FLEX CEUs

Vestibular Rehab: An Overview of Testing and Treatment Options

Introduction

Vestibular rehabilitation and balance training can be specifically addressed by physical therapy. The vestibular system is a network of structures responsible for sensing and maintaining balance in one's environment. When there is a disturbance to this system, an individual will experience a disruption to their equilibrium. This can cause symptoms that are not only uncomfortable but also lead to difficulties maintaining balance and understanding how to move one's own body in space. There are no other health specialists uniquely qualified to address such issues.

Physical therapists need to understand the fundamentals of the vestibular system in order to develop a deeper understanding of the associated conditions. Once a clinician understands the various ways in which the vestibular system can be disrupted, they must be able to recognize the respective symptoms. This can help a clinician concentrate on the most appropriate screening tools in order to efficiently find the proper diagnosis. Once the diagnosis is identified the best course of treatment can be decided on.

Treatment for vestibular disturbances will depend on the condition the patient has, along with other factors such as severity of symptoms and lifestyle of the patient. A treatment approach that involves in-clinic procedures and coaching on a thorough home program will be necessary.

This course will go over:

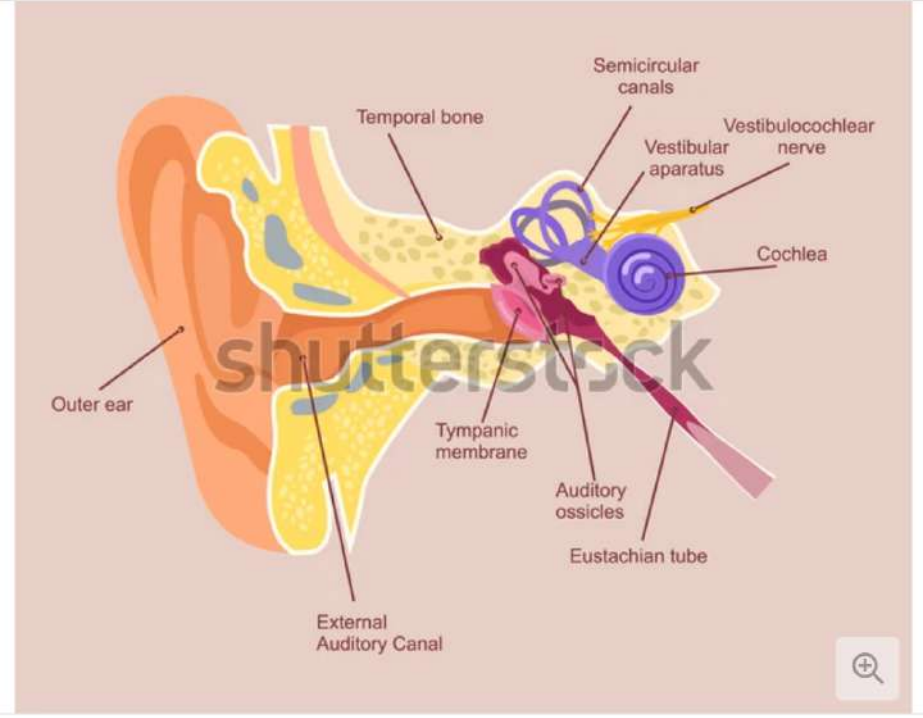
- The mechanisms involved around the vestibular system
- The roles each part of the system play in detecting and correcting body positioning
- The different causes and associated symptoms of common vestibular disturbances
- The different standardized tests performed in a physical therapy setting
- The factors that affect the prognosis of different vestibular disorders
- The common treatment methods for vestibular disorders

Section 1: The Mechanisms Involved Around The Vestibular System and Balance

The vestibular system is a part of the human sensory system that involves inner ear structures and nerve pathways that detect motion, head positioning, and spatial orientation. This information helps maintain equilibrium and the ability to sustain balance in static and dynamic postures.

The vestibular structures sit within the inner ear, which is located within the skull's temporal bone. The vestibular labyrinth is continuous with the cochlea, which is the organ involved with hearing. The vestibular labyrinth consists of two otolith organs and three semicircular canals (1).

The semicircular canals and the otolith organs exist on both the right and left sides of the head. These semicircular canals and otolith organs work together to let the brain know the direction, position, and speed of the head.



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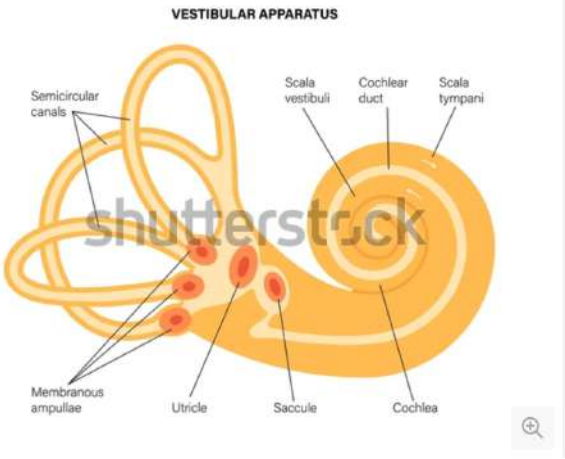
The semicircular canals consist of three tubes situated in different orientations to detect head movements in their respective directions. The horizontal canals detect rotation in the transverse plane (shaking the head “no”). The posterior canals detect movement in the frontal plane (head tilting ear towards shoulder). The superior canals detect movement in the sagittal plane (nodding the head “yes”).

Each semicircular canal has an extension called the ampulla. Within the ampulla are hair cells called stereocilia that are encompassed in a gelatinous membrane called the cupula. When the head moves, the endolymph moves too, displacing the cupula. Nerve cells located at the hair cells’ base detect this movement and send information to the brain via the vestibulocochlear nerve.

The two otolith organs, the utrical and saccule, sit medial to the semicircular canals. They detect forward and backward movement, acceleration, and gravitational forces. The utricle detects horizontal movements, and the saccule detects vertical movements. (1)



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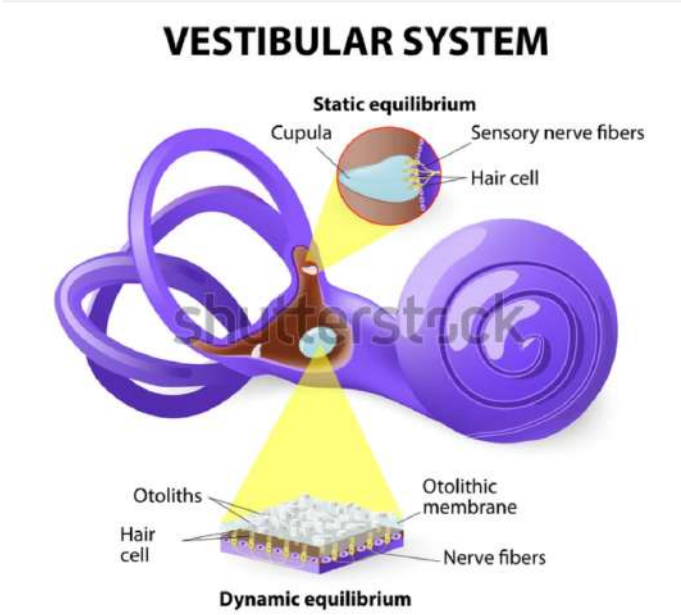
The utricle and saccule also contain stereocilia. Here, crystals of calcium carbonate, called otoconia, sit on top of the hair cells. When the head moves, the weight of the crystals displace the hair follicles. This movement generates a receptor potential to nerve cells going to the brain. This system distinguishes between laying down and sitting upright, as well as acceleration.

The vestibulocochlear nerve has two branches: the vestibular branch and the cochlear branch. The cochlear branch is responsible for hearing. The vestibular branch (commonly referred to as the vestibular nerve) enters the vestibular nucleus located on the brainstem and the cerebellum. The vestibular nucleus sends information to the thalamus and cerebellum to coordinate movement throughout the body (1, 10, 12).

Once the brain knows how the body is positioned and how it is moving, it can counter eye movement to keep the gaze constant even when the head moves. This compensatory response is called the vestibulo-ocular reflex (VOR). This reflex involves cranial nerves III, IV, and VI, all of which are responsible for eye movement.

- Cranial nerve III (oculomotor nerve) controls the medial rectus (moves the eyes inward towards the nose), inferior rectus (moves the eyes downward), superior rectus (moves the eyes upward), and the inferior oblique muscle (moves the eyes upward and outward).
- Cranial nerve IV (trochlear nerve) innervates the superior oblique muscles responsible for moving the eyes downward and towards the nose.
- Cranial nerve VI (abducens nerve) controls the lateral rectus muscles, responsible for looking outward.



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Section 1 Summary

- The vestibular system is considered a sensory pathway that helps prevent falling during static and dynamic movements.
- The semicircular canals, utricle, and saccule contain stereocilia that detect motion, acceleration, and gravity.
- The semicircular canals detect rotation of the head.
- The utricle and saccule detect gravity, acceleration, and vertical and horizontal movement.
- Signals from these hair cells are sent to the brain via the vestibular branch of the vestibulocochlear nerve to determine how to compensate for eye movement and maintain gaze and balance.
- It is essential to know the physiology and fundamentals to understand which part of the system can be disrupted in vestibular conditions.

Section 1 Key Words

Proprioception: The awareness of the position and movement of the body.

Equilibrium: The normal balanced state of the body that is maintained by the inner ear and that keeps a person from falling.

Cochlea: The spiral cavity of the inner ear which is responsible for hearing.

Vestibular Labyrinth: A structure located in the temporal bone that consists of the two otolith organs and the semicircular canals.

Semicircular Canals: Six (three on each side) fluid-filled tubes in the inner ear that contain endolymph which detects head rotation.

Endolymph: The fluid in the semicircular canals.

Utricle: Contains hair cells and otoconia which send signals to the brain concerning the orientation of the head, particularly horizontal movements.

Saccule: Contains hair cells and otoconia which send signals to the brain concerning the orientation of the head, particularly vertical movements.

Otoconia: Crystals that couple mechanic forces to the sensory hair cells in the utricle and saccule, which sense linear acceleration and gravity for the purpose of maintaining bodily balance.

Vestibulocochlear nerve: The sensory nerve responsible for transmitting information from the vestibular complex to the brain. It has two branches: the vestibular branch (responsible for vestibular information) and the cochlear branch (responsible for hearing).

Vesitbulo-ocular reflex (VOR): The body's response to maintain a stable retinal image in response to head movement.

Cranial nerve III: The oculomotor nerve. It innervates the medial rectus (moves the eye inward towards the nose), inferior rectus (moves eye downward), superior rectus (moves the eye upward), and the inferior oblique muscle (moves the eye upward and outward).

Cranial nerve IV: The trochlear nerve. It innervates the superior oblique (moves the eye downward and towards the nose).

Cranial nerve VI: The abducens nerve. It innervates the lateral rectus muscle (moves the eye horizontally out to the side).

Section 2: Etiology, Causes, Symptoms, and Diagnoses

Vestibular disturbances can occur in people of all ages and genders. Because it is difficult to diagnose, researchers cannot say for sure the prevalence of occurrence. However, it is known to affect adults and children, albeit rare for children to have a vestibular disorder. According to one study, it is thought that it can occur in up to 35% of adults aged 40 and older (5, 15).

Before ruling in a vestibular diagnosis, a clinician must be aware of other causes of dizziness. Issues that can disrupt the regulation of blood pressure, venous return, and heart rate, as well as medical emergencies such as stroke, can cause symptoms similar to vestibular disturbances.

A vestibular disorder can originate peripherally or centrally. Peripheral vestibular disturbances involve issues in the vestibular apparatus or vestibular nerve, both located in the inner ear. These conditions tend to be more common in women (2 women for every 1 man). Central vestibular disturbances involve the vestibular areas of the brainstem and cerebellum (3, 9).

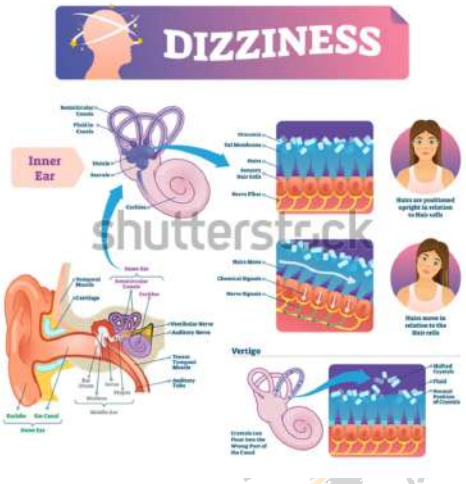
Either peripheral or central vestibular disturbances may be caused by head trauma (such as whiplash), ear infection, medications toxic to the vestibular system, strokes, tumors, genetics, aging, or unknown etiologies (15).

A patient with a vestibular disorder will complain of one or a few of the following (5, 15):

- Dizziness
- Motion sickness
- Feeling off balance
- Vertigo (perception of rotational movement/spinning of oneself or surrounding objects
- Brain fog
- Tinnitus (ringing in the ear)
- Hearing loss
- Vision impairment
- Nausea
- Vomiting
- Cognitive changes
- Psychological changes

Below are the three most common peripheral vestibular disorders:

- **Benign paroxysmal positional vertigo (BPPV):** Calcium (otoconia) builds up and gets displaced in the semicircular canals typically following a viral infection, head trauma, aging, or of idiopathic origin. The patient experiences positional vertigo, which means dizziness comes and goes, depending on how they are positioned. These symptoms only last a few seconds and are then resolved. These attacks usually come and go for several weeks but could recur in the future. BPPV accounts for about 50% of all vestibular disorders in older people (1, 13).



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- **Vestibular neuritis:** The inflammation of the inner ear affecting the vestibular nerve, typically experienced following a viral infection. The patient will experience vertigo for several weeks before it resolves (1, 8).
- **Meniere's disease:** Occurs when there is an increase in the endolymph, which increases the overall pressure in the ear. The cause of Meniere's disease is unknown but may be due to problems with fluid drainage, abnormal immune response, viral infections, or genetics. This pressure on the vestibulocochlear nerve will cause tinnitus, temporary and diminishing hearing loss, as well as vertigo. The patient will complain of a full feeling in their ear. This is usually experienced in middle-aged adults (1, 7).

Other peripheral vestibular disruptions include:

- **Acoustic neuroma:** Occurs when there is a schwannoma (tumor) on the vestibulocochlear nerve and trigeminal nerve. Because of this, the patient will experience tinnitus, hearing loss, vertigo, change in taste, facial numbness, and facial pain. The symptoms can get progressively worse as the tumor grows (2).
- **Labyrinthitis:** Inflammation of the inner ear caused by a viral or bacterial infection, allergies to medications, ear infection, drinking excessive alcohol, stress. The inflammation causes swelling in the inner ear, affecting both branches of the vestibulocochlear nerve. As a result, symptoms are similar to vestibular neuritis, plus tinnitus and hearing loss. The symptoms last days to weeks only and then resolve (1, 8).
- **Perilymphatic fistula:** A fistula (an opening in a barrier that separates two compartments) forms between the middle and inner ear, typically caused by trauma. This will cause tinnitus, hearing loss, and vertigo that occurs only during sneezing, intraabdominal or muscle straining, or hearing loud noises (2).

Central vestibular disorders affect the cerebellum or the brain stem. These symptoms typically involve sustained, non-positional vertigo (3). Some examples of central vestibular disorders are:

- **Posterior circulation infarction** (stroke to the area): Sudden onset of vertigo, ataxia, diplopia, cranial nerve defects, limb weakness (2).
- **Tumor:** Vestibular symptoms will be of gradual onset and progressively get worse. Symptoms will differ depending on where the tumor is located (2).
- **Multiple sclerosis:** Relapsing and remitting vertigo symptoms (2).
- **Vestibular migraine:** Vestibular symptoms will last minutes to hours and be accompanied by a visual aura and a headache (2, 3).

Section 2 Summary

- Vestibular disorders can occur in people of all ages but are typically seen in older adults.
- Vestibular disorders are either caused by disruptions in the peripheral or central vestibular systems.

- Peripheral vestibular disorders involve the vestibular apparatus (semicircular canals, vestibular nerve).
- Peripheral vestibular disorders tend to affect women and older adults more frequently.
- Central vestibular disorders involve the brain stem or cerebellum.
- The most common vestibular disorders include vestibular neuritis, BPPV, and Meniere's disease.
- Depending on what part of the vestibular system is involved will determine symptoms.

Section 2 Key Words

Peripheral vestibular disorders: An ailment affecting the parts of the vestibular system outside of the brain, including the inner ear and vestibular nerve. Symptoms are typically positional and resolve in a few weeks.

Central vestibular disorders: An ailment affecting the neurological parts of the vestibular system inside of the brain, including the brain stem or the cerebellum. Symptoms are typically progressive, reoccurring, or constant.

Vertigo: The sensation that oneself or the environment is spinning. Could range from mild and barely noticeable to severe that maintaining balance is difficult.

Tinnitus: When one experiences a ringing sound in one or both ears, with no external source.

BPPV: A common peripheral vestibular disorder that is characterized by short bouts of vertigo with changes in body positioning.

Vestibular neuritis: A common peripheral vestibular disorder characterized by inflammation of the inner ear causing vertigo.

Meniere's disease: A common peripheral vestibular disorder characterized by an increase in the endolymph and pressure in the inner ear.

Section 3: The Role of The Physical Therapist in Testing and Treatment of Vestibular Disorders

When a patient arrives at physical therapy with a possible vestibular disturbance, specific tests can be performed to rule in a diagnosis. First, a thorough history must be taken. Some common patient complaints may include:

- Dizziness
- Positional dizziness
- History of head trauma, car accident, whiplash
- Hearing loss
- Ringing in ears
- Balance difficulties
- Increased pressure or fullness in the ear
- Recent history of illness
- Change in vision/ double vision
- Headaches
- Sensitivity to loud noises
- Nausea
- Vomiting

Following the history taking, several exams can be performed to investigate further whether or not there are vestibular disturbances. Like any other physical therapy examination, postural assessments, proprioception, coordination, range of motion, and strength tests should be performed (9).

Testing

If a vestibular disturbance is suspected, the following tests can help make a differential diagnosis. Gait assessments, vision tests, and positional testing can rule in a vestibular

diagnosis (7). The aspects of each test can determine where the disturbance is coming from (central, peripheral, right side, left side, etc.). It is essential to communicate with the patient that these tests are intended to provoke symptoms.

Below are standard tests performed on those who may have a vestibular diagnosis:

- **Dynamic Gait Index (DGI):** Involves walking in 8 different conditions to assess an individual's ability to maintain balance (4, 8). This test is used to screen for balance problems, risk of falling, and vestibular issues. The different tasks include:
    - Walking on a level surface
    - Walking while changing speeds with the clinician's cues
    - Walking with head turns horizontally
    - Walking with head turns vertically
    - Walking and turning 180 degrees to a stop
    - Stepping over obstacles
    - Stepping around obstacles
    - Walking up and down stairs

    Each item is scored from a 0 to a 3, with 3 indicating normal, 2 mild impairment, 1 moderate impairment, and 0 indicating severe impairment. The highest score one can receive is a 24.

    Patients with vestibular dysfunctions may have trouble with walking with changing speeds, head turns, and changing directions suddenly.

- **Functional Gait Assessment (FGA):** This test is similar to the DGI with additional tasks intended specifically for patients with vestibular disorders. This test was created to reduce the "ceiling effect" of the DGI (6). The 10 tasks of this test battery include:
    - Walking on a level surface
    - Walking while changing speeds with the clinician's cues
    - Walking with head turns horizontally

- Walking with head turns vertically
- Walking and turning 180 degrees to a stop
- Stepping over obstacles
- Walking in tandem with arms crossed
- Walking with eyes closed
- Walking backward
- Walking up and down stairs

Each item is scored from a 0 to a 3, with 3 indicating normal, 2 mild impairment, 1 moderate impairment, and 0 indicating severe impairment. The highest score one can receive is a 30.

Patients with vestibular disorders may have difficulty changing speeds, head turns, changing directions, walking with eyes closed, and walking backward.

- **Clinical Tests of Sensory Interaction on Balance (CTSIB):** Commonly known as the "foam and dome test." This test can be performed in an office with minimal equipment and is usually performed on those suspected of having BPPV. The CTSIB determines a person's ability to maintain an upright standing posture within six different sensory conditions (14). These various sensory conditions include a patient standing for 30 seconds on a:
    - Firm surface with eyes open
    - Firm surface with eyes closed
    - Firm surface with visual conflicts, such as head-turning
    - Foam surface with eyes open
    - Foam surface with eyes closed
    - Foam surface with visual conflicts

    Patients with vestibular dysfunctions will have trouble balancing on the foam surface with closed eyes and visual conflicts. This is because they can no longer rely on their vision and their proprioception to maintain upright. These conditions single out the vestibular system.

- **Computerized dynamic posturography (CDP):** This test also investigates how a person maintains balance in response to visual, proprioceptive, and vestibular challenges (8). This requires a high-tech system that includes a visual and a force plate that the patient stands on to measure sway. The patient is suspended in a harness for safety. This is only available in a clinic that has this equipment. The CTSIB will give the clinician less data but is a cheaper version of this test.
- **Dix-Hall Pike Maneuver:** This procedure is used to make a differential diagnosis for BPPV. It can also let the clinician know what side is affected. This procedure involves:
    - The patient is sitting upright with their head turned 45 degrees to the side being tested.
    - The clinician supports the patient and then quickly lies them down, maintaining their head turned and then extending it 20 degrees below the table level.
    - In a positive test, a patient will display nystagmus (9, 10, 11, 12).

    This test can be performed with Frenzel goggles or video ENG equipment. These devices magnify the eyes so that the clinician can monitor the patient's eye activity.

    - For BPPV, horizontal nystagmus will typically be noted after a brief pause following the maneuver. The nystagmus will not last for more than one minute. If the test is repeated, the nystagmus will not be as strong and will eventually fatigue.
    - Signs of a central vestibular disorder include immediate eye response, vertical nystagmus, and no fatigue (15).
- **Gaze hold:** Have the patient look a few feet into the distance and the clinician will note any nystagmus. Spontaneous nystagmus is common in Meniere's disease, and constant nystagmus can occur in central vestibular dysfunctions (1, 14).
- **Vestibuloocular reflex (VOR) testing:** This will look for a patient's ability to move their eyes independently of their head. The clinician will look for nystagmus and the inability to perform any eye movements (7, 10). Some examples include:

- Eye-tracking: Can the patient follow a moving object in multiple directions. If there is a deficit in any direction or an asymmetry, the clinician should follow up with cranial nerve testing (see below).
- Saccades: Can the patient move eyes quickly from one target to another. If there is a deficit in any direction or an asymmetry, the clinician should follow up with cranial nerve testing (see below).
- Head oscillations: The clinician will move the patient's head in different directions and speeds to track eye movement and monitor nystagmus. These tests are often performed with the patient wearing Frenzel goggles.

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- **Cranial nerve testing:** These tests examine the function of the muscles controlled by the cranial nerves of the vestibular system (14). The clinician will ask the patient to perform the following:
  - Look upward to the right
  - Look upward to the left
  - Look horizontally to the right
  - Look horizontally to the left
  - Look downward to the right
  - Look downward to left

- Have the patient move only their eyes and have them follow your finger tracing the letter “H”

During this test, ask the patient if they experience any double vision or dizziness. The clinician should note the failure of movement or nystagmus. Keep in mind what actions the cranial nerves of the vestibular system are responsible for:

- Cranial nerve III (oculomotor nerve): Moves the eyes inward towards the nose, downward, upward, and diagonally up and out.
- Cranial nerve IV (trochlear nerve): Moves the eyes downward and towards the nose.
- Cranial nerve VI (abducens nerve): Moves the eyes out horizontally.

If a central vestibular diagnosis, or if a cardiovascular or neurological condition, is suspected. the patient must be referred to the appropriate medical professional. Clinicians such as neurologists, ENTs, PCPs, and radiologists are all clinicians who can perform further testing to check hearing and vision, blood tests, and imaging of the head and brain.

Treatment

Treatment for a vestibular diagnosis can include vestibular rehabilitation therapy, medications, surgery, counseling, and diet lifestyle changes. The following are types of rehabilitation exercises and techniques that can be helpful for patients with a vestibular diagnosis. One, or a combination of these methods, might be part of their rehab program.

- **Canalith repositioning maneuvers and procedures:** A series of coordinated movements intended to help those with positional vertigo or BPPV (9). These movements are specific to help the otoconia move appropriately in the vestibular canals. Two of the most common maneuvers are:
    - Epley maneuver (10):
        - The patient begins seated. The clinician turns the patient’s head 45 degrees to the affected side.

        - The clinician tilts the patient back to lay flat on the bed with the head maintained turned and extended back off the edge of the bed.
        - This will provoke symptoms as it is intended to move the otoconia to the apex of the canal.
        - This position is held until symptoms go away. Symptoms usually last up to 1 minute.
        - The clinician turns the patient's head 90 degrees to the unaffected side.
        - The clinician rolls the patient's body to the unaffected side. The head remains turned so that the patient is now looking at the floor.
        - This movement may provoke symptoms again. Remain here until symptoms subside.
        - The clinician helps the patient back to a seated position.
    - Semont maneuver (7):
        - The patient begins seated. The clinician turns the patient's head 45 degrees to the unaffected side (or the less affected side for cases that involve both sides).
        - The clinician lowers the patient quickly to the side that causes the worst vertigo. The patient will be facing the ceiling. This position is held for 30 seconds.
        - The clinician then moves the patient to the other side of the table. The patient is now facing the table. This position is held for 30 seconds.
        - The clinician then helps the patient return to a seated position.

    Both of these maneuvers can clear symptoms with just one treatment. However, other patients will need multiple treatments. A physical therapist can teach versions of these maneuvers to patients for them to perform at home.

- **Balance training:** Balance exercises are helpful for patients who have difficulty with balance due to their vestibular dysfunction (11, 13). These exercises will improve the patient's steadiness, safety, and confidence while performing static

and dynamic daily activities. There are an endless amount of exercises that can be performed here. They can be as simple as sitting on a firm surface with eyes open and then be progressed to kneeling, standing, and walking on uneven surfaces with eyes closed. The patient will be encouraged to repeat these exercises under the supervision of their therapist and will be asked to work through the symptoms to tolerance.

- **Gaze stabilization:** These exercises are helpful for patients who have unilateral or bilateral peripheral vestibular disturbances and central vestibular disorders. They are intended to improve the patient's vision while their head is moving. These exercises involve keeping the gaze on a target while moving the head in different directions (5). These exercises can be varied by:
    - Changing the speed of the head turns
    - Changing the direction of the head turns
    - Keeping the head stationary but moving the target
    - Performing these exercises sitting
    - Performing these exercises with a wide or narrow stance
    - Performing these exercises while walking

  The patient should perform these exercises under the supervision of a clinician. A physical therapist will also prescribe a home exercise program once the patient can perform these safely on their own.

- **Habituation:** These exercises are intended to decrease dizziness by exposing the patient to the exact movements and visuals that provoke the dizziness. The more exposure the patient gets, the intensity of the symptoms should lessen over time (4).
    - Brandt-Daroff exercises are a type of habituation. It is similar to the repositioning exercises mentioned above. The patient can perform this on their own for repetitions to expose them to dizziness.

Recovery

A vestibular disorder can be life-changing for an individual. As a clinician, it is crucial to educate your patient on how difficult recovery may be. During physical therapy sessions, symptoms will be provoked, which can be discouraging. The patient will also be encouraged to practice exercises at home. Asking a patient to provoke symptoms in the office and on their own in order to help in their recovery takes a lot of patience and dedication.

Other lifestyle and environmental factors play a role in the time it takes to recover. For example, older patients or have had symptoms for more extended periods before seeking treatment will likely have a longer recovery time than their counterparts.

The clinician must recognize the factors that can support recovery to give their patients the support and resources to help.

Factors that may limit recovery from a vestibular disorder include (7,12):

- Sedentary lifestyle
- Unhealthy diet
- Comorbidities
- Reliance on vestibular suppressant medications
- Anxiety and depression

Factors that may enhance recovery time include (14):

- Regular exercise
- Healthy diet
- Adequate sleep
- Younger in age
- Counseling for emotional support
- Dedication and perseverance to a rehabilitation program

Section 3 Summary

- A physical therapist can help in the diagnosis of a vestibular disorder.
- There are many tell-tale symptoms a patient can mention in their history, leading a clinician to perform further testing.
- Standardized tests such as the DGI, FGA, CTSIB, and CDP can pinpoint whether a patient has deficits in visual, proprioceptive, or vestibular systems.
- Gaze holding, VOR testing, and cranial nerve testing can determine where a patient might have deficits in their visual system.
- Positional tests such as the Dix-hall pike maneuver can help distinguish if a patient had BPPV, and on what side.
- Once a diagnosis is determined, the clinician can determine which course of treatment is best.
- It is important to educate and comfort the patient on this potentially long and enduring process.

Section 3 Key Words

Nystagmus: Involuntary rapid and repetitive eye movement in either an up and down, side to side, or circular pattern. The direction, time of occurrence, and duration of nystagmus can help make a differential diagnosis when evaluating for a vestibular disorder.

DGI: Dynamic Gait index. A test performed to determine an individual's ability to ambulate in 8 different sensory conditions.

FGA: Functional Gait Assessment. A test performed to determine an individual's ability to ambulate in 10 different sensory conditions. Slightly more specific to vestibular dysfunctions than the DGI.

CTSIB: Clinical Tests of Sensory Interaction on Balance. This minimal equipment test examines a person's static balance while given different visual and proprioception scenarios. Can help diagnose a vestibular dysfunction.

CDP: Computerized dynamic posturography. This test uses a computerized platform and screen to alter visual and proprioceptive inputs in standing. Can help diagnose a vestibular dysfunction.

Dix-Hall Pike Maneuver: A diagnostic procedure in which a clinician turns the head of the patient and quickly lays them down to see if symptoms and nystagmus are produced. This can help diagnose BPPV bilaterally and/or unilaterally.

Frenzel goggles: Goggles containing video cameras that are worn by the patient to detect nystagmus during VOR and positional examinations.

Epley maneuver: A treatment for BPPV that involves the head turned to the affected side, laying back, and rolling. Can be performed with a clinician or taught to the patient for home management.

Semont maneuver: A treatment for BPPV that involves head turned to the unaffected side, laying back, and rolling. Can be performed with a clinician or taught to the patient for home management.

Brandt-Daroff Exercises: A positional habituation exercise intended for a patient to self-treat vertigo.

Section 4: Case Study and Discussion

A 55-year-old female patient presents to an outpatient physical therapy clinic with dizziness complaints that have been on and off for the last 1-month. She reports being in a car accident about six weeks ago where her car was rear-ended. Following the car accident, she denied any medical care. You are the first medical professional she has been seeking since the accident. She works as a greeter and an item stocker at a local Wal-Mart. She has been having difficulty with work tasks that involve looking up and down and going from kneeling to standing to stock shelves.

She has a history of high blood pressure, which is managed by medication. She occasionally has bilateral knee pain which her doctor told her is from arthritis. There are no other significant findings and health is otherwise unremarkable. She would like to decrease her symptoms so she can get back to performing her work activities, playing with, and safely lifting her 2-year old grandson, as well as taking Zumba classes at the local gym.

What indicators support a vestibular diagnosis?

First, this patient reports bouts of dizziness. She also has recently endured a trauma involving a quick jerk of the head. The otoconia in one, or both, of her ears may have been dislodged. Further testing to examine her balance, gait, VOR, and signs of nystagmus will help determine how her vestibular system is functioning.

What are the best tests to perform on this patient?

Because the patient is on her feet and constantly changing positions at work, she would benefit from the functional gait assessment. This test will show you just how limited she is at work. It can also illustrate when she experiences symptoms. The Dix-Hall Pike maneuver will show if positional changes cause symptoms and nystagmus. If the nystagmus is present for 1 minute or less, we know that her dizziness is likely from BPPV. If she has symptoms when the test is performed while turning the head to the right, but not to the left, we know she has right-sided BPPV.

How would you determine whether or not this patient has a neurological problem or a central vestibular dysfunction?

Performing other tests such as VOR testing and cranial nerve testing can help determine whether or not this patient has a central vestibular dysfunction. Signs of cranial nerve involvement or disturbances in the VOR would include the inability to move the eyes in upward, horizontal, downward, and towards the nose motions. Other notable findings would consist of random bouts of nystagmus, a history of worsening symptoms, or progressively longer episodes of vertigo.

Conclusion

The vestibular system's peripheral aspect comprises the semicircular canals, the utricle, the saccule, and the vestibulocochlear nerve. This nerve connects the outside world to the brain at the cerebellum, which makes up the central aspect of the vestibular system. Having a sense of the anatomy and the system's inner workings makes it possible to make a differential diagnosis. Vestibular dysfunctions can affect anyone, with symptoms ranging from very mild to severe. A clinician can use various tests, complex and straightforward, to diagnose a patient's functional limitations and find the root cause of their condition. Once a diagnosis is found, there are multiple treatment approaches. Like

any physical therapy plan of care, there are no one-sized-fits-all. A clinician must consider a person's whole body, their specific deficits, and their normal daily activities to make the best and most achievable treatment for them.

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