Clinical Pearls: Infant vision examination
Deborah Orel-Bixler, PhD, OD
University of California, Berkeley School of Optometry

Recommended ages for examinations
Recommended populations
Recommendations by professions & legislation
Mandatory eye examinations prior to Kindergarten or preschool enrollment

Infant exam: Questions to answer
Address the chief complaint
Presence of strabismus?
Presence of significant refractive error?
Presence of ocular disease or anomaly?
Provide reassurance of typical development
Provide treatment or provision of appropriate services

Topics in Pediatric Case History
Patient medical history
Pre-, peri-, postnatal
Complications
Achievement of developmental milestones
Family eye and medical history
FOHx: strabismus, amblyopia, refractive error, eye disease

Questions to answer in the exam
Address the chief complaint
Presence of strabismus?
Assessment & Diagnosis of Strabismus
  Hirschberg, Angle Kappa, Krimsky, Bruckner
  Unilateral cover test, Alternating cover test
  Versions and ductions
  Base out prism test
  Stereoacuity

Infantile Esotropia
Onset before 6 months
  Prevalence 1-2% of population
  Account for 28-54% of all ETs
Large deviation  >30 pd up to 120 pd
Cross fixation
Pseudo-limitation of abduction
Overaction of inferior oblique muscles
Dissociated vertical deviation (DVD)
Latent nystagmus
Minimal refractive error

Treatment plan
Correct any hyperopia
Constant alternate patching
Surgery
Prognosis
Differential Dx for Infantile Esotropia:
Abducens (VI n.) paresis, MRI needed
Mobius
Duane’s Type I retraction syndrome
Accommodative Esotropia

Accommodative Esotropia
Refractive
Moderate to high hyperopia; 2 to 6D
>6 D → bilateral refractive amblyopia but no strabismus
Tx: Single vision lenses
   Non-Refractive (high AC/A)
   Low to moderate hyperopia
Near deviation >> distance deviation
   Tx: Bifocals

Primary Exotropia
~80% XTxs are intermittent
onset before age 2 y; 40% onset at birth
Genetic factor in 66%
No correlation with sign of refractive error
Intermittent @ d first, then increase in frequency XP → X(T) → XT
Association with CNS disorders

Anomalies of Oculomotor Development
Motor strabismus
   Infantile ET
   Accommodative ET
   Exotropia
   Nerve palsies
Sensory Strabismus
   “a blind eye becomes a turned eye”

Infant Exam: Questions to answer
Is there a significant refractive error?
Any that could lead to amblyopia
   Anisometropia
   High astigmatism
   Hyperopia risk for accommodative ET
Trends in refractive error
What and when to prescribe
Monitoring/Follow-up

Techniques for Assessing Refractive error
Retinoscopy
Trial lenses or lens bars
Working distance glasses
Distance fixation targets
Remember to:
   Use lenses to find “with motion” and reduce power to neutralization
   Scope both principle meridians of the eye
   Stay on axis
   Control accommodation
   Note change from with to against motion
Techniques for Assessing Refractive error
Retinoscopy with cycloplegia
To confirm refractive error
Decide final prescription
Remember to use:
  - 0.5% Cyclopentolate for < 6 mo
  - 1% Cyclopentolate for > 6 mo & dark irides
  - ALWAYS precede with topical anesthetic
  - supplement with Tropicamide with dark irides

Case ML: Infant Vision Examination
8 month old Caucasian male
First comprehensive vision exam
No strabismus
Retinoscopy without cycloplegia
  OD +1.50 -0.75 x 180  OS +1.25 -1.00 x 180
Retinoscopy with cycloplegia*
  OD +5.25 -1.00 x 180  OS +4.75 -1.00 x 180

What and when to prescribe?
Natural History and Epidemiology of Refractive error
What types of refractive error are typical
How refractive error changes with time
When refractive error interferes with normal development

Refractive error development
Average refractive error of newborns is hyperopia
Prevalence of astigmatism 15 to 30%
In premature infants, the mean refractive error is myopia
Prevalence of hyperopia and astigmatism decrease with age

Prevalence of Spherical Error : 1 month to 4 years
Mayer et al, 2001 Arch Ophthalmol
N = 514 full-term; Cycloplegic retinoscopy

Trends in Refractive Error in the First Year of Life
Severely hyperopic infants at birth remain so at 1 year
Hyperopia at birth (greater with cycloplegia than without) is likely to regress
Myopia at birth (less with cycloplegia than without) is likely to regress
Myopia at birth (same with or without cycloplegia) likely to be myopic at 1 year

Hyperopia is a risk factor for accommodative esotropia
Infants with > +2.5 D are 20 times more likely to develop esotropia (Ingram)
50% of 1 yr olds with +3.5 D developed ET
+ 3.5 D at 6 - 8 mos; by age 4 yr led to a 13-times increase in becoming strabismic and 6-times
increase in having amblyopia (Atkinson, 1996).
Clinical Impact
  - Full Rx for infants with esotropia
  - Partial spectacle correction if no ET

Case ML: Infant Vision Examination
Retinoscopy with cycloplegia*
OD +5.25 -1.00 x 180  OS +4.75 -1.00 x 180
Prescribe for fulltime wear
OD +4.00 -1.00 x 180 OS +3.50 -1.00 x180
F/U 1 mo watch for ET bring photos

Follow-up every 6 mos
Everything stayed the same until…….
Results at age 4 years

**JB: Infant Vision Examination**
9 month old caucasian female
No strabismus but FOHx infantile ET
Poor 10 Base out response OU
Uninterested in StereoSmile test
Retinoscopy without cycloplegia
OD +1.25 -0.50 x 180 OS +1.75 -0.75 x 180
Retinoscopy with cycloplegia
OD +4.75 DS OS +4.50 DS

What would you do?
Follow-up for infant with hyperopia

**Guidelines for Prescribing Refractive Error in Children**

**Minimum infant exam:** Assessment of Visual Acuity

Quantitative techniques
  - Preferential Looking
  - Visual Evoked Potential (VEP)

Qualitative techniques
  - Fixation & Following
  - Suppression of VOR
  - Fixation Preference
  - Objection to patching
  - 10 base down prism

Rule out presence of amblyogenic factors
Is there an eye disease/disorder?

**Amblyopia**
Prevalence 2-3%
6-10 million Americans
60,000 children per year
  - Leading cause of monocular vision loss in 20 -70 year olds
  - Risk of blinding trauma to fellow eye: 16 x greater in children

**Fear of Pediatric Examination?**
Be fast and flexible
Attention is brief, “one toy, one look”
Rely on objective measures
Detect amblyogenic factors rather than measure amblyopia directly
Tailor exam to developmental level of child
Use behavioral reinforcement
Cheerios, toys, praise, be entertaining
Establish rapport
Signs of vision problems in babies
1. Lack of eye contact by 1 month
2. Lack of visual fixation or following by 3 months
3. Lack of accurate reaching for objects by 6 months

Clinical relevance
Cortical visual impairment
  Definition; clinical signs and symptoms of CVI
  Associated neurological deficits
Etiology
Visual Impairment or Blindness in Infants adversely affects:
  Motor development
  Social and communicative development
  Cognitive development
  Emotional development
  Behavior
Infants/children with severe visual impairments should be considered as developmental emergencies and intervention should start immediately

Signs of vision problems in babies
4. Lack of the eyes moving together or strabismus after about 4 mos
5. White pupil (leukocoria) or a significant asymmetry in the usual "red eye" appearance in a flash photograph

DDx for Leukocoria
Congenital cataracts
PHPV
ROP
Posterior uveitis
Retinal dysplasia
Toxoplasmosis
Strabismus
Retinoblastoma
  Commonest malignant ocular tumor
  Prevalence 1 per 15,000 births
  Untreated = fatal; Treated 90% survival
  Usually Dx between 1 to 1.5 years of age
  Hereditary and non-hereditary forms
  Bilateral and/or multifocal

Signs of vision problems in babies
6. Nystagmus
7. Photophobia
DDx Infants with visual impairment, photophobia and nystagmus
Sensory nystagmus
congenital- onset between 8 - 12 weeks of age
acquired- onset within 1 mo after vision loss

Disorders of the retina
Leber’s congenital amaurosis
Albinism
Achromatopsia

Disorders of the optic nerve
Signs of vision problems in babies
8. Persistent tearing when the infant is not crying
   - Lacrimal duct obstruction
   - DDx of glaucoma or micro-ophthalmus
     - Term infants: Corneal diameter mean = 9.8 mm
     - Abnormal for term infants is >11 mm or < 9 mm
   - Decreased vision with glaucoma due to optic nerve damage, corneal scars, and cataracts.
   - The earlier the onset of glaucoma the poorer the prognosis

Signs of vision problems in babies
9. Ptosis
   - Lid Hemangioma
10. Any asymmetry of pupil size
    - Congenital Horner’s (rule out neuroblastoma)
    - Anisocoria, Mild ptosis, Heterochromia, lack of facial flushing
11. Any obvious abnormalities of the shape or structure of the eye

Helping hand
The first three years of life is the most critical period in every child’s development
Federal laws mandate early intervention services for infants who have disabilities and for their families
The primary purpose of early intervention services is to support families in enhancing their infant’s
development and to ensure optimal outcomes for them

Questions to answer in the exam
Address the chief complaint
Presence of strabismus?
Presence of significant refractive error?
Presence of ocular disease or ocular anomaly?
Provide reassurance of typical development
Provide treatment or provision of appropriate services
Referral to Pediatric Ophthalmologist
Referral to Blind Babies Foundation