Objectives

- Participants will be introduced to common impairments of the vestibular-ocular system that would trigger further investigation through utilization of the Vestibular Ocular Motor Screening tool (VOMs).
- Learners will gain hands-on training performing the Vestibular Ocular Motor Screening tool (VOMs) components to be implemented in post-concussive evaluation when warranted.
- Early rehabilitation strategies will be covered and participants will be able to identify which exercises to utilize based on results of the VOMs.
- Learners will be able to recognize importance of early identification of vestibular-ocular impairments and role of the Athletic Trainer/Vestibular Specialist relationship in returning athletes to activity.

About Me...Dr. W. David Carr

- Practicing AT for 25 years
- San Diego State University BA
- University of Michigan MS
- University of Southern Mississippi PhD
- Assistant Professor @ Missouri State University
- ImPACT Concussion Clinical Trajectories course - 2016
- The Missing Link: Visual and Vestibular Dysfunctions Following Concussion course - 2016
About Me...Dr. Becky Bliss

- Practicing PT for 16 years
- Ithaca College B.S. and M.S. PT 2001, Des Moines University DPT 2014
- Clinical Specialist in Neurological Physical Therapy (NCS) 2016
- Currently enrolled in DHSc Program UIndy
- Assistant Professor @ Wingate University Doctorate of Physical Therapy Program
- Certificate in Vestibular Rehab, APTA 2010
- Advanced Vestibular Rehab Certificate, APTA 2011
- Comprehensive Concussion Management, APTA 2015
- Impact Trained Physical Therapist

What Do You Use?

- SCAT 5
- SCAT 3
- Child SCAT 3
- SCAT 2 (mobile app)
- Sideline Impact Test (mobile app)
- NFL Sideline Tool
- SAC
- King-Devick Test
- Other?

What About the Vestibular Ocular Motor Screening Tool (VOMs)?
Risk Factors

- Several risk factors contribute to an athlete’s concussion recovery.
- Assessing the athlete’s concussion history can provide valuable information; specifically, the number of concussions, the severity of each concussion, and how close in time the concussions occurred to each other.
- Additionally, assessing concussion symptoms (number, severity, and duration), the age of the athlete, and any pre-existing conditions (e.g., history of migraines, headaches, ADD/ADHD, learning disabilities, depression, anxiety) before the season begins can help with managing a concussion if it ever occurs.

Metabolic Crisis

When Do You Assess for What is Driving Symptoms???

Typical Recovery

- 85-90% Concussions show signs of recovery in first 7-10 days... but NEW research says it may be more like 21-28 days (2016)
- Early identification of impairments aids in return to activity/sport without prolonged sequence
Predictors of Prolonged Recovery?

Published in the Journal of Pediatrics 2013:
“Symptoms Severity Predicts Prolonged Recovery after Sport-Related Concussion, but Age and Amnesia Do Not”

Boston Children’s and University of Pittsburgh Medical Center studied a total of 182 patients that presented to their clinics within three weeks of injury.

****We need to listen to the initial symptoms (especially headaches, dizziness and fogginess) described versus considering sex, age, loss of consciousness, and amnesia when discussing length of recovery.

Feasibility of Early PT for Dizziness After SRC: a RCT


- Subjects aged 10-23 years old with acute concussion and dizziness were enrolled from sports medicine centers.
- Forty-one participants were randomized into treatment and were seen for physical therapy beginning at 10 days post-concussion.
- Subjects in the experimental group received individually tailored, pragmatically delivered progressive interventions.
- Subjects in the control received prescriptive sham to minimally progressive interventions.
- The two primary outcomes were medical clearance for return-to-play and symptomatic recovery.
  - The median number of days to medical clearance for the experimental group was 15.5 and for the control was 26.
  - The median number of days to symptomatic recovery was 13.5 for the experimental group and was 17 for the control.

How Do We Treat Based on Symptomology?
Not a Perfect World

- Subtypes RARELY occur in isolation and often overlap
- The KEY is finding the “driving” subtype(s) to start management

---

What Objective Measurements are Available?

- Convergence: the ability of the eyes to work together to focus on something in near vision
- Accommodation: the ability of the eyes to clear an image
- Saccades: ability for eyes to jump from object to object (such as reading)
- Smooth Pursuits: ability of the eyes to follow a moving target
- Ocular Alignment: where the eye sits in the orbit

---

Definitions
Oculomotor Dysfunction Following mTBI

<table>
<thead>
<tr>
<th>Condition</th>
<th>mTBI</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Convergence Insufficiency</td>
<td>55%</td>
<td>5%</td>
</tr>
<tr>
<td>Saccadic Impairment</td>
<td>30%</td>
<td>0%</td>
</tr>
<tr>
<td>Pursuit Impairment</td>
<td>60%</td>
<td>0%</td>
</tr>
<tr>
<td>Ocular misalignment (vertical phoria)</td>
<td>55%</td>
<td>5%</td>
</tr>
<tr>
<td>Ocular misalignment (horizontal phoria)</td>
<td>45%</td>
<td>5%</td>
</tr>
<tr>
<td>Accommodative dysfunction</td>
<td>65%</td>
<td>15%</td>
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</table>

Capo-Aponte et al., Military Medicine 2012

Vergence Dysfunction

The consumption of soft drinks by American youth is increasing. National dietary surveys show that carbonated soft drink consumption more than doubled in youth aged 6 to 17 from about 5 ounces per day in 1977–78 to 12 ounces in 1994–96, the most recent years for which national data are available. Adolescent boys’ soft drink consumption more than tripled during those years.

There are at least two negative results to this soft drink explosion. First, the use of soft drinks is likely related to the rise in childhood obesity. A variety of studies suggest that we don’t eat fewer calories from other sources when we increase calories from beverages. If a child drinks 9 to 10 ounces of a soft drink, that’s equivalent to almost 120 calories.

Convergence Insufficiency

Image of a child with convergence insufficiency.
Accommodative Dysfunction

Failing to clean off your desk before lunch not only makes the risk of colds and flu worse for you, but it could also increase your chances of getting sick. A new report shows that close to half of Americans don’t clean their desks before sitting at them, and a third don’t wash their hands, which may foster the spread of infectious diseases like colds and flu.

Due to a shortage of the flu vaccine this year, health officials have urged the public to take measures to reduce their risk, and researchers say improving at-work hygiene and hand washing habits could have a major impact in reducing sick days. “Desks, phones, door handles, conference tables, the machines and other common workplace areas can be breeding grounds for bacteria-spreading germs,” says Brian Sharon, spokesperson for the Soap and Detergent Association, in a news release.

Oculomotor Dysfunction

Henry looked to the right. He looked to the left. He looked up, and he looked down. Where had Frog gone? Henry did not like being alone in the forest. “Frog, where are you?” Henry called. “Please come back!”

Abnormal Smooth Pursuits
Dizziness Post Concussion

- Dizziness reported in 55%-80% of concussed athletes
- Ocular impairments (blurred vision, diplopia, difficulty reading, etc.) seen in 30%
- Dizziness associated with protracted recovery
- Undiagnosed vestibular deficits may delay recovery

Areas Responsible For Binocular Function

- Accommodation System
- Vestibular System
- Oculomotor System
- Visual System

ImPACT Correlation with Visual/Vestibular Deficits

- Correlation with Visual Motor Speed (VMS) and Reaction Time (RT) on ImPACT
Vestibular Ocular Motor Screening Tool (VOMs)

- Brief screening tool used in concussion management
- Tracks progress and symptom provocation
- Utilization by the non-vestibular practitioner to identify deficits for referral
- Looks at:
  - Smooth pursuits
  - Saccades
  - Near Point of Convergence
  - VOR
  - Visual Motion Sensitivity

Scoring Sheet

<table>
<thead>
<tr>
<th>VOMS SCORING SHEET</th>
<th>Symptoms on a 0-10 point scale</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Smooth Pursuits</td>
</tr>
<tr>
<td>Breath</td>
<td>Score</td>
</tr>
<tr>
<td>Jaw</td>
<td>Score</td>
</tr>
<tr>
<td>Head</td>
<td>Score</td>
</tr>
</tbody>
</table>

Oculomotor Exercise Ideas
Convergence Exercises

- Pencil Push Ups (do not overtrain!)
- Brock String
- Arrow Chart/Dot Card

How Do You Make Convergence Functional?

What about Convergence and Reaction Time?
Convergence and Balance......

Accommodation Training
- Brock String
- Near/Far Heart Charts

Functional Accommodative Training....
Cheap Dynavision......

Visual Feedback

Oculomotor and Balance
Vestibular Exercise Ideas

Adaptation Exercises

- VOR x 1 and x 2 viewing exercises
  - Progression:
    - Duration, goal up to 2 minutes continuous
    - Velocity
    - Patterned/Busy backgrounds
    - Position
    - Target Distance
Cervical Exercise Ideas

Cervical Proprioceptive Exercises
- Head Laser with Targets
- Combine with Saccades
- Eyes Closed awareness

Motor Control Exercises
Motor Control

How Do I Know If They Are Ready to Go Back?

Saccades with Balance and Cervical Proprioception
Sport Specific Drills

Multi-Tasking.....

Are You Getting to Sport Specific Training?
How Do I Implement This as an AT?

- Concussion Management Policy
- Baseline Testing
  - ImPACT newcomers & re-ImPACT returners with history of concussion during previous year
  - Sway (mobile app) - balance & reaction time with mobile device
  - VOMs – football and soccer 2016 - considering all sports 2017
- Evaluation
  - Sideline – History, Sideline Impact Test (mobile app)
  - 4SP – ImPACT, Sway, VOMs – 24-48 hours after injury
- Resources – Don’t hesitate to utilize them!!
  - Physical Therapist - Vestibular Rehab Certification
  - Neurologist – Concussion Specialty

How Do I Implement This as an AT?

- Rehabilitation
  - Consider concussion rehab just as we do knee, ankle, or shoulder rehab etc.
  - Follow 5 phase return to play progression – cognitive, oculomotor/vestibular, cardiovascular, stretching, resistance, balance
  - Implement simple VO exercises in early phase rehab and advance as tolerated combining with sport specific training in the late phases
  - Majority of equipment used in VO rehab is very cost effective
  - Perform early exercises in offices or pool therapy room due to high stimulus in AT facility
  - Re-test ImPACT, Sway, and VOMs when 5 phase RTP progression has been completed before full release to sport
How Do I Implement This as an AT?

What about Telerehab???
- State Practice Acts
- Future Direction for Schools with remote locations and no Vestibular Specialist

Could This Work?????

Telerehabilitation Case
- 21 year-old female AT student (lacrosse player)
- Most recent Concussion 9/2016
- Two previous concussions
- Most recent 2 months prior to start of treatment
- Daily migraines, trouble concentrating, grades slipping, vision problems
Telerehabilitation Case

- Post Injury wait and see
  - Has not started exertional exercises/protocol
- Reports decrease in cognitive performance since injury
- Assessed in 11/2016

<table>
<thead>
<tr>
<th>Exam</th>
<th>Right</th>
<th>Left</th>
<th>Normal</th>
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<tr>
<td>VOR</td>
<td></td>
<td></td>
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<tr>
<td>JPE</td>
<td>&gt; 4.6</td>
<td></td>
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<tr>
<td>Ocular</td>
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<tr>
<td>Convergence</td>
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Telerehabilitation Case

- Cervical ROM: 25% limited left rotation and Left sidebending
- Cervical JPE: > 4.6 degrees in bilateral rotation and extension
- Oculomotor ROM: abnormal, left eye shows in-ward deviation in multiple quadrants
- Smooth Pursuits: abnormal
- Saccades: abnormal, hypometric in horizontal and diagonal planes
- Convergence: abn (normal, fatigue with repetitions)
- VOR: not formally tested but increased symptomology on VOMs testing by ATC
- VOR Cancellation: increased symptomology as reported on VOMs
- Cover Test: normal
- Uncover Test: mild esophoria
- Alternate Cover Test: mild esophoria
- Brock String: patient saw “x” cross proximally to yellow bead, confirms esophoria

Telerehabilitation Treatment

- Saccades 1 min 3x daily
- Cardio – no pounding, build up to 30 minutes
- Brock's string 1 min 3x daily
- Dot chart 1 min 3x daily
- Near chart 1 min 3x daily
- Laser target 1 min daily
- Laser tape strips 1 min daily
- Postural re-education
Telerehabilitation Case 2 Weeks Post Treatment

Treatment Progressed @ 2 weeks:

- Cervical dry needling/PRT/massage followed by laser activities (target and lines)
- Up to 30 minutes of cardio daily
- Block’s string 1 min 3x daily
- Lacrosse throw and catch daily
- Ball with letters and numbers
  - Throw ball against wall reading letters/numbers
  - Stand on Airex pad and toss ball reading letters/numbers
  - Walk and toss ball reading letters/numbers

Case Study – 6 weeks

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<tr>
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When she started her treatment plan was REST
Within 6 weeks she was nearly symptom free

When she started her treatment plan was REST
What if she started at 10 days post injury vs. 8 weeks post injury??
Hopefully You Don’t Feel Like This....

References


