Clinical Testing and Treatment of Infantile Strabismus

Curtis R. Baxstrom, MA, OD, FCOVD, FNORA

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Introduction

Infant Binocularity
- Is an infant binocular at birth?
- Exotropia vs. Esotropia
- Congenital vs. Infantile Esotropia
- Single vs. Multiple Causal Factors
- Esotropia - Time of Onset

Single vs. Multiple Factors Leading to Strabismus
Possible Factors of Strabismus

- Genetics
- Orientation and Localization
- Reciprocal Interspacing (bilateral, reflexes, etc.)
- Accommodation
- Abduction Deficits
- Motion Processing
- Vestibular influences
- Cross fixation
- Effects of treatment (lenses, etc.)

- Interocular Differences
- and Emmetropization
- Motor to Sensory Development
- Visual Field development and similarities within the visual fields

- Principles of development
- Attentional Distribution
- Systemic Disease / Trauma
- Monodeprivation (cornea, lens)

Time of Onset for Strabismus

- 4 Months - supine
- 9 Months - sitting / standing
- 18 Months - locomotion
- 3 Years - preschool, moving in space

Differential Diagnosis

- Accommodative esotropia
- Pseudoesotropia
- Duane’s Type I
- Nystagmus Blockage Syndrome
- 6th Nerve Paresis
- Others
Infantile vs. Accommodative Esotropia

<table>
<thead>
<tr>
<th></th>
<th>Infantile</th>
<th>Accommodative</th>
</tr>
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<tbody>
<tr>
<td>Onset</td>
<td>Birth to 6 months</td>
<td>&gt;6 months to 7 years</td>
</tr>
<tr>
<td>Angle</td>
<td>25 to 60 PD</td>
<td>10 to 40 PD</td>
</tr>
<tr>
<td>Refraction</td>
<td>&lt; 1.50 sphincts</td>
<td>&gt; 3.00 sphincts</td>
</tr>
<tr>
<td>Amblyopia</td>
<td>uncommon</td>
<td>uncommon</td>
</tr>
<tr>
<td>L or ML nystagmus</td>
<td>common</td>
<td>uncommon</td>
</tr>
<tr>
<td>DVD</td>
<td>common</td>
<td>uncommon</td>
</tr>
<tr>
<td>DOA</td>
<td>common</td>
<td>uncommon</td>
</tr>
<tr>
<td>Motion Asymmetry</td>
<td>common</td>
<td>uncommon</td>
</tr>
<tr>
<td>VOR</td>
<td>common</td>
<td>uncommon</td>
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Developmental Considerations and Unique Characteristics to Consider When Evaluating Infants

- Kraskin – “Three Fundamental Abilities”
- Rethy – “Vision moves from motor to sensory”
- Sutton – “Movement is learning”
- Streff – “Vision is Motor”
- Pepper – “Principles of Movement”

Developmental Considerations and Models

Three Fundamental Abilities Dealing with the Space Construct

<table>
<thead>
<tr>
<th>Information Processing</th>
<th>Movement Patterns</th>
<th>Three Fundamental Abilities</th>
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<tbody>
<tr>
<td>Balance with Gravity</td>
<td>Orientation</td>
<td>Freedom to compute</td>
</tr>
<tr>
<td>Where am I?</td>
<td>Localization</td>
<td>Range to compute</td>
</tr>
<tr>
<td>Balance with Task</td>
<td>Centering/ Identification</td>
<td>Facility to compute</td>
</tr>
<tr>
<td>Where is it?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manipulate Task</td>
<td></td>
<td></td>
</tr>
<tr>
<td>What is it?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Rethy – Motor to Sensory

Quantitative vs. Qualitative Information - RGMR
- Skeletal Component - seek and hold image
- Visceral Component - discriminates and defines the image
- Cortical Component - unifies and interprets the image

Visual Models and RGMR
- Optical Model - primarily skeletal
  - Reach - vergence
  - Grasp - accommodation
  - Release - change fixation or attention
- Developmental Model - adds visceral and cortical
  - Manipulate
    - Projection - as if it were …
    - Prehension - localize with hands, confirmation
    - Locomotion - time and space beyond reach

Projection and Manipulation
Principles of Movement (RGMR)

- Can I do it?
- How well can I do it?
- How long can I do it?
- Can I accept change?
- Can I problem solve?

Evaluation of Infants
What is the most important component of an infant exam?

Does the Case History tell us everything?

How about motor development as an indicator of visual development?

Prematurity

10 Years Ago
- 28 weeks 50% lived
- 26 weeks none lived

Today
- 30 weeks >80% live
- 26 weeks 50% live
- 24 weeks >25% live

Evidence for Developmental Hx


- Pulled Hastings Records and looked for Infantile Esotropia Dx that had not been previously treated
- Compared to matched to non esotropes by age and gender
  - Twenty Six Factors Evaluated
  - Twelve were significant at .05 or better
Evidence for Developmental Hx

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Behavioral Observations - Manipulation and Projection

- Fundamental abilities to learn the construct of space and time
- Projection - static or dynamic?
- Prehension
- Development of Postural Control
- Locomotion
- Don’t forget the factor of time

Visual Acuity

- Changing optical properties, focusing
- Differentiation of fovea, changes in photoreceptors and dendrites
- Myelination of visual pathway
- Increased synaptic connectivity and pruning
- * Changes in arousal, sleep cycles

Reduce the risk of SIDS

Babies should be placed on their backs to sleep. This is true both at night and for naps unless your doctor says otherwise.
Methods and Probes

- Fix and follow, resistance to occlusion
- OKN
- Teller cards
- Face Dot paddle
- Other FPL cards / paddles
- Electrodiagnostic – VEP / VER
Retinoscopy and Refractive Status

Special Considerations
- Qualitative factors - brightness, pattern, color, equality
- Single vs. multiple distances
- Autorefractors
- Four steps to binocularity-Getman
  - X 180-horizontal scan, X 90-vertical scan
  - X 45/135 (looking at two places at once?)
  - Cycloplegia (dilation enough)

Color of Retinoscopy (OEP 1958)
- Dull Red-low recognition or awareness
- Bright Pink-better recognition, not on spatially
- Dull Pink-first indication of quality reflex
- White Pink-better quality, some refractory states
- White-now "set" with quality and consistency
Development of Retinoscopic Reflex in Infants

- Findings of Getman, up to 8 months
- Random Stage
- Right or Left Stage
- Right and Left Stage
- Bilateral Stage

Accommodation

- Gross vs. Fine
- Striated vs. Smooth tissue
- Center of rotation, projection (as if)

Fixation and Abduction Deficits

- Fixation is a volitional limitation of movement
- Hirschberg differences
- Nasal retina more dominant
- Volitional abduction deficit with corresponding cross fixation pattern
- Relative abduction deficit not present or less with doll’s eye test (vestibularly driven)
- Gaze palsy

Pursuit and OKN Asymmetries
Vestibular Ocular Evaluation

IOOA – Inferior Oblique Overaction

DVD – Dissociated Vertical Deviation

and the Dorsal Light Reflex
**Stereopsis**

- **Visual Fields - binocular hemifield**
  - Birth: 17-34 degrees
  - 3 Months: 40-50 degrees
  - 6 Months: 70-84 degrees
Treatment of Infantile Esotropia

Traditional Medical Approaches

- Do Nothing, Deny Everything
- Lenses to “correct” refractive error
- Unilateral patching
- Muscle Surgery
- Botox injections

Traditional Optometric Approach

- Do Nothing
- Visual Guidance
- Lenses, Prisms
- Selective Occlusion
- Vision Therapy
  - Direct
  - Delayed or Passive
Procedures Should Possess Four Characteristics
- Must be of value in itself
- All techniques should be related in some fashion
- All techniques should set the stage for what follows, or establish a better foundation
- Each technique should serve as a measuring device (patient and therapist)

Traditional Visual Guidance

Refractive Status
- Smith and Atkinson support less than full manifest refraction
- Quality and range of visual contact
- Symmetry
- Watch facial changes

Selective Occlusion
- Complete
- Full vs. Part Time
- Selective
  - Area – sector, binasal, dot
  - Graded to Opaque
  - Set vs. alternating pattern
Why might sector occlusion help?
- Eliminates cross fixation pattern
- Prevent amblyopia
- Prevent anomalous correspondence
- Promote alternation of eyes
- Decrease confusion / strabismus
- Modify visual field relationships
- Modify amount and quality of light between eyes (suppression)
- Easier adaptation versus full occlusion

Treatment of Infants Beyond the Optical Model
- Extended Visual Guidance
- Cranial Osteopathy / Cranial-Sacral
- Abduction Deficit / Cross Fixation
- Motion Asymmetries
- Vestibular Considerations
- Later influences of accommodation
- Do developmental delays and conditions affect our outcomes?

What is the single greatest factor impeding our success with infantile esotropia?

Extended Visual Guidance
- Basics - change crib, viewing positions, inform regarding Johnny jump ups, walkers, etc.
- Bilaterality, Reciprocal Interweaving (Rowley)
- Arousal state should be considered
- Attentional Distribution
- Breaking of esotropia pattern
  - McCarthy(4mo) and Nasopalpebral Reflex, blink
- Watch for occlusion factors
- Increase lateral viewing and vestibular rotational activities
- Biochemical and nutritional considerations
- Others
Cross Fixation and Abduction Deficits

- Cross Fixation- binasals, sector
- Abduction Deficit
  - Cranial Osteopathy/Cranial Sacral
  - Pursuits/Saccades - Ludlam
  - OKN
  - Doll’s Eye - vary speed and range
  - Vestibular - Rotational Therapy

Cranial Osteopathy / Cranial Sacral Therapy

- Cranial pulse or rhythm
- Cranial molding and movement
- Petrosphenoidal Ligament / Ligament of Gruber

See [www.cranialacademy.com](http://www.cranialacademy.com)
Motion Processing Asymmetry

- Pursuits - slow to faster (N to T)
- OKN - slow to faster (N to T)
- Watch for changes in stereopsis
Vestibular Ocular Considerations

- What keeps an infant's eyes straight at birth?
- Vertical strabismus prior to age one?
- Self-stimulation for improving bilaterality
- Arousal

Vestibular Protocol

- Reason for vestibular stimulation
  - Child likes it
  - Arousal
  - Symmetrical ocular motor tone
  - Increase ROM, change pattern of gaze palsy
  - Combined with prism compensation, for angle reduction

Vestibular Protocol

- Eyes closed or in dark room
- In lap, chair or held
- Head position for lateral SC canals
- Rotations - minimum 1, maximum 10
- Fixation activity post rotation, also can use mirror if single caregiver
- Uncover or lights on for fixation
- Speed - just under 1 cycle per second
- PREVENTION/GUIDANCE - lateral swings
Infantile Esotropia Cases

Treatment Summary

- Case History and Evaluation
- Visual Hygiene
- Appropriate Lenses
- Selective Occlusion for Cross Fixation
- Range of Movement for Abduction Deficit and/or Cranial Osteopathy
- Once binocularity established, consider removing tools
- Appropriate follow-up care

Thank you for your interest in this special population!