



A Vision Lift: Use of Prisms for Treatment of a Right Homonymous Paracentral Visual field Defect

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Case History

A 52-year-old avid adventurer suffered a significant traumatic brain injury (TBI) after a hang-gliding accident. He presented for a vision therapy evaluation 3 months after the accident. Friends who observed the accident noted that he landed on the right side of his head, which was protected by a helmet. The patient did not remember either the accident or approximately a 2-week period surrounding the event. The history at the first exam was given mostly by his wife. He had trouble accurately describing his symptoms and at times finding the correct words to say. He stated that he was having difficulty reading; he was noticing that objects would seem to disappear randomly and reappear as he moved his head. Prior to the accident he was an engineer who designed medical equipment for surgeons; he was very particular about any changes that he noticed. He was also being followed by a neurologist and had begun an occupational therapy program.

Clinical Testing

TEST	FINDINGS
VAs	Dist: 20/20 OD, OS, OU Near: 20/30 OU (with +1.50 readers)
Pupils	PERRL (-)APD
EOMs	FROM OD, OS- pt noted that he would lose the light when following it down and to the right
CVF	FTFC OD, OS
NPC	Receded, BO vergence ranges low

Additional Testing

TEST	FINDINGS
King Devick	Performed slowly but accurately
MVTP-V	Performed slowly but was able to get most correct
Groffman line tracing	Performed slowly
Line bisection	No signs of neglect or midline shift
Clock-dial test	No signs of neglect or midline shift
Gates-oral Reading	While reading out loud he stated that he noticed a "thumbprint" would lead his reading and he would miss words or letters to the right. Ex. Said "Tal" instead of "Talk" as he missed seeing the "k"

Post-Trauma Vision Syndrome (PTVS)³

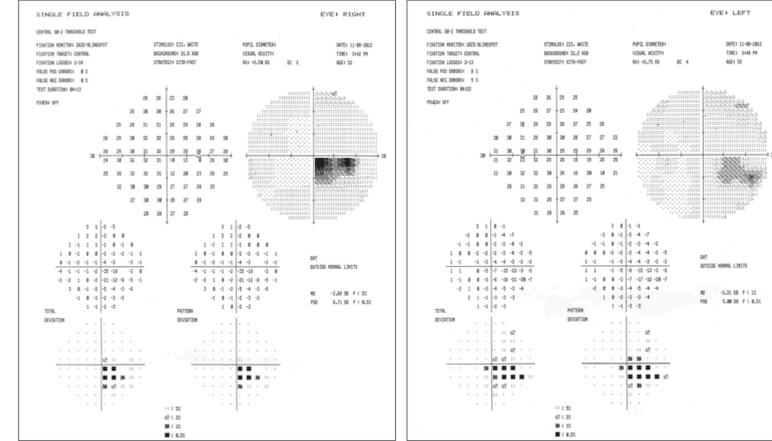
- Results from damage to the midbrain- superior colliculli which work to organize and integrate visual sensory information

Ocular Symptoms of PTVS³

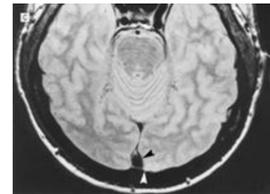
- Convergence insufficiency
- Accommodative dysfunction
- Strabismus (most likely exo)
- Low blink rate
- Ocular motor deficits
- Difficulties in attention and concentration
- Visual-spatial distortions
- Light sensitivity
- Dizziness

Localizing the Injury

Humphrey 30-2 Visual field testing was performed. Results showed a Right Homonymous Paracentral defect.



Visual fields indicated that damage from the TBI must have occurred in the left tip of the occipital lobe which is shown on the following MRI.¹



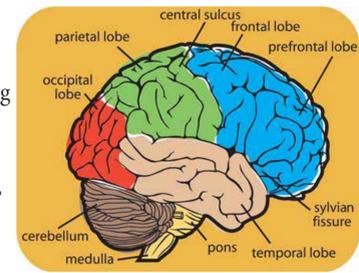
Listening closely to a patient's symptoms can give clues as to where the damage has occurred in the brain. Knowing what questions to ask is important.

- Equal hand/foot strength?
- Motor abilities?
- Coherent speech?
- Trouble recalling words?
- Memory problems?
- Visual symptoms?
- Reduced inhibitions?

- Cerebellum:** balance and coordination, voluntary motor movement coordination
- Parietal Lobe:**

- Right side: integrating sensory input (visual input), orienting towards a visual stimulus, selective attention network³
- Left side: manipulation of objects, writing tasks, understanding numbers³

- Frontal Lobe:** impulse control, initiation (saccades, FEF), judgment, memory, language, spontaneity, problem solving³
- Occipital Lobe:** primary visual cortex³
- Brain Stem:** arousal and consciousness³



By knowing where the damage has occurred, we can better manage the patient and their visual symptoms. For example, the patient may be having trouble with spontaneity and impulse control, which would indicate that the frontal lobe has been damaged. We can conclude that the patient will likely also have trouble with saccades, which are initiated in the frontal eye fields in the frontal lobe. Damage to the parietal lobe and occipital lobe can have significant visual consequences as well. If symptoms and signs correlate to right-side brain damage, it is important to look for visual spatial inattention as the patient may not be aware of this.

Our Patient

He was wearing a helmet when he crashed and was told by friends who observed the incident that he landed on the right side of his head. Most symptoms and signs demonstrated left brain damage, indicating a contra-coup injury.

- Visual field defect corresponds to damage at the left tip of the occipital lobe.
- His appearance showed a right side droop (seen in shoulder posture and the downward slanting of the right side of his mouth) which is consistent with left motor cortex injury.
- Trouble with word retrieval and some procedural memory indicates left frontal brain impairment.
- The patient's wife stated that he does not seem to filter what he says as he used to, indicating frontal brain deficits.
- Hand strength was assessed and was equal on both sides. Motor and gait also seemed to be intact.

Treatment

First Step: Vision Therapy Program^{4,5}

Directed vision therapy was initiated to address his binocular dysfunctions, which included convergence insufficiency and oculomotor dysfunction. Scanning activities were also incorporated into the therapy program to facilitate him in compensating for the field loss.

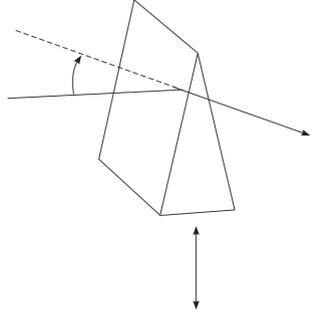
He came for 4 weekly sessions. Throughout his visits progress was made. His eye movements and convergence abilities began to improve. Home maintenance therapy was given as he could not keep weekly sessions. His clarity of mind and communication skills were also improving as his brain continued to heal.

Problem: He wanted to return to work but was still having trouble reading efficiently.

A study looking at reading eye movements postulated that the parafoveal region, along with the peripheral retina, guide a reader's eye movements to the upcoming words and sentences.⁶ These areas also facilitate reading by integrating information across separate fixations.⁶ This patient's paracentral scotoma disrupted his ability to look ahead while reading, causing slow, difficult reading.

Next Step: Yoked Prism^{2,5}

- Three prism diopters of yoked base down prism was trialed for 2 weeks over his reading Rx.
- He stated that he could see further to the right while reading and his reading speed improved.
- Three prism diopters were enough to shift what he read away from the scotoma allowing him to read more efficiently and return to his job.



Conclusions

- Thorough assessment of visual fields is essential for all brain injury patients. CVF are not always sufficient and automated fields may be required.
- Do not rush routine testing. Pay close attention to the patient's comments and observations during initial testing.
- Think about the quality of life of your patients, how you can help them return to their normal activities, and what their functional goals are.
- Think outside of the box: prisms can have multiple uses; not just for hemianopic field defects but for any defect that may be causing problems.
- Effective communication is important to help improve the patient's quality of life and to help them achieve their functional goals. By carefully listening to the patient's complaints, and with the assistance of clinical and functional testing, we are able to determine the cause of the patient's symptoms and initiate a proper course of therapy.

References

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