

VESTIBULAR REHABILITATION

Clinical benefits to patients with Parkinson's disease

Bianca Simone Zeigelboim¹, Karlin Fabianne Klagenberg², Hélio A. Ghizoni Teive³, Renato Puppi Munhoz^{3,4}, Jackeline Martins-Bassetto²

Abstract – Objective: To evaluate the effectiveness of the vestibular rehabilitation (VR) exercises by means of an assessment before and after the application of the Brazilian version of the *Dizziness Handicap Inventory* (DHI) questionnaire. **Method:** Twelve patients were studied, the following procedures were carried out: anamnesis, otorhinolaryngological and vestibular evaluation, and the application of the DHI before and after the VR. **Results:** Clinically resting tremors and subjective postural instability were the motor complaints most frequently associated with complaints of vertigo in 12 cases (100%); in the vestibular exam, all the patients presented abnormalities, frequently from the uni and bilateral peripheral vestibular deficiency syndromes in 10 cases (83.3%); there was significant improvement in the physical, functional and emotional aspects of the DHI after the completion of the VR. **Conclusion:** The VR following the Cawthorne and Cooksey protocol were shown to be useful in managing subjective complaints of several aspects evaluated in this protocol.

KEY WORDS: Parkinson's disease, rehabilitation, vestibular function tests.

Reabilitação vestibular: utilidade clínica em pacientes com doença de Parkinson

Resumo – Objetivo: Avaliar a eficácia dos exercícios de reabilitação vestibular (RV) por meio de avaliação pré e pós-aplicação da versão brasileira do questionário *Dizziness Handicap Inventory* (DHI). **Método:** Estudou-se 12 pacientes e realizaram-se os seguintes procedimentos: anamnese, avaliação otorrinolaringológica, vestibular e aplicação do DHI pré e pós RV. **Resultados:** Do ponto de vista clínico, o tremor de repouso e a instabilidade postural subjetiva foram às queixas motoras mais frequentes associadas às queixas de vertigem em 12 casos (100%); no exame vestibular, todos os pacientes apresentaram anormalidades, com frequência das síndromes vestibulares periféricas deficitárias uni e bilaterais em 10 casos (83,3%); houve melhora significativa dos aspectos físico, funcional e emocional do DHI após a realização da RV. **Conclusão:** A RV seguindo o protocolo de Cawthorne e Cooksey mostrou-se útil no manejo de queixas subjetivas de diversos aspectos avaliados neste protocolo.

PALAVRAS-CHAVE: doença de Parkinson, testes de função vestibular, reabilitação.

The aging process manifests itself by a decline in the functions of several organs in a linear fashion in function of the time with the exact transition point not definable, as in other phases. It is observed that at the end of the third decade, anatomofunctional alterations associated with aging become distinct¹. With an increase in life expectancy observed globally, the prevalence of degenerative diseases such as Parkinson's disease (PD) and Alzheimer's disease has become increasingly significant².

PD is characterized by a combination of at least 2 of the three cardinal signs of Parkinson's syndrome: resting tremors, rigidity and bradykinesia³. In PD, for more than two decades, sensory dysfunctions with variable intensities in smell, visual perception of colours and contrasts, proprioception and motor control have been described⁴. The characteristic functional abnormality is dopaminergic deficit secondary to the degeneration of the *substantia nigra pars compacta*⁵. The specific cause of this degeneration

¹Otoneurology Sector, Graduate Program in Communication Disorders, University Tuiuti of Paraná, Curitiba PR, Brazil, Audiologist, Ph.D. in Communication Disorders, Professor and Coordinator of the Graduate Program in Communication Disorders; ²Otoneurology Sector, Graduate Program in Communication Disorders, University Tuiuti of Paraná, Curitiba PR, Brazil, Audiologist, M.S., Curitiba PR, Brazil; ³Neurology Service, Department of Neurology, Hospital de Clínicas, Federal University of Paraná, Curitiba PR, Brazil, Neurologist; ⁴State of Parana Parkinson Association, Curitiba PR, Brazil, Neurologist. Financing: National Council of Scientific and Technological Development (CNPQ).

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Dra. Bianca Simone Zeigelboim – Rua Gutemberg 99 / 9º andar - 80420-030 Curitiba PR - Brasil. E-mail: bianca.zeigelboim@utp.br

remains unknown and is probably multifactorial, including genetic predisposition, oxidative stress and environmental factors, among others⁶. In the geriatric population, where the majority of the PD cases occur, there is a vulnerability in the ability of the central nervous system to process vestibular, visual and proprioceptive signs which are responsible for the maintenance of balance, with a decrease in the capacity to modify the postural adaptive reflexes. Symptoms such as vertigo and the difficulty to balance are part of these abnormalities⁷. Postural stability depends on the integrity of the vestibular system (vestibular labyrinth, vestibulocochlear nerve, nuclei, channels and interrelations in the central nervous system), the somatosensory system (sensory receptors located in the tendons, muscles and articulations) and vision⁷. The vestibular labyrinth is responsible for the balance and position of the body in space. Complaints of vertigo and postural instability of vestibular origin can occur at both peripheral and central levels⁸. Individuals above 75 years manifest vertigo as the most marked symptom and in these cases, the alterations of postural control are important causes of an increase in the risk of falls and in the morbimortality in this population⁹⁻¹¹.

The leading forms of treatment for vestibular dysfunctions are medical, surgical and vestibular rehabilitation (VR)¹². VR acts in a physiological manner on the vestibular system, and is a therapeutic remedy which involves proprioceptive and vestibular visual stimuli, with the intention of maintaining the corporal balance of patients with vertiginous symptoms^{12,13}. It is a procedural proposal based on central mechanisms of neuroplasticity known as adaptation, familiarization and substitution for obtaining vestibular compensation^{12,13}. The VR exercises seek to improve the vestibulovisual interaction during cephalic movement, increase the static and dynamic postural stability in conditions which generate conflicting sensory information and reduce individual sensitivity to cephalic movement¹²⁻¹⁴. VR is an important method in the therapeutic approach for patients with postural instability, which has opened new horizons in the oto-neurologic clinic over the past few decades.

The objective of our study was to evaluate the effectiveness of VR exercises by means of an assessment before and after the application of the Brazilian version of the *Dizziness Handicap Inventory* (DHI) questionnaire.

METHOD

Twelve patients (7 female) were evaluated with a diagnosis of PD according to the criteria of the Queen Square Brain Bank and followed by the Parkinson's Disease Association for Paraná State (APPP). All patients were selected because of complaints of vertigo, with mean age 70.83 ± 4.57 years. Everyone was evaluated in the Laboratory of Otoneurology of the Tuiuti University of Paraná. Patients with significant visual, psychiatric, rheumatological,

and musculoskeletal vulnerabilities or any abnormality that prevented completion of the evaluation and the VR, were not included in the study.

The patients were submitted to the following procedures:

Anamnesis – A questionnaire was administered with emphasis on otoneurological signs and symptoms.

Otorhinolaryngological evaluation – Administered with the objective of excluding any other alteration that might interfere with the exam.

Vestibular evaluation – The patients were submitted to the following tests which constitute the vestibular exam:

Not Logged

Positional nystagmus and vertigo and spontaneous and semi-spontaneous nystagmus in the frontal plane and at 30 degrees deviation from the plane of the four cardinal points were all studied.

Logged

For the completion of the vectoelectronystagmography (VENG) a thermosensitive Berger apparatus, model VN316 was used with three channels for registration. The Ferrante decreasing pendulous rotative chair was used together with a Neurograff visual stimulator, model EV VEC and a Neurograff air oto calorimeter, model NGR 05. The following ocular and VENG labyrinthine tests were performed according to the criteria proposed by the Mangabeira-Albernaz et al.¹⁵.

Calibration of ocular movements; analysis of spontaneous and semi-spontaneous nystagmus; analysis of pendulous tracking; analysis of optokinetic nystagmus; analysis of pre and post rotative nystagmus to the decreasing pendulous rotative test; analysis of pre and post caloric nystagmus.

When examination was completed, patients were informed about the VR program.

Implementation of the *Dizziness Handicap*

Inventory questionnaire (DHI), Brazilian version

This questionnaire originally designed by Jacobson et al.¹⁶ was culturally adapted to the Brazilian population by Castro¹⁷. The questionnaire was administered before and after completion of the VR exercises, assessing the level of disability related to dizziness in the activities of daily living and evaluating the emotional, functional and physical aspects totaling 25 topics. The responses allowed were “yes”, equivalent to a score of 4 “sometimes”, equivalent to 2 and “no”, equivalent to 0. The total scores ranged from 0 to 100 points, with the closer the value to 100, the greater the extent of disability caused by dizziness in the patient's activities of daily living.

VR Protocol of Cawthorne and Cooksey^{18,19}

The exercises were administered during three months, twice a week, followed by an assimilation of repetitions at home^{18,19}. The objective of this protocol was the improvement of static and dynamic balance function, with a recovery of spatial coor-

Table 1. Frequency of symptoms of 12 patients with Parkinson's disease.

Symptoms	Number of patients	Frequency (%)
Resting tremor	12	100
Vertigo	12	100
Subjective postural instability	10	83.3
Hearing loss	7	58.3
Tinnitus	6	50.0
Deviation in gait	3	25.0
Falls	3	25.0
Hyper sensitivity to intense sounds	2	17.0
Ear pressure	2	17.0
Difficulty to understand speech	1	8.3
Sensations of floating	1	8.3
Anxiety	1	8.3
Depression	1	8.3

dination. This protocol was selected because of its easy administration and allowed group performance.

Patients were oriented that they would be working within a level of minimal discomfort, and that the exercises could prompt symptoms which would activate the natural mechanisms of compensation. Follow-up sessions took place to make corrections, if necessary and offer guidance.

Statistical method

The descriptive analysis of the data from the anamnesis and the vestibular evaluation was performed. For an analysis of the data from the DHI questionnaire, Brazilian version, the Student t

Table 2. Frequency of abnormal findings in the vestibular evaluation in 12 patients with Parkinson's disease.

Findings	Number of patients	Frequency (%)
Unilateral vestibular hyporeflexia	5	41.6
Bilateral vestibular hyporeflexia	5	41.6
Unilateral vestibular hyperreflexia	1	8.3
Bilateral vestibular hyperreflexia	1	8.3
Positional vertigo and/or nystagmus	1	8.3
Study of spontaneous open-eye nystagmus	1	8.3
Asymmetry of post-rotative nystagmus	1	8.3
Calibration of irregular ocular movement	1	8.3

test was administered and a 0.05 or 5% level of significance was adopted to rule out the nullity hypothesis.

This study was approved by the Committee of Institutional Ethics, ruling no. 008/2005 all patients gave informed consent.

RESULTS

Clinically, we observed that the most common motor complaints were resting tremors and the subjective postural instability, associated with complaints of vertigo as shown in Table 1. Concerning the evaluation of the vestibular function, alterations were verified in all 12 patients (100%), with a prevalence of unilateral and bilateral hyporeflexia in 10 patients (83.3%) as shown in Table 2. The results of the vestibular exam established 5 cases (41.7%) of unilateral deficient peripheral vestibular syndrome, 4 cases (33.4%) of bilateral deficient peripheral vestibular

Table 3. Evaluation of the physical, functional and emotional aspects pre and post treatment.

Patient	Physical		Functional		Emotional		Total	
	Pre	Post	Pre	Post	Pre	Pos	Pre	Post
1	2	4	6	–	8	–	16	4
2	16	2	20	4	8	–	44	6
3	6	2	8	4	8	6	22	12
4	8	–	12	–	10	–	30	–
5	–	–	8	–	–	–	8	–
6	4	–	2	–	2	–	8	–
7	2	–	10	4	12	2	24	6
8	12	6	6	2	–	–	18	8
9	20	10	12	6	4	2	36	18
10	14	2	6	–	6	–	26	2
11	2	–	4	–	–	–	6	–
12	20	10	8	4	20	4	48	18
Mean	8.8	3	8.5	2	6.5	1.2	23.8	6.2
SD	7.3	3.8	4.7	2.3	5.9	2.0	13.8	6.7

SD: standard deviation.

syndrome, 1 case (8.3%) of unilateral irritative peripheral vestibular syndrome 1 case (8.3%) of bilateral deficient central vestibular syndrome and 1 case (8.3%) of bilateral irritative central vestibular syndrome.

The analysis of the DHI questionnaire, Brazilian version, showed significant improvement was observed in the marks total with variation from 6 to 48, mean 23.8, and standard deviation 13.8 in the pre-treatment and variation from 0 to 18 points, mean 6.2, and standard deviation 6.7 in the post-treatment, as shown in Table 3. The Student t test comparing the evaluations before and after RV showed p values (0.001960 physical; 0.000129 functional) and (0.000122 emotional). All were significant, considering the 5% level of significance.

In the analyses of the pre and post-treatment means of the physical, functional and emotional aspects, a decrease and a consequent improvement were observed in all the aspects evaluated. In the physical aspect the mean varied from 8.8 to 3, the functional aspect from 8.5 to 2 and the emotional aspect from 6.5 to 1.2.

DISCUSSION

Imbalance, gait disturbances and postural abnormalities are common in PD. The main symptom resulting from vestibular system dysfunction in the elderly is rotatory dizziness, which may or may not be associated with other types of dizziness¹². In the current study it can be verified, from a clinical point of view, that the most common motor complaints were resting tremors and subjective postural instability, associated with vertigo.

The aging of the sensory systems, especially vision, proprioception, plantar pressure receptors and internal ear functioning, in all system levels produces a neuronal loss that begins in the sixth decade and accelerates after 70²⁰. With respect to the vestibular evaluation, abnormalities of the peripheral vestibular system were observed in 10 patients (83.3%) and of the central vestibular system in 2 patients (16.7%). The prevalence of alterations in the peripheral vestibular system has been observed in several previous studies^{20,21}. The abnormal findings to the VENG, namely hyporeflexia, have already been reported in similar studies²¹ in PD patients and healthy elderly subjects. The reduction in the response to the caloric tests was perceived as one of the modifications of the vestibular system in relation to the aging process²². Several studies²² mention the loss of ciliated cells of the ampullary crests and the maculae, decline in the number of neurons of the vestibular ganglion, degeneration of the otoconia, decrease in the labyrinthine blood flow, progressive depression of neural stability, reduction in the compensation capacity of the vestibulo-ocular (responsible for maintaining vision stable during cephalic movement) and vestibulospinal (responsible for corporal sta-

bilization) reflexes, which contribute to a decrease in the speed of pursuit movements and to rotational and caloric hypoactivity of the vestibular system, at both the peripheral and central level.

Considering the DHI as a measure for specific conditions and which evaluates the health of individuals with vestibular disorders, the Brazilian version was administered before and after VR therapy. Significant improvement was detected in the three aspects evaluated and the analyses of the pre and post-treatment mean values typified symptomatologic improvements in all the patients. VR is a therapeutic process which seeks to accelerate the mechanisms of central compensation by means of neuronal plasticity with the execution of repetitive exercises²³. In our findings, the hypothesis that VR exercises can promote a decrease in vestibular symptomatology has been reinforced, with the exercises identified as strong allies in the treatment of peripheral dysfunctions.

Significant improvements were observed in our study using the parameters described in concurrence with previous studies^{24,25}, that also used the Cawthorne and Cooksey^{18,19} exercises. Subjective and objective improvement was also demonstrated in similar studies of the authors²²⁻²⁶. Additionally we observed an improvement in parameters of quality of life in all aspects.

In conclusion, the VR following the Cawthorne and Cooksey protocol were shown to be useful in managing subjective complaints of several aspects evaluated in this protocol.

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