THE ROLE OF VISION REHABILITATION IN BRAIN INJURY

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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

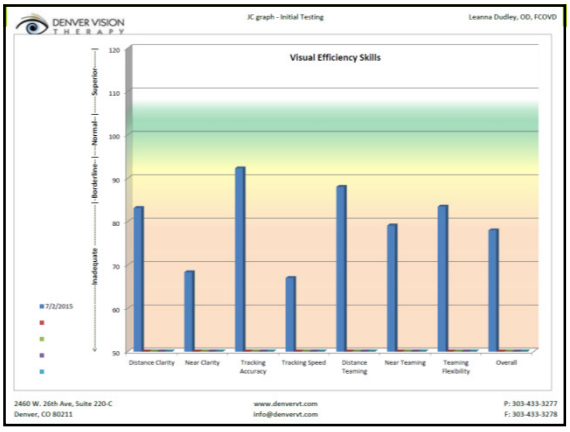
DENVER VISION THERAPY

Course Objectives

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

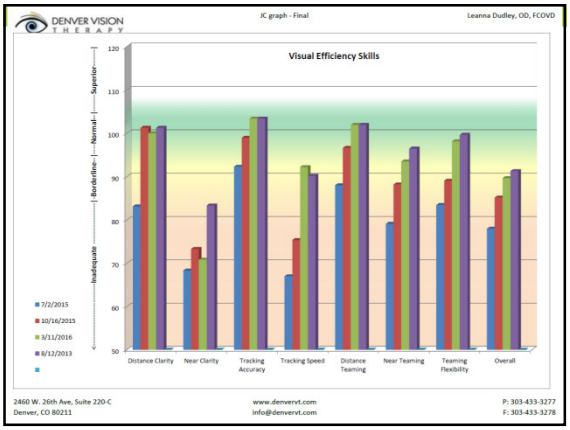
J.C.

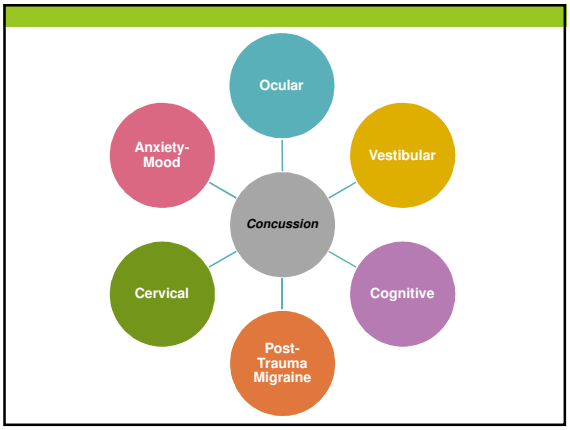
- 52yo WM
- Fell from a height of 14 feet, impact to forehead
  - 2 years ago
- Symptoms
  - Confusion, memory loss, poor balance, lots of blinking, unable to drive, unable to work or participate in hobbies, unable to read for longer than 5 minutes, eyestrain, double vision, headache, dizziness, loss 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





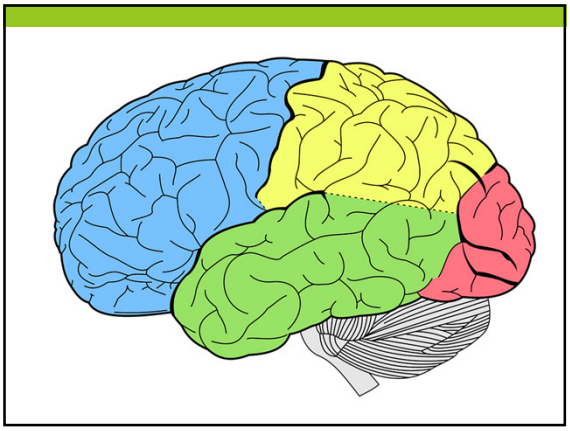
Optometric Terminology

- 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

Ciuffreda, K.J., Kapoor, N., Rutner, D., Suchoff, I.B., et al. Occurrence of oculomotor dysfunctions in acquired brain injury: A retrospective analysis. J Am Optom Assn. 2007; 78: 155-161.



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

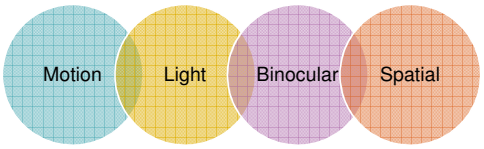
	Never	Seldom	Occasionally	Frequently	Always
Eye strain or pain	0	1	2	3	4
Eye fatigue or eye rubbing	0	1	2	3	4
Blurry Vision at near or far distance	0	1	2	3	4
Double Vision	0	1	2	3	4
Headache after visual task	0	1	2	3	4
Dizziness or nausea after visual task	0	1	2	3	4
Light Sensitivity	0	1	2	3	4
Poor Depth Perception	0	1	2	3	4
Bumps into objects/clumsiness	0	1	2	3	4
Can't tolerate "visually-busy" places	0	1	2	3	4
Uncomfortable while driving/riding in the car	0	1	2	3	4
Difficulty adjusting focus between near and far	0	1	2	3	4
Head tilt or unsteady gait	0	1	2	3	4
Closing one eye	0	1	2	3	4
Skipping words or lines while reading	0	1	2	3	4
Cannot read as long as you would like	0	1	2	3	4
Poor reading comprehension or slow reading speed	0	1	2	3	4
Poor memory	0	1	2	3	4
Decreased ability to participate in hobbies/sports	0	1	2	3	4
				Total:	

Score 10-15: Borderline vision problem.

Score 15+: Vision problem is likely. Developmental Vision Evaluation recommended.

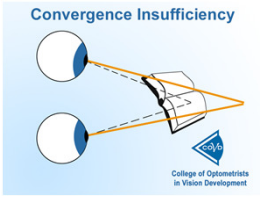
Post-Trauma Vision Syndrome

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



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

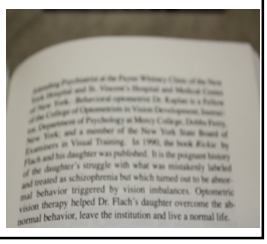


Vertical Heterophoria

- 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

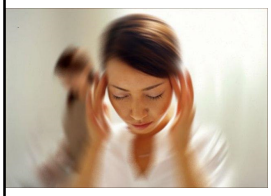


Oculomotor Dysfunction

- 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

Reading with tracking problems isn't as easy as it looks

Dizziness and vision

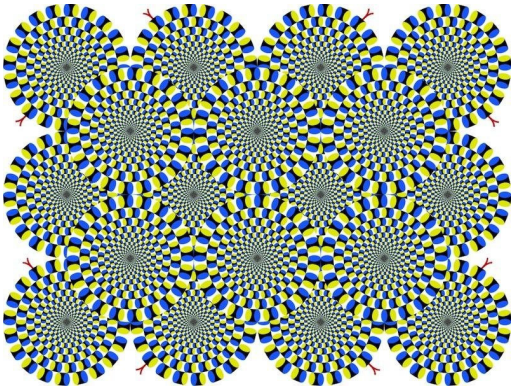


- Change in **Vestibular-Ocular Reflex (VOR)**
  - Visual input from the eyes doesn't match vestibular information
- **Peripheral motion sensitivity**
  - Poor processing of **motion**
- **Accommodation, oculomotor and binocular problems**

Visual Motion Sensitivity

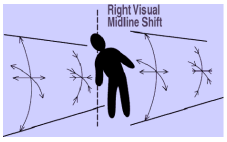
- Unable to 'filter' peripheral motion
- Symptoms:
  - Dizziness, headache, and/or anxiety from driving or grocery stores
- Signs:
  - Vision testing reveals slow adaptation, symptomatic during simple testing, visual motion triggers symptoms

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

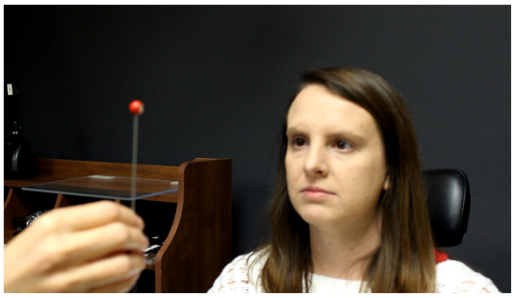
Type of Vision Disorder	% of mild TBI	% in average population
Binocular Disorder (Convergence insufficiency)	**56%**	**4-7%**
Pursuit or Saccadic	**55%**	**5%**
Accommodative dysfunction	**41%**	**9-15%**
Strabismus	**26%**	**2%**
TOTAL with Vision Disorder	**90%**	**20%**

- Ciuffreda, K.J., Kapoor, N., Rutner, D., Suchoff, I.B., et al. Occurrence of oculomotor dysfunctions in acquired brain injury: A retrospective analysis. J Am Optom Assn. 2007; 78: 155-161.

Screening for Vision Problems

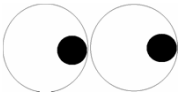
- Near Point of Convergence (repeat 3 times)
  - *"I'm going to bring this target close to your nose. Let me know when you see two of them."*
  - Use a small target
  - Use near vision correction
  - Watch the eyes
- Indications of failed screening
  - Break value less than 3"
  - Recovery value less 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

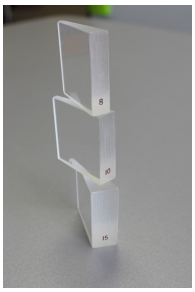
- For dizziness/nausea: peppermint or ginger
- For disequilibrium: weighted blanket, laying on ground
- For light sensitivity: brimmed hat, dark sunglasses
- For reading problems: Large font, lots of space

Optometric Treatment Options

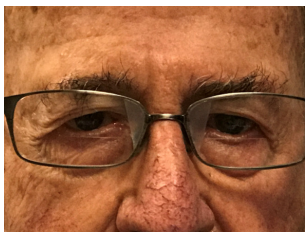
- Correct prescription for distance and near
  - No progressive lenses!
  - Tint is often prescribed (FL-41)
- Prism
- Binasal occlusion

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



Binasal Occlusion



Binasal Occlusion

- How does it work?
  - Reduces the amount of the visual field that overlaps between the two eyes

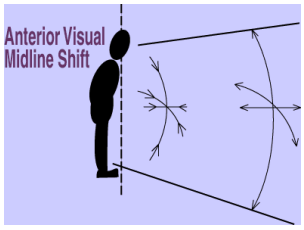
"Everything has slowed down, I can see it, and it's no longer a blur!"

"I never realized how much I was dealing with until you took it away!"

Proctor A. Traumatic brain injury and binasal occlusion. Optom Vis Dev 2009; 40(1):4550
https://c.ymcdn.com/sites/www.covd.org/resource/resmgr/ovd40-1/article_tbibinasalocclusion.pdf

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

Increase in…	Decrease in….
☐ Vision skills	☐ Symptoms
☐ Visual-Spatial awareness	☐ Risk for fall or re-injury
☐ Confidence	☐ PTSD and anxiety
☐ Balance and Stability	

Scharnweber AR, Palmer GA, Ampe HJ, Lenzen-Hammerel AM. Vision rehabilitation for traumatic brain injury and post-traumatic stress disorder. Vision Dev & Rehab 2016;2(2): 132-9

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

Ciuffreda, K.J., Rutner, R., Kapoor, N., Suchoff, I.B. Vision therapy for oculomotor dysfunctions in acquired brain injury. Optometry-J Am Optom Assn. 2008; 79: 18-22.

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)

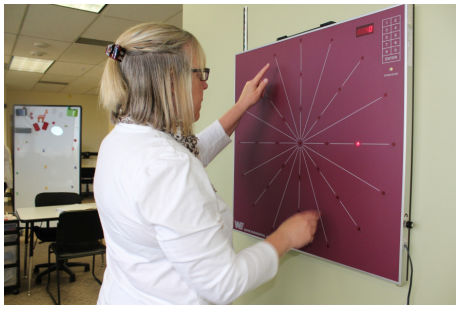
Ability to…	Pre → Post
Read comfortably	1.71 → 3.86
Comprehension	2.32 → 3.5
Attention in quiet room	2.21 → 3.07
Attention in noisy room	1.21 → 2.14
Reading Strategy	2.00 → 3.54

Ciuffreda, K.J., Han, Y., Kapoor, N., Ficarra, A.P. Oculomotor rehabilitation for reading in acquired brain injury. NeuroRehabil. 2006; 21(1): 9-21

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*

Clark JF, Gram P, Ellis JK, Mangine RE, et al. An exploratory study of the potential effects of vision training on concussion incidence in football. Optom Vis Perf 2015;3(2):116-25

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

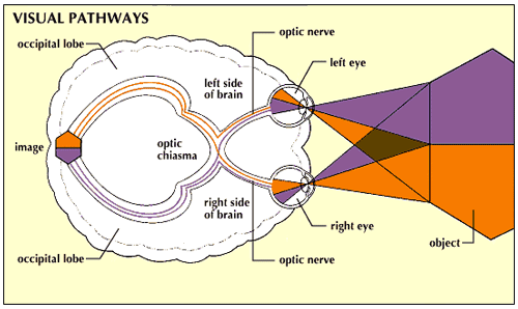
- 90% of patients have vision symptoms

Optometric rehabilitation and vision rehabilitation is life changing

- Improved quality of life
- Increased activities of daily living

Stroke and Vision

Stroke and Vision



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 Ir Orthopt J 2012;9

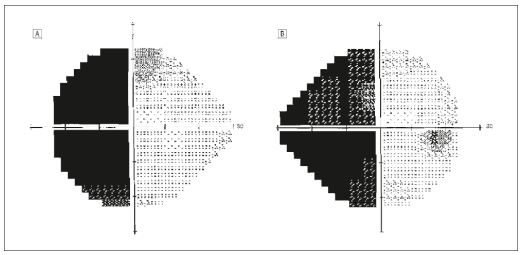
Stroke and Vision

Vision Disorder	Incidence in Stroke	Incidence in TBI
Binocular Disorder (Convergence Insufficiency)	37%	56%
Pursuit or Saccadic Eye Movement Dysfunction	55%	55%
Accommodative Dysfunction	13%	41%
Strabismus	37%	26%
TOTAL with a Vision Disorder	87%	90%

- Ciuffreda, K.J., Kapoor, N., Rutner, D., Suchoff, I.B., et al. Occurrence of oculomotor dysfunctions in acquired brain injury: A retrospective analysis. J Am Optom Assn. 2007; 78: 155-161.

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.**"

Suchoff, I.B. The diagnosis of visual unilateral spatial inattention. Brain Injury/Professional 2005; 2: 22-25.

Neglect

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

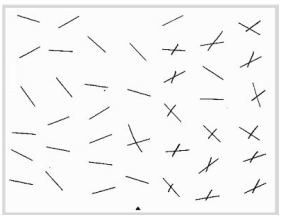
3 months after CVA:

- **17%** of right brain lesions have neglect
- **5%** of left brain lesions have neglect
- Most commonly damage to temporal or parietal lobe

Ringman, et. al. Frequency, risk factors, anatomy and course of unilateral neglect in an acute stroke cohort. Neurology 2004; 63(3): 468-474

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

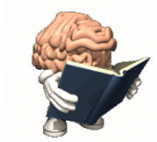
Rossetti, et.al. Prism adaptation to a rightward optical deviation rehabilitates left hemispatial neglect. Nature 1998, Sep 10;395(6698:166-9

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?

COVD College of Optometrists in Vision Development
Prevention • Enhancement • Rehabilitation

NORA
Neuro-Optometric Rehabilitation Association

QUESTIONS?

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