Pediatric Vision Screening

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Introduction: Questions We Hope to Answer

- Why is pediatric vision screening important?
- When should I be screening children’s eyes?
- What is the best way to screen?
- Is there any new and improved pediatric vision screening technology I should be adopting?
The Importance of Pediatric Vision Screening

- Amblyopia affects up to 5% of the population (>10 million Americans).
- In the first 4 decades of life amblyopia causes more vision loss than all other ocular diseases combined!
- Amblyopia has a “window period” for treatment in early childhood.
- Screening can prevent otherwise fatal disorders such as retinoblastoma.
Vision Screening: Scope of Problem

Only 21% of preschool children and even fewer children below preschool age are screened for these conditions.

Amblyopia is Very Cost-Effective to Treat

- Membrano, et al: Cost/QALY $2,281 for Amblyopia Tx
- Comparisons:
  - Hypertension screening/therapy in asymptomatic 49 yo = $25,000/QALY
  - Annual screening for Diabetic Retinopathy in high risk diabetics = $41,700/QALY
Pediatricians Are the Natural First Line of Defense – The Medical Home

- Children already come to Pediatrician.
- Vaccinations and screening are already a part of care protocol.
- Screening in pediatrics should be most cost effective (no separate office visit, no extra-time off work for parent).
AAP Policy on Vision Screening

- AAP in concert with AAO and AAPPOS have a joint policy statement recommending screening beginning at birth and throughout childhood during well child visit.

  - Serial screening in the MEDICAL HOME
    - Ensures age-appropriate monitoring of visual system.
    - Is more efficient and cost effective than comprehensive eye exams for asymptomatic children.
      - 500,000 newborns/year in CA x $100 eye exam = $50 million
  - Pediatricians are best champions for a child’s health.
Brief Overview of Ocular Anatomy, Physiology and Terminology
Retinal Anatomy

The Retina

Macula

Optic Nerve Head

Retina
Eye Movements
Refractive Errors

- Nearsighted
- Farsighted
- Astigmatism
- Anisometropia
Myopia (Near-sightedness)

- Eyeball too long
- Can’t see far away
- Correct with specs, contact lens, or excimer laser (adults)
Hyperopia (Far-sightedness)

- The eyeball is too short
- “Accommodation” will increase the effective lens power in the eye and focus at both near and far
- Crossing may occur
Astigmatism

- “Warpage” of the cornea like a football
- Light rays in one axis are not focused the same as in opposite axis
- Corrected with glasses
What is Amblyopia?

Unilateral or bilateral decrease of visual acuity caused by form vision deprivation

and/or

Abnormal binocular interaction for which no organic cause can be detected
Amblyopia

The Physician sees nothing and the Patient very little
Amblyopia...In Other Words:

- The camera (eye) is capable of taking the picture but the computer (brain) doesn’t recognize that there is an image.

- “Either use it or lose it!”
Children are Different

- Developing cortical connections
- Window of opportunity for diagnosis and treatment...just like with language development
Screen for Causes of Amblyopia

- Refractive errors
- Obstruction of optical pathway (e.g. cataract or corneal scar)
- Strabismus
- Other—anything that blocks input of visual information to the brain
Motility Terminology

- **Strabismus** = ocular misalignment
- **Esotropia** = eyes turn in
- **Exotropia** = eyes turn out
- **Hypertropia** = one eye higher than the other
Milestones

- 30 weeks - Blink to light
- 31 weeks - Pupils react
- 2 to 3 weeks - Early fixation
- Horizontal gaze - Birth
- Vertical - 2 months
- Fixate - Birth to 3 months
- Follow - 3 months
Other Visual Functions

- Color ? (3 months)
- Field – Adult-like 1 year
Normal Development of Vision and Eye Movements

BIRTH – Term

- Fixation
- Poor following
- Intermittent strabismus frequently present
- Visual acuity 20/400 to 20/600
One Month

- Horizontal following to midline
- Improving alignment
- Visual acuity 20/300
Two Months

- Vertical following begins
- Improving alignment
- Visual acuity 20/200
Three Months

- Good horizontal & vertical following
- Normal alignment
- Visual acuity 20/100
- Accommodation begins
- Binocularity detectable
Six Months

Visual acuity 20/30–20/40
Binocularity well developed
Eight to Ten Years?

- End of sensitive period for amblyopia
When Should We Screen?

- Begin at birth and during all subsequent well child visits.
  - Think of vision screening like vaccinations!
  - Different screening at different developmental/age levels.
# Periodicity Table for Screening

## Periodicity Schedule for Visual System Assessment in Infants and Children

<table>
<thead>
<tr>
<th></th>
<th>Newborn to 6 months</th>
<th>6 months to 12 months</th>
<th>1 to &lt;3 years</th>
<th>3 to &lt; 5 years</th>
<th>5 years and older</th>
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<tbody>
<tr>
<td><strong>Ocular History</strong></td>
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<tr>
<td><strong>External inspection of lids and eyes</strong></td>
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<td><strong>Red Reflex Testing</strong></td>
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<td><strong>Pupil examination</strong></td>
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<tr>
<td><strong>Ocular Motility Assessment</strong></td>
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<td><strong>Instrument Based Screening</strong></td>
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<tr>
<td><strong>Visual Acuity Fix and follow</strong></td>
<td>x</td>
<td></td>
<td>+</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td><strong>Visual Acuity age-appropriate optotype assessment</strong></td>
<td></td>
<td></td>
<td>x</td>
<td>Δ</td>
<td>x</td>
</tr>
</tbody>
</table>

+: Bill using CPT 99174  
Δ: Bill using CPT 99173  
*: If unable to test visual acuity monocularly with age appropriate linear optotypes, instrument-based screening is suggested.
Age Specific Screening: NEWBORN

- External evaluation for obvious ocular malformations and infections
  - NOTE: Too young to evaluate alignment!!!

- RED REFLEX TEST—preferably prior to discharge from newborn nursery
  - Very important to r/o retinoblastoma or congenital cataracts
    - If congenital cataracts not removed in first 2 to 3 months of life, permanent loss of sight occurs
Bruckner Reflex
Leukocoria is an Urgency!

- Diff Dx include cataract, glaucoma, PHPV, Retinoblastoma, Retinal detachment, etc.

- In addition to sending a consult, CALL ophthalmologist to make sure the patient is seen ASAP!
See RED

Red reflexes from the retinas can be used by the physician to great advantage. The illustration shown here depicts the inequality of the red reflection or the interference with the red reflections in various conditions. The white dots represent corneal light reflexes.

Techniques: Set the ophthalmoscope (preferably one with a halogen light source*) on zero or close to zero, stand a few feet away from the child seated in the parent’s lap, attract the child with voice or noise encouraging the child to look at the light, compare the red reflexion from each pupil. Both red reflections should be viewed simultaneously and alternately. An expanded observation is the position of the white reflection, the corneal light reflex.

The beauty of this test is that it can be done with a “hands-off” approach; it can furnish accurate information without dilatation of the pupils. As a screening device it is very cost effective. We encourage you to work with this technique. It is useful far beyond all other manual inspection tests for assessment of vision, refraction, motility, alignment, injury evaluations, and eyelid-pupil relationships.

**NORMAL**—Child looks at light. Both red reflections are equal.

**UNEQUAL REFRACTION**—One red reflection is brighter than the other.

**NO REFLEX (CATARACT)**—The presence of lens or other media opacities blocks the red reflection or diminishes it.

**FOREIGN BODY/ABRASION (LEFT CORNEA)**—The red reflection from the pupil will back-light corneal defects or foreign bodies. Movement of the examiner’s head in one direction will appear to move the corneal defect in the opposite direction. (Parallax)

**STRABISMUS**—The red reflection is more intense from the deviated eye.
Basic Techniques for Examining Children’s Eyes

- Age specific
- Start with HISTORY
  - Moms are great diagnosticians!
- Common EXAM components
  - Assessment of vision
  - External anatomy
  - Pupil function
  - Motility
  - Ocular fundus/Red Reflex testing
Ocular History

- Does child appear to see well distance and near?
- Any crossing?
- Family history of eye disorders?
- Recurrent discharge or redness?
- Extreme photophobia?
- NOT to worry about:
  - “Sits close to TV a lot”
External Examination

- Are eyelids symmetric?
- Pupil symmetry?
- Any redness, inflammation, or discharge?
- Cornea clear?
- Are the eyes aligned?
Pupil Exam

- Are the pupils round?
- Symmetric?
  - If asymmetric, is it more asymmetric in dark or light?
- Reactive to light?
Motility Assessment

- Is the pupil light reflex central?
- Do the eyes move fully in all directions?
- Pseudostrabismus vs. true strabismus
Pseudostrabismus
Vision Assessment

- Infants: Eye contact, follows face, smiles
- Toddlers: Cover each eye and follows objects (fix and follow)
- Verbal: Visual acuity screening with appropriate optotype (symbol/letters)
Visual Acuity (VA) Testing

- To have good VA both anterior and posterior visual pathways must be functioning.
- VA testing is the current “gold standard.”
- Can be very labor intensive.
- Should be performed at earliest possible age.
Checking VA

The 3 common errors:

- Child peaks.
- Child memorizes.
- Examiner only projects one letter at time (crowding phenomenon).
VA Testing – “Traditional Eye Chart” Technique

- Patch one eye.
- Generally test at 10 feet.
- Referral criteria:
  - Age 3–5 years
    - Fewer than 4 out of 6 objects correct on the 10/20 (aka 20/40) line or >2 line difference between eyes
  - Age 6 or older
    - <20/30 for 4 of 6 objects or >2 line difference between eyes
AAPOS Vision Screening Kit

- Can order from:
  - AAPOS: [http://www.aapos.org/a hp/vision_screening_kit](http://www.aapos.org/a hp/vision_screening_kit)
  - AAP: [http://tinyurl.aap.org/pu b221192](http://tinyurl.aap.org/pub221192)
Free JVAS Computer-based Screening Test

http://pedig.jaeb.org/JVAS.aspx

- Age specific standardized rapid test
- HOTV surround matching
- Runs on any Windows PC
- Downloadable free of charge
FREE JVAS Vision Screener

http://pedig.jaeb.org/JVAS.aspx

Print Matching Card
FREE JVAS Vision Screener

http://pedig.jaeb.org/JVAS.aspx

Calibrate and Run
FREE JVAS Vision Screener

http://pediq.jaeb.org/JVAS.aspx
FREE JVAS Vision Screener

http://pedig.jaeb.org/JVAS.aspx

Screening Results

Age: 4 years

Right Eye: PASS
Vision meets age appropriate visual acuity of 20/40 or better.

Left Eye: PASS
Vision meets age appropriate visual acuity of 20/40 or better.

The age appropriate visual acuity thresholds used in this program are consistent with AAP/AAO/AAPOS pediatric vision screening policy statements.

AAP - American Academy of Pediatrics
AAO - American Academy of Ophthalmology
AAPOS - American Association for Pediatric Ophthalmology and Strabismus

RESULTS WILL NOT BE SAVED.
Record the results before clicking Close.

Close
What about new vision screening technology?
New Screening Technology

- **Remember in the pre-verbal child, the only way to detect amblyopia is to indirectly detect the risk factors.**
  - Refractive errors
  - Media opacities
  - Strabismus
Objective Screening Technology

- Photoscreening
- Automated refractors
- VEP screening
- Retinal birefringence
Photoscreening

- Similar to Bruckner Reflex.
- Exploits the red-eye one gets in photography to help assess both alignment and refractive error.
Hyperopia

Anisometropia
Photoscreening

- Instrument-based screening is now endorsed by the USPSTF as a valid measure for screening preschool children.

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

- For children older than 5 years, VA testing still preferred.

Photoscreening: Barriers

- **Cost**
  - Instrument, labor, time, space

- **Reimbursement**
  - The adoption of such technology will be highly dependent on the payment decisions of third-party payers. Some third-party payers still fail to reimburse for these technologies, calling them “experimental,” despite the USPSTF recommendation and the AAP position statements on photoscreening.
Summary

- Vision screening should begin at birth and continue throughout well child visits.
- Vision screening is age-appropriate
  - Early Red Reflex testing mandatory
  - VA testing in verbal children
- Objective screening technology is effective, improving, but needs to be reimbursed for widespread adoption.
- Pediatricians are our best line of defense for preventable blindness!
Additional Reading

Challenging Cases in Pediatric Ophthalmology

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