Concussion Management
Vestibular Rehabilitation

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Disclosure

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TRIA Spring Conference 2015

I have no financial relationships to disclose
Objectives

- Understand why the vestibular system is important to athletes
- Summarize general vestibular problems that can arise post concussion
- Perform the basic vestibular and ocular motor examination for patients post-concussion
- Explain what indicates a positive finding on the vestibular examination
- Summarize the literature support for vestibular screening and treatment for patients post-concussion
Why are we talking about this today?

- There are 300,000 sport related concussions per year in the U.S. - age 15 – 24
  - (Gessel, 2007)

- Football had the highest rate of concussion – when comparing rates and patterns across 20 different sports
  - Majority of concussions happened in football – 47% (n of study = 1,936)
  - (Marar, 2012)
Vestibular System

- 80% of concussions should get better in 7 – 10 days
  - (Consensus Statement – Zurich, 2012)

- How can we help the remaining 20% get back to baseline?

Let's talk about the vestibular and ocular motor system......
Why check for vestibular system when evaluating concussion?

1. Headache (71%)
2. Feeling slowed down (58%)
3. Difficulty concentrating (57%)
4. Dizziness (55%)
5. Fogginess (53%)
6. Fatigue (50%)
7. Visual blurring / double vision (49%)
8. Light sensitivity (47%)
9. Memory dysfunction (43%)
10. **Balance problems (43%)**

Lovell, Collins et al. 2004
Review of Literature

- ENG of 309 whiplash patients show frequent vestibular abnormalities, abnormal calorics in 57%, and abnormal rotational tests in 51%. 
  *Toglia, 1976*

- “Vestibular complaints are the most frequent sequelae of mTBI. Vestibular physical therapy has been established as the most important treatment modality for this group of patients.” *Gotshall, 2011*
A Review of the Literature

- “A combination of cervical and vestibular physiotherapy decreased time to medical clearance to return to sport in youth and young adults with persistent symptoms of dizziness, neck pain and/or headaches following a sport-related concussion.” Schneider, 2014

- “Vestibular and ocular motor impairments and symptoms have been documented in patients with sport related concussions.” “Sixty one percent of patients reported symptom provocation after at least 1 VOMS item.” Mucha, 2014
How is the vestibular system involved when participating in sports?
What does the Vestibular System do?

- Senses linear and angular speed
- Senses rotational movements of head
- Senses linear movements of the head
- Senses head position in space
Vestibular System:

**One of the three balance system in your body:**
- Vision
- Somatosensory

**Peripheral Vestibular System:**
- Semicircular canals
- Otoliths: Utricle and Saccule
- Vestibular Ganglia
- Vestibular Nerve

**Central Vestibular System:**
- Vestibular Nuclei
- Cerebellum
- Cortex
- Thalamus

http://en.wikipedia.org/wiki/Vestibular_system

http://www.nimh.nih.gov
Vestibular System in Inner Ear

http://drsethevans.com/2014/01/27/how-does-your-ear-work/
Peripheral Vestibular System

- **Otoliths:**
  - Utricle – senses head tilt
  - Saccule – senses linear acceleration of the head

- **Semicircular Canals** – senses rotation of the head
Vestibular System Function

Diagram showing:
- Vestibular
- Vision
- Somatosensory
- Vestibular Nucleus
- Cerebellum
- Eye Movts
- Balance
Vestibular Impairments post Concussion

- VOR impairment
- Visual Motion Sensitivity
- BPPV (incidence in younger athletic population is low)
Cluster of Symptoms for Vestibular Impairments

- Dizziness
- Nausea
- Balance problems
- Headache
- Sensitivity to visual motion – busy environments etc.
- Blurred vision (when moving head)
Vestibular Exam:

- **VOR x 1**: Assessment of peripheral vestibular labyrinth / any of the central pathways
- Treatment: Head eye coordination exercise using various targets

http://en.wikipedia.org/wiki/Vestibulo-ocular_reflex

Youtube.com
Measuring VOR

- Head Thrust test
- Head shake Nystagmus test
- Clinical DVA
- Computerized DVA
- Head movement with stationary target test
Measuring VOR

http://cp.neurology.org/
VOR x 1 - Lab

- Target at comfortable distance in front of patient.
- Target is stationary and head moves 30 degrees side to side, and then up/down
- Try to keep target in focus and NOT becoming blurry
- Abnormal = dizziness, and blurry vision
Vestibular Exam:

- **VOR Cancellation:** “over-riding” of VOR
  - This can be used to assess visual motion sensitivity
    - Increased awareness of normal visual motion
  - Symptom provocation created by moving crowds, busy environments
    - Ex: supermarket, school hallway, hockey game
  - Treatment: Ball toss, Lunges with medicine ball tracking
VOR Cancellation - Lab

- Move head, body, and target side to side, and then up/down
  - Target is at comfortable distance in front of patient
- Want to cancel out background, and be able to focus on target
- Abnormal – dizziness, blurry vision
BPPV

- Occurs less often in athletic population
- Otoconia (calcium carbonate crystals) from the otolith detach and move into one of the semicircular canals – causing the sensation of head rotation = vertigo

www.imgarcade.com
BPPV Screening:

Dix- Hall Pike Test (Posterior Canal)

Roll Test (horizontal canal)

www.physio-pedia.com
Clinical Pearls for this diagnosis:
- Duration of symptoms less than 1 minute (typically)
- Occurs when head is in certain positions
- Sense of vertigo vs. dizziness
  - Vertigo = room is spinning – rotational component to symptom
- Subjective complaints of BPPV:
  - Dizziness caused by getting out of bed, rolling in bed, looking up, or lying down
- Treatment: Canalith Repositioning Maneuver
Cluster of Symptoms for Ocular Motor Impairments

- Blurred vision
- Double vision
- Headache
- Difficulty reading
- Impaired eye movements
- Poor visual concentration

Mucha, 2014
Literature Review

- Ocular Motor Impairment found in patients post mild TBI
  - Convergence insufficiency = 55%
  - Saccadic dysfunction = 30%
  - Smooth pursuit impairment = 60%

Capo- Aponte, 2012
Ocular-motor Exam:

- **Saccades**
  - **Function:** ability to look at one target, and then quickly at another
    - Generated in region of the pons (horizontal) / midbrain (vertical / torsional)
  - Abnormal findings
    - over / undershooting (cerebellar / brainstem lesion)
    - More than 3 saccades to get to target
    - Slow speed
    - abnormal findings = central problem
  - Treatment: 2-target exercise, clock exercise
Saccades - Lab

- Hold target or finger tip about 15 degrees to one side of the nose, and then to the other side of the nose.
  - Do in horizontal and vertical direction
  - Can also use one target and nose as the second target

- Looking for number of eye movements in takes for the patient’s eyes to reach the target.
- Normal is 2 or less
- If you can clearly pick up trajectory of eye movement from one target to the next = going too slow!
Ocular-motor Exam:

- **Smooth Pursuit**
- **Function:** Ability to smoothly follow target with eyes
  - Sensitive in identifying pathologies involving CNS
    - Cortex, Basal ganglion region, Brainstem, Cerebellum, Oculomotor nucleus
  - Abnormal findings
    - asymmetric eye movement
    - saccadic movement/ not smooth movement while tracking (age is a factor)
    - Abnormal finding = central problem
  - Treatment: 9 point pattern, online computer exercise
Smooth Pursuit Eye Movement - Lab

- Have patient follow the target slowly horizontally – 30 degrees to left and right and then vertically – 30 degrees up/down
- Key is to move finger or target at correct speed – about 20 degrees per second
- Abnormal smooth pursuit = jerky eye movement (saccadic intrusions)
Ocular-motor Exam:

- **Convergence**

- **Function: ability to turn eyes inward to focus on a target**
  - Near-point convergence break cut off (6 cm)
  - recovery cut off (10 cm)
  - Test patient 3 times!! – to see if fatigue is a factor
  - Abnormal findings
    - Break point is greater than 6 cm
    - Recovery point is greater than 10 cm
    - Abnormal finding = central problem
  - Treatment: Brock string, Pencil Push-Ups
Hold a target in your hand about 2 feet away from the patient's face. Ask him/her to focus on the target while moving it toward the patient's nose.

The eyes should converge and the pupils should constrict.

Stop the test and measure when the patient develops double vision – NOT BLURRED VISION.

Greater than 6 cm from nose = abnormal

Recovery point greater than 10 cm from nose = abnormal
When do you refer your athletes to vestibular therapy?

- Look for positive tests on VOMS assessment
- Be on the look out for persistent and prolonged signs / symptoms that relate to the vestibular or ocular motor systems.
  - Dizziness
  - Fogginess
  - Space and motion discomfort
  - Blurred / double vision
  - Imbalance
  - Headache
  - Poor visual concentration

- Remember – 80% of these symptoms should resolve two weeks post concussion, so referral should be after 2 weeks.
Management Team:

- It’s TEAM WORK!!!
References:


Emory Vestibular Competency Course materials


