VESTIBULAR CONSIDERATIONS FOLLOWING TBI & HOW TO RECOGNIZE THEM

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Treatment Philosophy
• Engaging and supporting the whole person to optimize their care and healthcare experience

Post Doctoral Accreditations
• Certified Orthopedic Manual Therapist (COMT)
• Certified Vestibular Specialist
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Education
• University of Kansas Medical Center, Doctorate in Physical Therapy (2017)
• Kansas State University, Bachelor of Science in Kinesiology (2014)
OBJECTIVES

• Summarize the function of the vestibular system

• Describe the difference between peripheral and central vestibular function

• Recognize the signs and symptoms of vestibular dysfunction in TBI patients

• Summarize the pathophysiology of vestibular dysfunction in TBI patients

• Apply vestibular screening tests to appropriate TBI patients

• Identify appropriate referral sources for patients with vestibular considerations following TBI
WHAT IS THE VESTIBULAR SYSTEM
ANATOMY AND FUNCTION OF THE VESTIBULAR SYSTEM

- **Primary Function:** obtains sensory information about motion, head position and spatial orientation
- **Secondary Function:** involved in motor functions for balance, head and body stability with movement, and maintaining posture

**Anatomy**
- **Peripheral Vestibular System**
  - Semi-Circular Canals
  - Otolith Organs: Utricle and Saccule
- **Central Vestibular System**
  - Vestibular Nuclei
  - Cerebellum & Cortex
PERIPHERAL VESTIBULAR SYSTEM

Semi-Circular Canals

- 3 Canals
  - Arranged at perpendicular angles to one another
  - Filled with fluid (endolymph)
  - Stimulated by specific head motions
    - Anterior Canal: detects ROLL (up/down)
    - Posterior Canal: detects PITCH (side/side tilting)
    - Horizontal Canal: detects YAW (rotation/turning)
PERIPHERAL VESTIBULAR SYSTEM

• Otolith Organs: Detect linear acceleration/deceleration and gravity
  • Saccule: Senses linear acceleration in the sagittal plane (head is pitched forward) or you’re suddenly lifted vertically in an elevator
  • Utricle: Senses linear acceleration in the frontal plane (head tilt) as well as horizontal linear acceleration like sliding across the floor in a rolling chair
• Detection via otoconia (“crystals”) and hair cells
CENTRAL VESTIBULAR SYSTEM

Vestibular Nuclei

- Initial primary processor of incoming vestibular sensory information
- Ability for direct FAST connections between incoming information and motor output
- 4 nuclei, located in the pons & medulla
CENTRAL VESTIBULAR SYSTEM

• Vestibular Nuclei
  • Superior vestibular nuclei – stabilize gaze
  • Medial vestibular nuclei – stabilize posture
  • Lateral vestibular nuclei – stabilize posture
  • Inferior vestibular nuclei – cerebellum
CENTRAL VESTIBULAR SYSTEM

Cerebellum
• Intimately connected with the vestibular system
• High-level main adaptive processor
• Monitors vestibular responses and adapts as necessary

Cortex
• No “vestibular cortex”
• Vestibular information is integrated and processed in multiple areas of the brain
  • Including Temporoparietal Cortex, Thalamus, Limbic System, and even regions involved in sleep
VESTIBULAR FUNCTION RECAP

“The vestibular system is responsible for integrating information from head movements and limb position to maintain visual and balance control. It is a complex network that includes the inner ear, brainstem, cerebellum, cerebral cortex, ocular system, and postural muscles.”

- Peripheral System – “Raw Data Collector”
- Central System – “Information Transfer Center”
SIGNS & SYMPTOMS OF VESTIBULAR DYSFUNCTION
SIGNS & SYMPTOMS OF TBI

Monitor for exacerbation of pre-existing conditions.
SIGNS & SYMPTOMS OF VESTIBULAR DYSFUNCTION

- Reduced Desire to Move the Head
- More Cautious Movement
- Dizziness (with or without vertigo)
- Motion Sickness
- Poor balance
- Decreased Postural Control
- Nausea
- Vomiting

- Double Vision
- Oscillopsia (Bouncing Vision)
- Visual Motion Sensitivity
- Migraine/Vestibular Migraine
- Auditory Impairment
- Tinnitus (Ringing in the Ears)
CAUSES OF DIZZINESS IN TBI

Peripheral
- Mechanical (i.e. BPPV)
- Hypofunction
- Nerve Damage

Central
- Trauma (i.e. damage to the brain stem of cerebellum)
CAUSES OF DIZZINESS IN TBI

Mechanical
- Displaced otoconia disrupting the accuracy of the “raw data” collector

Hypofunction
- When one or both “raw data” collectors aren’t functioning fully
SCREENING TESTS FOR VESTIBULAR DYSFUNCTION

Rhomberg Testing
• Stand with feet together with eyes open then closed
• Positive: Unable to maintain balance, opens eyes

Fukuda Testing
• March in place for 60 seconds with eyes closed
• Positive Test: opens eyes, can’t complete test for 60 seconds, moves more than 18” in any direction, rotates more than 30 degrees
WHERE TO REFER

It depends...

• Vestibular Certified Physical Therapist
• Concussion Certified Physical Therapist
• ENT
• Audiologist
• Neuro-ophthalmologist
QUESTIONS?
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Call/Text: 785-477-1093
www.sparqpt.com
Instagram: @drkelsyrayl_dpt
Insurance: Private Pay, Medicare, Medicaid
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