

The Balance Concept on Unilateral Vestibular Hypofunction Patients Changes the Balance and Quality of Life

Silvia Maria Sobral Oliveira^{1*}, Allan Mateus da Silva Lima¹, Carolina Veiga Pereira¹, Emily Macedo Mainardi¹, Gabrielle Woan Hua Seifert Wu¹, Isis Pinheiro Damasceno¹, Luciane Lobato Sobral Santos², Rodrigo Santiago Barbosa Rocha², Maryana Therumy Kabuki³ and Larissa Salgado de Oliveira Rocha⁴

Abstract

Objective: To evaluate the Balance Concept influence upon balance and quality of life of unilateral vestibular hypofunction (UVH) patients and their self-perception.

Method: 6 patients were selected, both sexes and mean ages $55,33 \pm 20,66$, and the mean time of UVH basis diagnosis of $4,33 \pm 3,32$ years, were submitted to exercises based on Balance Concept three times a week, during 12 sessions and assessed by the Mini-Mental State Examination (MMSE), Dizziness Handicap Inventory questionnaire and Berg Balance Scale. Shapiro Wilk test and T test sample data ($p < 0,05$) were used.

Results: It was observed on Berg Balance Scale significant increase by comparing pre-treatment over post-treatment ($p = 0,0059$), likewise on Dizziness Handicap Inventory scale, which was significant if comparing pre-treatment and post-treatment rates ($p < 0,0001$), in the same way, it was reported by the patients, an improvement after the proposed protocol.

Conclusion: The used protocol based on the Balance Concept in this study helped the reduction of dizziness and balance improvement on unilateral vestibular hypofunction patients, reflecting directly on their daily activities.

Keywords: Vestibule of the labyrinth; Movement; Rehabilitation; Physical therapy; Dizziness; Postural control; Self-image; Quality of life

Received with Revision May 05, 2021, Accepted: May 19, 2021, Published: May 24, 2021

Introduction

One of the integrators for body balance manage is the vestibular system, this has sensorial functions, which provides to central nervous system (CNS) information about position and movement on the head and the gravity direction. Then, the CNS uses this information along with the somatosensorial and visual systems to build an image of the whole body position, movement, and the place around, and in an imbalance can cause many disorders [1].

In reference to the peripheral vestibular system, it is located in the ear's inner part, which is composed by three main functions, including visual image stabilization on the retina's fovea during head movement, maintaining postural balance and providing information for space orientation. Thus, the disabilities that involve the peripheral vestibular system can cause disorders, which are named as vestibulopathy [2].

Then, on the elderly population the emergence of sensorial system's disorders are usual, since it is common the presence of otoneurological symptoms like dizziness and lack of balance, characterized by unilateral vestibular hypofunction (UVH) derived from toxic reactions or from aging [3,4].

The vestibulopathys brings multiple symptoms, which can cause

- 1 Undergraduate of Physical Therapy at University Center of State of Pará (CESUPA), Brazil
- 2 PhDs in Human Movement Science from Methodist University of Piracicaba (UNIMEP) and Professor at University of the State of Pará - UEPA, Brazil
- 3 Lecturer at Inspirar College and at University Center Mauricio de Nassau (UNINSSAU) and Graduate Certificate in Neurologic Physical Therapy, Brazil
- 4 PhD in Human Movement Science from Methodist University of Piracicaba (UNIMEP) and Professor at University Center of State of Pará - CESUPA, Brazil

*Corresponding author:

Silvia Maria Sobral Oliveira

Tel: +55(91)981372487

✉ silviasobral.m@gmail.com

Undergraduate of Physical Therapy at University Center of State of Pará (CESUPA), Tv. Dom Romualdo Coelho, Brazil.

Citation: Oliveira SMS, da Silva Lima AM, Pereira CV, Mainardi EM, Wu GWHS, et al. (2021) The Balance Concept on Unilateral Vestibular Hypofunction Patients Changes the Balance and Quality of Life. Health Sci J. 15 No. 5: 835.

drops, considered as causing agent for morbidity and mortality on people above 65 years old. Also, it shows buzzing sounds, alterations on body balance, primarily in deprivation of visual information and gait disorders, bringing fears, bad mood, loss of self-confidence, anxiety, depression or panic [6]. Then, the quality of life (QF) becomes committed, because of these patient's daily activities limitations [7,8].

According to all the commitments caused on vestibulopaths, one of the rehabilitation ways is the vestibular rehabilitation (VR), which has a base working related to CNS neuronal plasticity, applied with the primary goal to improve the visual-vestibule interaction during the cephalic movement and to provides a visual stabilization, likewise to upgrade the static and dynamic postural stability on conditions that produces sensorial information and creates disturbance [9].

On vestibular disorders patient's treatment, it can be applied more contemporary physiotherapeutic procedures, like the Balance Concept, where it is possible to do, at the same time, the treatment and the assessment of self-perception and balance in a more complex way, correlating to functionality [10].

So, the Balance Concept has as primordial definition the potential to control the center of gravity at the supporting base. By contrast to what is often thought, the Balance is not composed only by protection and balance responses, in a way that these are just reactive mechanisms, searched to get a suitability. The concept still enlarges for previously assets mechanisms description, which are early responses that brings a preventive memory of the action and protection mechanisms [11].

In this perspective, it is understandable that the Balance Concept has its own analogy about functionality and it is vulnerable to anatomophysiologic and pathologic changes, since that, to the performance of responses and mechanism mentioned, there is system's integrity needs, sensoriomotor mainly, as far as the sensorial part needs a motor feedback on these actions execution, even though it has been known that aging brings disabilities to the person on this subject [12].

So, this research objective was to evaluate the repercussions of the Balance Concept above balance and quality of life on unilateral vestibular hypofunction patients, in the same way to analyses their self-perception.

Methodology

The study's configuration is quantitative, longitudinal and randomized, performed at University Center of State of Pará Physical Therapy's Clinic School (CESUPA), started after the approval from the Ethics Committee in Research with Humans (ECRH) with opinion number 4.114.561 and the participants signature of Informed Consent.

The sample was composed by six participants with unilateral vestibular hypofunction diagnosis, assessed on Bettina Ferro de Souza University Hospital, both sexes, with two feet support conditions and in a 20-85 age group. Although, have been excluded that ones whose had 10-22 score in the Mini-Mental State Examination (MMSE), wheelchair users, orthopedic problems, fractures, visual and hearing issues that could prevent

the activities performance and/or that ones with comorbidities that would have intervened in the protocol's applicability, as well as who would feel uncomfortable.

After the assess, it was applied the Berg Balance Scale (BBS), with the intent to functionally measure the static and dynamic balance performance, which is composed by 14 activities, where each one is scored in an ordinal scale of five points, ranging from 0 (incapable of execution) to 4 (normal execution), and the total score is from 0 to 56, and the higher the score reached means a better balance.

Besides, it was applied the Dizziness Handicap Inventory (DHI) questionnaire, which has the intention to assess the self-perception of disabling effects caused by dizziness on vestibulopaths patients' quality of life, which is formed by 25 questions, that are divided on 7 physical aspect questions, 9 emotional aspect questions and 9 functional aspect questions. The answers are nominal scale form, being "yes" equally to 4 points, "sometimes" equally to 2 points and "no" equally to 0 points. So, the score rages from 0 to 100, and the higher the score reached, the bigger will be the person's disorder level.

In this study, the participants were assessed on pre-treatment and post-treatment during 12 sessions, performed three times a week, 60 minutes duration each session.

The protocol through the Balance Concept was initially consisted on a fixed and stable surface keeping feet together and eyes open, following by the same activity with eyes closed, later, getting an unstable surface, with the Balance Beam foam. Next, it was conducted an activity circuit constituted with free gait training, gaiting around different barriers and on varied textures surfaces. At the end, the volunteers returned at the fixed and stable surface, but standing one foot behind another with eyes open, switching to eyes closed, and involving to the unstable surface (the foam), with and without the visual aid and to finish it was made the same exercise but one-foot standing, and this activity circuit was executed during 3 times each session.

To statistical analysis, the BioEstat5.3[®] program was used, which the chosen test for data normality has been Shapiro Wilk Test along with T Test sample data for comparison of pre-treatment and post-treatment considering $p \leq 0,05$.

Results

The sample were composed by 3 (50%) of individuals from male gender and 3 (50%) from female gender, and mean ages 55,33 \pm 20,66 and the mean time of basis diagnosis of 4,33 \pm 3,32 years.

About the total scores from BBS and DHI assessed before and after the treatment, it was proved a positive average increase on static and dynamic stability through the BBS, bringing a consideration about DHI related to the participants' quality of life. It was noticed that the scales' average values, got a meaningful statistic ($p \leq 0,05$), what resulted on improvement on balance analysed by BBS ($p=0,0059$) and dizziness analysed by DHI ($p < 0.0001$), which had positive effects on volunteers' quality of life, as shown in the **Table 1**.

Although, making the analysis from the 14 topics of BBS in an

individually way comparing pre and post treatment, it confirmed that there haven't been a significant improvement ($p > 0,05$) on the analysed scale activities like "sitting to standing", "standing unsupported", "sitting unsupported", "standing to sitting", "transfers", "standing with eyes closed", "standing with feet together", "reaching forward with outstretched arms", "retrieving object from floor", "turning to look behind", "turning 360°", "placing alternate foot on stool", "standing with one foot in front" and "standing on one foot", as shown in the **Table 2**.

However, on DHI evaluation, it wasn't detected any significant improvement about the physical aspect point ($p > 0,05$), otherwise, in the functional aspect, it was observed an upgrading on item 5, which corresponds to the difficult on laying down or getting up from bed ($p = 0,04$). Furthermore, in the emotional aspect, the items which matches to frustration feeling ($p = 0,004$),

Table 1 Average register \pm DP related to scales' total scores on pre-treatment and post-treatment of UVH individuals.

Balance	BBS	DHI
Pre-treatment	48.5 \pm 5.08	41 \pm 14.73
Post-treatment	55.33 \pm 1.63*	21 \pm 12.63*

*Differ statistically pre and post-treatment in comparison with intra-group ($p \leq 0.05$).

afraid of going out alone ($p = 0,01$), disabled feeling ($p = 0,02$), and becoming inclined ($p = 0,02$), also got a significant progress if compared pre and post treatment, as the descriptors on **Table 3**.

Discussion

The outcome of this research suggested a prevalence of balance disorders as dizziness consequence, which is caused by UVH. The UVH is one of the most principal causes of dizziness, which is defined by the fusion of a bad space orientation, resulting on instability, in conjunction with postural imbalance, and it can causes drops high risks [13]. So, the treatment needs to be early, and the practices have to be clear and specific, since that great results are achieved and are able to avoid or reduce damages [9].

The VR has the goal of working on vestibular system excitation, whereby the central mechanisms of neuronal plasticity, which are adjustment, the habituation and at last the vestibular replacement [14,15]. As so, on execution of VR integrity based on the Balance Concept, it is possible to reach these mechanisms, producing greater efforts for the manage of body stability, considering it's execution on unstable and different textures surfaces, which guarantees a bigger necessity of sensorial information [16].

Then, the Balance Concept is formed by reactive mechanisms, with

Table 2 Average register \pm DP of variants of BBS related to pre and post-treatment.

Item	Pre-treatment	Post-treatment	p-value
Sitting to standing	3.5 \pm 0.54	4 \pm 0	0.07
Standing unsupported	3.83 \pm 0.40	4 \pm 0	0.36
Sitting unsupported	4 \pm 0	4 \pm 0	1
Standing to sitting	3.66 \pm 0.51	4 \pm 0	0.17
Transfers	3.5 \pm 0.54	4 \pm 0	0.07
Standing with eyes closed	4 \pm 0	4 \pm 0	1
Standing with feet together	3.33 \pm 1.63	4 \pm 0	0.36
Reaching forward with outstretched arms	3.5 \pm 0.54	4 \pm 0	0.07
Retrieving object from floor	3.33 \pm 1.63	4 \pm 0	0.36
Turning to look behind	3.66 \pm 0.51	4 \pm 0	0.17
Turning 360°	3.5 \pm 0.83	4 \pm 0	0.20
Placing alternate foot on stool	3.5 \pm 4	4 \pm 0	0.07
Standing with one foot in front	2.66 \pm 1.50	4 \pm 0	0.08
Standing on one foot	2.5 \pm 1.51	3.33 \pm 1.63	0.09

* Differ statistically pre and post-treatment in comparison with intra-group ($p \leq 0.05$). Source: Author's.

Table 3 Average register \pm DP of variants of DHI related to pre and post-treatment.

	Item	Pre-treatment	Post-treatment	p-value
Functional Aspect	Difficult on laying down or getting up from bed	2.33 \pm 1.96	0.66 \pm 1.0	0.04*
Emoional Aspect	Frustration feeling	1.66 \pm 0.81	0 \pm 0	0.004*
	Afraid of going out from home without someone to accompanies	2.33 \pm 1.50	0 \pm 0	0,01*
	Disabled feeling	2,33 \pm 1,96	1 \pm 1.09	0.02*
	Damage on relationships with relatives or friends	1.33 \pm 1.03	0 \pm 0	0.02*

* Differ statistically pre and post-treatment in comparison with intra-group ($p \leq 0.05$). Source: Author's.

Average register \pm DP of variants of DHI related to pre and post-treatment.

the intention to fit in that action, likewise pre-active mechanisms, called as preliminary reactions. Thereby, it is understandable that the Balance has a similarity to functionality [11]. Therefore, the activities proposed on the protocol needed an integration and coordination of sensorial, motor and biomechanical activities, being meaningful to the daily played functions, like walks in straight line, overcome barriers, bends, climbing stairs and go down ramps, those ones that need base support reduction.

Still on this perspective, the final result of BBS, deserves a highlight, because it boosts the idea that the study also needs to be based on functionality, because it is through the performed postures on the activities circuit of Balance protocol, it was possible to reach meaningful results, and was needed a higher motor strategies activation to keep itself stable, as much as to stable surfaces, and to unstable surfaces, and even though with or without visual supply.

Moreover, the Balance is vulnerable to anatomophysiological and pathologic changes, because to the mechanisms execution mentioned above, it is necessary the sensorial system integrity along with motor systems, since it is through the motor corrective action that the sensorial feedback will be produced, and this tracing goes inside a closed and continuous circuit, so it is comprehensive that aging causes deficits on this context [17,18].

However, basing on the analysis made on this study, many researches approaches commitments on older people about UVH, and the risks that can lead to symptomatology improvements [4,19]. Although, on this research, it was noticed an young age person with current disorders, and during the application of the proposal, it already reported an upturn about symptomatology, and was confirmed at the end by BBS and DHI analysis, indicating a great improvement of quality of life.

Thus, the reports index about the lack of autonomy, the imposed barriers above the fear of drops and its consequences, are elevated [3,14,20]. So, a comparative was made after the proposal on this study and it was observed that all patients reported an improvement over self-confidence, autonomy on doing their activities, good humor, and getting a better interpersonal and

psycho-social relations. Within this scope, through the final DHI analysis, it was demonstrated a considerable upgrading about the patient's condition, causing a positive effect on quality of life at the end of the approached proposal.

Additionally, there is still a shortage of studies on the subject addressed in this research, brought out the need to develop more studies about the activity of physical therapy on UVH, since the affected individuals shows various limitations that influences quality of life.

Conclusion

So the issues about what is UVH, was confirmed the effectiveness of physical therapy through the protocol based on the Balance Concept, because it had satisfactory outcomes on the BBS and DHI, due to the small number of sessions.

However, during the individual analysis of the scales items, there is no level of significance mostly. So, it becomes necessary to do a more detailed approach and with a bigger sample number, since that on this research it was a restriction.

Declarations

Approval and ethics consent

The study obeyed the ethical rules according to the 466/12 and 580/18 Resolution from the National Health Council and was submitted to the approval from the Ethics Committee in Research with Humans (ECRH) of the University Center of State of Pará (CESUPA) (4,114,561) before its execution.

Competing Interests

There is no interest conflict from the authors Silvia M. S. Oliveira, Allan M. S. Lima, Carolina V. Pereira, Emily M. Mainardi, Gabrielle W. H. S. Wu, Isis P. Damasceno, Larissa S. O. Rocha.

Funding Declaration

No financial aid was received.

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