Vision Screening in Children

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Disclosure:
The author has been a consultant for
Iscreen, Diopsys, Pediavision, Plus Optix,
Gobiquity, Welch Allyn, and Rebiscan, and is
the lead author of the AAPOS VSC
recommendations and the pending AAP
Policy Statement on Pediatric Vision
Screening.

Screening for Amblyopia:
Problems
- Preschool children too young to test
  acuity directly
- 4,000,000 U.S. Preschoolers
- Children not in organized groups until
  Kindergarten
- No well-validated test
- No Federal mandate

The Past
- Traditional screening tests of acuity
  Allen, LEA, programs
  Preliterate illiterate E, HOTV, Landolt C
  Stereopsis tests for alignment

The Future
- New technologies for preschool children
- Acuity testing in school aged child

1998: Stewart-Brown and Snowden
“no evidence vision screening is effective”

Is Vision Screening Effective?
- Kvarnstrom (Acta Ophth Scand 2001)
- Reduction of significant (20/60)
  amblyopia
- 2% to 0.2% following screening
  implementation
- 47% of amblyopic children V A
  20/30 or better
Compared amblyopia in screened and unscreened populations

- Amblyopia 1.0% vs 2.6%
- Amblyopia 20/60 or worse: 0.1% vs 1.7%

Haifa, Israel
(Eibschitz et al; J AAPOS 2000)

Intensive screening: amblyopia 0.6% (age 7.5 years)
Single screening (age 3): amblyopia 1.8%

ALSPAC Study: Intensive Screening vs Orthopic Screening Only

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Natural History of Untreated Amblyopia
(Simons and Preslan, BJO 1999)

- 18 children aged 4-6, screened and non-compliant
- Screened again 1 year later
- One child (glasses sporadically) some improvement
- Seven deteriorated
- 3 developed amblyopia with non-compliance

Amblyopia: Increased Risk of Vision Loss in Fellow Eye

National surveillance in UK (1997)
Lifetime risk of fellow eye loss 1.2%
65% were unable to continue paid employment

Amblyopia: Increased Risk of Vision Loss in Fellow Eye

- Detect amblyopia risk factors
- No detection of amblyopia
- Test younger children
- Natural history unknown; leads to overreferral

New Technologies for Vision Screening

Types of Refractive Screening

- Off axis photoscreening
  - iScreen
  - Vision Research Corp.
  - MTI
- Retinal Birefringence
  - Pediatric Vision Screener
- Automated refraction
  - Welch Allyn SureSight
  - Nikon Retinomax
  - Plus Optix
  - Spot
  - Gobiquity
- Visual Evoked Potentials
Difficulty with many New Screening Technologies

- They do not detect amblyopia.
- They only detect factors that cause amblyopia.

What Screening Should Detect? Causes of Amblyopia?

- High hyperopia
- Anisometropia
- High bilateral astigmatism
- Significant media opacities

Decreased Acuity? Foveation?

Preschool Vision Screening: What Should We Be Detecting and How Should We Report It? Uniform Guidelines for Reporting Results of Preschool Vision Screening Studies

Rationale for paper: set criteria for automated vision screening
- Consensus document
- Little data at that time

Off-Axis Photoscreening

- Linear flash away from camera axis
- When eye aligned and focused:
  - Flash reflects in eccentric retina
  - No flash reflex seen by camera
- When eye misaligned or not focused:
  - Blur of flash enters central retina
  - Can be observed by camera aperture

State of the Art

Guidelines for automated preschool vision screening: A 10-year, evidence-based update

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Figure 2. In the photoscreening process, a normal eye focuses the image of the flash on the retina outside the area seen by the camera (bounded by the blue dots).

Figure 3. In hyperopia, the image reaches the retina before it comes to a focus. The image of the flash is blurred enough on the retina to spill into the area visible to the camera (the area bounded by the blue dots).

Figure 4. Theoretical image of a hyperopic (farsighted) eye. Notice the bright "crescent" formed in the upper region of the pupil. The extent of the bright area is proportional to the degree of uncontrolled hyperopia.

Results; Tennessee
\( n > 200,000 \) (MTI); now \( > 500K \)

- Successful screening: \( 96.7\% \)
- Referral Rate: \( 4.6\% \)
- Pass Rate: \( 92.1\% \)
- Predictive Value: \( 74\% \)
LCIF Core Four Programs  
(Donahue, JAPOS, 2006)

- MTI photoscreener, volunteer screeners
- 13 programs worldwide
- Over 750,000 children screened worldwide
  - Now over 2,000,000
- Similar effectiveness: RR 6%; F/U 46%; PVP 68%