BALANCE AFTER BRAIN INJURY

VESTIBULAR SYSTEM DISORDERS:
ANATOMY, ASSESSMENT and TREATMENT

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OBJECTIVES

- Understand variables that contribute to balance deficits
- Understand the relationship between a brain injury and balance
- Become familiar with the components of a vestibular/balance assessment
- Describe common treatments for balance impairment after brain injury

BRAIN INJURY BALANCE RELATIONSHIP

23-81% of persons with TBI have dizziness and lack of balance

DIZZINESS PRESENTATION: Umbrella term

- Spinning/vertigo
- Feeling "off"
- Unsteady
- Lightheaded

COMMON CAUSES OF BALANCE DEFICITS POST TBI

MEDICATIONS

- Side effects
  (cardiac, tranquilizer, blood pressure, anti seizure medication)
- >4 increased risk for falling

VISUAL IMPAIRMENTS

COMMON CAUSES OF BALANCE DEFICITS POST TBI

VESTIBULAR IMPAIRMENTS (whiplash, virus, concussion, etc.)

- BPPV
- Labyrinthine Concussion
- Traumatic endolymphatic hydrops

SENSORY IMPAIRMENTS

MENTAL HEALTH ISSUES (psychogenic dizziness)

- Anxiety
- Depression

BALANCE EVALUATION

- Systematic testing of the physiological systems responsible for balance

  MUSCULOSKELETAL

  SOMATOSENSORY

  VISUAL

  VESTIBULAR

BALANCE EVALUATION

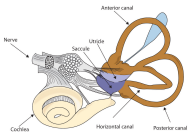
SOMATOSENSORY
- Sensory discrimination
  - Impaired or absent

MUSCULOSKELETAL
- Strength testing

BALANCE EVALUATION

VISUAL
- Oculomotor testing

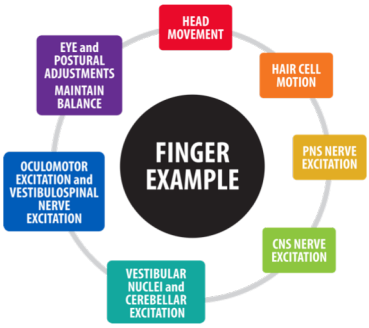
VESTIBULAR
- Inner ear/body relationship



OCULOMOTOR ASSESSMENT

The relationship between what we see, how the brain processes and the motor response.

This interaction allows a person to stay balanced in both static and dynamic situations.



OCULOMOTOR ASSESSMENT

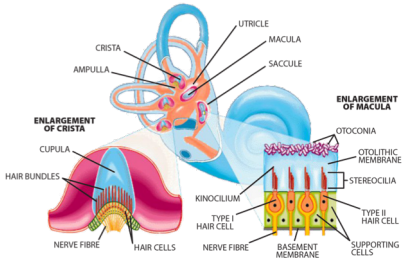
EXAMPLE:
- Spontaneous nystagmus
- Smooth Pursuit
- Saccades
- Gazed Evoked Nystagmus
- VOR Head thrust
- DVA Testing

VESTIBULAR SYSTEM OVERVIEW

3 SEMI CIRCULAR CANALS
- Bony Labyrinth & Membranous Labyrinth
- Angular motion
- Perilymphatic vs. endolymphatic fluid
- Ampulla: connects to Utricle
- Co-Planar pairing

OTOLITHIC ORGANS
- Vertical or linear motion
- Otoconia
- Hair cells
- CNS connections: CN VIII to Vestibular Nuclei to VOR and VSP/VCR: posture and eye stability dynamic/static conditions

VESTIBULAR SYSTEM ANATOMY



VESTIBULAR ASSESSMENT

CNS vs. PNS

CNS Disorders:
- CVA
- MS
- TBI
- Brain tumor
- AVM

CNS Treatment
- Habituation
- Compensatory techniques/strategies
- Environmental modifications
- Education

VESTIBULAR ASSESSMENT

CNS vs. PNS

PNS Disorders
- BPPV: Otoconia get out of place and settle in the Semi Circular canal
- Meniere's disease
- Vestibular Hypofunction

PNS Treatment
- Canalith Repositioning Maneuvers (CRT)
- Gaze stabilization exercises
- Compensatory techniques/strategies
- Environmental modifications
- Education

PNS VESTIBULAR ASSESSMENT

BPPV

BPPV Cause
- Crystal (otoconia) has become dislodged and is floating in one of the SCC

BPPV symptoms
- Attacks spinning/vertigo in certain *positions*
- May occur with nausea/vomiting in certain positions

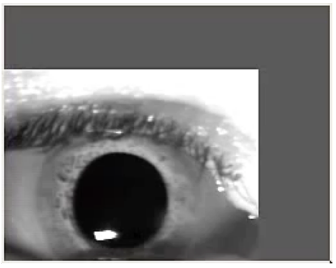
BPPV TESTING

Dix-Hallpike: Determines which semi circular canal (SCC) is involved based on the nystagmus seen in a clients eyes during maneuver.
- Upward Beating Nystagmus: Posterior Semi Circular Canal
- Downward Beating Nystagmus: Anterior Semi Circular Canal
- Nystagmus should fade within a few seconds (canalithiasis). If nystagmus persists (cupulolithiasis).

Roll Test: Test for the horizontal SCC.
- Downward beating Nystagmus: Cupulolithiasis
- Upward beating Nystagmus: Canalithiasis

DIX HALLPIKE

(+) Dix Hallpike (nystagmus)



WHAT TO DO NEXT?

RECHECK THE CANALS

Are they clear?

REHABILITATE THE VESTIBULAR SYSTEM (weak after injury)

Head motion

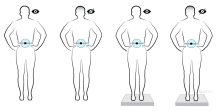
Eye motion

Body motion

mCTSIB

CLINICAL TEST OF SENSORY INTERACTION ON BALANCE DEMONSTRATION

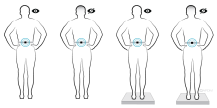
- Firm surface eyes open
- Firm surface eyes closed
- Foam surface eyes open
- Foam surface eyes closed



mCTSIB

mCTSIB helps to determine which balance system is impaired.

- Firm is **somatosensory**
- Foam eyes open is **vision**
- Foam eyes closed is **vestibular**
- Normal score is 30 seconds in each position with no postural sway



VESTIBULAR TREATMENT FOCUS

Strengthen the vestibular system through input from somatosensory, visual and vestibular stimulation.

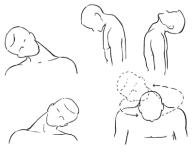
HEAD MOTION + EYE MOTION = VESTIBULAR FUNCTION

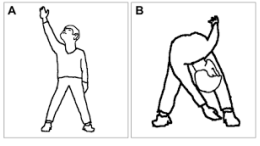
VESTIBULAR TREATMENT FOCUS

EXAMPLE:

VESTIBULAR TREATMENT FOCUS

EXAMPLE:





CONCUSSION

Dizziness: 23%-81% of post TBI

Concussion can cause:

BPPV	Unilateral vestibular loss	Post traumatic anxiety
Labyrinthine concussion	Migraines	Post traumatic vertigo
Perilymphatic fistula	Diffuse axonal injury	Central post traumatic vertigo

CONCUSSION

Treatment

- Multifactorial
- Multi-professional
  - PT
  - OT
  - Mental Health

CONCUSSION

Treatment

1. Warm Up
2. Balance Specific Exercises
3. VOR/gaze stabilization exercises (VORx1 & VORx2)
4. Eyes Open/closed
5. Habituation
6. Relaxation
7. HEP
8. Exercise Diary

(Kleffelgaard 2016)

VESTIBULAR/OCULAR-MOTOR SCREENING
(VOMS) FOR CONCUSSION

Vestibular/Ocular Motor Test:	Not Tested	Headache 0-10	Dizziness 0-10	Nausea 0-10	Fogginess 0-10	Comments
BASELINE SYMPTOMS:	N/A					
Smooth Pursuits						
Saccades – Horizontal						
Saccades – Vertical						
Convergence (Near Point)						(Near Point in cm): Measure 1: _____ Measure 2: _____ Measure 3: _____
VOR – Horizontal						
VOR – Vertical						
Visual Motion Sensitivity Test						

QUESTIONS?