Infantile Esotropia
Diagnosis and Management

Introduction

“He who sees things grow from the beginning, will have the finest view of them.”
Aristotle 384-322 B.C.

Congenital vs. Infantile Esotropia

- Nixon, et. al. study
- Sondi, Archer, von Noorden study
- PEDIG 2002-175 infantile eT (40% reported at birth)
- Trust parents observations? Scan pattern?
- Scheiman and Wick reviewed infantile esotropia - found 28-54% of all esotropia is infantile in origin
- Treat this as an infant, child or adult?

Causes of Infantile Esotropia

What leads to the Development and Diagnosis of Infantile eT?
Eye Scan 2-3 months

Eye Scan 4-6 months

Infantile vs. Accommodative

<table>
<thead>
<tr>
<th></th>
<th>Infantile</th>
<th>Accommodative</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Onset</strong></td>
<td>8-6 mo</td>
<td>&gt;6 mo to 7 yrs</td>
</tr>
<tr>
<td><strong>Angle</strong></td>
<td>25-60PD</td>
<td>10-40PD</td>
</tr>
<tr>
<td><strong>Refraction</strong></td>
<td>&lt;+3.00D</td>
<td>&gt;+3.00D</td>
</tr>
<tr>
<td><strong>Amblyopia</strong></td>
<td>uncommon</td>
<td>common</td>
</tr>
<tr>
<td><strong>LN, MLN</strong></td>
<td>common</td>
<td>uncommon</td>
</tr>
<tr>
<td><strong>DVD, IOOA</strong></td>
<td>common</td>
<td>uncommon</td>
</tr>
<tr>
<td><strong>Motion Asym</strong></td>
<td>common</td>
<td>uncommon</td>
</tr>
<tr>
<td><strong>VOR</strong></td>
<td>common</td>
<td>uncommon</td>
</tr>
</tbody>
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The whole is greater than the sum of its parts.

Gestalt Theory

PEDIG Studies of Infantile Esotropia

- Clinical Spectrum of Early-onset Esotropia
  - Amblyopia frequently develops ↑ (increases post-surg)
- The Natural History of Infantile Esotropia During the First Six Months of Life
  - Early surgical Tx may lead to increased coarse stereo ↑
- Spontaneous Resolution of Early Esotropia
  - <20 wk, <40PD, int or variable-likely to resolve
  - Constant >40PD after 10wk-not likely to resolve
  - *CONCERN – abduction deficit, off axis size

Etiological Factors

- Abduction Deficit/Pseudoparesis
  - Why not recognized ↑ What if it disappears later ↑
  - Atrophy vs. Contracture, Primary vs. Secondary actions
- Cross Fixation
  - Abducting eye should lead localization - West
- Motion Processing Asymmetries
  - Nasal to Temporal develops with stereopsis - Tychsen
- Suppression and DVD, IOOA
  - Dorsal Light Reflex - Brodsky
- Others
Abduction Deficit – Underreported?

- Paresis vs. Paralysis vs. Pseudoparesis
  *Basic motor disorder is abduction deficit, if asymmetric-can develop amblyopia.
  *95.4% demonstrated abduction, 63 of 65 cases

What Leads to an Abduction Deficit?

- RARE-bilateral sixth nerve palsy, uni-maybe
- Birth trauma
- Viral infection
- Vaccination – 2,4,6 mo 6 types, MMR-case reported
- Impingement of CN 6 by petro-sphenoidal ligament?
- Lack of oculocentric direction – T-N motion based, thus not leading by abduction, cross fixate leads T-N basis
- Precipitated by ear, nose, throat infection-petrous infl.
- Other – Perhaps CN3 myelinated prior to CN6?

Motion Processing

- At birth T to N is present (subcortical)
- Monocular N to T begins 2-3 mo., est. 4 mo.
- Symmetry by 9 mo., cortical in origin
- Confusion using OKN as visual acuity tool?
- Visual experience needed for maturation
- *Stereo parallels development of OKN at 4-6 mo. CRITICAL?

Motion Processing

- *Can be used as differential test for time of onset / type of esotropia
- Likely on a continuum (qualitative)
- Right and Left not necessarily symmetrical
- Evaluation – OKN, Pursuits, Motion VEP
- Basis for Latent Nystagmus, or also vest.?
- Key - evaluate MONOCULAR!!!

Development of Motion Pathway

Monocular Pursuit Asymmetry
Traditional Medical Treatment

- Monocular Patch – what is goal?
- Surgery – now pushed earlier, vs. europeans
  - Why earlier?
- Botox
- Prisms – Birch and Stager study
- Non-Surgical Treatment – Rethy, Sarniquet-Badoche and others

Birch and Stager Prism Study

- Compensatory prism with infantile esotropia
- Up to 4 mo. strabismics showed some stereo, equal to normals
- After 4 mo. the stereo still dropped off with compensatory prism in place vs. normals
- Why?
  - Ocular motor may not be symmetrical – development of atrophy / contracture
  - Lack of proprioceptive support
  - No change in abduction deficit or motion asymmetry

Birch Prism and Stereo Study

Mistake of Strabology - Rethy

- Miss the possibility of prevention
- Believe in unknown causes
- Apply symptomatic tx, not causal therapy
- Does an Optometric approach cover these?
“Treatment should be directed toward what is best for the patient, not for the surgeon.”

Stefan Rethy, MD

Review of Literature

- Spontaneous Recovery
- Amblyopia
- Stereopsis
- DVD, IOOA
- Surgery vs. Non-Surgical

Spontaneous Recovery

- PEDIG Study
- Smaller angles, more intermittent appear to recover easier
- Infants who do NOT develop vergence 3-4 mo, appear to develop infantile eT, is cross fixation a substitution for the development of vergence?
- Over the years, many pediatrics do not refer out and often suggest infants will grow out of it

Vanishing Infantile Esotropia

Clark and Noel Canadian J Ophthal 1982;17(3):100-2

Three cases of large angle infantile esotropia are presented. Over a minimum of 37 mo the angle decreased spontaneously to less than 10 prism diopters without surgery or the use of glasses.

Complications of infantile esotropia developed including: bilateral IOOA, latent nystagmus and dissociated vertical deviation.
Spontaneous Resolution of Infantile Esotropia

3 cases diagnosed with infantile esotropia prior to 6 months demonstrated spontaneous recovery of their condition. By age 34 to 59 months the esotropia had changed to exophoria, esophoria less than 4 PD or orthophoria.

These patients showed relatively poor stereocuity, dissociated vertical deviation and overaction of the inferior oblique muscles.

VeNoorden-Surgical Success

Optimal – Before 2 years best
Desireable
Acceptable
Non-Acceptable

BEST OVERALL 1-3 is after 4 years

SUMMARY of Early Surgical Outcomes

- Ignores possible causes for infantile et
- Amblyopia increases
- No more with Stereopsis, but better quality
- Fusion-no difference if surgery before 2 yo
- Increase in DVD/IOOA
- Side effects do occur
- Concerns about ADHD, LD, Cognitive and Behavioral concerns secondary to early anesthesia

Do No Harm?
Interventions for Infantile Esotropia (Review)
The Cochrane Library 2005 #4 and again 2011

The main body of literature on interventions for IE are either retrospective studies or prospective cohort studies. It has not been possible through this review to resolve the controversies regarding the type of surgery, non-surgical intervention and age of intervention. There is clearly a need for good quality trials to improve the evidence base for the management of IE.

Optometric Literature on Tx of Infantile Esotropia

- London, Griffin, Mazer-13 mo surgery, 11yo VT
- Christenson-post surgery, after one year old
- Forrest-8.5 mo phoric by 2yo, essentially motor therapy
- Maples-seen 6 mo, started tx at 18 mo, Topical Journal on Infants, OVD 37(3) 2006
- Data not found regarding abduction deficit, motion processing, IOOA or DVD, in any cases

Barriers to Infantile Esotropia Tx

- Some say it is too difficult to work with infants
- I disagree, we simply need to get into the infants world and help them to discover learning
- Here is a typical example of a young one who we worked with and just needed developmentally appropriate activities to help pattern appropriate visual skills.

Optometric Management

- Binasal and Sector Occlusion
  - Placement considerations
- Abduction Considerations
  - Abducting eye should lead localization, motor fusion
  - Stereopsis should follow, temporal considerations
- Motion Processing Considerations
  - Onset matches development of stereopsis
  - Perhaps key to gaze holding, stereopsis

Why might binasal occlusion work?

- Impedes Cross Fixation – KEY!
  - Decreases abduction deficit, the abducting eye should be leading lateral localization !!!
  - Promotes N-T motion processing !!!
- Prevents amblyopia
- Promotes peripheral fusion
- Prevents anomalous correspondence
- Promotes alternation of eyes, easier guidance and ADL

Why might binasal occlusion work ?

- Vary width and effects upon Sensory-Motor
- Can place asymmetrically for promotion of alternation
- This modifies visual field relationships, also known as penalization
- Modifies amount and quality of light approaching the eyes (suppression) ?
Lateral Viewing

Abduction should lead

**How might a binasal work?**

**Binasal Effects on Visual Input**

- Emphasis to localize monoc. with less confusion
- Nasal Retinal Localization
- Motor Fusion
- Decussate
- Temporal R.- Stereopsis
- Non-Decussate
- Cross at Corpus Callosum

**Visual Field to Ocular Dominance Columns**

**Abduction Deficit - Therapy**

- Pursuits
- Saccades (eye throwing?)
- Monocular prism jumps
- OKN Cloth (motion)
- VOR – doll’s eye
- Vergence if fusing – in/out, lateral excursions
- Ron, et. al. study on oculomotor subsystem transfer

*Binasal helps set the stage for biocular work*
Motion Processing Therapy

- Binasal sets the stage for treatment
- Types – pursuits, OKN, Vestibular input
- ADL’s- feeding, diaper change, etc.

Vestibular Applications

- Parents including it daily, with fixation (mirror)
  - Consider prism with it therapeutically?
- Increase arousal – involved in therapy, postural control improved, suppression? (BO/BI ranges)
- *Slow away from abduction deficit for stretching
- *Faster, post rotary nystagmus to break abduction, with volitional looking
- Sue Barry speaks of NOVELTY in adult plasticity, what about infants?

Cranial Osteopathy

- Cranial pulse, rhythm
- Cranial molding and movement
- Petrosphenoidal ligament (ligament of Gruber)
- www.cranialacademy.com
- Upledger Institute – Chiropractic, others

Considerations of the Petrosphenoidal Ligament ala… Ligament of Gruber

- Origins are dorsum sellae(sphenoid) and petrous process(temporal bone)
- CN6 passes below it, before entering the cavernous sinus…
- But…2/3 are divided, half under and half above.
- Thus only 1/3 of cases would be possibly fully affected by the ligament..is this why we don’t see more abduction deficits?
Optometric Goals

- Decrease abduction deficits
- Decrease cross fixation
- Increase alternation
- Promote ipsi eye leading localization
- Emphasize peripheral fusion
- Do we “cure”, or manage the condition?

Case Examples

- Does infantile esotropia treatment include only infants? Or also adults who had it earlier?
- Early onset, abduction releases early on
- Abduction won’t release, what else?
- Adult infantile esotropia

Summary Overview

- Decrease abduction deficit and cross fixation
- Increase lateral tracking, motion processing
- Allows for peripheral fusion, decrease need for suppression, effects upon DVD and IOOA
- If you believe a surgical approach should be your first choice of treatment, what might be easier for a surgeon…treat an infantile esotrope with an abduction deficit or full range of movement? (hint: think consecutive exotropia)

Thank you for the opportunity to share with you some ideas and thoughts on the diagnosis and treatment of infantile esotropia!