

Using VOMS for Concussion Management




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Conflict of Interest Statement

- I have no conflict of interest to disclose.

Objectives

- To identify the effects of how sustaining a concussion can have on vestibular-ocular function of a patient.
 - To understand the evaluation process of vestibular-ocular function both pre- and post-concussion to properly manage and make return to play decisions.
 - To utilize VOMS exercises as part of the clinician's plan of care for a patient who has sustained a concussion and has vestibular-ocular dysfunction.
 - To evaluate a patient pre- and post-VOMS exercises for exacerbation of their signs and/or symptoms and determine the proper progression for the exercises.
 - To implement return-to-play guidelines following a concussion utilizing different rehabilitation techniques, including VOMS, that address all deficits a patient may have post-concussion.
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CONCUSSIONS

What is a Concussion?

- NATA Position Statement: Management of Sport Concussion - A concussion, which is a form of mild traumatic brain injury (mTBI), has been defined as a trauma-induced alteration of mental status that may or may not involve the loss of consciousness.¹
- McCrory et al. defines a concussion diagnosis as an injury caused by a direct blow to the head, face, neck or elsewhere on the body with impulsive force transmitted to the head, resulting in impaired neurological function and acute clinical symptoms.²

Concussion Frequency

- The World Health Organization's (WHO) Collaborating Centre Task Force estimate that the annual incidence of concussion is 100 to 300/100,000 emergency department visits³
 - Many go unreported – closer to 600/100,000³
- It is estimated that 1.6-3.8 million concussions occur annually as a result of sport participation⁴
 - Many by high school aged students^{5,6}
 - Account for approximately 5% of all collegiate sport-related injuries⁷

Mechanisms of Concussion

- Direct blow to the head or body
 - Head snap forward, backward, or rotate to the side⁸
- Common in collision or contact sports⁹
 - Football, soccer, lacrosse, boxing, ice hockey wrestling¹⁰
- Not limited to only contact sports
 - Baseball, softball, gymnastics, field hockey, volleyball, cheerleading, track
- Non-sport related
 - Motor vehicle accidents & direct contact with an inanimate object¹¹

Signs & Symptoms¹²

- Dizziness
- Headaches
- Blurred vision
- Abnormal eye tracking
- Diplopia
- Photophobia
- Tinnitus
- Delayed verbal & motor responses
- Slurred speech
- Concentration problems
- Memory deficit
- Disrupted coordination
- Behavioral changes
- Loss of consciousness^{9,13}

Evaluation

- Determining level of consciousness
- Assessing ABC's and cervical spine
- HOPS
 - Neurological Exam
 - Cranial Nerves
 - Dermatome, myotome, and reflexes
 - Coordination (Cerebellar) Tests
 - Romberg Test
 - BESS Test
 - Finger-to-nose
 - Tandem gait
 - Cognitive (Cerebral) Tests

Romberg Test



Single Leg Non-Dominant Stance (eyes open/closed)

Tandem Stance Non-Dominant in Back (eyes open/closed)



Tandem Stance Non-Dominant in Back (eyes open/closed) on Foam

Single Leg Non-Dominant Stance (eyes open/closed) on Foam



Cerebellar (Balance) Tests

- Balance Error Scoring System (BESS)⁹

Types of Errors

1. Hands lifted off iliac crest
2. Opening eyes
3. Step, stumble, or fall
4. Moving hip into > 30° ABD
5. Lifting forefoot or heel
6. Remaining out of testing position for > 5 sec

The BESS is calculated by adding one error point for each error during the six 20-second tests.

Score Card (# errors)	FIRM Surface	FOAM Surface
Double-Leg Stance (narrow stance- feet together)		
Single-Leg Stance (nondominant foot)		
Tandem Stance (nondominant foot in back)		
Total Scores		

BESS Test



Coordination (Cerebellar) Tests

- Tandem Gait¹⁴⁻¹⁶
 - Heel-to-toe walking



Cognitive (Cerebral) Tests

- Baseline measurements vs. post-concussion^{10,17}
 - Memory recall
 - Retrograde amnesia - who won last week, where they live, food ate for breakfast
 - Anterograde amnesia - game score, last play, 3 word recall
 - Serial 7
 - Backward spelling
 - Months in reverse order

Sport Concussion Assessment Tool (SCAT)

- Development & Implementation^{18, 19}
 - Symptom scale
 - Maddocks' questions/score
 - On-field markers of concussion
 - Amnesia, loss of consciousness
 - Return to play
- Revisions
 - SCAT2: 2004 – Glasgow Coma Scale (GCS), alternate word lists, BESS (hard surface only)
 - SCAT3: 2013 – additional physical/objective signs, option for foam stances or timed tandem gait
 - SCAT5: 2017 – more alternative digits, neurological screen, modified tandem gait (no timing)
- Children's SCAT (< 13 yo)²⁰⁻²²
 - Versions 3 and 5

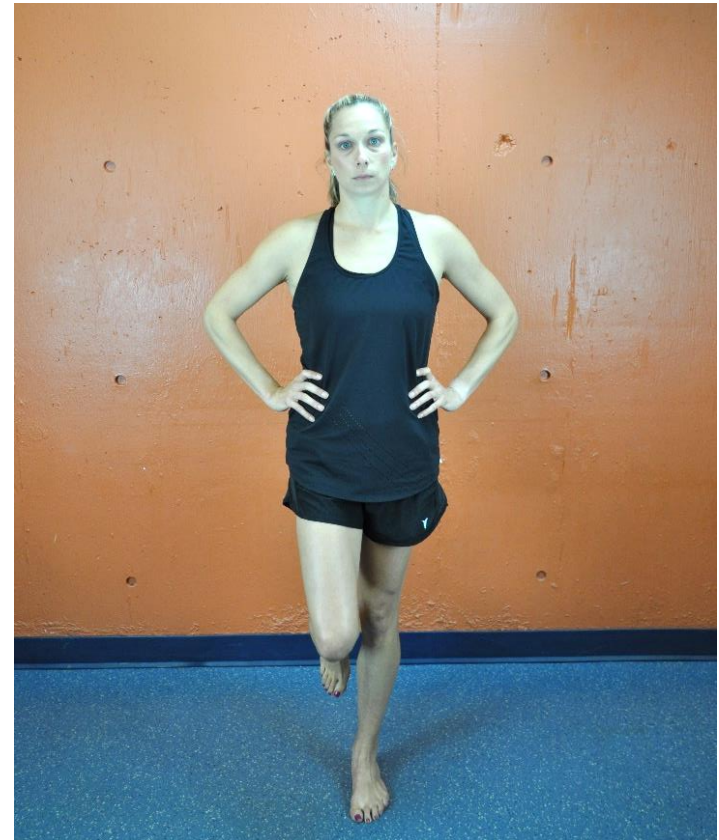
Neurocognitive Tests

- Pencil & Paper^{23, 24}
 - Stroop Color Word Test
 - Symbol Digit Modalities Test
 - Controlled Oral Word Association Test
- Computerized^{23, 25}
 - ImPACT
 - Sway
 - CNS Vital Signs
 - ANAM


EFFECTS OF CONCUSSION ON ACTIVITY

Maintaining Balance & Stability

- Joint posture
 - Relies on nervous system
 - Spinal cord
 - Brain
 - Voluntary control
 - Muscle selection during movement
 - Conscious
 - Unconscious



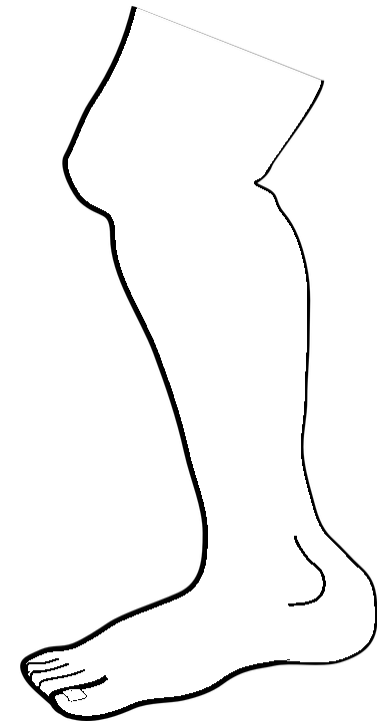
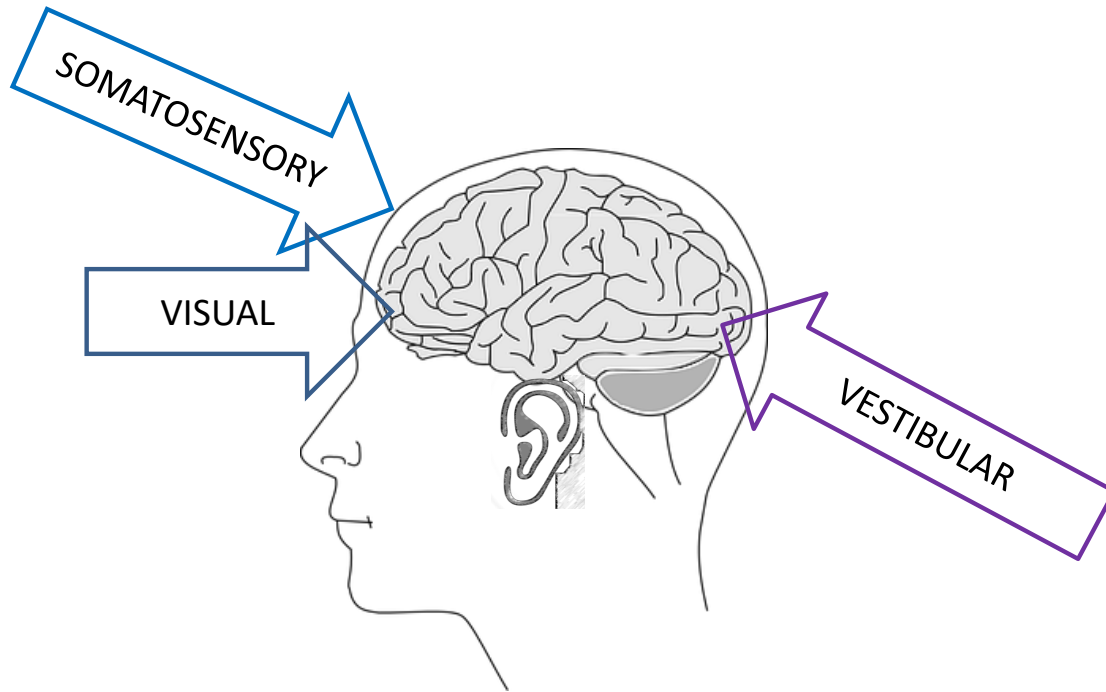
Balance & Motor Symptoms Associated with Concussion²⁶⁻²⁹

- Short-term
 - Balance & static postural control
 - Gait unsteadiness & dynamic postural control
 - Long-term
 - Altered postural control
 - Gait impairment
 - Increased risk of lower extremity injury
 - Clinical symptoms vs. Balance & Gait alterations
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Sensory Influence

- Sensory signals
 - Initiated by brain, peripheral nervous system (PNS), or both
- Visual (Eyes)
 - Vision
 - Spatial orientation & positions relative to environment
- Vestibular (Ear)
 - Head movement & orientation relative to gravity
- Somatosensory (Receptors)
 - Location of one body part to another
 - Awareness in space (proprioception)
 - Loads
 - Joint position receptors
 - Ruffini endings, Golgi receptors, Pacinian corpuscles
 - Muscle length & tension receptors
 - Muscle spindles & Golgi tendon organ

Brain Functions



Age Considerations³⁰

- Ages 4 to 6
 - Integration of all systems can overload brain
 - Balance & coordination may suffer
- Ages 7 to 10+
 - More reliant on somatosensory & vestibular systems
 - Fewer postural adjustments
 - Concentrate on other tasks (ball movement, monitoring opponents)
 - Process information related to developing strategies and tactics



RECOMMENDATIONS FOR RETURN TO PLAY POST-CONCUSSION



Acute Rest

- Most widely used intervention³¹⁻³⁴
 - Cognitive and physical exertion can ↑ symptoms^{19,35}
 - Mitigates post-concussion symptoms
- Minimizing energy demands on the body³⁶⁻³⁸
- Decreased risk sustaining another concussion³⁹
 - Note: restricting sport participation that would put patient at risk, rather than usual activities⁴⁰⁻⁴²

Prolonged Rest

- Prolonged rest
 - Not beneficial⁴³
 - Physical deconditioning⁴⁴, metabolic disturbances⁴⁵, fatigue, depression⁴⁶
- Recommendations
 - Early post-injury (24-48 hours)
 - Decrease effects of symptoms
 - After 24-48 hours, gradual increase in activity
 - Below cognitive & physical symptoms exacerbation threshold⁵⁸

Rehabilitation

- Stepwise progression
 - Light aerobic activity⁷ → sport/work specific activities⁴⁷
- Focusing on systems affected⁴⁸
 - Vestibular
 - Cognitive
 - Sensorimotor

Vestibular Rehabilitation

- Found to improve dizziness and gait & balance dysfunction^{49,50}
- Vestibular/Ocular Motor Screening (VOMS)⁵¹
 - Smooth pursuit
 - Horizontal & vertical saccades
 - Convergence
 - Horizontal vestibular ocular reflex (VOR)
 - Visual motion sensitivity (VMS)

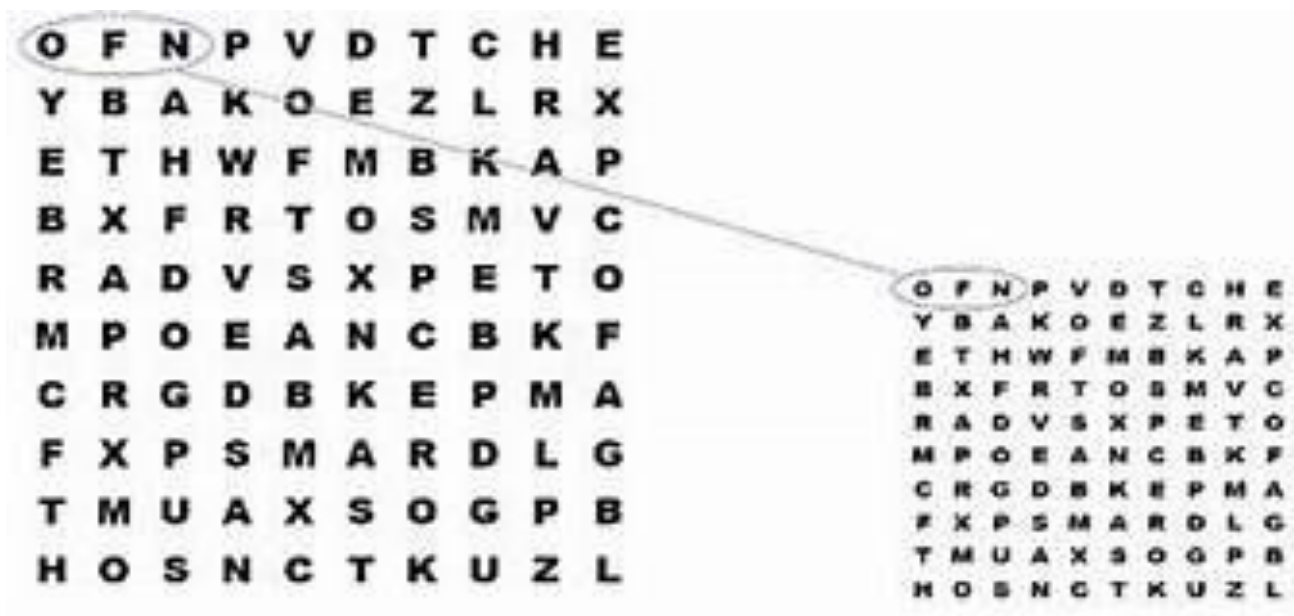
Smooth Pursuit



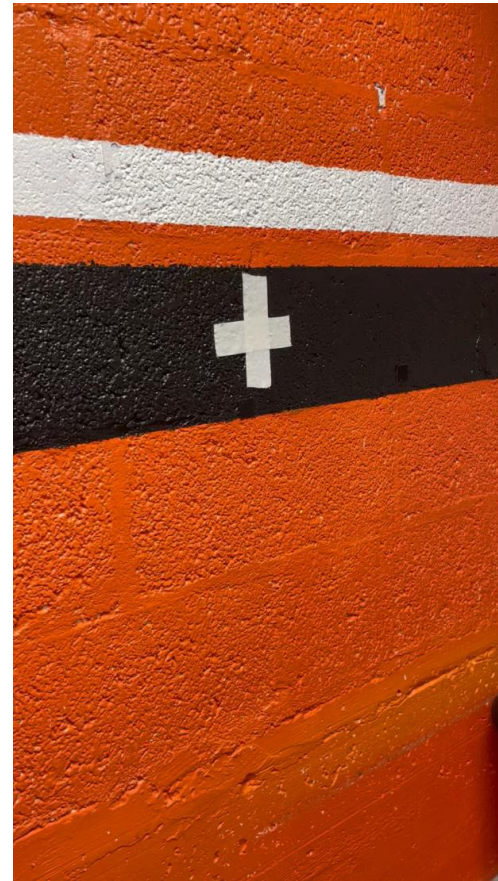
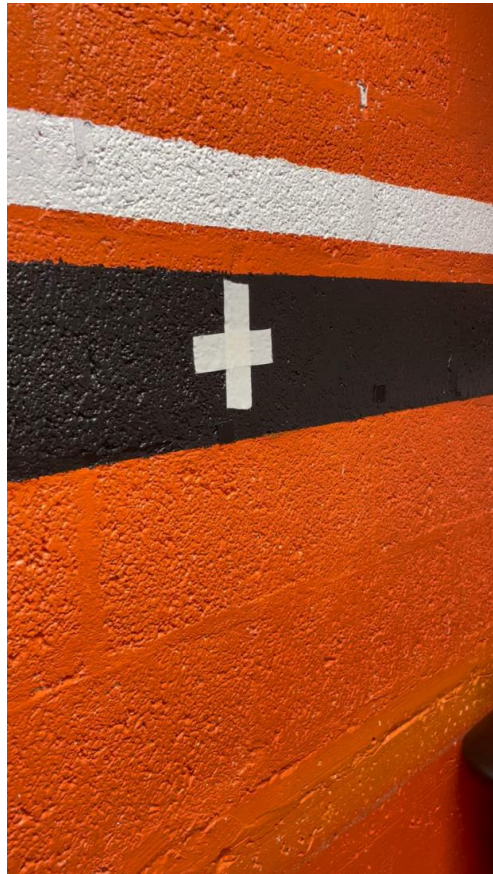
Horizontal Saccades



Convergence




VOR Testing



VMS Testing



Summary

- Clinical Symptoms
 - Cognitive & Motor Deficits
 - Using VOMS as part of RTP protocol
 - Subjective RTP guidelines
 - No one-size-fits-all approach
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QUESTIONS?

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THANK YOU!

