Objectives

- Review diagnosis of common nearpoint vergence disorders:
  - Convergence excess
  - Convergence insufficiency
  - Fusional vergence dysfunction
- Explain how to use added plus lenses or relieving prism in managing these conditions
- Review research on efficacy of treatment
- Explain how to prescribe VT for these conditions

Overview of Nearpoint Vergence Disorders

- Prevalence
  - ~14% of children (Scheiman et al., JAOA 1996)
  - ~10% of university students (Porcar & Martin-Palomera, OVS 1997)
  - Convergence excess more common than convergence insufficiency in the general population
  - Convergence insufficiency VERY common in acquired brain injury

Common Symptoms of Convergence Excess

- Blurred near vision
- Eyestrain
- Headaches
- Diplopia
- Poor reading comprehension
- Each had a prevalence of 24-47% in CE (Gallaway & Scheiman, JAOA 1997)

Common Symptoms of Convergence Insufficiency

- Loss of place when reading/having to re-read
- Loss of concentration/sleepiness when reading
- Blurred or double vision
- Eyestrain and/or headache with visual tasks
- Words appearing to move on page
- Each had a prevalence of 20-50% in CI (Barnhardt et al., OVS 2012)
Main Types of Nearpoint Vergence Disorders

Convergence Excess (CE)
- Examination findings through refractive correction:
  - Nearpoint esophoria
  - High AC/A ratio
  - Reduced divergence range at near
  - Difficulty w/ -2.00 D. lenses on binocular lens flippers
  - PRA lower than -1.50
  - Increased lag on MEM retinoscopy

Convergence Excess
- Differential diagnosis:
  - Divergence insufficiency (greater eso at far)
  - Basic esophoria (similar angle near and far)
  - Ocular inflammation
  - Sympathetic paralysis
  - Syphilis
  - Drug-induced accommodative/convergence spasm
    - e.g., pilocarpine, sulfonamides, high doses of thiamine

Convergence Insufficiency (CI)
- Examination findings through refractive correction:
  - Receded NPC – often more receded w/ red lens versus accommodative target (Pang et al., OPO 2010)
  - Exophoria at near at least 4Δ greater than at far
  - Reduced fusional convergence range/ failure to meet Sheard's criterion
  - Difficulty w/ +2.00 D. lenses on binocular lens flippers
  - NRA lower than +1.50

Convergence Insufficiency
- Differential diagnosis:
  - Divergence excess (greater exo at far)
  - Basic exophoria (similar angle near and far)
  - Ischemic infarction
  - Viral infection
  - Parkinson's disease
  - Parinaud syndrome
  - Multiple sclerosis
  - Myasthenia gravis
  - Prior strabismus surgery

Fusional Vergence Dysfunction
- Examination findings through refractive correction:
  - Normal near phoria
  - Receded NPC
  - Reduced convergence & divergence ranges
  - Difficulty w/ both +2.00 and -2.00 lenses on binocular lens flippers
  - PRA lower than -1.50 and NRA lower than +1.50
Fusional Vergence Dysfunction

- **Differential diagnosis:**
  - Rule out vertical deviation
  - Systemic disease or medications causing weakness

Management of Vergence Disorders – Convergence Excess

Lenses for CE

- Give appropriate distance Rx with added plus for near (single vision or multifocal)
  - Add for long-term use, or possibly discontinue after VT
  - Attempt to eliminate near esophoria with added plus
    - Near phoria + gradient AC/A gives a starting point
  - Try to balance the NRA and PRA
    - \( \frac{NRA + PRA}{2} \)

Vision Therapy for CE - Efficacy

- Gallaway & Scheiman (JAOA 1997)
  - 83 CE patients ages 7-32 years (mean 11.8 years)
  - 84% reported total relief of symptoms
  - Significant improvements in divergence ranges following VT
- Daum (AJPO 1982 and 1986)
  - Divergence can be significantly improved with VT
  - VT is intended to improve divergence amplitudes and reduce symptoms, not eliminate esophoria.

Vision Therapy for CE

- Expected treatment time: 12-15 weekly office visits
- Prescribe 15-20 minutes/day home VT
- Work on 3-4 techniques during office visits
- Prescribe 2-3 of these techniques daily at home
- More VT needed if there are concurrent oculomotor or accommodative problems

Management of Vergence Disorders – Convergence Insufficiency
Lenses for CI
- Give appropriate distance Rx
- Added plus lenses usually not accepted well for near (if true CI)

Base-in Prism for CI
- No better than placebo for children (Scheiman et al., BJO 2005)
- BI prism may be useful in presbyopic adults with CI (Teitelbaum et al., OVS 2009)
  - Sheard’s formula: \[ \text{BI } \Delta = \frac{2 \times \text{exophoria} - \text{BO range to blur}}{3} \]
  - Consider prescribing the horizontal associated phoria value for near (fixation disparity neutralization)

Vision Therapy for CI - Efficacy
- CITT (Arch Ophthalmol 2008)
  - 221 children ages 9-17
  - Treated with 12 weeks of office-based VT
  - 73% showed decreased symptoms and improved convergence skills
- CITT 12-month follow-up (OVS 2009)
  - 84% of office-based VT group remained asymptomatic

Vision Therapy for CI - Efficacy
- Improved academic behaviors (Borsting et al., OVS 2012)
  - Correlate with successful VT for CI
  - VT is intended to improve amplitude and speed of convergence long-term, and to reduce symptoms.
  - Improvements documented objectively (Scheiman, et al., OVP 2014)

Vision Therapy for CI
- Treatment of choice
- Expected treatment time: 12-15 weekly office visits
  - More VT needed if there are concurrent oculomotor or accommodative problems
  - Prescribe 15-20 minutes/day home VT

Management of Vergence Disorders – Fusional Vergence Dysfunction
Lenses for Vergence Dysfunction
- Prescribe the appropriate distance lens prescription
- Added plus lenses may not be accepted for near work
- Relieving prism is not indicated due to normal phorias

VT for Vergence Dysfunction
- Treatment of choice
- VT goals as for CI, except:
  - Emphasize both convergence and divergence improvement
  - Expected treatment time: as with CI

Typical VT Sequence for Vergence Disorders
- Monocular accommodation (& oculomotor) skills
- Gross vergence/physiological diplopia
- Fusional vergence
  - Smooth
  - Jump
- Binocular accommodation
- Integration/loading of procedures
- Maintenance

Accommodative VT
- Brock string activity progression
  - Single bead push-up (or push-away)
  - Multiple bead jumps
  - "Bug on string" – voluntary vergence

Gross Vergence/Physiological Diplopia VT
- Brock string activity progression
  - Single bead push-up (or push-away)
  - Multiple bead jumps
  - "Bug on string" – voluntary vergence

Fusional Vergence VT
- Accommodation ideally remains on the target plane while patient convergences or divergences
- Improve smooth ranges before emphasizing jumps
Practice combining techniques to make them more automatic
- Vergence
- Accommodation
- Pursuits
- Saccades
- Gross motor

Patient FM: 10 y.o. female
- Referred for VT with diagnosis of CI
- Poor performance in reading with A’s in math
- Notes headaches, tearing, diplopia and thus is avoiding near work
- Recent Rx: +0.75 -0.75 x 090 OU (20/20 far, near)
- Ocular health: normal
• Control lenses for exam: none
• CT: ortho at far, 12° exophoria at near
• Gradient AC/A: 3/1
• NPC: 3/9 cm, repeated 9/15 cm
• Stereo: 20°, (±) forms
• Prism bar vergences: BI 14/20/8, BO x/14/0 at near
• Minus lens amplitudes: 10.75 OD, 11.50 OS
• NRA: +2.75, PRA: -1.50
• Acc. facility: 15 cpm OD, 12 OS, 5.5 OU
• MEM: A/R cylinder unaided, +0.75 sph. OU aided
• Developmental Eye Movement test: high vertical & horizontal times, ratio, and errors

• Diagnosis:
  Saccadic dysfunction
  Convergence insufficiency
• Treatment:
  Continue current Rx for school/close work
  Begin VT
  Saccadic VT:
    • Hart chart saccades (all variations)
    • Sanet Vision Integrator saccades
    • Ann Arbor letter tracking
  Vergence VT (BO, BI, smooth & jump):
    • Pencil push-up, Brock string, Barrel card
    • Vectograms, Computer vergences, Eccentric circles, Lifesaver card, Aperture rule
  Integration VT:
    • Binocular lens flippers, BIM/BOP
    • Lifesaver card with pursuit movements
  Maintenance: Letter tracking, Lifesaver card

• Patient FM: Results
  • Patient attended 12 office VT visits over 4 months
  • Excellent compliance with home VT
  • Improved comfort: no symptoms with close work
  • Improved grades in reading
  • CT: ortho at far, 2° esophoria at near
  • NPC: to nose, repeatedly
  • Stereo: 20°, (±) forms
  • Prism bar vergences: BI x/14/6, BO x/35/20 at near
  • DEM: slightly slow, but normal ratio and errors

Thank you!

kfrantz@ico.edu

Management of Nearpoint Vergence Disorders

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