Disclosures

- Nothing to disclose

Course Goals

- Develop the ability to take a history for a child with reading problems, including knowledge of educational terms
- Learn specific tests for symptoms of a child with reading problems including how the tests assess for problems in visual skills that are important for reading.
- Review treatment options

Once upon a time, there was a very ugly duckling. One day a beautiful princess came along and rescued him from a horrible fate. She picked him up into her hands and was ready to kiss him when.... when....

Smith had made a promise. But could Turboland keep it? By 1961 some jabots had reached a few hundred kilometers up into the surrounding belt. But the gelf was almost a quarter of a million kilometers away! A trip to the gelf and back would take eight yims. By 1961 only one turban had ever been up in a jabot—and for only fifteen stashes!

1. Summarize the paragraph in your own words.
2. Who made a promise?
3. List two goals that Turboland achieved by 1961.
4. Based on these accomplishments, did Turboland achieve what Smith had promised? Explain.
5. How do you think Turboland might have felt about Smith?
Chief Complaint

- What type of problem reading?
  - Blurry vision
  - Tired when reading
  - Words double
  - Headaches when reading
  - Blurry vision
  - Loss of place
  - Words move on the page
  - May indicate visual efficiency problem

Visual Efficiency Problems

- Acuity
- Binocularity
- Accommodation
- Motility/Tracking
- When children read to learn
- Grades 3 (end of year) / 4+

Chief Complaint

- What type of problem reading?
  - Reversals
  - Letters
  - Words
  - Poor recall for material (i.e. spelling words)
  - Difficulty recognizing words
  - Problems learning alphabet
  - Sloppy handwriting
  - Problems sounding out words
  - Poor comprehension
  - Problems learning the main idea from insignificant details

Visual Processing Problems

- Visual Spatial Skills
  - Laterality/directionality
- Visual Analysis Skills
  - Visual Discrimination
  - Visual Form Constancy
  - Visual Memory
  - Visual Figure Ground
  - Visual Closure
  - Important to reading, math concepts
  - Earlier grades K-3 when child is learning to read

Educational History

- Current grade in school
  - Retention? When?
  - On grade level for math/reading?
  - Prior testing
  - Interventions?
  - Accommodations (public schools)
    - IEP
    - 504 Plan

Refractive Error

- Myopia
- Astigmatism
- Hyperopia
Hyperopia - Preschool

- Vision in Preschoolers (VIP) Uncorrected Hyperopia and Preschool Early Literacy
  - Ophthalmology 2016
  - Retinoscopy ≥ +4.00 OR
  - Retinoscopy ≥+3.00 ≤ +6.00 with decreased near acuity (20/40 or worse) and stereo (240° or worse) in 4-5 year olds
  - WORSE EARLY LITERACY in grade K
  - TOPEL
  - Print knowledge
  - Definitional vocabulary
  - Phonological awareness

Hyperopia - School age

- Rosner & Rosner 1997, JAOA
- 782 Children diverse racial & ethnic backgrounds
- Grades 1-5
- Result: Significantly lower achievement test scores among children with refractive error > +1.25 (dry)
- vanRijn et al 2014 OVS
- 65 children Ages 9-10
- At least +0.75 in least hyperopic eye
- Result
  - Full correction improved 1 minute reading score 13%

Over Minus

- Over minus by 2D can cause ADHD symptoms!

Visual acuity alone is a very poor predictor of reading efficiency and symptomatology

Association between reading speed, cycloplegic refractive error, and ocular motor function in reading-disabled children versus controls

Deficits in visual function are far more prevalent in school-aged children with [developmental dyslexia] than in [typically-developing] readers [...]

JAMA Ophthalmology
Assessing Binocularity:
- Cover test
- Near Point of Convergence
- Stereopsis – Global/Local
- Phoria
  - Von Graefe technique
  - Modified Thorrington
- BI/BO Vergences
  - Step
  - Smooth

Diagnosing Binocular Vision Disorders
- Convergence Insufficiency
  - Prevalence 6-10% pediatric population
  - Associations: ASD, ADHD, Concussions, Lyme Disease, Alzheimer’s, Parkinson’s
- Convergence Excess
  - Prevalence: 0.8-7.1%
  - 5.4% EP'

Convergence Insufficiency - Signs
- Receded NPC
  - ≥26cm
- XP’ > XP
  - By 4Δ
- Reduced positive fusional vergence (Base out)
  - Fail Sheard
  - Blur/Break ≤ 15Δ
  - Prism Bar
- CISS > 16

Near Point of Convergence
- Accommodative target
  - Fixate letter along the patient’s midline; slowly move the stick towards the patient at eye level
  - Subjective
  - Objective
- Can repeat 3X to see if worsens
- Non-accommodative target (R/G)
  - Subtler cases
  - Normal – 1cm
  - Abnormal – very reduced

Sheard’s
- Fusional reserve must be at least twice the demand for asymptomatic
  - 10XP’, blur/break > 20
- Phoria can vary
- Time of day, testing
- Sheard’s does not look at recovery
  - 10 exo
  - BO x/22/0

CISS - Convergence Insufficiency Symptom Survey
Convergence Insufficiency Treatment

- BI Prism
- Sheard’s?
  - Vergence ($\Delta$) = 2/3 demand (phoria) - 1/3 reserve (blur/break)
  - Ex: 16$^\Delta$ XP'; NBO : x/24/16
  - $[2(16)-24]/3 = 2.67^\Delta$
- Vision Therapy (CITT Study)

Convergence Insufficiency Treatment Trial (CITT) ART

- Binocular/accommodative therapy does not improve reading.
- Both treatment and placebo groups improved in reading but not to a significant degree.
- 16 weeks
- Exclusion
- Uncorrected hyperopia

CITT - ART

<table>
<thead>
<tr>
<th>Treatment Group</th>
<th>Placebo Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brock String</td>
<td>Ductions and versions</td>
</tr>
<tr>
<td>3 Dot Card</td>
<td>Prism dissociated bi-ocular rock</td>
</tr>
<tr>
<td>Eccentric Circles</td>
<td>High Low Contrast VA</td>
</tr>
<tr>
<td>Aperture Rule</td>
<td>After Image</td>
</tr>
<tr>
<td>Vectograms</td>
<td>Visual Closure Skills</td>
</tr>
<tr>
<td>Computer Orthoptics</td>
<td>Visual Figure Ground</td>
</tr>
<tr>
<td>Bulls Eye Rock</td>
<td>Visual Spatial Skills</td>
</tr>
<tr>
<td>Lens Sorting</td>
<td>Visual Discrimination</td>
</tr>
</tbody>
</table>

Convergence Insufficiency Treatment Trial (CITT)

- Most effective treatment for CI was office based therapy combined with home reinforcement activities (75% achieved improvement v. 43% home based)

We even have imaging data to support VT interventions now!

"The significant change in blood oxygen level dependent response in the occipital areas following rehabilitative vision therapy... suggests that both depth and vergence may be enhanced..."
Pseudo-CI?

- Really an accommodative problem
- Present with signs of CI
  - Reduced NPC
  - Reduced PFV
  - XP'
- May also demonstrate: reduced amplitude of accommodation, high lag
- But, patients with CI can have accommodative problems

Pseudo-CI?

- Testing
  - NPC Accommodative and non-accommodative target
    - More reduced non-accommodative = CI
    - Both “bad” = PCI
  - Retest NPC with low plus!
  - If pseudo CI will improve
- Treatment
  - Low plus glasses for near
  - VT

True CI

- XP'
- Reduced NPC
- Low PFV
- May have low amps
- Plus makes it worse
  - NPC worsens

Pseudo CI

- XP'
- Reduced NPC
- Low PFV
- May have low amps
- Plus makes it better
  - NPC improves
  - TTN

Convergence Excess

- EP' > EP
  - Cover Test
  - Von-Graefe
- Reduced negative fusional vergence (BI)
- Other findings
  - Low positive relative accommodation (PRA)
  - High negative relative accommodation (NRA)

Convergence Excess

- Treatment
  - Low plus glasses for near
  - Vision therapy
  - Prism Glasses (BO)
    - Saladin’s 1:1 Rule for Esophoria
    - BO ∆ = (phoria - B1 recovery)/2
    - Ex: 8° EP', NFI range x/4/2
    - (8-2)/2 = 3° BO
Randot Stereopsis
- Do not allow the patient to turn or tilt the head
- Expected 40” for Wirt Circles
- All shapes (bifoveal)
- Retest with new prescription anytime
  Wirt stereopsis is reduced
  - Low hyperopia

Signs and Symptoms of an Oculomotor Dysfunction
- Loses place while reading or uses finger to keep place
- Skips lines
- Rereads words or lines
- Word omissions, substitutions and/or transpositions
- Poor reading fluency
- Math columns
- Problems with Scantron sheets

Gross Measurement of Saccades
- Chairside Saccades
  - 16 inches apart
  - Look at each target
  - Change timing
  - Horizontal
  - Head movement common < 8-9 years
- NSUCO Saccades
  - Standardized
  - Accuracy, Ability, Head, Body Movement
  - No instructions
  - Standing

NSUCO Scoring

Saccadic Tests
King Devick (K-D)
- 3 Horizontal Tests of increasing difficulty
- Normed times for each age
- Concussion
- www.kingdevicktest.com
DEM Test C Read as quickly as possible across each row.

KD Saccadic Test Demo

KD Saccadic Test 1

KD Saccadic Test 2

KD Saccadic Test 3

Research on Treatment of OMD
Treatment of Oculomotor Dysfunction

- Automaticity problem = referral to SLP
- Vision Therapy
  - Monocular saccades
  - Large to small
  - Equalize skills between eyes
  - Can incorporate accommodation/vergence

Accommodative Symptoms

- Blurry vision when reading
- Headaches when reading
- Eyestrain
- Red eyes when reading
- Tired when reading
- Avoids reading
- Near to Far or Far to Near Blur

Accommodative Anomalies

- Prevalence
  - Very variable 1-70%!!
- Methods
- Common with other BV conditions
  - 74% in CIT Study
- Common with Medications
  - ADHD Stimulant Medications
  - SSRIs
- Common in systemic conditions
  - DS
  - CP

Assessing Accommodation

- Accommodative Amplitude: Push-up Method/Pull Away/Minus Lens
- Negative Relative Accommodation (NRA)
- Positive Relative Accommodation (PRA)
- Accommodative Facility (+/-2.00)
- Accommodative Response
  - Monocular Estimate Method (MEM)

Accommodative Facility

- +/-2.00 lenses
- 20/30 print at 40 cm with child saying ‘clear’ or calling out letters as lenses changed.
- Done binocularly and if problem, monocularly
- Binocular also uses vergence

<table>
<thead>
<tr>
<th>Age</th>
<th>Binocular</th>
<th>Monocular</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 year old</td>
<td>1.5-1.5 cm</td>
<td>3.8 cm</td>
</tr>
<tr>
<td>7 year old</td>
<td>1.6 cm</td>
<td>4.5-6.5 cm</td>
</tr>
<tr>
<td>8-12 years</td>
<td>3.5-3.5 cm</td>
<td>6.5-9.5 cm</td>
</tr>
<tr>
<td>13-30 years</td>
<td>3-13 cm</td>
<td>6-16 cm</td>
</tr>
</tbody>
</table>

Accommodative Response

- MEM (Monocular Estimate Method) retinoscopy
- Distance Rx
- Child reads off age-appropriate card on retinoscope
- Scope each eye when reading
  - Do not occlude an eye
- Expected +0.50 (+0.25 to +0.75)
- High in DS, CP
Amplitude of Accommodation - normal values

- Hofstetter’s norms
  - Average amplitude: 18.5-1/3 age
  - Minimum amplitude: 15-1/4 age
- But: Swedish study
  - Overestimated by 2D!
  - (15-1/4 age) - 2

Sterner B. et al. The amplitude of accommodation in 6-10 year old children – not as good as expected! Ophthal Physiol Opt 2004. (24); 246-51

Diagnosing & Treating Accommodative Dysfunction

- Accommodative Insufficiency – difficulty stimulating accommodation
  - Low amps
  - High MEM/FCC
  - NRA>PRA
  - Treatment
    - Low plus at near

- Accommodative Infacility – difficulty changing accommodative response
  - Falls accommodative facility monocularly
  - May have difficulty with NRA/PRA (low)
  - Treatment
    - Low plus at near
    - Vision Therapy

Visual Processing Problems - Evaluation

- Visual Spatial Skills
  - Tests for letter reversals
    - Jordan/Gardner
  - Visual Analysis Skills
    - Test of Visual Perceptual Skills (TVPS)
  - Integration of Vision
    - Eye Hand (Visuomo)
    - Beery VMI
- Optometrist
- Psychologist

Visual Spatial Skills

- Jordan/Gardner
  - Identify reversed letters alone or in words

TVPS

- Visual Discrimination – identify the same object
- Visual Spatial Relations – identify the different form
- Form Constancy – find same form rotated, different size
**TVPS**

- **Visual Figure Ground** – find form hidden among others (main idea from insignificant details)

- **Visual Closure** – which form will make the complete form

**TVPS - Memory**

- **Visual Memory**

- **Visual Sequential Memory**

**Visual Motor Integration**

**Other resources:**

[Image of other resources]

**THANK YOU!!**

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