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Session 104: Updates in Vestibular Rehab: Clinical Practice Guidelines for Vestibular Hypofunction

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Objectives

■ Participants will be able to discuss action statements brought forth from the research and utilize these guidelines in practice of vestibular rehabilitation for peripheral vestibular hypofunction.
■ Participants will name and understand the 4 components of a vestibular rehabilitation program.
■ Participants will participate in case studies to review findings and develop an appropriate vestibular rehabilitation program based on findings in alignment with clinical practice guidelines.
Vestibular System

- Located in inner ear, composed of static and dynamic sensory inputs to provide position sense in space
- Provides input about both linear and angular head velocity
- Central vestibular system located in pons and medulla coordinate input from vision, vestibular and somatosensory systems
- Motor output:
  - Vestibulo-ocular reflex for gaze stabilization
  - Vestibulo-spinal reflex for postural stability through musculoskeletal system

(Heckmann, 2007) (Alyahya et al, 2006)

What is Vestibular Hypofunction?

- Normal vestibular system: tonic firing from both systems is symmetrical
- Unilateral vestibular loss results in static asymmetry, which is interpreted as movement and disruption of dynamic vestibular responses to
- Causes may include: viral infection (neuritis, labyrinthitis), Meniere’s disease, acoustic neuroma, surgical procedures, ototoxicity
- Diagnostic Criteria for inclusion: Unilateral vestibular hypofunction was determined by either caloric or rotational chair testing
- Results:
  - Static: nystagmus, asymmetry in muscle activity of lower extremities, postural asymmetry
  - Dynamic: VOR dysfunction, visual blurring, disequilibrium, gait ataxia
  - Musculoskeletal: neck pain, headaches, postural changes

(Herdman, 2007) (Wilhelmsen and Kvale, 2014)

Recovery

- Static recovery: occurs in days to months following onset due to regeneration of peripheral sensory hair cells, axonal sprouting, increased synaptic weight of remaining vestibular inputs
- Dynamic recovery: requires both visual input and head and body movement
- Vestibular Adaptation / Habituation: reducing asymmetry at peripheral or central levels recovery of VOR through neuroplasticity
- Substitution: utilization of other systems to compensate for vestibular loss

Clinical Presentation

- Acute Vestibular Hypofunction: sudden onset of dizziness (constant spinning) persisting for several days with motion sensitivity, imbalance, changes in gait with wide base of support, veering, balance challenge with turns or with head movements, possible falls, possible neck pain and cervicogenic headaches
- Chronic Vestibular Hypofunction, uncompensated: dizziness, motion sensitivity, guarded through head and neck, postural changes – fixed trunk, increased weighting of visual and/or somatosensory cues, may use an assistive device, increased fear/anxiety, activity avoidance, more sedentary
- Bilateral Vestibular Hypofunction: balance deficits, increased weighting of visual and vestibular cues, difficulty in dark, especially on uneven surfaces, less dizziness due to bilateral involvement

Clinical Practice Guidelines

- Purpose: to recognize who, what, when and how to treat patients with peripheral vestibular hypofunction
- Evidence-based support for vestibular rehab to include intervention and discharge planning
- Identify needs for future research to improve clinical management

Levels of Evidence

- I: Evidence from high-quality (≥50% critical appraisals) diagnostic studies, prospective studies or randomized controlled trials
- II: Evidence from lesser quality (<50% critical appraisals) diagnostic studies, prospective studies or randomized controlled trials
- III: Case-controlled studies or retrospective studies
- IV: Case study or case series
- V: Expert Opinion
Grades of Recommendations

- **A**: Strong Evidence – a preponderance of level I and/or level II studies supports the recommendation, must include at least 1 level I study.
- **B**: Moderate Evidence – a single high-quality randomized controlled trial or a preponderance of level II evidence supports the recommendation.
- **C**: Weak Evidence – a single level II study or preponderance of level III and IV studies supports the recommendation.
- **D**: Expert Opinion – Best practice based on clinical experience of the guideline development team and guided by the evidence, which may be conflicting. Where higher quality studies disagree with respect to their conclusions, it may be possible to come to agreement on certain aspects of intervention.

(Hall et al, 2016)

Action Statements

- Clinicians should offer vestibular rehab to patients with acute, subacute, or chronic unilateral or bilateral vestibular hypofunction (level I, strong recommendation).
- Clinicians should not offer saccadic or smooth pursuit exercises in isolation (without head movement) as specific exercises for gaze stability for patients with unilateral or bilateral vestibular hypofunction (Level I, strong recommendation).
- Clinicians may provide targeted exercises to accomplish specific goals appropriate to address identified impairments and functional limitations (Level II, moderate recommendation).
- Clinicians may offer supervised vestibular rehab to patients with unilateral or bilateral peripheral vestibular hypofunction (Level I-III, moderate recommendation).
- Gaze stabilization exercises for HEP should be performed 3x/day (Level V, expert opinion)
  - Acute / subacute: minimum of 12 minutes per day.
  - Chronic: minimum of 20 minutes total per day.

Action Statements Continued

- Clinicians may use achievement of primary goals, resolution of symptoms or plateau in progress as reasons for stopping vestibular rehab (Level V, expert opinion).
- Clinicians may evaluate factors that modify rehab outcomes (level I-III, weak to strong recommendation)
  - Age does not affect potential for improvement with vestibular rehab.
  - Gender does not impact rehab outcomes.
  - Time from onset (acute): earlier intervention improves rehab outcomes.
  - Time from onset (chronic): vestibular exercises improve outcomes regardless of time from onset, however, potential for harm related to decreased quality of life or falls suggests initiation ASAP.
  - Time from onset (chronic): neuroplasticity may be optimal at onset.
  - Co-morbidities: anxiety, migraine and peripheral neuropathy may negatively impact rehab outcomes.
  - Vestibular suppressants: long-term use may negatively impact rehab outcomes.

Harm / benefit ratio for vestibular rehab in terms of quality of life and psychological stress: clinicians should offer vestibular rehab for peripheral vestibular hypofunction (Level I-III, strong recommendation).

Treatment Approach

- Vestibular suppressants may be used in acute stage after vestibular neuritis, however evidence does not support medication for management of chronic patients
- Surgical approach is reserved for patients with fluctuating vestibular functions and symptoms not controlled by medication or lifestyle modification
  - Goal: convert a fluctuating deficit into a stable deficit to facilitate central vestibular adaptation
- Vestibular rehab is exercise-based approach addressing four components:
  - Gaze stabilization
  - Habituation
  - Gait and balance
  - Walking for endurance

Gaze Stabilization

- Goal: promote vestibular adaptation
  - Vestibular adaptation – long-term changes in neuronal response to head movements to reduce symptoms, normalize VOR and postural stability
- Requires head movement for vestibular input to VOR
- Retinal slip: process of losing visual focus on the target during head movement
  - Target blurs with head movement if VOR is not functioning properly
- Performed in both horizontal and vertical planes
  - Prescribed 3x/day: Acute/subacute total 12 min, chronic total 20 min/day

Gaze Stabilization: Treatment Progression

- Increase speed of movement: goal of 2 Hz or 120bpm on metronome
- Add busy visual background to minimize visual dependence
- Adjust base of support to challenge balance
- Adjust surface to more compliant surfaces for improved sensory integration in balance
Habituation

- Goal: reduce behavioral response to repeated exposure to a provocative stimulus
- Habituation requires provocation of symptoms through vestibular stimulation
  - Significant and ongoing patient education for compliance
- Repetition of movements or activities that cause mild-moderate symptoms promotes synaptic level neuroplasticity
- Recent approaches involve optokinetic stimuli or virtual reality

Treatment: Habituation

- Goal: reduce behavioral response to repeated exposure to a provocative stimulus
- Habituation requires provocation of symptoms through vestibular stimulation
  - Significant and ongoing patient education for compliance
- Repetition of movements or activities that cause mild-moderate symptoms promotes synaptic level neuroplasticity
- Recent approaches involve optokinetic stimuli or virtual reality

Balance and Gait Training

- Goal: improve static and dynamic balance to decrease risk of falls and injury, promote return to activity
- Static balance
  - Vary surface
  - Vary base of support
  - Add dynamic movements of head, arms, perturbations
- Dynamic balance
  - Walking with head turns
  - Vary base of support – marching, tandem walking, sidestepping
  - Vary visual input – busy background, holding mirror, special glasses with stripes, sunglasses
Endurance

- Goal: improve endurance to address sedentary lifestyle that occurs secondary to dizziness and imbalance
- Address through walking or aerobic exercise.
- General conditioning exercise such as stationary bicycle alone has not been found to be beneficial for patients with vestibular hypofunction (Hall et al, 2016)

Chronic Motion Sensitivity

- Chronic motion sensitivity affects 20-30% of general population described as sub-clinical chronic motion sensitivity
- Motion sensitivity: "disturbing sense of vertigo or dizziness associated with head movement"
- Motion sensitivity: visual-vestibular conflict
- Long-term results: activity avoidance
- These patients will benefit from vestibular rehab for improved sensory integration, re-weighting of sensory inputs to decrease motion sensitivity (Alyahya et al, 2016)

Vestibular Functional Assessments

- Need to assess areas to be treated:
  - Gaze
  - Habituation - Motion Sensitivity
  - Balance and Gait
  - Endurance
  - Sensory Integration
Vestibular EDGE (VEDGE)

- Academy of Neurologic Physical Therapy (Neurology Section of APTA): neuropt.org
- Vestibular EDGE documents: Evidence Database to Guide Effectiveness
  - recommended outcome measures
  - Vestibular EDGE: Shared with permission from The Academy of Neurologic Physical Therapy. VEDGE Taskforce Members: Matthew R. Scherer, PT, PhD, NCS, Chair; Linda B. Horn, PT, DScPT, MHS, NCS, Co-Chair; Elizabeth Dannenbaum, MSPT, Jennifer L. Fay, PT, Karen H. Lambert, PT, MPT, NCS; Teresa A. Ricks, PT, MPH, NCS; Jennifer L. Stakes, PT; Diane M. Whaley, PhD, PT, NCS

VEDGE: Areas of Assessment

<table>
<thead>
<tr>
<th>Body Structure &amp; Function</th>
<th>Activity</th>
<th>Participation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dizziness</td>
<td>Balance / falls</td>
<td>Community Function</td>
</tr>
<tr>
<td>Muscle Performance</td>
<td>Gait</td>
<td>Driving</td>
</tr>
<tr>
<td>Sensory Integration</td>
<td>High Level Mobility</td>
<td>Health &amp; Wellness</td>
</tr>
<tr>
<td>Somatosensation</td>
<td>Transfers</td>
<td>Home Management</td>
</tr>
<tr>
<td>Spatial Orientation</td>
<td></td>
<td>Leisure / Recreation Activities</td>
</tr>
<tr>
<td>Vertigo</td>
<td></td>
<td>Life Satisfaction</td>
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<tr>
<td>VOR / Gaze Stability</td>
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<td>Quality of Life</td>
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<td></td>
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<td>Role Function</td>
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<td>Shopping</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Social Function</td>
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<tr>
<td></td>
<td></td>
<td>Work</td>
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</tbody>
</table>

VEDGE Rating Scale

4 = Highly Recommended: excellent psychometric properties and clinical utility AND is free or reasonably accessible to the broad community of providers

3 = Recommended: good psychometric properties and good clinical utility OR has excellent psychometric properties and clinical utility however; it is not free and may require access to specialized testing equipment that is beyond the means of many clinicians or clinics

2 = Reasonable to Recommend at this time: adequate to good psychometric properties and clinical utility, however, is not free and may require access to specialized testing equipment that is beyond the means of many clinicians OR has been validated in other patient populations but not in persons with vestibular deficits OR has only adequate clinical utility

1 = Not Recommended: poor psychometric properties OR poor clinical utility
Vestibular Functional Assessments

■ Gaze stabilization
  - Best assessed by Dynamic Visual Acuity using eye chart, horizontal and vertical
  - >2 line change between static and dynamic visual acuity indicates deficit in DVA and will lead to gaze stabilization exercises
  - Gaze stabilization will also be utilized for sensory integration by adjusting visual and somatosensory cues, so should be assessed and performed regardless of DVA findings

■ Habituation
  - Best assessed by Motion Sensitivity Quotient
  - High inter-rater reliability, good validity, sensitivity and specificity for detecting motion-provoked dizziness
  - Findings from MSQ will direct treatment
  - Functional outcome measure for objective findings of reported symptoms
  - Vestibular Functional Assessments

### Baseline Symptoms Intensity

<table>
<thead>
<tr>
<th>Position</th>
<th>Intensity Score</th>
<th>Duration</th>
<th>Total Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sitting to supine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supine to left side</td>
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<tr>
<td>Supine to right side</td>
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<tr>
<td>Supine to sitting</td>
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<td></td>
<td></td>
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<tr>
<td>Left Hallpike-Dix</td>
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<tr>
<td>Up from left Hallpike-Dix</td>
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<tr>
<td>Right Hallpike-Dix</td>
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<tr>
<td>Up from right Hallpike-Dix</td>
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<td></td>
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<tr>
<td>Sitting, head tipped to left knee</td>
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<tr>
<td>Head up from left knee</td>
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<tr>
<td>Sitting, head tipped to right knee</td>
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<td></td>
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<tr>
<td>Head up from right knee</td>
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<tr>
<td>Sitting, head turns (5x)</td>
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<td></td>
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<tr>
<td>Sitting, head pitches (5x)</td>
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<tr>
<td>In stance, 180 degree turn to left</td>
<td></td>
<td></td>
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<tr>
<td>In stance, 180 degree turn to right</td>
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</tbody>
</table>

**Total Score:** ________

(Total Score x total # positions provoking symptoms) ÷ 20.48

- 0 - 10 = Mild
- 11 - 30 = Moderate
- >30 = Severe
Vestibular Functional Assessments

- **Balance and Gait**
  - mCTSIB – sensory integration in balance
  - Sense balance under 4 conditions: 1. Firm eyes open, 2. Firm eyes closed, 3. Foam eyes open, 4. Foam eyes closed
  - Helps to determine somatosensory dependence (1,2) Visual dependence (1,3) ability to use vestibular cues (4)
- **10 meter walk test, TUG (manual and dual task), Functional reach**
- **Endurance**
  - 6 minute walk test
  - 5 time sit to stand
  - 30s chair stand

Participation and Function

- **Patient questionnaires**
  - Dizziness Handicap Inventory
  - Activities-Specific Balance Confidence Scale
  - Vertigo Handicap Questionnaire (VHQ)
  - Vestibular Disorders Activities of Daily Living Scale (VADL)
  - Vestibular Rehabilitation Benefit Questionnaire (VRBQ)
  - UCLA Dizziness Questionnaire (UCLADQ)
  - Vestibular Activities and Participation (VAP)
  - Disability Rating Scale (DRS)

Questions?
Case Study 1

- 57 y/o female presents with 2 year history of dizziness secondary to labyrinthitis. She reports symptoms of dizziness, imbalance, fear of falling, and fear of being home alone due to dizziness. She states she is dizzy all the time. She is visibly upset, however, willing to pursue treatment with the education provided regarding her condition and plans for treatment. She ambulates with a 4 wheeled walker and requires some form of external support for sense of stability. Diagnosis: Chronic unilateral vestibular hypofunction
- Activities-Specific Balance Confidence Scale: 67% (moderate)
- Dizziness Handicap Inventory: 82 (severe)
- Motion Sensitivity Quotient: 73.4 (severe motion sensitivity)
- Dynamic Gait Index: 27/24 (increased risk of falls <21/24)
- mCTSIB: increased sway conditions 2-4, positions 2 and 4 held for >5s each – patient is visually and somatosensory dependent and has limited ability to use vestibular cues for balance (fear and anxiety play a significant role in findings)

Case Study 2

- 32 y/o male presents with dizziness described as spinning with associated nausea and vomiting that lasted 3 days and began 7 days ago and has slowly improved. He works in a factory where he feeds pieces from left to right into a machine over a 10 hour shift. Impairments include dizziness, decreased balance, inability to perform work duties. Diagnosis: Labyrinthitis with left vestibular hypofunction (acute)
- Patient Questionnaires:
  - Activities-Specific Balance Confidence Scale: 67% confidence in balance
  - Dizziness Handicap Inventory: 82
  - Motion Sensitivity Quotient: 73.4
  - Dynamic Gait Index: 27/24
  - Dynamic Visual Acuity:
    - Static: 20/20
    - Dynamic: 20/70 = 4 line change
  - mCTSIB: increased sway on condition 2, loss of balance after 10s condition 4: visually dependent with difficulty using vestibular cues for balance
  - Patient goals: eliminate dizziness, restore balance, return to work, fishing and hunting
Case Study 3

- Patient is a 42 y/o female presenting with bilateral vestibular loss due to autoimmune disease. She presents with chronic unilateral vestibular loss with the “normal” side more recently affected creating a bilateral hypofunction. She has bilateral hearing loss requiring hearing aids, imbalance while walking outdoors on uneven surfaces, and inability to walk in dark or low lit environments where she has experienced 4 falls. She denies dizziness. She ambulates with a single point cane with wide base of support, without assistive device reaches for objects, especially with turns. She works as a gym teacher in the elementary school (K-5).

- Activities-Specific Balance Confidence Scale: 20% (low level of functioning)
- Dizziness Handicap Inventory: 0
- Motion Sensitivity Quotient: 0
- Dynamic Visual Acuity: 5 line change (<3 WNL)
- Dynamic Gait Index: 13/24 assessed without assistive device (<21/24 indicates increased risk of falls)

- Treatment Techniques:
- Treatment Progression:
- Prognosis: ______________________________
- Long-term limitations: ____________________
- Return to work: __________________________
Questions?
- Lab: gaze stabilization
- VEDGE documents

References
- VESTIBULAR EDGE: Shared with permission from The Academy of Neurologic Physical Therapy. VEDGE Taskforce Members: Matthew R. Scherer, PT, PhD, NCS, Chair; Linda B. Horn, PT, DScPT, MHS, NCS, Co-Chair; Elizabeth Dannenbaum, MScPT; Jennifer L. Fay, PT; Karen H. Lambert, PT, MPT, NCS; Teresa A. Rice, PT, MPH, NCS; Jennifer L. Stoskus, PT; Diane M. Wrisley, PhD, PT, NCS.