THE ROLE OF VISION REHABILITATION IN BRAIN INJURY
Leanna Dudley, OD, FCVOID

My Background
- Pacific University College of Optometry
- Residency at SUNY College of Optometry
- Vision Therapy and Rehabilitation
- Private Practice for 9 years
  - Binocular vision
  - Brain Injury
  - Developmental vision problems
  - Special needs

Course Objectives
- Recognize symptoms of vision problem
- Learn how to screen for vision problem
- Treatment options and coping strategies

J.C.
- 52yo WM
- Fell from a height of 14 feet, impact to forehead
- 2 years ago
- Symptoms
  - Confusion, memory loss, poor balance, lots of blinking, unable to drive, unable to work or participate in hobbies, unable to read for longer than 5 minutes, eyestrain, double vision, headache, dizziness, loss of place while reading, poor comprehension, etc.
- Exam:
  - Binocular vision problems
  - Motion sensitivity and light sensitivity
  - Oculomotor dysfunction

J.C.
- Treatment
  - New glasses with prism
  - Vision rehabilitation once a week for 30 sessions
  - Home activities for 20-30 minutes 4-6 times a week
  - 4 hour drive each way
- Improvements
  - Able to read, work on projects around the house, drive in familiar places.
  - NO headaches, NO dizziness, NO eyestrain, NO blurry vision, NO balance problems
Optometric Terminology

- Fixation
- Saccade
- Pursuit
- Binocular
- Accommodation

Vision by the numbers

- 90% of individuals that have a concussion will demonstrate 1 or more ocular difficulties
- 80% of all sensory function involves vision
- 70% of our brain is dedicated to vision
- 50% of the cranial nerves impact vision directly or indirectly
- 40% of individuals will have ocular difficulties longer than 3 months


Symptoms of Vision Problem

- Disequilibrium – dizziness, feeling fullness in head, feeling like going to fall
- Light sensitivity – indoors, especially fluorescent lights
- Reading difficulty – fatigue, eyestrain, headache, poor attention and comprehension
- Double vision – ANY double vision is problematic
- Blurry vision – may come and go
- Sensitive to visual motion – dislikes grocery stores and visually-busy places
Post-Trauma Vision Syndrome

- Persist beyond 3 months
- Result of concussion or whip lash event
- Characterized primarily by symptoms

Motion • Light • Binocular • Spatial

Convergence Insufficiency

- Affects reading and near work significantly
  - Symptoms: Double vision, eyestrain, headache, blurry vision, words moving on the page, nausea, dizziness
  - Signs: Exophoric eye posture and reduced NPC or convergence

Vertical Heterophoria

- One eye aims higher than the other
  - Very small amounts can have a very big impact on symptoms
  - Symptoms: Double vision, fatigue, headache, eyestrain, poor reading comprehension, dizziness, head tilt
  - Signs: One eye aims higher than the other on optometric phoria testing. Poor compensating ability with horizontal and vertical vergence ranges

Accommodative Dysfunction

- Difficulty focusing the ‘camera lens’ of the eye
  - ‘Autofocus camera with a broken computer system’
  - Symptoms: Blurry vision, fatigue or eyestrain, sensitivity to lights, headache
  - Signs: Reduced accommodation, change in glasses prescription, blurry vision, poor reading comprehension

Oculomotor Dysfunction

- Difficulty with pursuit or saccadic eye movement
  - May be accurate, but difficult to execute (blink, latency, fatigue, dizziness)
  - Symptoms: Skipping words or lines while reading, words moving on the page, fatigue while reading, poor comprehension
  - Signs: Any symptoms or signs during simple tracking activity
Dizziness and vision

• Change in Vestibular-Ocular Reflex (VOR)
  • Visual input from the eyes doesn’t match vestibular information
• Peripheral motion sensitivity
  • Poor processing of motion
• Accommodation, oculomotor and binocular problems

Visual Motion Sensitivity

• Unable to ‘filter’ peripheral motion

Symptoms:
  • Dizziness, headache, and/or anxiety from driving or grocery stores

Signs:
  • Vision testing reveals slow adaptation, symptomatic during simple testing, visual motion triggers symptoms

Disclaimer: if you have these problems, you may not want to look at the next slide

Visual Midline Shift Syndrome

Symptoms:
  • Leaning, falling or veering to one side during mobility
  • Poor balance and stability
  • Difficulty with visual-spatial tasks

How does this affect the patient?
  • Visual Midline is your reference point

TBI and Vision

<table>
<thead>
<tr>
<th>Type of Vision Disorder</th>
<th>% of mild TBI</th>
<th>% in average population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Binocular Disorder</td>
<td>56%</td>
<td>4-7%</td>
</tr>
<tr>
<td>(Convergence insufficiency)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pursuit or Saccadic</td>
<td>55%</td>
<td>5%</td>
</tr>
<tr>
<td>Accommodative dysfunction</td>
<td>41%</td>
<td>9-15%</td>
</tr>
<tr>
<td>Strabismus</td>
<td>26%</td>
<td>2%</td>
</tr>
<tr>
<td>TOTAL with Vision Disorder</td>
<td>90%</td>
<td>20%</td>
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</tbody>
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Screening for Vision Problems

• Near Point of Convergence (repeat 3 times)
  • “I am going to bring this target close to your nose. Let me know when you see two of them.”
  • Use a small target
  • Use near vision correction
  • Watch the eyes

• Indications of failed screening
  • Break value less than 3”
  • Recovery value less than 5”
  • Significant effort or symptoms
Near Point of Convergence

Screening for Vision Problems

- Smooth Pursuits
  - "Follow this target with your eyes"
  - Circle or figure 8
  - 16-20 inches from patient

- Saccades
  - "Look at the target that I say the name of"
  - 2 targets, 6 inches apart

- Indications of failed screening
  - ANY head movement, jerky eye movement
  - Symptoms occur (dizzy, nausea, diplopia)

Pursuits and Saccades

Considerations

- Minimize movements
- Dim lighting
- Close eyes between tests
- Eliminate busy background

Coping Strategies

- For dizziness/nausea: peppermint or ginger
- For disequilibrium: weighted blanket, laying on ground
- For light sensitivity: brimmed hat, dark sunglasses
- For reading problems: Large font, lots of space

Optometric Treatment Options

- Correct prescription for distance and near
  - No progressive lenses!
  - Tint is often prescribed (FL-41)

- Prism
- Binasal occlusion
Prism in Glasses
- Vertical prism
  - Compensates for vertical deviation of the eyes (one eye aims higher)
- Horizontal prism
  - Compensates for an inward or outward turning of the eye
- Yoked prism
  - Helps realign space with where the patient expects it to be

Binational Occlusion
- How does it work?
  - Reduces the amount of the visual field that overlaps between the two eyes
  - "Everything has slowed down, I can see it, and it’s no longer a blur!"
  - "I never realized how much I was dealing with until you took it away!"


Optometric Treatment Options
- For Visual Midline Shift Syndrome
  - Yoked prism in glasses
  - Vision Rehabilitation

Optometric Treatment Options
- Vision Rehabilitation
  - Strengthen the connections between areas of the brain that have been weakened

<table>
<thead>
<tr>
<th>Increase in…</th>
<th>Decrease in…</th>
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</thead>
<tbody>
<tr>
<td>Vision skills</td>
<td>Symptoms</td>
</tr>
<tr>
<td>Visual-Spatial awareness</td>
<td>Risk for fall or re-injury</td>
</tr>
<tr>
<td>Confidence</td>
<td>PTSD and anxiety</td>
</tr>
<tr>
<td>Balance and Stability</td>
<td></td>
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</tbody>
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Success through Vision Rehabilitation
- Study
  - Treated for binocular and oculomotor problems with vision rehabilitation
  - Success defined as elimination of at least 1 signs and 1 symptoms

- TBI: 90% success
- CVA: 100% success

Success through Vision Rehabilitation

- Study: Oculomotor rehabilitation for reading in ABI (2006)
- Saccadic eye movement disorder which affected reading (symptomatic)
- Scale 1 (poor) to 5 (good)
- Example: Reading improved from 5-10 minutes to 15-30 minutes
- All improvements were statistically significant (p<0.01)


<table>
<thead>
<tr>
<th>Ability to</th>
<th>Pre</th>
<th>Post</th>
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</thead>
<tbody>
<tr>
<td>Read comfortably</td>
<td>1.71</td>
<td>3.86</td>
</tr>
<tr>
<td>Comprehension</td>
<td>2.32</td>
<td>3.5</td>
</tr>
<tr>
<td>Attention in quiet room</td>
<td>2.21</td>
<td>3.07</td>
</tr>
<tr>
<td>Attention in noisy room</td>
<td>1.21</td>
<td>2.14</td>
</tr>
<tr>
<td>Reading Strategy</td>
<td>2.00</td>
<td>3.54</td>
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Vision Rehabilitation

Vision Rehabilitation

Vision Rehabilitation

Vision Rehabilitation

Prevention Through Vision Training

- Report from University of Cincinnati: Vision training with a college football team during 2010
- Concussion rate fell by over 80% from pre-vision training years (2006 to 2009) to post-vision training years (2010 to 2013)

Concussion incidence fell from 9.2 to 1.4 concussions per 100 game exposures

What about insurance?

- Coverage for vision rehabilitation codes is poor
  - Especially in Colorado
- Most optometric doctors are out of network with regards to medical insurance
  - Reimbursement is rare, and very low
- Other means?
  - Some optometrists participate with medical lien companies
  - Some optometrists participate in workman’s comp
  - Care Credit

TBI and Vision - Summary

Vision problems are highly prevalent after TBI

- 90% of patients have vision symptoms

Optometric rehabilitation and vision rehabilitation is life changing

- Improved quality of life
- Increased activities of daily living

Stroke and Vision

- Localized pathology = specific deficits
- Visual field and spatial awareness
  - 52% experience visual field loss
  - 20-43% experience neglect
- 90% of stroke patients have a symptomatic vision problem

Naeem Z. The prevalence of vision problems in stroke patients and the effectiveness of the current screening tool used. Br J Orthopt J 2012;3

Stroke and Vision

Vision Disorder Incidence in Stroke Incidence in TBI

<table>
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<tr>
<th>Vision Disorder</th>
<th>Incidence in Stroke</th>
<th>Incidence in TBI</th>
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<tr>
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Visual Field Loss

- Homonymous Hemianopsia

Treatment for Visual Field Loss

- Adaptive rehabilitation and scanning techniques
- Flicker Stimulation and Borderzone Stimulation (NovaVision)
- Specialized Prism

Unilateral Spatial Inattention (Neglect)

“...Lack of awareness for sensory events located toward the contralesional side of space (e.g., toward the left following a right lesion), together with a loss of orienting behaviors, exploratory search, and other actions that would normally be directed toward that side. Neglect patients often behave as if half of their world no longer exists.”


Neglect

- Can’t pay attention to one side of visual field when something on the other side is present

3 months after CVA:
- 17% of right brain lesions have neglect
- 8% of left brain lesions have neglect
- Most commonly damage to temporal or parietal lobe


Screening for Neglect

- Visual field testing: single presentation vs simultaneous presentation
- Line cancellation test or picture copy test

Questions

- “Does it ever seem that one side of the world is missing?”
  - Neglect = no
- “Do you frequently bump into people and/or objects while you are walking?”
  - Neglect = individual will say no, caregiver will say yes
- “Do you sometimes unintentionally miss eating food on one side of your plate?”
  - Neglect = individual will say no, caregiver will say yes
Treatment for Neglect

- Vision Rehabilitation – yoked prism adaptation and scanning


Vision Rehabilitation after Stroke

- Vision problems respond well to vision rehabilitation
- Takes less time to reach objectives than TBI patients
- Study by Ciuffreda (2008): Oculomotor difficulty when reading
  - 100% had complete resolution or marked reduction of reading symptoms
  - Optometric tests showed marked improvement or normalization in 100%

Stroke and Vision

- Patients can make impressive recovery in function
- Reading can give patients back a significant quality of life and contribute to activities of daily living
- Limitations in mobility do not hinder progress as much as you might think

Where to find a neuro-optometrist?

QUESTIONS?
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