- Bifocals
- Orthokeratology

Glasses

- Undercorrection
  May increase myopia progression
  (Chung et al Vision Res 2002;42:2555-2559)

- COMET trial
  (Correction of Myopia Evaluation Trial)
  found that PALs do not stop progression of myopia at 3 years (≠0.20D)

Contact lenses

- CLAM study
  (Contact Lenses and Myopia Progression)
  small difference between RGPs and soft CLs (but no AL difference; all corneal)

- Orthokeratology (ortho-K) (CRT)
  “46% reduction in axial elongation”
  Mean difference in AL at 2 years: 0.25 D (p=0.012)
Atropine

- Night topical atropine
- Slows progression of low and moderate myopia and axial elongation
- Placebo eyes progressed -1.20 D (±0.69)
- Treated eyes progressed -0.28 D (±0.92)
- After treatment is stopped, treated eyes had a higher rate of myopic progression

Chua et al. Ophthalmology 2006;113:2285-2291

Atropine concerns

- Short-term effects: photophobia, glare, cycloplegia
- Long-term effects:
  - UV exposure (early cataracts, macular degeneration)
  - Loss of accommodation and premature presbyopia
  - Lack of long term follow-up

Pirenzepine

- 2% Pirenzepine ophthalmic gel BID
- Not available in the U.S.
- Effective in slowing myopia over 1-2 year period
- Treatment effect ~ 0.4 diopters (2 years)

Ophthalmol 2005:112:84-91

Outdoor activities

- Many cross-sectional studies
- Higher levels of total time spent outdoors associated with less myopia in:
  - 12 year-old Australian children, rural school children in Taiwan, Singapore teenagers...
  - But not in preschool children in Singapore, adolescents in rural China...
- How about 5 year old kids in San Francisco??
Go, play outside!

Thank you!

• One artist who was myopic and painted without glasses was Paul Cezanne (1839-1906). Myopic spectacles were readily available in his time, but he refused to wear the glasses, saying:

“Take those vulgar things away.”

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