International Encyclopedia of Rehabilitation

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Vestibular rehabilitation

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In order to maintain balance, vision, the somato-sensory system and the vestibular organ interact and register inputs from the surroundings, which are integrated and processed in the brainstem. The vestibulo-ocular reflex (VOR) coordinates eye and head movements, making it possible, for example, to walk and read signs at the same time (Möller C, 1989). The cervico-ocular reflex interacts with the VOR, providing information about head movements in relation to the trunk (Karlberg M, 1995). Sensory receptors in the skin as well as mechanoreceptors in the muscles provide input as to how gravity affects the body (Magnusson M et al, 1990; Stal F et al, 2003). Input from the different parts of the balance system is constantly reconsidered and response from the motor cortex is sent back. This means that the body is in motion, even if we think that we are standing still. This constant movement is called postural sway (Rogind H et al, 2003). Postural sway is proportional to the balance of the individual, i.e. small postural sway is an indication of well-functioning balance (Enbom H, 1990).

Dizziness, vertigo and impaired balance may be caused by lesions within the central or peripheral systems (McClure J, 1986). The central nervous system is plastic, and therefore vestibular compensation in peripheral as well as central vestibular disorder is possible (Luxon LM and Davies RA, 1997; Suarez H, 2003). The process of compensation is a result of active neuronal and neurochemical processes both in the cerebellum and in the brain stem, who respond to sensory conflicts produced by pathology in the balance system (Telian SA and Shepard NT, 1996). To facilitate vestibular compensation, vestibular rehabilitation programs are used. Such programs were first developed by Cawthorne and Cooksey in the forties, originally used for peripheral vestibular disorder and post-concussion syndrome (Cooksey I, 1946; Cawthorne T, 1945). Modern research has widened the use of vestibular rehabilitation even more, to patients with other causes of dizziness, such as multisensory dizziness and dizziness and vertigo concomitant with whiplash associated disorders (Hansson EE et al, 2006; Hansson EE et al, 2004; Kammerlind A, 2001).

Vestibular rehabilitation exercises aim to facilitate rearrangement and recruitment of control capacities of the vestibular system and to modify response to head movements and vestibular stimulus (Cohen H, 1992) and at the same time, help the patient to overcome fear of activities that might provoke dizziness (Yardley L and Luxon L, 1994). By using exercises that provides the central nervous system with repeated exposure to a range of eye, head and body movements, vestibulo-ocular and vestibulo-spinal adaptation is promoted (Luxon LM and Davies RA, 1997). Proprioception is challenged by letting the patient stand on foam and the vestibulo-ocular reflex is challenged by using eye-movements. By using head- or trunk movements, the vestibular system is even more challenged. As the vestibular system improves, it is important to increase the degree of challenge of the exercises. More challenging balance-pads, changes in body positions and exclusion of vision by using closed eyes are ways to make the exercises more difficult.

Vestibular rehabilitation programmes can be used as training programmes used by the patient at home, as supervised training in group sessions but have shown to be most effective when customized to the individual patient and supervised by a trained physical therapist (Telian SA

and Shepard NT, 1996; Badke MB et al, 2004) and a long period of rehabilitation is often necessary before improvements are seen (Keim RJ, 1992). It is feasible in tertiary care as well as in primary health care, and in the community (Hansson EE, 2006; Yardley L et al, 1998). An example of a vestibular rehabilitation programme, used in the acute phase, is shown in Table 1 and an example of a vestibular rehabilitation programme used in primary health care, is shown in Table 2.2.

Diagnoses where vestibular rehabilitation is feasible

Vestibular hypo function

One of the most common causes of vestibular hypo function is peripheral vestibular lesion, a sudden, one-sided deficit in vestibular function, in clinical practice often called vestibular neuritis. The aetiology is often unknown; however, viral infection is suggested to be the cause (Eaton DA and Roland PS, 2003). In elderly patients, indication of vascular lesions has been found. There is strong scientific evidence for vestibular rehabilitation for vestibular hypo function.

Multisensory dizziness

The condition is characterized by pathology involving multiple sensory systems such as vision, hearing, peripheral vestibular function, balance and muscle function. The patient with multisensory dizziness often describes a feeling of unsteadiness which is accentuated when walking outdoors or on an uneven surface. Situations with many sensory inputs, such as in crowds, augment the symptoms. A typical feature of this condition is problems with walking.

There is strong scientific evidence for vestibular rehabilitation for multisensory dizziness.

Meniérès disease

This condition, described by Prosper Ménière in 1860, is characterised by cluster of vertigo, combined with hearing loss and tinnitus and/or aural fullness, probably caused by endolymphatic hydrops. Vertigo attacks are often accompanied by loss of equilibrium. Research has pointed to benefits of vestibular training both for vertigo attacks and for disequilibrium and there is strong scientific evidence for vestibular rehabilitation for Meniérès disease.

Vestibular surgery

Examples of vestibular surgery are ablative vestibular surgery or labyrinthectomy. After vestibular surgery, vertigo, nausea and disequilibrium occur. To treat this, vestibular rehabilitation is used, both as preventive, before surgery, and for rehabilitation after surgery. There is moderately strong scientific evidence for vestibular rehabilitation after vestibular surgery.

Neurological causes of dizziness

Dizziness can occur after a stroke or concomitant with migraine or brainstem vascular disease. Infections in the nervous system (i.e. meningitis), metabolic dysfunctions (hyperventilation), inflammatory disease, intoxication and tumours are other neurological causes of dizziness and dizziness occurs often among patients with epilepsy and with dementia. One-third of patients with multiple sclerosis experience vertigo some time during the course of the disease. There seems to be insufficient scientific evidence for vestibular rehabilitation for neurological causes of dizziness. However, the results of research in the

field are promising enough to recommend vestibular rehabilitation for this group of patients too.

Benign positional paroxysmal vertigo (BPPV)

The theory of the pathogenesis of BPPV is that degenerative debris from the utricle floats free in the endolymph of, most often, the posterior canal. The debris causes an illusion of movement which, in turn, causes vertigo, nystagmus and nausea. The Dix-Hallpike manoeuvre confirms the diagnosis, and it can be treated either with canalith repositioning manoeuvres or habituation exercises. Unsteadiness and decreased postural control can occur. There is insufficient scientific evidence for vestibular rehabilitation as treatment for unsteadiness and decrease in postural control after BPPV, but also here, the results of research are promising enough to recommend vestibular rehabilitation.

Phobic postural vertigo (PPV)

The diagnosis of PPV is based on six typical features:

1) Dizziness and subjective disturbance of balance in an upright static position and during motion, despite normal clinical balance tests.

2) Postural vertigo described as fluctuating unsteadiness, often taking the form of attacks or sometimes the perception of illusory body perturbations for mere fractions of seconds.

3) Vertigo attacks that can occur spontaneously but which, after specific questioning, are found to be almost invariably associated with particular constellations of perceptional stimuli or social situations. There is a tendency to develop rapid conditioning, generalisation and avoidance behaviour.

4) Anxiety and distressing vegetative symptoms accompanying and subsequent to the vertigo attack, and elicited by direct questioning.

5) Typically, an obsessive-compulsive personality in patients who often have affective lability and mild depression.

6) Frequently, onset of the condition is following periods of particular stress or after the patient has experienced an illness, usually a vestibular disorder.

The first three of these features are compulsory, however, the rest is often found in most patients.

Vestibular rehabilitation, in combination with cognitive behavioural therapy, has shown to have effects on depression, anxiety and self-perceived handicap among patients with PPV. There are only a few studies, so there is insufficient scientific evidence. However, once again are results promising enough to recommend vestibular rehabilitation for patients with PPV.

Migraine-associated dizziness

Almost two third of patients with migraine have vertigo or dizziness as one symptom. Migraine-associated dizziness is often divided into three groups: one group of patients with vertigo as aura but no concomitant migraine, one group with migraine-associated dizziness

from arteria basilaris provided areas and one group with benign, recurrent vertigo. Research has found effects of vestibular rehabilitation on dizziness handicap, activity-specific balance confidence, dynamic gait and in posturography among patients with migraine-associated dizziness. Once again, there are only a few studies, so there is insufficient scientific evidence, but results are promising enough to recommend vestibular rehabilitation for this group of patients too.

Dizziness concomitant to whiplash associated disorder (WAD)

Almost 25% of persons with WAD have dizziness as one symptom (Drottning M et al, 1995). The muscles of the neck are abundantly provided with proprioceptors. This proprioceptive system provides sensory input for control of posture, spatial orientation and coordination of eye, head and body (Karlberg M et al, 1996). The cervico-ocular reflex interacts with the vestibulo-ocular reflex but seems to be a secondary contributor to the stabilization of visual field (Norré ME, 1990). Persons with cervico-brachial pain have been shown to have more disturbances in balance than healthy subjects (Karlberg M et al, 1995) and their disturbed postural control differs from that in patients with vestibular neuritis (Karlberg M et al, 1996).

Muscular tension is associated to WAD and elevated tension in the muscles in the upper cervical region can cause an increase in sensory input from the proprioceptive system of the neck, which, in turn, creates a conflict, since other proprioceptive systems do not provide the same increase in sensory input. The brain cannot manage such a mismatch of information and the patient experiences dizziness, which occurs at the same time as the neck pain (Karlberg M, 1995). Treatment of the muscular findings among patients with cervical dizziness has shown to be feasible (Karlberg M et al, 1996). Not only muscular tension can cause dizziness concomitant to WAD, abnormal electronystagmograhpic findings have also been reported (Oosterveld WJ et al, 1991) and those who develop dizziness later, also have signs of vestibular damage immediately after the injury (Bergenius J et al, 2000). Research about vestibular rehabilitation for patients with dizziness concomitant to WAD has shown improvements in postural control as well as in self-perceived handicap (Hansson EE et al, 2006). However, there are too few studies but still enough to recommend vestibular rehabilitation as treatment for dizziness concomitant to WAD.

Summary

Vestibular rehabilitation is a concept of exercises, aimed to facilitate recovery of the vestibular system. The use of vestibular rehabilitation has broadened the last decade, since research has pointed to a multiple number of diagnoses were it is feasible. It is important to customize the exercises to the individual patient and as the vestibular system improves, it is important to increase the degree of difficulty of the exercises. If vestibular rehabilitation is neglected, recovery often fails.

Table 1: Example of vestibular rehabilitation program used in the acute phase

Exercises lying down

- Lie on your back, move eyes from side to side, as fast as possible.
- Lie on your back, move eyes up and down as fast as possible.

Exercises in sitting

- Move eyes from side to side as fast as possible.
- Move eyes up and down as fast as possible.
- Look at a fixed point in front and turn head from side to side.

Exercises in standing

- Move eyes from side to side as fast as possible.
- Move eyes up and down as fast as possible.
- Look at a fixed point in front and turn head from side to side.
- Look at a fixed point in front and shake your head.

Exercises in walking

- Look from side to side while walking.
- Look at a fixed point in front and turn head from side to side while walking.

Table 2: Example of vestibular rehabilitation program used in primary health care

Warm up phase

Ten minutes: Walking around in the room and changing direction as well as turning the head from side to side. Exercises in standing including training of co-ordination of movements.

Circuit training

Two minutes for each exercise and two laps in the circuit.

- Walking forward and backwards on a slope while turning the head from side to side.
- Standing up and sitting down on a chair while turning the head from side to side. Closed eyes if possible.
- Standing on a trampoline, eyes closed and slightly flexing the knees and turning the head from side to side simultaneously.
- Standing on foam with eyes closed and turning the head from side to side.
- Standing on a sport mat, walking on the spot and turning the head from side to side. Closed eyes if possible.
- Sitting on a ball, feet on foam, eyes closed and bouncing slightly while turning the head from side to side.
- Walking forward and backward while turning the head from side to side.

Recovery phase

Five minutes: Soft, relaxing movements. Stretch of the muscles in the upper cervical region.

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