

Treatment of Peripheral Vestibular Hypofunction

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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:
 - Falls/Frequent tripping
 - Difficulty balancing on uneven surfaces
 - Veering while walking
 - 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

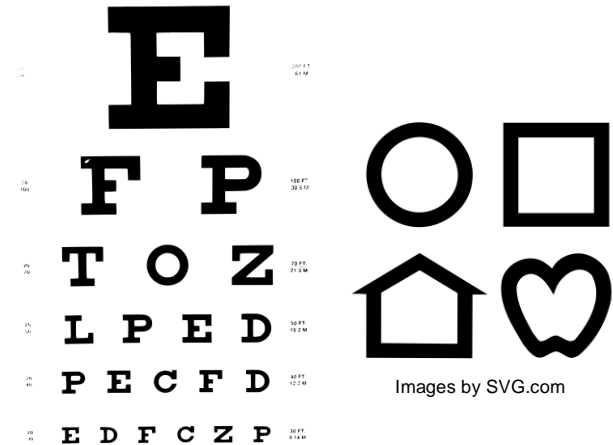


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Dynamic Visual Acuity (DVA)

- 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

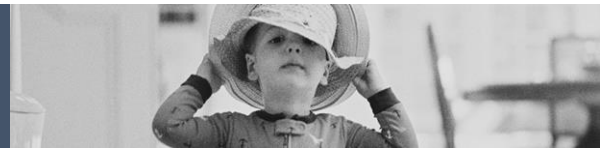


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Unilateral Vestibular Hypofunction

- 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



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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

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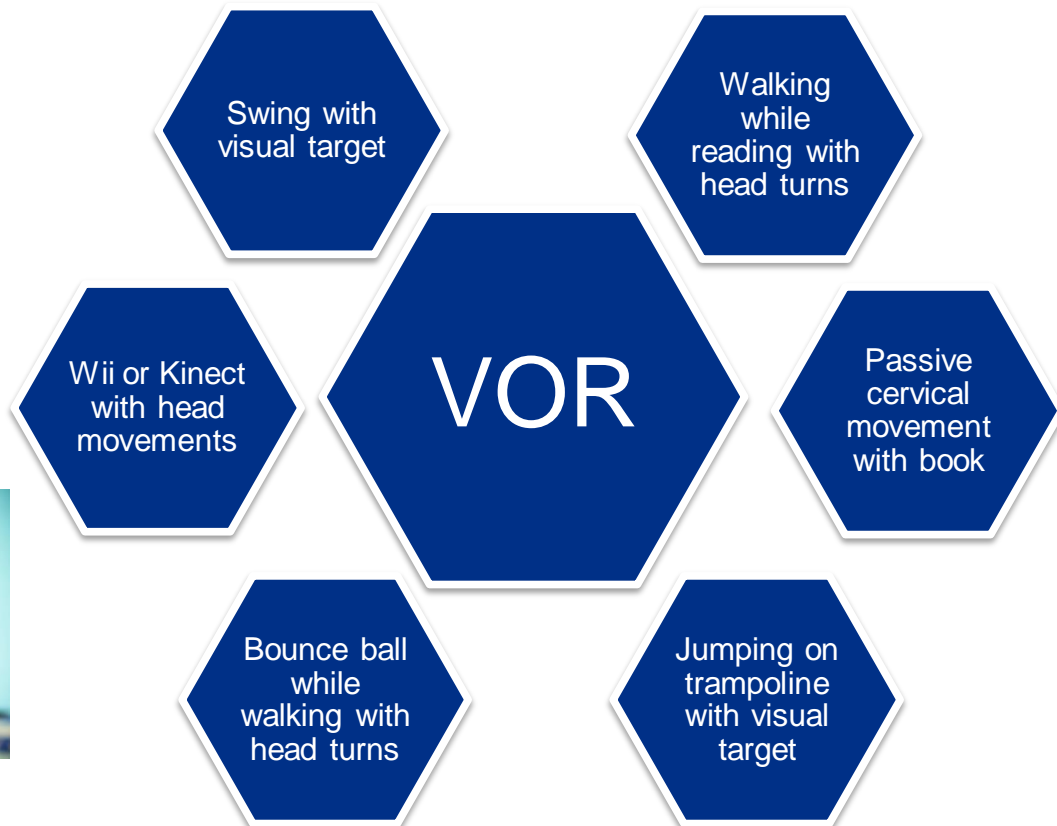


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Vision Exercises- Saccades

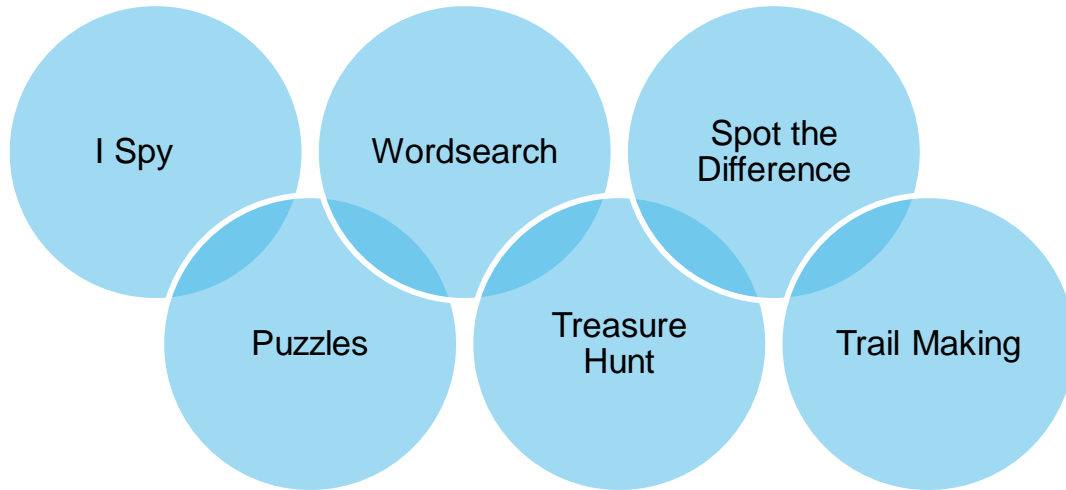


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Yoga Poses

Agility ladder

Simon Says

Stomp Rocket

Scooter

Physioball

Kick ball

Sports

Animal walks

Balance beam

Wii Sports

Obstacle course

Balance

BOSU dual task



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**

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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



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