Treatment of Peripheral Vestibular Hypofunction

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Disclosures

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Objectives

1. Discuss the difference between unilateral and bilateral vestibular dysfunction
2. Review treatment principles for adaptation, substitution, and habituation with consideration for pediatric population
3. Understand treatment variations for older vs younger children
Postural Control

- Internal Cues
  - Vestibular System
- External Cues
  - Somatosensory and Visual Systems
Peripheral Vestibular System

- Semi-circular Canals
  - Angular acceleration of the head
- Otolith Organs
  - Linear acceleration and static head tilt
  - Utricle (horizontal)
  - Saccule (vertical)
Vestibular Reflexes

● Vestibulo-spinal Reflex (VSR)
  ○ Motor response for postural control

● Vestibulo-ocular Reflex (VOR)
  ○ Gaze stabilization with head movement
Vestibulo-Spinal Reflex (VSR)

● Signs of dysfunction:
  o Falls/Frequent tripping
  o Difficulty balancing on uneven surfaces
  o Veering while walking
  o Standing with wide base of support
Vestibulo-Spinal Reflex (VSR)

- Modified Clinical Test of Sensory Integration on Balance
- Balance Error Scoring System
- Dynamic Gait Index
- Bruininks-Oseretsky Test of Motor Proficiency (BOT-2)
- Functional Gait Assessment
- Peabody Developmental Motor Scales (PDMS-2)
Vestibulo-ocular Reflex (VOR)

- Symptoms of dysfunction
  - Difficulty reading or focusing with head movement
  - Dizziness and blurry vision
  - Fear avoidance of head movement
  - Symptoms with certain frequency of head movements
Dynamic Visual Acuity (DVA)

- Functional measure of VOR
- Active assisted head turns at 2 cycles per second
- Positive test $\geq 2$ lines from baseline visual acuity
Head Impulse Test (HIT)

- Clinical sign of unilateral or bilateral vestibular hypofunction
- Corrective saccades determine side of lesion
  - Positive test if seen after head is rotated TOWARD affected side
Unilateral Vestibular Hypofunction

- Peripheral vestibular system in one ear is not functioning properly
- Viral or bacterial infection
- Symptoms:
  - Dizziness or vertigo
  - Balance impairment
  - Oscillopsia

Image by Wikimedia Commons
Unilateral Vestibular Hypofunction

- Treatment addresses compensation through:
  - Adaptation
  - Substitution
  - Habituation
  - Motor Learning
Bilateral Vestibular Hypofunction

- Both ears are not functioning properly
- Congenital disorders, infections, or ototoxic medications
- Symptoms:
  - Balance and gait impairments
  - Gross motor delay
  - Oscillopsia
Bilateral Vestibular Hypofunction

- Treatment focuses on compensating for the loss of vestibular function and improving remaining function
  - Adaptation
  - Substitution
  - Functional activities
Pediatric Considerations for Treatment

- Type and nature of the vestibular lesion
- Mechanisms of recovery
  - Acuity of diagnosis
  - Age of patient → development
  - Active participation/motivation of patient
  - Requirements for motor learning
Adaptation
- Dynamic gaze stabilization and recovery of postural control

Substitution
- Alternative strategies to enable gaze stability and balance

Habituation
- Improve symptoms after repeated exposure to provocative movement
Plan of Care

- Unilateral vestibular hypofunction
  - Short duration
  - Compensation and return to baseline
- Bilateral vestibular hypofunction
  - Longer duration
  - Uptraining remaining systems takes time
Goals for Treatment

- Acquisition of age appropriate gross motor skills
- Participation in age appropriate play activities
- Decrease symptoms
- Normalize vestibular system function during mobility
Exercises
VOR

- Swing with visual target
- Walking while reading with head turns
- Wii or Kinect with head movements
- Passive cervical movement with book
- Bounce ball while walking with head turns
- Jumping on trampoline with visual target

Where the world comes for answers

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Vision Exercises- Saccades

- I Spy
- Wordsearch
- Spot the Difference
- Puzzles
- Treasure Hunt
- Trail Making

Image by Pixnio.com
Yoga Poses
Stomp Rocket
Physioball
Kick ball
Balance beam
Obstacle course
Agility ladder
Simon Says
Scooter
Animal walks
Sports
Wii Sports
BOSU dual task
Balance

Image by Flickr.com
Otolith Organs

● Older Children
  ○ Sit ups
  ○ Lunges, squats
  ○ Basketball dribble and shoot
  ○ Single leg deadlift

● Younger Children
  ○ Playground swings
  ○ Scooterboards
  ○ Yoga ball bouncing
  ○ Jumping, skipping
  ○ Tricycles
Semi-circular Canals

● Older Children
  ○ Diagonal ball follow
  ○ PNF with bands
  ○ Star taps
  ○ Turn and catch bean bags
  ○ Side to front planks
  ○ Jump turns

● Younger Children
  ○ Sit and spin
  ○ Swings
  ○ Scooterboard
  ○ Rolling
  ○ Quadruped with head turns

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Lab Practice

- DVA/VOR
- Head Impulse Test
- Static Balance
  - 10 yo with UVH
- Dynamic Balance
  - 4 yo with BVH
References


References


