



Psychomotricity in Vestibular Dysfunction Therapy (VDT): A Collective Health Question

Paulo Bastos and Elisangela Hermes*

¹Department of Health Science, Federal University of Mato Grosso do Sul, Campo Grande, Brazil

*Corresponding Author: CDepartment of Health Science, Federal University of Mato Grosso do Sul, Campo Grande, Brazil

E-mail: elisangelacarellhermes@gmail.com

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SYNOPSIS

This study aims to analyse the effect of psychomotor stimulation on Vestibular Dysfunction Therapy (VDT). Vestibular Dysfunction triggers vertigo, a common symptom which affects the life quality of the general population when untreated and / or prevented. The scientific investigation was carried out through systematic review of retrospective observational or experimental studies and critical review of literature. It is necessary for physicians to distinguish among the different kinds of dizziness concerning aspects such as syncope, imbalance, varied cephalic sensations or vertigo. In most cases, it results from unilateral lesion or dysfunction of the vestibular apparatus or the VIII cranial nerve. VDT is a physiological therapeutic procedure performed by speech therapists to improve and restore the body balance disorder that accompanies the clinical condition. Several studies have determined that body balance is stimulated through three psychomotor mechanisms: 1. Adaptation – CNS ability to restore body balance and spatial orientation by mechanisms triggered by the displacement of the image in the retina during the cephalic movement. 2. Habituation - recovery process of vestibular function activity, resulting from repetitive exercise stimulation. 3. Replacement - CNS ability to replace deficient vestibular function by sensorimotor mechanisms in order to recover the stability of the visual field. Some of the most used protocols are Cawthorne & Pooksey Protocol; Herdman's Protocol; Exercises and manoeuvres in Benign Paroxysmal Positional Vertigo (BPPV); Vestibular Re-education through Virtual Reality;

Dynamic Computerized Post urography. In this context, psychomotricity, defined as the trans disciplinary field that studies and investigates relations and reciprocal and systemic influences between psychism and motor becomes the scope of comparative studies to prove the efficacy of exercises related to dynamic postural balance for the prevention and treatment of Vestibular Dysfunction.

Keywords: Psychomotricity; Vertigo; Functional Neurology; Collective Health; Audiology; Speech Therapist

INTRODUCTION

Vestibular dysfunction triggers the vertigo symptom, which is common in the general population (5 to 10% of the world population), and affects quality of life when untreated and/or prevented [1,2].

The maintenance of postural balance depends on the perfect interaction among the information from the sensorial systems (visual, perceptive and vestibular), the processing in the Central Nervous System (CNS) and the appropriate execution by the effector system (neuromuscular). The integration of the sensorial information by CNS triggers, among other things, Vestibulo-Ocular (VOR), Vestibulo-Spinal (VSR) and Vestibulo-Cervical (VCR) Reflexes, which act on the stabilization of the visual field and on the maintenance of the erect posture during bodily and cephalic movement [1-3].

When there is a conflict in the integration of sensorial information, especially due to vestibular dysfunction, the symptoms and signs of bodily balance disorder become frequent. The main symptom of vestibulopathy is dizziness, which is defined as the sensation of disturbance of bodily balance, being either rotational (vertigo) or not [2-4]. Dizziness comes from lesion of the peripheral or central vestibular system in about 85% of the cases. Research carried out with 230(146 women and 84 men) individuals with suspected vestibular disorder showed that the most frequent kind of dizziness was instability, followed by vertigo [5]. Other symptoms, directly or indirectly related to vestibular disease may occur such as headaches, sight darkening, nystagmus, sleep disorders, tinnitus, and hearing loss [5-7].

A thorough otoneurological evaluation (anamnesis, vestibular tests, static and dynamic balance tests, auditory evaluation) is fundamental for a precise diagnosis of the vestibulocochlear activity and to direct the therapy to be carried out [8-10].

There are three kinds of treatment for vestibular dysfunctions: meditative, surgical and vestibular rehabilitation. Other authors add change of habits and inappropriate behaviour's (smoking, alcoholism, eating mistakes) and when necessary, psychological assistance. Others point out that the best therapeutic treatment is

vestibular rehabilitation which can be used with or without medication [11-13].

Vestibular Rehabilitation (VR) is a therapeutic resource applied to individuals presenting body balance disorders of vestibular origin. It is based on central mechanisms of neuroplasticity known as adaptation, habituation and substitution, whose objective is vestibular compensation [14,15]. VR exercises aim to improve vestibulo-visual interaction during encephalic movement as well as static and dynamic postural stability as they produce conflicting sensorial information [16-18].

VR is indicated for peripheral vestibular condition: Benign Paroxysmal Positional Vertigo, Meniere disease in the intercrisis period, Vestibular Neuritis, Bilateral or Unilateral Vestibular Areflexy, Presbivertigo – multifactorial deficiency in the elderly, Kineticosis, pregnant women with dizziness and also in central vestibulopathy [19-21]. The VRT result will depend on many factors such as vertigo aetiology, patient's age, use of vestibular system suppressant medication such as benzodiazepines, individual's capacity to perform the proposed exercises, psychic condition and patient's active cooperation. There is contraindication for some of the vestibular rehabilitation maneuvers mainly in cases of alterations in the cervical spine (disc herniation), obstructions in the carotid or vertebral basilar system and serious cardiopathy [22,3]. There are various VR protocol, the most used of which being Cawthorne & Cooksey's, Herdman's, the Italian Otoneurology Association's and Norre's. This study aims to analyze the effect of psychomotor stimulation on Vestibular Dysfunction Therapy (VDT) [24-28]. Psychomotricity is a therapeutic modality in which body movement can bring relevant benefits for people concerning balance, resistance, mobility of joints, gait speed, in addition to the positive effects over metabolism such as reduction of cardiovascular diseases, osteoporosis, diabetes, and above all prevention of the risk of fall which are linked to factors as muscular strength, body posture stability, neuromuscular coordination and stability of structural bone properties [29,30]. Therefore, the systematic review tried to evidence the use of psychomotricity, that is, the motor stimulus activating cerebral plasticity as therapeutic methodology in vestibular rehabilitation and its results.

METHODS

In order to verify the group of publications on the theme, a bibliographic survey was carried out in the months of February and March 2018 in the LILACS, EMBASE, MEDLINE, SciELO, Cochrane, ISI Web of Knowledge electronic databases and virtual libraries of theses and dissertations at the University of Sao Paulo (USP), Federal University of Mato Grosso do Sul, (UFMS) and State University of Campinas (UNICAMP).

As research strategy in the databases, the combination of the key words psychomotricity; vestibular rehabilitation; otoneurology; collective health and functional neurology was used. The searches were limited by language (English, Portuguese and Spanish) and the publication date is until March 2018. The publications which resulted from the initial selection strategy were analyzed according to the following inclusion criteria for the review: 1) subjects with vestibular dysfunction, 2) process of random sampling of subjects, 3) presence of VR assisted group and control group; 4) intervention defined with psychomotor stimulation exercises to restore vestibular function and bodily balance by means of cerebral neuroplasticity. Studies presenting research with pharmacologic and electrophysiological interventions were excluded as well as repositioning maneuvers without association with psychomotor exercises.

The selected articles for systematic review were analyzed by means of structured script including the following items: sample characteristics, outcome, methodological design, characteristics of the intervention, results and intervention effects. The outcome occurred through the subjective evaluation of dizziness intensity and bodily unbalance, clinical tests to assess balance and gait, and questionnaires and/or scales to measure the impact of vestibular dysfunctions on everyday activities. The analysis was carried out by means of a critical review of the contents and it was then compared with other publications on the subject.

RESEARCH SYNOPSIS

Picture I – Articles selected for systematic review

Authors	Sample Characteristics	Treatment	Result
[31]	Patients under primary treatment with benign paroxystic postural vertigo and unilateral, peripheric or central vestibular hypofunction.	Plantar and cervical area stimulation based on proprioception. Electrostimulation using a device similar to TENS influences cervical reflex. Spinal for rising activation up to the vestibular nuclei simulating the information which should come from the affected labyrinth. Plantar stimulation performed with balance techniques with cushions over the feet.	This procedure shortened the patient's bedridden time in about 50% and progressively restored corporal balance

[32]	124 patients (aged 59 ± 18) with unilateral (n = 51) and bilateral (n = 73) dysfunction were evaluated	Vestibulo-ocular movements were prescribed based on Herdman and dynamic movements were also performed.	From the 86 patients who finished the intervention, 61% presented gains in balance and locomotion. After the treatment is ceased, the individuals should continue to perform the exercises to prevent the symptoms from coming back
[33]	A study was carried out with 15 women aged 64 (experimental group) and 15 women aged 65 (control group) in order to verify the improvement of balance and reduction of fall risk.	The therapy consisted of vestibular exercises such as Cawthorne's and Cooksey's , involving head, neck and eye movements; postural control exercises in different positions (sitting in bipodal and unipodal support, walking); use of soft support surface to reduce proprioception and exercises with eyes closed to make it impossible to use eyesight.	The conclusion of the study shows improvement in balance and reduction of falls.

[34]	55 elderly individuals were evaluated; 31 with dizziness symptoms and 24 without dizziness symptoms, included in a water aerobics program.	12 water aerobics sessions carried out twice a week, during six weeks, lasting 50 minutes each. Class based on warm up activity, aerobic and local exercise work, stretching, recreational activity and body relaxation. Pre-test and Post-test carried out through static and dynamic computerized posturography.	Improvement was found in the physical, emotional and functional aspects of quality of life and in the performance of activities of daily living.
[35]	Systematic review of literature on VR for subjects complaining of dizziness, based on 12 articles. Most studies do not focus on a specific age. Four of them referred to elder and only one to children.	Seven research tests used Cawthorne & Cooksey's Protocol as being easily applied and allowing for use with groups.	The significant improvement in the symptoms varied between 35.2% and 91.89%. All of them mentioned the effectiveness of the procedure. The handicap reduction also proved to be consensual. The studies published by the professional speech therapists presented some particularities when compared to the ones published by the physiotherapists. The use of more than one VR protocol and the application of at least one handicap questionnaire for dizziness is prevalent.
[36]	Systematic review where 10 studies were selected. 10 studies published between 2005 and 2015 were selected; Original articles, randomized clinical trials, cohort studies or bibliographic review which approached the use of vestibular rehabilitation techniques in the treatment of vestibulopathy were used.	Techniques applied in VR: - Cawthorne & Cooksey's Protocol was prevalent. Other studies used: - Apley's Maneuver using cervical collar and postural orientation; - Apley's Maneuver without using cervical collar and without postural orientation; - Apley's Maneuver using minivibrator on the mastoid on the affected side without using the collar and without postural orientation. - Herdman's adaptation exercises. Results Evaluation: -Some studies used static a posturography before and after Otolith Repositioning Maneuvers (ORM). - Pre e post-VR assessment through the Dizziness Handicap Inventory (DHI) questionnaire.	The effectiveness of the otolith repositioning maneuvers was proven. Reduction in the vertigo cases, improvement in balance and quality of life. It is relevant to divulge forms of non-invasive treatment so as to inform different kinds of professionals.

DISCUSSION

The articles selected in this revision showed positive evidences of VR in postural control, functional capacity and quality of life of individuals with complaints or diagnosis of vestibular dysfunction. Despite the methodological diversity between the studies, it was observed that there was a prevalence of the Cawthorne and Cooksey's Protocol, short term intervention time (three months on average), amongst other parameters. This protocol uses exercises by means of eyes, head and body movements, in the sitting and ortostatic positions [31,32]. It was selected by most researched authors for being easy to apply and for allowing group work, with more interaction among the participants. Studies carried out with box sexes were included, with prevalence of those with adult and elders in order to allow for a broader discussion about

the effects of that intervention, considering that the structural and physiological alterations in the vestibular system begin to emerge in fact at 40 years of age, that is, in middle-aged people [33-35]. The diversity in the inclusion criteria of the studies was quite challenging as the samples were compared. The adequate identification of vestibulopathy and its causes are indispensable to implement the best kind of treatment [36]. It is estimated that 20% of the elderly individuals affected by vestibular dysfunction present vestibulopathy of vascular origin.

Various studies refer to loss of hair cells in the cristae ampullaris and maculae, reduced number of nerve cells in the vestibular ganglion (Scarpa), degenerated otocones, reduced labyrinthine blood flow, progressive neural stability depression, reduced compensatory capacity of ocular-vestibular reflexes (responsible for maintaining stable eyesight during head movements) and vestibular-spinal reflexes (responsible for bodily balance), all of which contribute to reduced velocity of eye tracking motion and rotational and caloric hyporeactivity of both peripheral and central vestibular systems [37,38,39]. Grouping individuals with a single etiology of vestibular dysfunction became unfeasible, since many of them have more than a diagnosis responsible for dizziness manifestation.

Among the most used audiologic tests for diagnosis of vestibular disorder, there was a prevalence of vectoelectronistagmography with caloric testing; auditory brainstem responses and liminal tonal audiometry, inter alia. Among the clinical manifestations assessed by the otorhinolaringologists, dizziness and postural instability were described as a pattern concerning the diagnosis of vestibular disorder [40,41].

Among the outcomes, the original or adapted self-assessment pre and post-intervention protocols were the most used instruments to evaluate the patients' subjective perception concerning the degree or intensity of dizziness, oscillopsia, postural instability and/or bodily unbalance. In order to measure the impact of dizziness in the quality of life and everyday activities, the most used protocol was the Dizziness Handicap Inventory (DHI) [38]. This questionnaire was culturally adapted to the Brazilian population. The questionnaire assesses the emotional, functional and physical aspects through 25 questions. The score ranges from zero to 100 points, and the closer to 100, the worse the dizziness effects on the patient's life. It is important to highlight that the subjective measures consider the individual's perception concerning the impact of symptoms which are difficult to quantify, such as dizziness in daily living.

The postural control was assessed by means of static and dynamics balance tests, functional scales and by computerized posturography [31,32,35,36]. Although the functional tests are useful in outlining the functional prognosis, they do not contribute much to determine muscular weakness or shortening, or motor incoordination, which are relevant aspects while planning a personalized treatment which may reflect on VR effectiveness.

However, the computerized posturography is applied in the laboratory assessment of bodily balance. Among the outcomes which used the computerized posturography, the most important are the stability limit, latency for the beginning of the movement, the excursion of the pressure center and the influence of the sensorial interaction over the bodily balance [30,36]. Computerized posturography complements the conventional tests to establish vestibular diagnosis and is relevant to the clinical approach, documentation and monitoring of the treatment of bodily balance disorders.

The systematic review in this study is concordant to state that VR exercises, either personalized or in groups, performed in the clinic and daily at home, reduce the sensorial symptoms in patients with dizziness and bodily unbalance. The age factor is not considered limiting to the final response to the treatment.

In the analysed studies there was no comparison of the effectiveness between the personalized and group VR intervention, or under home visits/guidance. However, the most used form

was group treatment with home guidance. Such assistance strategies are more suitable considering the great demand and the costs of service provision to the population with vestibular disorder. The protocols focusing on education, demonstration and home exercises presented satisfactory results. Nevertheless, the personalized VR exercises lead to symptoms remission in 85% of patients with vestibulopathy, whereas the generic ones present complete resolution in 64% of the cases [42].

The vestibular programs using psychomotor training are applied by professionals having knowledge and understanding of the vestibular system and its connection with the other functional neurobiomechanical body systems [40,43]. Based on the neuronal plasticity mechanisms, it is possible to reach vestibulo-ocular reflex stabilization during head movement associated with the offer of more postural stability and improvement of the individual's quality of life [41].

A wide variety of terminology is observed amongst authors to define the use of motor stimuli in VR. The following terms are prevalent: kinesiotherapy, bodily movement, head movement, ocular movement, cervical movement, postural stimulation, physical exercise, gait, unipodal and bipodal support, bodily rotation, motor stimulus with eyes closed.

CONCLUSION

Patients presenting dizziness usually avoid moving too much, as this triggers symptoms associated with this condition; thus, the reduction in movement, eventually causes a delay in the compensation system. Psychomotor training has advantages over other treatments as it provides patients with appropriate repetitive exercises, which accelerate and stimulate adaptation mechanisms, allowing for a faster return of their balance as they perform everyday activities in the long term, which, besides improving labyrinthitis, may prevent it from returning or evolving. After fifteen days of psychomotor stimulation it is possible to observe improvement in relation to the symptoms; the average short-term investment is estimated for a period of three months.

The therapeutic approach of vestibulopathy by means of psychomotricity should have a multidisciplinary character. VR is an effective tool in the control of clinical signals and symptoms. In the collective health area it should have a preventive focus, besides promoting better quality of life for the world population affected by the dizziness or vertigo symptom.

The VR program based on psychomotricity should include balance training, muscular strengthening, motor tasks which include repetitive head movements and gaze stabilization. Besides improving bodily balance, it also has the prophylactic function, helping individuals to regain self-confidence, reducing anxiety and improving social interactions.

In some cases, patients present ambulation restrictions, so gait exercises cannot be performed, which compromises the treatment result. Therefore, one of the main guidelines for VR is treating the aetiology triggering the vestibulopathy.

Neural plasticity increases synaptic efficiency, reactivates synapses and creates new connections. Such effects regulate eyesight, proprioception, hearing, cognition and multimodal sensorial arrangements for patients' rehabilitation.

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