

Overview of Concussion Management

Presented by: Bridgett Wallace, PT, DPT

360 Balance

7900 Shoal Creek Blvd., Ste 200

Austin, TX 78731 (512) 345-4664

www.360balance.com

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Objectives – The course participant will be able to:

- Recognize the impact of concussions and need for a comprehensive care model.
- Identify the components of sideline and advanced testing.
- Explain the rationale for vestibular exercises.

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The Need for Concussion Protocols

- Estimated >300,000 sports-related concussions annually
- Estimated 20% (+) likelihood of sustaining a concussion in contact sports
- Previously established parameters >10 yo
- Notable variability among providers (>15 tools)
- Low sensitivity and specificity

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The Need -- continued

- Common indicator for return-to-play is absence of headache
- Too much dependence on loss of consciousness
- Poor clinical algorithms with mild head injury
 - 79% of patients hospitalized for two days or fewer and with a normal neurological examination will experience dizziness within three months following a head injury. (University of Virginia Health System, Department of Otolaryngology - Head & Neck Surgery, Vestibular & Balance Center. http://www.healthsystem.virginia.edu/internet/otolaryngology/patient_vbc.cfm.)

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The Recommended Process

- Start with baseline (clinical and/or computerized)
 - Neurocognitive testing
 - Balance testing
- Following a concussion: C.L.E.A.R.
 - Clear from life threatening issues
 - Listen to their symptoms (e.g., Graded Symptom Checklist)
 - Evaluate per sideline protocol (cognitive & balance function)
 - Assess findings: (+) → Do not RTP; (-) withhold 15 minutes
 - Re-assess: (+) → Do not RTP; (-) consider RTP w/greater caution in adolescent athletes

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Recommended Process - continued

- The objective of a sideline assessment is not to make a diagnosis but to identify impairments, especially red flags.
 - Any loss of consciousness
 - Worsening in the status of the athlete
 - Any significant change in vital signs
 - Findings in sideline tests (cognitive/balance)
 - Behavioral changes

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Recommended Process – continued

- Imaging (MRI, CT scan) may be warranted
- Computerized Cognitive Testing
- Further vestibular (inner ear) diagnostic testing is often indicated
 - Electronystagmography/Videonystagmography
 - Computerized eye and head coordination
 - Computerized balance testing
 - Audiogram if hearing complaints
- A comprehensive neurological examination and evaluation is a must!

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ENG/VNG

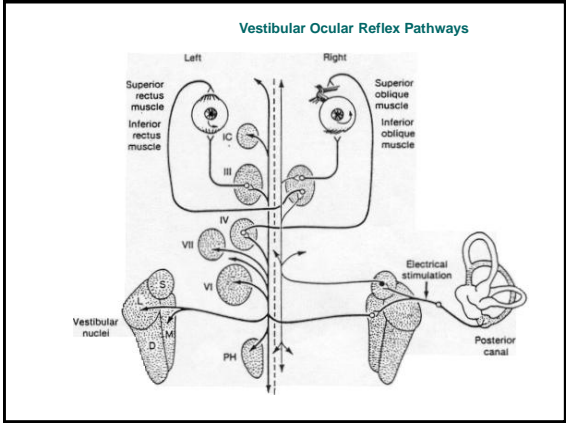
- Nystagmus – rapid eye movement
 - cardinal sign of vestibular pathology (peripheral and/or central)
- Oculomotor – tracking, saccades, optokinetic
 - Key component of differentiating peripheral vs central pathology
- Positional – seated->supine, sidelying, etc.
 - Strong indicator of benign positional vertigo, which is common post head trauma
- Calorics – if warranted (cool & warm air or water)
 - Most valuable for identifying vestibular weakness

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Computerized Vestibular Ocular Reflex Testing (Eye & Head Coordination)

- Newer technology that measures eye & head coordination related to sensory information from the vestibular system.
- The VOR allows visual tracking of objects and is of particular importance in more dynamic situations (e.g., walking, quick head movements, etc).
- A VOR impairment can result in movement-related dizziness, unsteadiness and/or visual blurring during dynamic activities.
- Computerized testing evaluates the ability to use their VOR efficiently to maintain visual stability at fast speeds of head movement.

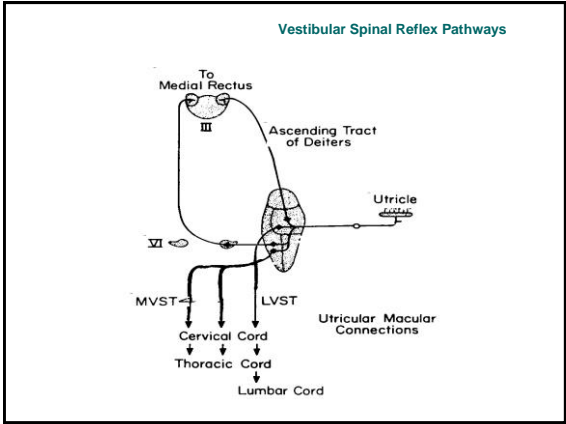
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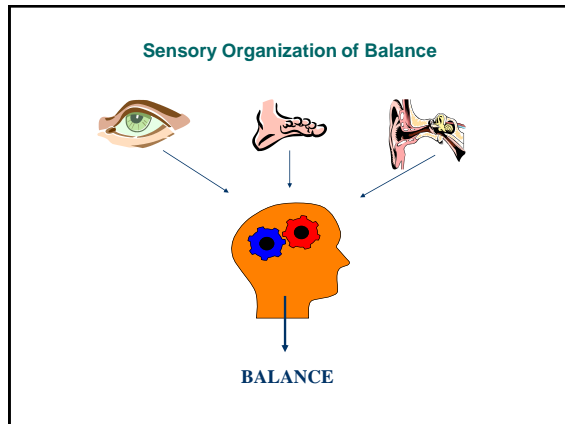
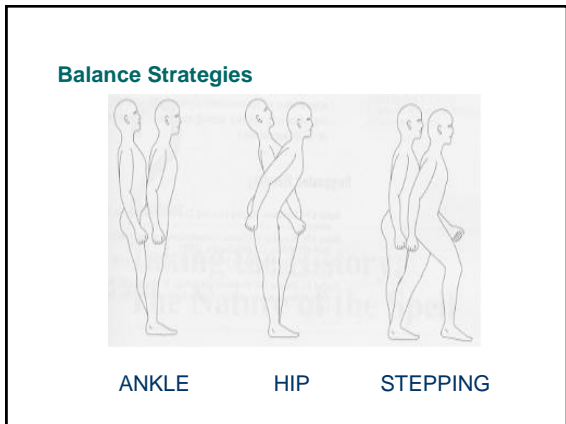


Computerized Vestibular Spinal Reflex Testing (Balance Strategies)

- Technology that measures the use of visual, tactile and vestibular information for balance.
- The VSR facilitates information regarding the appropriate use of balance strategies (e.g., ankle, hip, stepping).
- Computerized testing identifies impairments in one or more of the sensory systems.
- Frequently referenced in the literature as an integral component of concussion testing.

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Limits of Stability

- The maximum distance an individual can lean away from the base of support (BOS) without losing balance

Anterior: 8°	} 12° A/P
Posterior: 4°	
Lateral: 8°	} 16° lat

The diagram shows a person standing inside a cone that represents the limits of stability. The cone is wider at the base and tapers towards the top, indicating the range of lean that can be maintained without losing balance.

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What if I don't have technology?

- Advanced computerized testing (e.g., vestibular and/or ImPACT) is not mandatory.
- Impairments (cognitive or balance) noted, however, should at the very least be referred to an appropriate provider.
- Regardless of what specialty testing is available, a comprehensive neurological examination is needed.

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Components of Exam: Subjective

- Clinical History
 - PMH
 - Nature of Injury
 - Previous Injury(ies)?
- Graded Symptom Checklist (GSC)

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Components of Exam: Objective

• Mental	• Coordination
• Cranial Nerve	• Static Balance
• Sensory	• Gait
• Motor	• Other
• Nystagmus	- Tone
• Oculomotor	- Tremors
• Coordination	- Reflexes

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Purpose of Examination

- Differentiate peripheral versus central findings
- Recognize the need for further testing
- Identify if appropriate for rehabilitation

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Rationale for Treatment

- The goal is to promote adaptation through central nervous system compensation for the vestibular deficits.
 - Example: If (+) vestibular oculomotor reflex (VOR) findings, then prescribe eye and head coordination exercises.
 - Example: If poor use of vestibular inputs for balance, then prescribe exercises on unstable surfaces with eyes closed.

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Case Study

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Athlete 1 -- Hx

- 20 yo female basketball player
- PMH: no previous concussions; baseline testing WNLs (cognitive and balance)
- Sustained concussion during b-ball game
- No LOC
- CCs (>72 hours s/p MHI): movement-related dizziness, imbalance; HA; nausea; fatigue; concentration problems; tinnitus; aural fullness.

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Athlete 1 – Initial Examination

- Clinical: (neurological exam essentially normal)
 - Tandem - <10 sec; SLS x 5 sec
 - Romberg, firm x 14 sec; Foam x 9 sec
 - Dynamic Visual Acuity: 20/40 (3 line difference)
 - GSC: 24
- Computerized
 - VSR: impaired use of vestibular cues for balance
 - VOR: reduced gain (accuracy) across all frequencies in horizontal plane
 - ImPACT™: (+) findings

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Exercises

- VOR
 - Per eye chart
 - Per walking with head movements then progressed to jogging and running
- Balance
 - Static & Dynamic – to centralize center of gravity (e.g., tandem and SLS activities)
 - Compliant/unstable Surfaces with eyes closed

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Exercises – cont

- Additional (non-balance)
 - Exertional activities
 - Sport – specific activities – non-contact
- ATC monitoring symptoms/responses to activities
- Other: minimizing sensory input, especially auditory and visual

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Athlete 1 – Follow-Up (5 days)

- Clinical:
 - Tandem & SLS x 30 sec bilaterally
 - Romberg, firm x 30 sec; Foam x 30 sec
 - DVA: 20/20 (0 line difference)
 - GSC: 0
- Computerized
 - VSR: normal use of sensory inputs for balance
 - VOR: low-normal gains at fast speeds (5-6 Hz)
 - ImPACT™: no significant difference from baseline

*Note: VOR exercises were continued for 3 more weeks

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Successful diagnosis and treatment of the post-concussional athlete requires a collaborative effort from *all* team members:

- ATC/PT -- for providing an accurate and thorough evaluation at onset of injury
- TEAM PHYSICIAN/PA -- for supervising protocol implementation and monitoring appropriate treatment regimens
- Specialty Providers/Consultants-- for providing advanced testing and plan of care recommendations.



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Q&A:

Presented by: Bridgett Wallace, PT, DPT

E-mail: bridgett@360balance.com

Address: 360°Balance
7900 Shoal Creek, Ste 200
Austin, TX 78757
Tel: 512-345-4664
www.360balance.com

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