Indicators for Prescribing Spectacles in Normal Preschool Children

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To treat or not to treat...  
That is the question  

How do we make treatment decisions?  

- Presence of symptoms or physical findings  
- Asymptomatic patient?  
- Preverbal patient who can't give symptoms?
Decision making in asymptomatic patients:

- How we were taught
- What makes physiologic sense
- What is normal vs. what is abnormal
- Published guidelines
- Evidence-based medicine

The Spectrum of Refractive Error

The numbers in the spectrum vary based upon age.

Indications for spectacle treatment:

The symptomatic patient
Myopia:
- Easy to comprehend
- Older individuals have higher demands and require treatment for lower myopia
- School work, driving regulations
- Young children have a myopic working distance
- A 4 month old – 2.00 myope is vastly different from a 14 year old – 2.00 myope

Hyperopia – reasons to treat
1. Accommodative Esotropia
   - Treat to allow development of binocular vision
   - Untreated accommodative strabismus > 6 mos duration increases risk of needing EMS (Dickey and Scott, Birch, others)
2. Atkinson prospective study
   - Treated vs. untreated hyperopes
   - If hyperopia > + 3.50
     - 13x risk of strabismus or amblyopia
     - Treatment decreases to 4 X

Spectacles in childhood esotropia
1. Infant if > + 2.50
2. Child with > + 2.00 modify depending upon Ac/A ratio
Bifocal prescribing in childhood esotropia

1. Accommodative Esotropia
   a. Distance ≤ 8 ET
   b. Near > 10 ET
   c. Prescribe +3.00
   d. Split pupil style
   e. Progressive add contraindicated

2. Consider Prescribing prophylactically
   a. Low hyperopia with large distance-near disparity

Reasons to treat asymptomatic hyperopia:

- Family History of Strabismus
- Infantile and accommodative esotropes more likely to have parents who are primary monofixators.

Questionable reasons to treat asymptomatic hyperopia:

- Poor accommodative effort
- Remember to use a strong near stimulus
- Miosis, convergence, accommodation linked
- Are they able to play video games without difficulty?
Hyperopia and academic performance:

- Helveston, E
- 1910 1st-3rd graders with formal exams
- Reading abilities, visual functions, refraction and academic performance.

Hyperopia and academic performance: (Helveston)

- No relationship between acuity, refraction, and academic performance.

Reasons not to treat hyperopia

1. Interfere with emmetropization
Reasons not to treat hyperopia

1. Interfere with emmetropization
2. Expense of spectacles
3. Inconvenience to parents – “my son won’t wear his glasses”
4. Lack of perceived benefit to child – “He can pick up a cheerio on the floor.”
Evidence-based medicine: helping us draw the line:

1. Normal accommodative abilities
   - Southall, 1937
   - 4000 children
   - Mean accommodative amplitude of 14 diopters for an 8 year old. (range 12-16 D)

Optics Questions:
1. How much accommodation is necessary for a +4.00 hyperope to read a near target at 1/3 m?
2. What is the maximum amount of uncorrected hyperopia that can be tolerated by a second grader, when reading, who has a working distance of 33 cm and needs to hold half his accommodation in reserve to remain comfortable?

Optics answers:
1. \( +3.00 \left( \frac{1}{3} \right) + 4.00 = +7.00 \)
2. \( 14/2 = 7 \text{ D (reserve)} - 3 \text{ D (near effort)} = +4.00 \)
Defining hyperopia

- Is it to distinguish from emmetropia or to decide when it is pathologic?

Natural history data:

(Kuo, AAPOS, 2003). Normal infants in pediatric ophthalmology office.
- Mean hyperopia +1.4±1.1 D
- 95% have ≤ + 3.25 D

How much hyperopia is present in healthy children?

- Refractive error determined
- 3 countries
- Plotted in distribution
- AJO April, 2000
Distribution of right eye spherical equivalent refractive error in right eyes of children ages 5 to 7, 8 to 10, 11 to 13, and 14 to 15 years. Data points represent a one-half diopter interval (for example, those associated with +2 on the axis represent greater than +1.75 to 2.25 diopters or less). Those at the extreme ends represent -4.25 diopters or less and greater than +4.25 diopters.

Distribution of spherical equivalent refractive error in right eyes of children ages 5 to 7, 8 to 10, 11 to 13, and 14 to 15 years. Data points represent a one-half diopter interval (for example, those associated with +2 on the x-axis represent greater than +1.75 to less or equal to +2.25 diopters). Those at the extreme ends represent less than or equal to -4.25 diopters and greater than +4.25 diopters.
Does hyperopia decrease acuity?

- Chile & Nepal
- 21 children $\geq 4.00$
- All uncorrected acuity of 20/40 or better

Distribution of uncorrected visual acuity (VA) by spherical equivalent refraction in children. D= diopters; logMAR = logarithm of the minimum angle of resolution.

Practice Patterns & Guidelines:

- Survey data
- 212 optometrists
- 102 ophthalmologists
- asymptomatic 6-year old child
- would you prescribe at $+3.00 - +4.00$?
- Optometrists: 33%
- Ophthalmologists: 5%
- For a 2 year old most prescribe at $+5.00$
Harvey et al (1998)

AAPOS member survey (68% response rate)
- determined where 25%, 50%, 75% would dispense
- age group: < 2 year old, 2-4 year old, 5-7 year old

<table>
<thead>
<tr>
<th></th>
<th>25%</th>
<th>50%</th>
<th>75%</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 2 year old</td>
<td>+4.00</td>
<td>+5.00</td>
<td>+5.50</td>
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<tr>
<td>2-4 year old</td>
<td>+4.00</td>
<td>+4.00</td>
<td>+5.00</td>
</tr>
<tr>
<td>5-7 year old</td>
<td>+3.00</td>
<td>+4.00</td>
<td>+4.50</td>
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</table>

Prescribing guidelines:
- American Academy of Ophthalmology, Preferred Practice Patterns
- Childhood Eye Examination:
  - "cycloplegia is mandatory"
  - 3 years and younger: + 4.50 D
  - 4 and older to improve acuity or alleviate asthenopia
What to detect in preschool vision screening
- Hyperopia > +3.50 D in any meridian.
- VIP (Optometry)
- Criteria important to detect: Hyperopia > + 3.50

A Consensus (if there can be one):
Probably consider treating for above +3.50
- Modify up: younger children
- Modify down: family history, Down syndrome
- Measure using cyclopentolate
- Treat accommodative strabismus with full plus
- In high hyperopia decrease plus by + 1.50

How well do we adhere to these guidelines?
Stewart-Brown (1985)

- 10-12% had been prescribed spectacles
- 67% were wearing them
- 20% of those wearing glasses had no uncorrected acuity deficit; additional 15% had < 2 lines deficit.

Tennessee Lions Outreach Program

- Statewide preschool photoscreening program
- Detailed records and database
- Follow-up examination data on all referred children
- Amblyogenic factors are gold standard for pathology
- Allows observation of management

Methods

Children Referred Following Photoscreening

- Pathology detected (True positive)
- No pathology detected (False positive)

Database query: How often were spectacles prescribed to children without pathology?
Data Analysis

• Whether or not glasses prescribed
• Level of refractive error
• Training of eye doctor
• Number of children seen by eye doctor


• 102,508 children screened
• 97% successful screening
• 4.7% referral rate
• 74.8% follow-up data

• 3,640 children referred
• 2,750 children with AAPOS amblyogenic factors
• 890 normal (false-positive screening)
Summary Data Regarding False-Positive Examinations

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<tr>
<th>Examination by</th>
<th>Number of Doctors</th>
<th>Number of Examinations</th>
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<tbody>
<tr>
<td>Optometrist</td>
<td>186</td>
<td>413 (46.4%)</td>
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<tr>
<td>Comprehensive Ophthalmologist</td>
<td>78</td>
<td>205 (23.0%)</td>
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<tr>
<td>Pediatric Ophthalmologist</td>
<td>11</td>
<td>272 (30.6%)</td>
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<tr>
<td>Total</td>
<td>275</td>
<td>890</td>
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Frequency of Prescribing Glasses in Absence of Refractive or Other Pathology

<table>
<thead>
<tr>
<th>Type of Doctor</th>
<th>Number of Examinations</th>
<th>Glasses Given</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td>Optometrist</td>
<td>413</td>
<td>145</td>
<td>35.1%</td>
</tr>
<tr>
<td>Comprehensive Ophthalmologist</td>
<td>205</td>
<td>24</td>
<td>11.7%</td>
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<tr>
<td>Pediatric Ophthalmologist</td>
<td>272</td>
<td>5</td>
<td>1.8%</td>
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<tr>
<td>Total</td>
<td>890</td>
<td>174</td>
<td>19.6%</td>
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</tbody>
</table>

Spherical Equivalent Refractive Error for Children Without Amblyogenic Factors Who Were Prescribed Glasses

<table>
<thead>
<tr>
<th>Type of Doctor</th>
<th>Spherical Equivalent Refractive Error</th>
<th>Myopia</th>
<th>Hyperopia</th>
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<tbody>
<tr>
<td></td>
<td>≥ 1.0 D</td>
<td>0 - &lt; 1.0</td>
<td>≥ 1.0</td>
</tr>
<tr>
<td>Optometrist</td>
<td>4</td>
<td>4</td>
<td>15</td>
</tr>
<tr>
<td>Comprehensive Ophthalmologist</td>
<td>3</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>Pediatric Ophthalmologist</td>
<td>1</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>8</td>
<td>4</td>
<td>26</td>
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Prescribing Rates

<table>
<thead>
<tr>
<th><em>Experienced</em> Doctors</th>
<th>Less experienced Doctors / p</th>
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</thead>
<tbody>
<tr>
<td>Optometrist</td>
<td>36.1%</td>
</tr>
<tr>
<td>Ophthalmologist</td>
<td>10.5%</td>
</tr>
<tr>
<td>Pediatric Ophthalmologist</td>
<td>1.5%</td>
</tr>
<tr>
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<td></td>
</tr>
</tbody>
</table>

Less-experienced Doctors:

| Optometrist | 34.6%   |
| Ophthalmologist | 12.6%   |
| Pediatric Ophthalmologist | 10% (1/10) |

*Experienced: at least 5 false-positive examinations

Refractive Error of Four Patients
Prescribed Spectacles by Experienced Pediatric Ophthalmologists

1. +2.00 + 1.50 x 90 OU
2. OD: +3.50 sph; OS: +3.00 sph
3. OD: +2.00 sph (V: 20/30); OS: +3.00 sph (V: 20/60)
4. OD: -3.00 + 1.00 x 90; OS: -3.00 + 1.50 x 90

- 5,000,000 children born yearly
- Spectacles cost $150 each
- Baseline prescribing rate 1.8%
- Observed prescribing rate 19.6%
- 18% get unnecessary glasses (19.6-1.8)
- Cost $135,000,000/year
- If pediatric ophthalmologist filled, $205,000,000/year
The Solution:

- Evidence-based guidelines of risk factors.
- Natural history studies of emmetropia.
- Better education of ophthalmologists and optometrists.
- Recognition of cycloplegia in managing children.
- Assessment if owning a dispensary effects prescribing habits.

Children are not little adults.
They have unique needs.