PEDIATRIC VISION SCREENING

GUIDELINES FOR PRIMARY CARE PROVIDERS AND SCHOOL NURSES

Jeffrey L. Berman, MD
Maine Eye Center
Children’s Eye Care
Portland, Maine

Learning Objectives

- Appreciate the importance of vision screening during childhood.
- Understand methods that enhance the accuracy of visual acuity screening.
- Appreciate new technologies that can identify signs of potential vision problems.

Why Perform Vision Screening?

- Primary Care Providers and School Nurses:
  - The first line of defense to detect preventable vision loss in children.
- Recommended as part of the American Academy of Pediatrics Bright Futures Periodicity schedule.
- Why do children lose vision?
  - Amblyopia: commonly referred to as “lazy eye”

Amblyopia

- Amblyopia is a decrease in vision development that happens when the brain does not get normal stimulation from the eye(s).
- Abnormal development of vision results when one or both eyes send a blurred or distorted image to the brain.
- The brain is unable to “learn” to see clearly with that eye, even when glasses are used.
Amblyopia Develops in Children

- If not treated in early childhood, amblyopia results in permanent loss of vision.
  - The most common cause of vision loss in adults 20-70 years of age is untreated childhood amblyopia.
- Amblyopia is caused by untreated, usually unequal refractive errors, strabismus, or defects within the eye (e.g. cataract).

Amblyopia

- Affects 2-4% children in US
- Most asymptomatic emphasizing importance of careful vision screening
- “Dull or blunt sight” from abnormal visual experience during the critical period of development (10-12 yo)
- Most commonly caused by strabismus or anisometropia (unequal focusing errors) or occasionally from ocular media opacities (congenital cataracts) or obstruction of visual axis (severe ptosis, capillary hemangioma)
- Treatment involves addressing underlying cause (glasses, strabismus surgery, cataract removal) and penalization with patching or Atropine drops
- NIH funded PEDIG studies have looked prospectively at duration of patching, atropine penalization, etc through Amblyopia Treatment Studies
- Older children (teenagers) may still be amenable to treatment

Pseudostrabismus

- Optical illusion due to epicanthal folds/wide nasal bridge
- Light reflexes centered in pupils, no movement cover test
Cover Test

- Use a good fixation target
- Lights are poor fixation targets
- Alternatively cover each eye
- Deviated eye will move to pick up fixation if vision present
- Any shift means referral

Infantile Esotropia

- Onset usually in first year of life
- Typically large angle (really crossed)
- Often cross fixate, may have poor abduction (pseudo-abduction deficit)
- Early surgery gives better chance for binocular vision
- Monitor for amblyopia

Accommodative Esotropia

- Usual onset between 1 and 3 years old
- Usually smaller, intermittent esotropia, worse with focusing
- Usually associated with high hyperopia (farsighted)
- Glasses responsive
- Can be non-refractive component (partially accommodative)
- Monitor for amblyopia

Intermittent Exotropia

- Onset usually between 1 and 4 years old
- Usually worse with fatigue, visual inattention
- Monocular eye closure or squinting in sunlight
- Amblyopia less common
- Surgery for poor fusional control
Red Reflex: Check it at EVERY Well Child Visit

Abnormal Red Reflex

- Retinoblastoma
- Congenital cataract
- Other ocular abnormalities (coloboma, Coat’s disease, Toxocara infection)

Screening Early is Best

School-aged vision screening may occur too late:

- Amblyopia starts becoming less responsive to treatment after 5 years of age.
- Permanent vision loss occurs by 8 years of age.

Vision Screening in the United States

- National Eye Institute (NEI)
  - Amblyopia affects 2 - 3% of children in the United States
    - An estimated 4.5 million children with preventable vision loss.
American Academy of Pediatrics Policy Statement
*Pediatrics January 2016*

- Instrument-based screening (photoscreening) is recommended for children 12-months of age and older unless they can reliably perform visual acuity testing with eye charts.
- Direct measurement of visual acuity using eye charts remains the gold standard for vision screening and can often begin by 4-years of age.

Barriers to Screening

- Poor cooperation of young children
- Takes too long to perform
- Staff not adequately trained
- Poor reimbursement for providers

Visual Acuity Screening is the Current Gold Standard

- In cooperative children, direct measurement of visual acuity using visual acuity charts remains the gold standard for vision screening.

Visual Acuity Screening Guidelines

Age-Dependent Thresholds
Newborn to 35 Months (0-3 years)

Procedures for the Evaluation of the Visual System
Pediatrics January 2016

- Take a health history: eye problems in close relatives?
- Check vision (tracking), eye movement (motility) and alignment (strabismus)
  - Corneal light reflexes should be centered
  - Cover testing if able
- Check pupils and red reflexes (round, equal, bright)

36 Months to 47 Months (3-4 years)

Measure Visual Acuity

- Must be able to identify the majority of the 20/50 line optotypes with each eye.
- Testing should be done at 10 feet.
- Opposite eye must be effectively covered.

36 Months to 47 Months (3-4 years)

Recommended Chart Types

Lea Symbols
HOTV Letters

Less than Ideal Chart Choices
Not Recommended for Children
48 Months to 59 Months (4-5 years)

- Must be able to identify the majority of the 20/40 line optotypes with each eye.

![HOTV Match Card]

60 Months and Older (5+ years)

- Must be able to identify the majority of the 20/32 (or 20/30)* line with each eye.
- Sloan letters (shown)
  - Preferred over Snellen Letters
  - Snellen charts have a 20/30 line*
- Repeat testing:
  - Every 1-2 years

![Sloan letter chart]

AAPOS Vision Screening Kit
Conforms to AAPOS/AAO/AACO/AAP Visual Acuity Standards

- Contents:
  - Occluder patches
  - Occluder glasses
  - Occluder paddle
  - 10 ft. measuring cord
  - Match response card
  - Acuity charts:
  - -Sloan letters
  - - Available with choice of Lea symbols or HOTV letters
  - Two instructional DVDs

Threshold and Critical Line Options
Threshold Screening

- Reading down the eye chart until a Threshold line is crossed...
  - e.g. 20/32 for age 5+ years
- Or as far down as possible.
  - Allows for inter-ocular comparison between the two eyes.
  - Refer children with a two-line difference between eyes.

Do not allow “Peeking”

- Be sure that eye not being tested is completely covered
- No hints from siblings or parents

Critical Line Screening is Faster
Only read a single “critical” line with each eye

Supplemental AAPOS Vision Screening Kit

Basic kit plus
- Stereo testing
- Color vision testing
- Near acuity charts for testing at 16 inches.

Each chart has two boxed critical lines: one for each eye.
Computerized Eye Charts

• Apps for tablets / phones
• Desk and Laptop programs
• On-line programs

On-line Visual Acuity Screening

• The Jaeb Center for Health Research is a nonprofit center for clinical trials and epidemiologic research in ophthalmology and diabetes.
  – Pediatric Eye Disease Investigator Group (PEDIG)
• JVAS (Jaeb Visual Acuity Screener) is free for Windows PCs. JVAS
  – Pediatric visual acuity screener meant for non-ophthalmic health care professionals.

AAPOS Vision Screening App. for iPad

AAPOS Vision Screening App for iPad available in iTunes Store

JVAS (Jaeb Visual Acuity Screener)

• Test distance 5 feet (1.5 m)
• JVAS also has an HOTV matching card PDF available for download
Reimbursement for Acuity Screening

CPT 99173
- Use with screening tests of visual acuity
  - Wall charts
  - Computerized eye charts
  - AAPOS Vision Screening Kit

Instrument-Based Screening: Commonly Called “Photoscreening”

- Photoscreeners, autorefractors, and other devices do not replace visual acuity screening with eye charts.
- Particularly helpful in children ages 1-5 years.

Photoscreeners

- One of original screening instruments
- Took 2 Polaroid photos of the eyes
- Size and shape of the red reflex crescent used to estimate refractive error and amblyopia risk
Instrument-Based Screening

When to Screen?

- The AAPOS Vision Screening Committee recommends instrument-based screening for children ages 1 to 3 years.
- Instrument-based screening is also an acceptable alternative to vision screening with an acuity chart for children ages 3 to 5 years.

Visual Acuity Screening is the Current Gold Standard

- Direct measurement of visual acuity using vision charts is the current gold standard for vision screening, unless the child is not reliably able to perform such a test.

What is the Difference Between Vision Screening with Eye Charts and Vision Screening Devices?

- Vision screening with eye charts tests the actual visual acuity (20/20 etc.)
- Vision screening devices typically do not test visual acuity directly.
  - Screening devices test for eye conditions or risk factors that may cause decreased vision or amblyopia.

Instrument Screening: What is a Photoscreener or Autorefractor?

- An instrument that takes a photographic image of the eye’s red reflex, or some other measurement, to estimate the refractive error.
  - “prescription” of the eye
- Also may detect ocular misalignment and other conditions degrading or blocking line of sight (cataract).
Common Photoscreeners and Autorefractors

- Welch Allyn SureSight
- Righton Retinomax
- Welch Allyn "Spot"
- PlusOptix S12R
- iScreen

Typical Photoscreeners in Use

- iScreen Vision
- iScreen Vision provides a fast, easy, and portable pediatric vision screening solution for infants and pre-school and school-age children that is as simple as using a digital camera.
- iScreen Vision’s vision screening process is covered by many insurers under CPT code 99174 for "Instrument-based ocular screening."
- One keystroke sends images and information to iScreen Vision Central Analysis for an independent clinical review by a trained technician
- A full patient report is usually returned to the physician before the patient leaves the office – typically within minutes
- List price of $4,000 plus per screen cost

Welch Allyn Spot

- Supports AAP screening guidelines for early detection of amblyopic risk factors
- Automated screening provides thorough, objective, and easy-to-understand results
- Easy to use, easy to implement with minimal user training required
- Adequately powered for mass screening events
- Captures readings 97% of the time helping to screen otherwise difficult patients
- Screens for refractive errors, strabismus and anisocoria
- Uses lights and sounds to help engage children
- MSRP of $7,500
Plusoptix

- 20 years of Pediatric vision screening experience
- Created the worlds first immediate read vision screener and first pediatric auto-refractor
- Specificity and Sensitivity as high as 95%
- 3 different models of Pediatric vision screeners from $5,500 to $6,500
  - Screens for refractive errors, strabismus and anisocoria
  - Warranty covers accidental damage

Diopsys “Enfant”

- Diopsys “Enfant” VEP vision test.
- Tests the entire visual pathway: “front to back”
  - Eye
  - Optic nerve
  - Visual cortex

Other Vision Screening Devices

EyeSpy 20/20

- Automated computer software
- Tests:
  - Visual acuity
  - Stereopsis
  - Color vision
- Runs on a standard laptop or desktop computer
EyeSpy 20/20

After testing the visual acuity of each eye, the program generates a report. With cloud-based storage, EyeSpy 20/20 can integrate and store data collected from other devices such as photoscreeners and school databases.

REBIScan
Pediatric Vision Scanner

- Assesses foveal fixation
- Amblyopic eyes are found to have abnormal fixation (microstrabismus).

REBIScan Pediatric Vision Scanner

- Retinal birefringence technology.
- Tests for the amblyopia by detecting microstrabismus.

GoCheck Kids Vision Screening App

- A modern version of the “photoscreener”
- Smartphone app analyzes the red reflex of the eye
When to Photoscreen?
- Generally not before 1 year of age.
  - Poor fixation behavior impedes measurement.
- The false positive rate is high.
- There is a low likelihood of ophthalmic intervention.
  - Except for constant strabismus, cataract, glaucoma, retinoblastoma.
  - Correction of refractive error typically delayed.

Instrument Screening is Useful For:
- All children ages 1-3 years
  - Usually unable to perform visual acuity chart tests
- Some children ages 3-5 years
  - Acuity chart testing is preferred, but...
  - Instrument-based screening is an acceptable alternative
- Older children who are non-verbal, developmentally delayed or otherwise unable to perform testing with acuity charts

Instrument Screening is Not Experimental
- The United States Preventive Services Task Force (USPSTF) has recognized photoscreening as appropriate methodology for vision screening of children aged 3-5 years.

Photoscreening is Endorsed by the American Academy of Pediatrics
- The American Academy of Pediatrics has issued a policy statement supporting the use of these technologies for preschool vision screening


Instrument Screening May be Better?

- A randomized, controlled, multi-centered cross-over study demonstrated photoscreening to be superior to direct testing of visual acuity for screening of well children ages 3-6 years in the pediatric office.


Referral Criteria for Instrument Screening

Considerations:
- Age of patient
  - Passing criteria are more generous (higher thresholds) for younger children and more stringent (lower thresholds) for older children.
- Sensitivity
  - High rate of detection but also high rate of referrals for false positives.
- Specificity
  - Fewer false positives but will miss some at-risk kids.

Warning!

- There is a difference between the Refractive Risk Factor Target numbers on the preceding table and what the screening instrument settings should be.
- Children can accommodate tremendous amounts (change the focusing power of their eyes).
  - this potentially affects some of the instrument readings
- Device manufacturers will have guidelines specific to your needs.
Reimbursement for Instrument Screening

CPT 99174
• Use with automated photoscreening and autorefraction:
  – Photoscreeners
  – Autorefractors
  – Fixation “Pediatric Vision Scanner”
  – Do not use 99173 which is only for tests of actual visual acuity (eye charts)

Reimbursement for Acuity Screening

• For screening tests of visual acuity
  – 99173 is used for tests such as wall charts or computerized eye charts where the child identifies letters or symbols.
  – Example: AAPOS Vision Screening Kit

References and Links

• Visual System Assessment in Infants, Children and Young Adults by Pediatricians
  – American Academy of Pediatrics Policy Statement

• Procedures for the Evaluation of the Visual System by Pediatricians
  – American Academy of Pediatrics Clinical Report

References and Links

• Bright Future and Preventative Medicine Coding Fact Sheet
  – American Academy of Pediatrics
  – AAP.org → Professional Resources → Practice Transformation → Coding at the AAP
  – Updated January 2016
# Vision Screening Recommendations

<table>
<thead>
<tr>
<th>Age</th>
<th>Tests</th>
<th>General/Strategic Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newborn</td>
<td>Newborn</td>
<td>Have vision screening within 1 month of birth.</td>
</tr>
<tr>
<td>3-11 weeks</td>
<td>Infant</td>
<td>法定</td>
</tr>
<tr>
<td>7-11 months</td>
<td>Toddler</td>
<td>法定</td>
</tr>
<tr>
<td>2 years</td>
<td>Preschool</td>
<td>法定</td>
</tr>
<tr>
<td>3 years</td>
<td>Kindergarten</td>
<td>法定</td>
</tr>
<tr>
<td>4 years</td>
<td>Elementary</td>
<td>法定</td>
</tr>
</tbody>
</table>

Note: Screening every 2 years after age 5.