

Vestibular Rehabilitation

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Overview

Vestibular rehabilitation therapy (VRT) has been a highly effective modality for most adults and children with disorders of the vestibular or central balance system. A form of physical therapy, it uses specialized exercises that result in gaze and gait stabilization. Most VRT exercises involve head movement, and head movements are essential in stimulating and retraining the vestibular system. In a number of studies, customized VRT programs were significantly more effective than generic exercises.

An estimated 90 million Americans (42% of the current population) experience dizziness at least once in their lifetime. Some patients develop permanent balance deficits with subsequent functional limitations.

For patients over 75 years of age, dizziness is the number one reason for visiting a physician, and dizziness is a significant risk factor for falls in elderly individuals. Falls have been estimated to be the leading cause of serious injury and death in persons older than 65 years. It was estimated that in 2018, fall-related injuries in persons aged 65 years or older resulted in 3 million emergency department visits in the United States, with over 950,000 hospitalizations or transfers to another facility (such as a trauma center) and about 32,000 deaths.[1] Some estimates state that as many as half of all cases of dizziness are due to vestibular disorders. Data from the National Health and Nutrition Examination Survey found that persons with symptomatic vestibular dysfunction have a 12-fold increase in the odds of falling.[2]

Vertigo can be caused by both peripheral and central vestibular deficits. About three-fourths of vestibular disorders are peripheral (inner ear and vestibular nerve). The most common peripheral vestibular disorder is benign paroxysmal positional vertigo, followed by uncompensated Ménière disease, vestibular neuritis, labyrinthitis, perilymphatic fistula, and acoustic neuroma. Central vestibular deficits cause about one-fourth of dizziness. The most common central causes of dizziness and vertigo are cerebrovascular disorders, cerebellar disease, migraine, multiple sclerosis, tumors of the posterior fossa, neurodegenerative disorders, medications, and psychiatric disorders.

Although adults are typically plagued with dizziness and vertigo disorders, children also experience dizziness and vertigo.[3] Children may be affected more than adults, and this prevents normal childhood activities that range from athletics to playground activities. The most common cause of childhood vertigo is benign paroxysmal vertigo of childhood.

The basis for the success of VRT is the use of existing neural mechanisms in the human brain for adaptation, plasticity, and compensation. The extent of vestibular compensation and adaptation is closely related to the direction, duration, frequency, magnitude, and nature of the retraining stimulus. Specifically designed VRT exercise protocols take advantage of this plasticity of the brain to increase sensitivity and restore symmetry. This results in an improvement in vestibuloocular control, an increase in the gain of the vestibuloocular reflex (VOR), better postural strategies, and increased levels of motor control for movement. Other factors that affect the degree of individual compensation include overall physical status, the functional status of remaining sensory systems, integrity of central brain mechanisms, age, and higher sensory functions such as memory, motor coordination, and cognitive ability.

Vestibular Rehabilitation Therapy

Definition

Vestibular rehabilitation therapy (VRT) is a specific form of physical therapy designed to habituate symptoms, and promote adaptation to and substitution for various aspects of deficits related to a wide variety of balance disorders.[4] VRT is effective in improving the functional deficits and subjective symptoms resulting from unilateral and bilateral peripheral vestibular

hypofunction as well as from central balance disorders.[5]

Goals

By improving vestibular function and promoting mechanisms of central adaptation and compensation, VRT aims to do the following:

- Improve balance
- Minimize falls
- Decrease subjective sensations of dizziness
- Improve stability during locomotion
- Reduce over dependency on visual and somatosensory inputs
- Improve neuromuscular coordination
- Decrease anxiety and somatization due to vestibular disorientation

The process of compensation depends on various mechanisms, including substitution strategies, prediction strategies, and cognitive strategies. Components of VRT may involve learning how to trigger the symptoms in order to "desensitize" the vestibular system (habituation) for positional or motion-provoked symptoms, adapting to improve the gain of the vestibuloocular or the vestibulospinal reflexes, and substituting alternative senses to replace lost vestibular function by biasing use away from the dysfunctional vestibular input. When combined, this results in a progressive waning of symptoms of imbalance, disequilibrium, and motion-induced unsteadiness. As compensation occurs for a vestibular deficit, the remaining CNS processes allow sufficient control of eye, head, and body movements to maintain stable gaze, posture, and position.

Substitution strategies use several techniques, including alternate sensory inputs to drive motor output, alternate secondary motor responses instead of primary motor responses, and incorporating strategies of prediction and anticipation of intended motor behavior. The cervical-ocular reflex (COR) may be developed as an alternate source of visual stability during head movements. This is an example of a substitution strategy for deficits in the VOR.

VRT also takes advantage of the adaptive characteristics of the CNS to reestablish homeostasis within the vestibular system. Adaptation refers to long-term change in the neuronal response with the goal of reducing symptoms and normalizing gaze and postural stability. This results in increased VOR accuracy, refinement of oculomotor skills, improvement in postural control, and use of appropriate movement strategies. Adaptation serves to extinguish symptoms of dizziness provoked by motion or visual stimulation. Specifically tailored exercises promote adaptation by altering the input-output relationships of the VOR, including gain, timing, and direction. Adaptation exercises have been shown to improve symptoms of patients who are post-surgery for resection of acoustic neuroma.

Habituation exercises, first described by Cawthorne and Cooksey in the 1940s, consist of a series of eye, head, and body movements that provoke vestibular symptoms, which theoretically fatigue the vestibular response and force the CNS to compensate by habituation to the stimulus. Habituation exercises are used for patients experiencing from motion or position-provoked symptoms.

Vestibular Rehabilitation Therapy Program

Designing an individualized vestibular rehabilitation therapy program

Several factors must be considered when designing a vestibular rehabilitation therapy (VRT) program for an individual patient. Therapeutic efficacy may be limited by the extent and location of damage to the vestibular system. The status of visual and proprioceptive systems, physical strength, motor skills, and integrity of the cerebellum are critical to the successful application of a VRT program. Studies have found that patients with cerebellar dysfunction show little improvement in function with vestibular rehabilitation.

Other factors that affect the outcome of a VRT program include general physical health, decision-making and cognitive abilities, age, memory, and the presence of psychological and anxiety disorders.

A study by Kleffellgaard et al found that in patients with mild to moderate traumatic brain injury, an 8-week program of group-based VRT led to faster recovery from dizziness and balance problems, as measured at 2.7-month follow-up after baseline testing, using the Dizziness Handicap Inventory and High-Level Mobility Assessment Tool. However, by 4.4-month follow-up after baseline testing, the VRT and non-VRT groups showed no significant recovery differences.[6]

Age may not be a factor in outcome: a study published in 2008 found that patients who underwent aquatic physiotherapy for vestibular rehabilitation achieved improvement in dizziness symptoms, balance, and quality of life regardless of age, use of vestibular suppressant medications, and time since symptom onset.[7] Another study, however, concluded that the younger the patient, the greater the need to return to the patient's "normal," due to the demands of society and of their life before injury to the vestibular system occurred. In order to achieve this, according to the report, the rehabilitation must be tailored to each individual. The different stages of recovery will be different for each patient and will need to be assessed by trained individuals in charge of their care, which can prove to be subjective and difficult.[8]

Another study also stressed the importance of individualizing vestibular rehabilitation for each patient, discussing coordination between practitioners and caregivers. For patients with posttraumatic headaches and/or underlying visual and oculomotor dysfunctions, vestibular rehabilitation can decrease dizziness and vertigo and improve static and dynamic balance through various exercises that target the patients' specific impairments. It is also important to coordinate learning strategies in order to maximize adaptation and motor learning and avoid overstimulation.[9]

VRT is typically designed as a therapist-directed, patient-motivated, home-based exercise protocol. Individuals visit the therapist on a limited basis. The patient engages in custom-designed exercises at home several times a day without therapist supervision. VRT exercises are graduated, beginning at the minimal skill level that the patient is capable of performing; complexity is increased as compensation and habituation occur. Patients have regular follow-up visits with the therapist until compensation and habituation are complete and optimal balance is attained.

A retrospective study by Tanaka et al indicated that in patients with chronic unilateral peripheral vestibular disorder, greater benefit results from multiple interventions by a physical therapist (an initial session and then once a week) than from a single intervention (ie, one intervention followed by home therapy without a physical therapist). Four weeks after the initiation of VRT, patients in the study's multiple-intervention group demonstrated significant improvement in the Timed Up and Go Test, the Dynamic Gait Index, and the Functional Gait Assessment score, while members of the single-intervention group did not. The Activities-specific Balance Confidence (ABC) Scale did not significantly improve in either group by 4 weeks. The average age of the study's patients was 70.4 years.[10]

A 2016 evidence-based clinical practice guideline from the American Physical Therapy Association Neurology Section, for vestibular rehabilitation of peripheral vestibular hypofunction, includes the following recommendations[11] :

- Vestibular rehabilitation should be offered to persons with unilateral or bilateral vestibular hypofunction who have vestibular deficit-associated impairments and functional limitations (strong evidence)
- Voluntary saccadic or smooth-pursuit eye movements should not be performed in isolation (ie, without head movement) as exercises for gaze stability in rehabilitation (strong evidence)
- Specific exercise techniques aimed at identified impairments or functional limitations may be offered by clinicians (moderate evidence)
- Based on patient preference, supervised vestibular rehabilitation may be provided by clinicians (moderate evidence)
- Gaze stability exercises, as one part of a home exercise program, may be prescribed by clinicians a minimum of 3 times per day (expert opinion extrapolated from the evidence)
- Adequate supervised vestibular rehabilitation sessions that allow patients to comprehend the program's goals and understand how to independently manage themselves and progress can be considered (expert opinion extrapolated from the evidence)

Components of VRT program

An effective VRT program uses a team of healthcare providers to assess and treat patients with balance disorders. This team should include a physician trained in the evaluation and treatment of balance disorders (typically a neurotologist, otolaryngologist, or neurologist), a vestibular therapist or physical therapist trained in balance testing and vestibular therapy, and an occupational therapist. Studies have shown that minimalist interventions are sometimes the most effective. Further studies are needed to determine the best type of exercises, the context of the exercises and the duration and intensity of the exercises.

The accurate diagnosis and assessment of a patient is critical for a successful individualized VRT program. The diagnosis and assessment include quantifying the degree of damage to peripheral vestibular structures and central vestibular pathways and evaluating the individual level of physiologic and neurologic compensation. Functional abilities such as gait, ambulation with head movement, balance with altered sensory cues, and balance under static (sitting, standing) and

dynamic conditions are assessed. The most reliable test for balance assessment is the Timed Up and Go Test, and the best predictor of falls is the Unipedal Stance Test. Sensory evaluation should include visual and proprioceptive abilities because multisensory deficits can impede functional progress. Posturography can differentiate whether a patient's balance dysfunction is due to vestibular loss or proprioceptive loss by measuring pelvis and shoulder sway.

Patient assessment should also include complete evaluation of the patient's medical history and detailed history of the patient's balance symptoms. The clinician should elicit a clear description of the type of symptoms experienced by the patient (vertigo, imbalance, disequilibrium, presyncopal sensations, gait ataxia) and the frequency and duration of the symptoms. Specific activities and head or body positions that provoke symptoms should be determined. Visual disturbances, such as oscillopsia (blurred vision with head movement), should be documented.

The patient's subjective perception of the impact of the symptoms on daily activities should be evaluated. The most commonly used subjective measures include 2 questionnaires that assess the individual's handicap (Dizziness Handicap Inventory) and disability (Activities-specific Balance Confidence Scale) due to disequilibrium. The Dizziness Handicap Inventory (DHI) is an accepted, standardized questionnaire that addresses the subjective rating of balance dysfunction. The DHI has a high test-retest reliability and internal consistency. The DHI measures total subjective handicap and individual subscales of physical, emotional, and functional health. The patient's perceived abilities are assessed with the Activities-specific Balance Confidence (ABC) Scale by assessing confidence in 16 specific daily activities.

Finally, the effects of vestibular rehabilitation should be measured to monitor therapeutic response. In the past, only the Computerized Dynamic Posturography was used to assess vestibulospinal reflex. Newer techniques have recently been developed that additionally evaluate the vestibuloocular reflex changes due to vestibular rehabilitation: the dynamic visual acuity test (DVA) and the Gaze Stabilization Test (GST). For follow-up of patient self-assessed dizziness impact after rehabilitation, the Vestibular Rehabilitation Benefit Questionnaire was recently refined and validated. The Dynamic Gait Index has been used to assess fall risk after rehabilitation.

A randomized, controlled trial indicated that combining vestibular and cervical spine physical therapy reduces the time to medical clearance for return to sport in individuals with prolonged symptoms (ie, dizziness, neck pain, and/or headaches) of a sports-related concussion. In the study, two groups of patients with persistent postconcussion symptoms received postural education, cognitive and physical rest, and range-of-motion exercises, with graded exertion provided once the patients were asymptomatic. One group, however, also underwent cervical spine and vestibular rehabilitation.[12]

The investigators found that 73% (11 of 15) of the participants who received spine and vestibular therapy were cleared for return to sport within 8 weeks, compared with 7% (1 of 14) of the control group.[12] Even though this was a small study, the results suggested that clinicians should consider combination therapy to help speed up the recovery process in select patients.

Using the Argentinian version of the DHI, a study by Verdecchia et al indicated that in elderly patients with vestibular disorders, the total DHI score and the inventory's functional, physical, and emotional subscale scores correlate with "usual gait speed," while the total DHI score and the functional and emotional subscales (as well as patient age) correlate with the Timed Up and Go Test.[13]

Quantitative Vestibular Testing

Electronystagmography

Electronystagmography (ENG) involves a battery of tests that assesses central and peripheral vestibular function, lateralizes the lesion, and describes organization. Central vestibular function is reflected in oculomotor tests for nystagmus, reflexes (optokinetic nystagmus), and integrated motion (saccades, pursuits).[14] Peripheral eighth cranial nerve and labyrinthine function are evaluated in response to various stimuli (positional/positioning, caloric, rotational chair testing).

Nystagmus can be observed, recorded, and quantified. Electrooculography (EOG) indirectly measures eye movement by detecting changes in the electrical charges produced by the corneal-retinal potential using skin electrodes. Eye movements can also be quantified directly using infrared oculography (IRO) and video-oculography (VOG). They use either an infrared sensitive video camera or goggles respectively to track the movement of the pupils. IRO techniques allow direct observation of eye movements and eliminate many artifacts present on EOG.

Quantified dynamic visual acuity

Dynamic visual acuity (DVA) is a behavioral measure of vestibular function that quantifies one's ability to see clearly during

predictable (active) or unpredictable (passive) head movements. Measuring visual acuity during head movement is one of the best functional tests in patients with unilateral and bilateral vestibular hypofunction. Herdman et al have demonstrated the reliability and validity of DVA to identify the side of vestibular dysfunction in both unilateral and bilateral vestibular hypofunction.[15] DVA also can be used to measure individual semicircular canal function.

Vestibular evoked myogenic potential test

The vestibular evoked myogenic potential test (VEMP) assesses the saccule and its central projection (the inferior vestibular nerve) to evaluating the CN XI circuit. A series of tones are presented to each ear individually, and the corresponding evoked sternocleidomastoid responses are recorded during the patient's neck flexion. The absence of a response reflects damage on that side. One limitation of VEMP is that it can't be used with conduction hearing defects such as otosclerosis.

Computer dynamic posturography

Computer dynamic posturography (CDP) is used to test the vestibulospinal reflex and assess balance maintenance. This is a multisensory assessment of balance that has been shown to give insight into an individual's functional status, compensation, and fall risk. CDP assesses the 3 major senses involved in balance: vestibular, vision, and proprioception. A force plate measures body sway under different visual and postural conditions.

The Sensory Organization Test measures postural stability under 6 different sensory conditions. The first 3 conditions are tested with the patient standing on a firm surface with eyes open and closed and with perturbed vision (sway-referenced visual enclosure on a fixed platform). The final 3 conditions test the patient while standing on a perturbed surface with the same 3 visual conditions (eyes open, eyes closed, sway-referenced). The patient's reliance on particular sensory information is determined by comparing sway with normative values for each condition. VRT exercises then can be designed to address the specific areas of deficit.

Limits-of-stability (LOS) testing is used to determine how well an individual can move the center of gravity over the base of support while maintaining an upright posture. Information from this test battery is useful for predicting fall risk and for determining specific balance exercises to improve movement skills without the patient experiencing a fall.

Patient Selection

Vestibular rehabilitation therapy (VRT) should be considered for patients with stable symptomatic vestibular deficits that have not completely resolved by means of natural compensation. These patients traditionally gain the most from VRT. Individuals with unstable lesions (ie, those with demyelinating disease, seizure disorder, progressive degenerative processes, or fluctuating or episodic symptoms of imbalance) are not candidates for VRT. Optimal candidates have stable central or peripheral vestibular deficits and intact cognitive, cerebellar, visual, and proprioceptive systems.

A study comparing the efficacy of VRT in patients with vestibular migraine with that in patients with vestibular symptoms but no migraine found that both groups obtained equal benefit from therapy. Specific rehabilitation regimens were tailored to individually fit each patient's presentation.[16]

Patient motivation is a significant factor in successful implementation of a VRT program. Additionally, recent reports have demonstrated that vestibular exercises are generally effective regardless of the patient's age and duration of symptoms. Several studies have in fact shown that older patients show more improvement in postural control than age-matched patients undergoing routine precautions. One should also consider the impairment of the dizziness because all dizziness does not need rehabilitation. The patient must also stop any vestibular suppressants prior to any VRT; this encourages the vestibular system to fully adapt to its new thresholds.

Typically, physicians prescribe VRT for patients who have not recovered after 2-3 months. The brain usually takes 3 months to recover from either an organic insult or surgical trauma. However, starting rehabilitation sooner has been shown to reduce fall risk and fall incidence. In an effort to advocate earlier VRT, Venosa and Bittar recently published a study showing that VRT for acute vertigo lessens the duration of symptoms and the need for vestibular suppressants.[17]

Vereck et al found that when subjects who underwent acoustic neuroma resection began early vestibular rehabilitation, they did significantly better than the control group.[18] Thus, VRT should be helpful for acute and chronic vertiginous patients.

Exercise Protocols

Vestibular rehabilitation exercises focus on gaze stability and gait stability. Gait stability includes both static and dynamic balance exercises.

VOR stimulation exercises

The VOR maintains stable gaze and visual focus during active and passive head motion. This first set of exercises is designed to improve the gain and accuracy of the VOR.

The first activity involves moving the head while focusing on a stationary target while attempting to maintain stabilizing gaze on the card. For head movements in phase with a target (X1 viewing), hold a card with lettering at arm's length with eyes focused on the letters. Move the head from side to side, increasing speed with each progression. Repeat the entire cycle 20-30 times. The head can also be moved vertically and diagonally. Progress from sitting to standing with the feet shoulder width apart to standing with the feet together to standing partially pointed (one foot half way ahead of the other) to standing pointed (one foot completely in front of the other). The patient should progress from standing on a firm surface to standing on a compliant surface. Post the card on the wall with a plain background and progress to posting on a wall with a busy patterned background.

As function improves, the exercise can be advanced to moving the card opposite to head movement. For head movement "out of phase" with target (X2 viewing), the patient holds a card with lettering at arm's length with eyes focused on the letters. The patient moves the head to the right and the card to the left while keeping the eyes focused on the letters. Then, the patient moves the head to the left and the card to the right keeping the eyes focused on the letters. The patient begins slowly and increases speed as the test progresses but keeps the letters in focus. This is repeated the entire cycle 20-30 times. This test can also be performed in a vertical direction. The patient can progress from sitting to standing to a sharpened stance as described above.

Ocular motor exercises

To increase pursuit gain, the patient holds a card with lettering at arm's length. Then the patient moves the card left and right across the visual field, tracking with eye movement and keeping the head still. The full cycle is repeated 20-30 times. The test can be performed in the vertical and diagonal directions with increasing speed but being certain to keep the letters in focus. After this the patient can progress from sitting to standing to a sharpened stance as described above (see VOR stimulation exercises above).

To improve saccade latency, velocity, and accuracy, the patient can hold a card with lettering in each hand approximately 15 inches apart at arm's length. While keeping the head still, the eyes are moved back and forth from card to card with 1 second per card. This is repeated 20-30 times for the complete cycle. This test also can be performed in the vertical and diagonal planes. The patient can progress from sitting to standing to a sharpened stance as described above (see VOR stimulation exercises above).

Habituation exercises

Habituation exercises are the focus of vestibular rehabilitation with respect to benign paroxysmal positional vertigo. Although 2007 guidelines for management of benign paroxysmal positional vertigo recommend initial treatment of the condition with particle repositioning maneuvers (PRMs) such as the Epley, Liberty, or Semont, more recent studies have shown that combining PRM with vestibular rehabilitation improves outcomes. In a rapid systematic review, Epley was found at 1-week follow-up to be more effective than VRT in the treatment of posterior benign paroxysmal positional vertigo. At 1-month follow-up, however, VRT and the Epley maneuver appeared to equally effective, although the evidence was inconsistent.[19]

Chang and Chern showed that additional vestibular rehabilitation exercise training that emphasized vestibular stimulation (repeated head movements to habituate vestibular responses) showed improved ability and functional gait performance in patients who had already undergone PRMs.[20] The experimental group demonstrated decreased sway velocity with eyes closed and single-leg stance with eyes closed after four weeks of treatment. Habituation exercises have also been shown to aid in the recovery of patients with vestibular neuritis.

Balance exercises

The patient stands with the feet together. The patient may maintain balance by reaching out and touching the wall in front of them. The patient begins to take the hands off the wall for progressively longer periods. First the patient begins by taking 1

hand at a time off the wall and alternates hands. Second, the patient sharpens the stance and stands with the feet shoulder-width apart looking at a target on the wall. The patient narrows the base of support by sharpening the stance.

This is performed first with arms outstretched, then close to the body, and then folded across the chest. The patient can sit and then stand with the head bent forward 30° and head bent backward 30°. The patient reaches up as though for an object over the head and then bends over as though picking up an object from the floor. The patient can then progress from sitting to standing to a sharpened stance. Exercises are performed in dim lighting and then with eyes closed. The difficulty level is raised by standing on foam or a pillow and then standing to one leg.

Another exercise is making a circle with a ball. The eyes focus on the ball and then the patient moves it in a circular fashion in both directions with increasing speed. The head and body moves with the ball. Difficulty level is raised as the patient progresses from sitting to standing to a narrowed stance.

Tai chi is an effective adjunct to balance exercises, especially for those with imbalance when standing.[21] Recent studies have demonstrated beneficial effects of the traditional Chinese exercises such as tai chi on balance and decreasing fall risk. These slow and deliberate routines may train balance mechanisms in a different and complementary way to more conventional standing, walking, and head-movement exercises.

Gait exercises

In walking exercise 1, the patient begins by walking next to a wall with the hand out for support. Then, the patient gradually increases the number of steps without support. *Difficulty is raised by narrowing the stance and by walking heel to toe.

In walking exercise 2, the patient walks with the head in motion going left and right with increasing speed. The stance is narrowed and the patient can also move the head in the vertical plane. The patient practices turning when walking, first with large circles, then with gradually smaller turns, in both directions.

In walking exercise 3 (sit to stand), the patient walks from one chair to another chair position 10 feet away. Upon reaching the first chair, the patient sits without using the hands, waits for 5 seconds, and rises without using the hands. The patient goes to the second chair, touches it, and, with support, practices standing on 1 leg for 5 seconds. The entire cycle is repeated 10 times. The patient can add head movements as the exercise progresses, increase walking speeds, and decrease the width of gait.

Combined category exercises

For an obstacle course, the patient can step over objects and around furniture. Difficulty is increased by bending over, picking up objects, throwing and catching objects, bouncing them off walls, and walking on differing compliance surfaces.

The patient can also practice at the grocery store by pushing a cart. First the patient pushes with minimal support and then no support from the cart. The patient can begin with slow, small head movements, increasing speed and degrees of motion. Also the crowd can play a factor in the rehabilitation. The patient should go when few patients are shopping and then progress to a crowded time of the day. The patient should make an effort to look at items that are on the top and bottom shelves.

The patient can also walk at the mall by beginning with slow walks close to the wall and by going with the flow of the crowd. Then the patient can increase speed, move away from the walls, and go against traffic. Window shopping with purposeful head movements is helpful.

Computer-aided rehabilitation

Recent advances in the ongoing research of vestibular dysfunction and rehabilitation have incorporated technology in the treatment sessions. One group incorporated virtual reality VRT into the traditional VRT sessions and documented improved posturography, vertigo, and mental health scores.

At the time of its publication, the 2007 Cochrane review claimed that this study had been the only study which reached statistical significance in comparing different forms of vestibular rehabilitation. The review deemed that evidence was sufficient to support the addition of a simulator based activities to vestibular rehabilitation programs. NASA has used this virtual reality technology and taken it one step further.[22] They hope to train the vestibular system to decrease motion sickness, increase function in disorienting environments, and speed recovery when returning to gravity and solid ground. The use of this technology is definitely exciting.

Electrotactile stimulation

Vestibular rehabilitation has also been incorporated with electrotactile vestibular substitution system (EVSS) for the treatment of bilateral vestibular loss in patients with aminoglycoside-induced ototoxicity.

Aquatic physiotherapy

Gabilan et al studied the use of aquatic physiotherapy as part of vestibular rehabilitation in patients presenting with chronic dizziness with unilateral vestibular hypofunction. All rehabilitation exercises took place in a pool and included tasks such as rotational control of the trunk, gait with thrust, sitting position on a float, upright buoyancy, and balance control during turbulence. The study found that the participants had lower DHI scores, reduction in variation of body displacement by posturography, and significantly lower self-perception of dizziness intensity.[7]

Other

Novel vestibular rehabilitation techniques are on the horizon. For example, a study by Sparrer et al indicated that early rehabilitation using the Nintendo Wii Balance Board can benefit elderly patients with acute vestibular neuritis. It was found that patients whose therapy included use of the device had shorter inpatient stays than did other patients in the study. Patients who used the Wii Balance Board also showed faster resolution of nystagmus, as well as greater improvement on the Sensory Organization Test, the DHI, the Vertigo Symptom Scale, and the Tinetti questionnaire.[23]

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