An Unsuspected But Treatable Cause Of Persistent Post-Concussive Symptoms:
Binocular Vision Dysfunction
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Mild Traumatic Brain Injury
Definition –
"An alteration in brain function or other evidence of brain pathology, caused by an external force"
The force can be shaking, rotation, direct blow, concussion (blast), or head hitting an object
(ACRM Position Statement)

Mild TBI
- Concussion
- Most get better/resolve in 2wks – 3 mos
- 15-20% have persistent Post Concussion Syndrome or Mild TBI sequelae

Mild Traumatic Brain Injury - Treatment
- Pain management
- PT, OT, SLP
- Neuropsychology testing and counseling
- Improvement, achieving functional goals.....but the patient still has the above symptoms
- ......let’s look at vision............

Look at Vision
- Binocular Vision Dysfunction can contribute and or cause all of these symptoms
- BVD can be caused by vertical - horizontal Heterophoria, and vertical - horizontal Heterotropia / Stabismus
  - Cranial nerve injuries
  - Vestibular impairment
  - The "fusion center" for vision is knocked out of balance

Mild TBI
The headache may just be the tip of the ........
- Headaches
- Neck pain
- Dizziness
- Diminished hearing
- Diminished smell (smell)
- Diminished taste
- Nausea / vomiting
- Diplopia (double vision)
- Diminished vision
- Hypersensitivity to noise
- Drowsiness
- Fatigue
- Irritability
- Anxiety
- Depression
- = Post Concussion Syndrome

The headache may just be the tip of the ........
Communicative dysfunction
- Word finding
- Delayed processing
- Delayed reaction time
- Impaired memory
- Perceptual problems
- Impaired concept formation
- Impaired reasoning
- Fuzziness
- = Post Concussion Syndrome
What Did You Feel?

- Nausea
- Dizziness / Lightheadedness
- Headache / Eye pain
- Anxiety / Nervousness

Imagine feeling like this all the time!

Mild TBI and BVD

- Refer for eval if ≥15 on BVDQ or if positive answers to Red Flag questions
- If symptoms persisting >3 mos
- If symptoms are limiting progress in therapies
- Rx with prism therapy glasses

Ironic feeling like this all the time!

Mild TBI and BVD

- 30% of my chronic mTBI patients will have BVD
- Some are getting worse medications, fatigue, anxiety, depression
- Not getting better after 3 months of recovery and treatment
- Screen for BVD
- Binocular Vision Dysfunction Questionnaire (BVDQ)

Mild TBI and BVD

- Rx with prism therapy glasses
- Efficient
- Allows me to wean medications for pain, anxiety, migraines
- Enables patients to participate more effectively in cognitive therapies, RTW, Computers, etc

Vertical Heterophoria and Superior Oblique Palsy

- Vertical Heterophoria (ICD9: 378.43) and Superior Oblique Palsy (ICD9: 378.53) are binocular vision disorders where one eye sees an image higher than the other eye.
- The brain responds to this uneven image (and impending double vision (diplopia)) by using / overusing the eye alignment muscles (Extraocular Muscles (EOM’s)) to realign the images.
- The resulting strain and fatigue of the EOM’s causes symptoms of headaches, a feeling of being disoriented, lightheadedness, anxiety and visual and reading difficulties.

History of VH & SOP

- Dr. Jennifer Doble
- Dr. Arthur Rosner

History of VH

- George T. Stevens, MD 1887
- Raymond Roy, OD 1950

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History of VH

- George T. Stevens, MD 1887
- Raymond Roy, OD 1950
Vertical Heterophoria & SOP Symptoms
- Pain Symptoms
- Vestibular Symptoms
- Reading Symptoms**
- Standard Vision Symptoms
- Binocular Vision Symptoms**
- Psychological Symptoms

**Commonly recognized as being due to VH+SOP
THE REST ARE NOT!!

Head and Face Pain
Reading Symptoms

8 Physical Findings of VH & SOP
1. Elevated Eye Brow

2. Orbital Asymmetry

3. Head Tilt

4. Trapezius Muscle Tenderness / Tightness

 Causes of VH & SOP

VH & SOP Physical Findings

- Reproduction of symptoms with
  5. EOM exam
  6. NPC (near point of convergence)

- 7. Drifting to one side with ambulation (VH) or wobbling side to side (SOP)

- 8. Alleviation of symptoms with 5 Minute Cover Test

Causes of VH & SOP

Pathophysiology

Vertical Heterophoria
Superior Oblique Palsy

Factors That Trigger / Worsen VH & SOP Symptoms

- Prism Challenge Technique
  - Invent equipment

Superior Oblique Palsy

Recurrent Theme for These Patients
- Symptoms not recognized as being syndromic for VH & SOP
- Symptomatic for a long time
- Seen by many different care providers
- Many tests performed (including CT, MRI, audiogram, ENG, EEG, Holter)
- Many medications tried
- Many procedures performed
  - Never Improved

Superior Oblique Palsy

Two Big Roadblocks To Diagnosing VH & SOP:
1. Vertical alignment measurements and equipment used to diagnose VH & SOP are not sensitive enough

Two Big Roadblocks To Diagnosing VH & SOP:
2. Symptoms aren't recognized as being due to a binocular vision problem

Superior Oblique Palsy

Binocular Vision Dysfunction Questionnaire (BVDQ)
- Adult (validated) and Pediatric Versions
- They are the most powerful and consistent tools to identify VH & SOP Suspects
  - Likert Scale: 3 2 1 0
- Adult BVDQ and Pediatric BVDQ
  - Score > 15 is abnormal
  - Positive answer to RED FLAG questions is abnormal
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Results of Treatment

- 33% - 50% reduction of symptoms w/i 20-30 mins of prism application
- 80% by the end of treatment

Where Do Pts Go For Care?

Research and Academic Activities

Retrospective Data Analysis:

38 TBI Patients Diagnosed with VH with Complete Data Sets
Average age: 38 years (range 12 – 87 yrs)
Female = 66% (25)
Male = 34% (13)
Average duration of symptoms = 9.9 years (3 months to 30 years)
Neuroimaging (38 patients):
- Brain MRI with & w/o contrast ($2500-$3500)
  - 61% had both
  - 68%
- HCT w/o contrast ($1000-$1500)

7 Binocular Vision Questions

- Skip lines while reading
- Head tilt
- Pain with eye movement
- Words run together while reading
- Double / overlapping vision near
- Close or cover an eye
- Double / overlapping vision far

You'll miss this condition if you only look for binocular vision symptoms!

Top 10 BVDQ Questions

1. Shoulder and neck discomfort
2. Headache
3. Glare / sensitivity to bright lights
4. Dizzy / lightheaded
5. Tired easily with close-up tasks
6. Blink to clear up distant objects
7. Unsteady / drift to one side
8. Dizziness with provocative head movements
9. Car rides = uncomfortable / dizzy
10. Do you skip lines while reading

You have to ask the right questions to come up with the right answers!

Conclusion

- Binocular vision dysfunction (BVD) appears to be causing post-concussive symptoms in ~ 30% of all TBI / ABI patients with persistent symptoms (>3 months)
- The TBI / ABI appears to be causing the BVD
- Treatment of the BVD with realigning prismatic lenses reduces post-concussive symptoms 80%
- BVD Suspects can be easily identified with a validated questionnaire
- BVD can be firmly diagnosed by the Prism Challenge Technique
Ongoing Research

- Validation of BVDQ – completed; submitting for publication
- Prospective ED Headache study – in progress
- Improvement of NPC with prismatic lenses
- Improvement of K-D with prismatic lenses
- Retrospective study of pts with BVD and:
  - Headache
  - TBI
  - Anxiety
  - Dizziness

Which Patients to Screen for VH and SOP using the BVDQ?

- Children with "reading and learning difficulties" (?LD; ?RD)
- Children with "hyperactivity" (?ADD/ADHD?)
- Children with motion sickness / car sickness
- Difficulty watching 3D movies
- Agoraphobia
- Panic attacks

Which Patients to Screen for VH and SOP using the BVDQ?

- Patients who have dizziness, headache, neck ache, visual / reading difficulties, anxiety
  - TBI with symptoms persisting 3 months or longer after injury
- Those with Physical Findings of VH & SOP
- Elderly with difficulty with balance / frequent falls
- Chiropractic neck pain

Who to Refer?

- High score on BVDQ ≥ 15
- OR
- Positive answers to any of the RED FLAG questions

"Who, indeed, could have supposed that a mere ocular defect could have given rise to so serious a train of evils...and who that had not seen it, could believe that the correction by glasses of the eye trouble could have given a relief so speedy and so perfect that the patient described it as a miracle?"

S. Weir Mitchell, Headaches and Eye Strain, April 1876