Use of Digital Photoscreeners to Detect Amblyopia Risk Factors

A multidisciplinary evidence-based approach care and cost implications

Presenters
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Disclosures
David Silbert MD FAAP
- Gobiquity
  - Consultant
  - Speaker
  - Equity Interest
- Kaneka
  - Consultant
  - Research support

Visual Acuity Testing vs Photoscreening
- Recognition Visual Acuity
  - Historically considered “Gold Standard” for detection of amblyopia in children
  - Few studies validating in children

Predictive Value of Photoscreening and Traditional Screening of Preschool Children
- *J AAPOS* 2005 Apr; 9(2):114-20 Salcido AA, Bradley J, Donahue SP
- Compared the usefulness of traditional vision screening and photoscreening
  - 3 and 4-year-old children
  - Pediatrician’s office

Methods
- Six pediatric clinics used:
  - MTI Photoscreener
  - HOTV charts/Random Dot E
- One testing method for 6-month period
- Switched to the other for the following 6 months
Referred children

• Complete eye examination with cycloplegic refraction
• Local ophthalmologists or optometrists
• Results forwarded to Vanderbilt Ophthalmology Outreach Center
• Amblyogenic factors defined using 2003 AAPOS referral criteria

Results

• 605 screened with the photoscreener
• 447 screened with traditional techniques
• Mean time for screening 2.5 minutes vs 5.9 minutes (P < 0.01)
• Untestable rates similar (18% vs 10%)
• Referral rates similar: 3.8% vs 4.5%
• PPV amblyogenic factors
  – 73% for photoscreening (8/11)
  – 0% acuity testing (10/10 normal)

Conclusion

Salcido et al

• Photoscreening more time efficient
  – Higher PPV in 3 and 4-year-old children
• Study unable to validate utility of traditional screening techniques in preschoolers Support for
• Attention should be turned toward making photoscreening feasible for widespread implementation

Flip chart Visual Acuity Screening for Amblyopia Risk Factors Compared to the PlusoptiX A09 Photoscreener, Tests Performed by a Lay Screener

Binocul Vis Strabolog Q 2013;28(4):222-8. Silbert DI, Matta NS, Brubaker A

• Gold standard of vision screening
  – considered to be acuity testing
• Compare acuity testing to new technology for pediatric vision screening programs

Objective

• Determine reliability of recognition visual acuity screening performed by a Lay Screener to the plusoptiX A09 photoscreener
• For detection of amblyopia risk factors (ARF’s)

Design of Study

• Basic training to Lay Screener
• Both tests performed on all children
  – monocular visual acuity testing
    • 10 foot Pati Pics single crowded chart
    – plusoptiX A09 photoscreener
    – alternated which test first
• Complete peds-ophth exam with cycloplegic refraction
Referrals

- Patti Pics screening,
  - referred if they failed to reach threshold visual acuity of 20/40 in either eye
- plusoptiX referral based on pre-set referral criteria (Matta/Silbert criteria)

Results

- 71 children screened
- Flip chart-screening
  - Sens 83%, Spec 44%, FP 56% and FN 17%
- plusoptiX A09
  - Sens 94%, Spec 89%, FP 11% and FN 6%

Acuity screening in a population with prevalence of amblyopia of 5% applied to 200 children

<table>
<thead>
<tr>
<th></th>
<th>Amblyopia</th>
<th>No amblyopia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Failed acuity test</td>
<td>8 True positive</td>
<td>106 False positive</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>83%</td>
<td>98%</td>
</tr>
<tr>
<td>Specificity</td>
<td>44%</td>
<td>99%</td>
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<tr>
<td>Passed acuity test</td>
<td>2 False negative</td>
<td>84 True negative</td>
</tr>
<tr>
<td>Positive Predictive Value</td>
<td>7%</td>
<td>98%</td>
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2003 AAPOS amblyopia risk factors:

- Anisometropia (spherical or cylindrical) > 1.5 D
- Any manifest strabismus
- Hyperopia > 3.5 D in any meridian
- Myopia magnitude > 3.0 D in any meridian
- Any media opacity > 1 mm in size
- Astigmatism > 1.5 D at 90 degrees or 180 degrees;
  > 1.0 D in oblique axis (more than 10 degrees from 90 degrees or 180 degrees)
- Ptosis ≤ 1 mm margin reflex distance
2013 AAPOS referral criteria

Refractive risk factors targets

<table>
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<tr>
<th>Age (months)</th>
<th>Astigmatism</th>
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<th>Anisometropia</th>
<th>Myopia</th>
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<td>12 - 30</td>
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Nonrefractive amblyopia risk factor targets

All Ages
* Manifest strabismus > 8 prism diopters in primary position
* Media opacity > 1 mm

2013 AAPOS referral criteria

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Nonrefractive amblyopia risk factor targets

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Visual Impairment in Children Ages 1-5: Screening

Recommendation Summary

Summary of Recommendations and Evidence

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<th>Population</th>
<th>Recommendation</th>
<th>Grade (Rating)</th>
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<tr>
<td>Children, Age 3-5 Years</td>
<td>The USPSTF recommends vision screening for all children of at least five years of age to detect the presence of amblyopia or risk factors.</td>
<td>B</td>
</tr>
<tr>
<td>Children, &lt;3 Years Age</td>
<td>The USPSTF concludes that the current evidence is insufficient to assess the balance of benefits and harms of vision screening for children 3 years of age or younger.</td>
<td>I</td>
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USPSTF

- Found adequate evidence that (B):
  - vision screening tools have reasonable accuracy in detecting visual impairment, including refractive errors, strabismus, and amblyopia
  - early treatment for amblyopia, including the use of cycloplegic agents, patching, and eyeglasses, for children 3 to 5 years of age leads to improved visual outcomes
- Found inadequate evidence that (I):
  - early treatment of amblyopia for children <3 years of age leads to improved visual outcomes

Grading of USPSTF

- Grade B
  - The USPSTF recommends the service
  - High certainty that the net benefit is moderate
  - Moderate certainty that the net benefit is moderate to substantial
  - Offer or provide this service
- Grade I
  - Evidence insufficient to assess the balance of benefits and harms of the service
  - Evidence is lacking, of poor quality, or conflicting
  - Balance of benefits and harms cannot be determined
**USPSTF Screening Tests**

- Feasible tests in primary care:
  - Visual acuity tests
  - Stereoacuity tests
  - Cover-uncover test
  - Hirschberg light reflex test
  - Use of Autorefractors
  - Photoscreeners
    - Instruments that detect amblyogenic risk factors and refractive errors

**USPSTF Current Practice**

- Younger children often unable to cooperate with:
  - Visual acuity testing
  - Stereoacuity.
- Screening of younger children may be difficult
  - Yields false-positive results
  - Child’s inability to cooperate with testing

**USPSTF Research Needs**

- Well-designed studies needed to identify:
  - Optimal age for screening
  - Optimal screening methods
  - Optimal screening frequency
  - Most-favorable combinations of screening tests
  - Optimal treatment for amblyopia and the optimal treatment duration
  - Long-term benefits and harms of preschool vision screening
    - Such as quality of life, school performance, and labeling or anxiety