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Vestibular Rehabilitation: Its Effectiveness After Discharge

Reabilitação Vestibular: sua efetividade após a alta

Rehabilitación Vestibular: Su efectividad después del alta

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Abstract

Introduction: Vestibular rehabilitation is a treatment for chronic dizziness that uses personalized exercises aimed at restoring postural control and reducing dizziness. There is little discussion in the literature about the long-term benefits of this intervention. **Objectives:** To describe the profile of patients seen at the Vestibular Rehabilitation Outpatient Clinic and verify body balance improvement after speech-language-hearing therapy discharge. **Methods:** Sociodemographic data, diagnosis, previous treatment, and existing complaints were collected. The information was obtained via phone calls and medical records. The data were statistically analyzed using a significance level of 5%. **Results:** 26 individuals participated, of whom 21 (80.8%) were female, with a mean age of 67 years. The main complaint was non-rotational dizziness. The most common vestibular test result was unilateral vestibular hypofunction. Among the interviewees, 25 (96.2%) reported improved symptoms after the treatment, with reduced Dizziness Handicap Inventory scores. Seven participants (26.9%) remained asymptomatic since the end of rehabilitation. Those who still reported dizziness described it as less intense than before the intervention. **Conclusion:** There was a prevalence of females, older adults with incomplete middle school, no established otoneurological diagnosis, complaint of non-rotational dizziness, and vestibular test results of unilateral vestibular hypofunction. Vestibular rehabilitation effectively reduced the symptoms. Successive exposure to exercises after treatment helps maintain balance. However, adherence to exercise after discharge is still low.

Keywords: Dizziness; Postural Balance; Quality of Life; Neurotology; Speech, Language and Hearing Sciences

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Authors' contributions:
DARA: acquisition, analysis, data interpretation and article writing.
ASA: research design, assistance in data collection and analysis, critical review and approval of the final version.
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Resumo

Introdução: A reabilitação vestibular é um tratamento para tontura crônica que utiliza exercícios personalizados visando restaurar o controle postural e reduzir a tontura. Pouco se discute na literatura sobre os benefícios em longo prazo desta intervenção. **Objetivos:** Descrever o perfil dos pacientes atendidos no Ambulatório de Reabilitação Vestibular e verificar a melhora do equilíbrio corporal após a alta fonoaudiológica. **Métodos:** Foram colhidas informações acerca dos dados sociodemográficos, diagnóstico, tratamento anterior e queixas existentes. As informações foram obtidas por contato telefônico e acesso aos prontuários. Os dados foram analisados estatisticamente utilizando nível de significância de 5%. **Resultados:** Participaram 26 indivíduos, sendo 21 (80,8%) do gênero feminino, com média de idade de 67 anos. A queixa principal foi tontura não rotatória. O resultado do teste vestibular mais comum foi hipofunção vestibular unilateral. Dentre os entrevistados, 25 (96,2%) relataram melhora dos sintomas com o tratamento, com redução da pontuação obtida no Dizziness Handicap Inventory. Sete participantes (26,9%) permaneceram assintomáticos desde o término da reabilitação. Aqueles que relataram ainda sentirem tontura, descreveram que esta possui menor intensidade que no período anterior à intervenção. **Conclusão:** Houve prevalência de indivíduos do gênero feminino, idosos, com ensino fundamental incompleto, sem diagnóstico otoneurológico estabelecido, com queixa de tontura não rotatória e resultado do teste vestibular de hipofunção vestibular unilateral. A reabilitação vestibular foi eficaz para redução dos sintomas apresentados. A exposição sucessiva aos exercícios após o tratamento auxilia na manutenção do equilíbrio. Contudo, a adesão à realização dos exercícios após a alta ainda é baixa.

Palavras-chave: Tontura; Equilíbrio Postural; Qualidade de Vida; Neuro-Otologia; Fonoaudiologia

Resumen

Introducción: La rehabilitación vestibular es un tratamiento para la vértigo crónico que utiliza ejercicios personalizados con el objetivo de restaurar el control postural y reducir el vértigo. Hay poco debate en la literatura sobre los beneficios a largo plazo de esta intervención. **Objetivos:** Describir el perfil de los pacientes atendidos en el Ambulatorio de Rehabilitación Vestibular y verificar la mejora del equilibrio corporal después del alta fonoaudiológica. **Métodos:** Se recopilaron información sobre datos sociodemográficos, diagnóstico, tratamiento previo y quejas que aún persistían. La información se obtuvo por contacto telefónico y acceso a los registros médicos. Los datos se analizaron estadísticamente utilizando un nivel de significación del 5%. **Resultados:** Participaron 26 individuos, siendo 21 (80,8%) del género femenino, con una edad promedio de 67 años. La queja principal fue vértigo no rotatorio. El resultado del examen vestibular más común fue hipofunción vestibular unilateral. Entre los entrevistados, 25 (96,2%) informaron una mejora en los síntomas con el tratamiento, con una reducción en la puntuación obtenida en el Dizziness Handicap Inventory. Siete participantes (26,9%) permanecieron asintomáticos desde el final de la rehabilitación. Aquellos que informaron que todavía experimentaban vértigo describieron que este tenía una intensidad menor que en el período anterior a la intervención. **Conclusión:** Hubo una prevalencia de individuos del género femenino, ancianos, con educación primaria incompleta, sin un diagnóstico otoneurológico establecido, con queja de vértigo no rotatorio y un resultado del examen vestibular de hipofunción vestibular unilateral. La rehabilitación vestibular fue efectiva para reducir los síntomas presentados. La exposición sucesiva a los ejercicios después del tratamiento ayuda a mantener el equilibrio. Sin embargo, la adherencia a la realización de los ejercicios después del alta sigue siendo baja.

Palabras clave: Mareo; Equilibrio Postural; Calidad de Vida; Otoneurología; Fonoaudiología

Introduction

Body balance depends on the integrity of three systems in the human body: vision, the somatosensory system, and the vestibular system, which are responsible for perceiving and picking up external stimuli[1]. The vestibular system detects linear body movements (up, down, forward, and backward) and perceives angular head acceleration in the axial, coronal, and sagittal planes. The vision quickly assimilates body displacement and verifies depth perception, while the somatosensory system indicates the position of the part of the body in space[2].

Changes in the functioning of any of these systems may cause dizziness symptoms readily perceived by the subject, giving the sensation that the surroundings are moving, or the body is in locomotion in space[2]. Dizziness encompasses various sensations related to body balance disorder[3]. The most reported sensations are that of spinning in the environment, imbalance, instability, spatial disorientation, floating, brain fog, and drunk feeling[3]. These symptoms normally hinder the patients' activities of daily living and impair their physical, functional, and emotional domains[4].

Vestibular rehabilitation (VR) is a noninvasive treatment for chronic dizziness that uses a set of personalized exercises to help reestablish postural control and diminish dizziness complaints[5]. This therapy is grounded on three neurophysiological processes that favor the reestablishment of body balance: compensation, habituation, and adaptation[4,5].

Compensation is a process of sensorineural relearning that occurs when the other systems responsible for body balance (vision, proprioceptive, and the central nervous system) take on the vestibular function that has been lost to minimize the asymmetry between labyrinth reflexes to avoid vestibular nuclei disturbance, thus reducing the patient's symptoms. Habituation, in its turn, is based on presenting the same stimulation successively at regular intervals to mitigate the sensory response. Such stimuli are likely to cause mild to moderate episodes of dizziness; hence, repeating this exercise over time should desensitize the patient and consequently help them adapt to those sensory stimuli[4].

The literature scarcely discusses the long-term benefits of VR exercises to maintain postural control. Thus, this study aimed to describe the profile of patients with a history of dizziness attended at the VR outpatient center of a teaching clinic and verify whether some time after being discharged from the speech-language-hearing (SLH) therapy they maintained the body balance they had acquired.

Methods

This cross-sectional, descriptive observational quantitative study was approved by the Research Ethics Committee of the Federal University of Minas Gerais (UFMG) under evaluation report no. 0551.0.203.000-11. The study of this manuscript belongs to a broader previously approved research project.

The sample was made up based on the following inclusion criteria: (1) patients who had been submitted to VR at the SLH outpatient center of the São Geraldo Hospital – Clinics Hospital (HC-UFMG) and had been discharged from the treatment 6 months to 5 years before, (2) individuals who were undergoing VR at the HC-UFMG SLH outpatient center but had their treatment interrupted by the COVID-19 pandemic, and (3) patients who volunteered to answer the questionnaire in this study. The exclusion criteria were as follows: (1) patients who abandoned the VR treatment and (2) patients with self-reported or evident cognitive deficits.

It is important to highlight that the participants whose in-person treatment was interrupted by the social isolation caused by the COVID-19 pandemic improved importantly from the dizziness symptoms and were very close to being discharged from rehabilitation. All these patients were instructed to continue doing the listed exercises at home twice a day, every day of the week. They were also contacted remotely every week to follow up on their progress and adjust the exercises, as in the in-person treatment, until they were discharged from VR. All participants who were discharged from SLH therapy were instructed to continue doing the listed exercises at home once a day at least three times a week.

Data were collected with a medical history form structured based on the theoretical framework of the Body Balance Assessment Protocol used in the said service and on the researchers' experience (Chart 1). It was used to characterize the participants and gather data on sociodemographic issues, diagnosis, previous treatment, and possible complaints the subjects still had.

Chart 1. Form used to obtain data on the current postural status of patients submitted to vestibular rehabilitation.

COLLECTION FORM – CURRENT POSTURAL STATUS OF PATIENTS SUBMITTED TO VESTIBULAR REHABILITATION

1. Name: _____
2. Current age: _____
3. Sex: _____
4. Educational attainment: _____
5. Previous diagnosis: _____
6. Main previous complaints: _____
7. Duration of dizziness before VR: _____
8. Previous vestibular test result: _____
9. DHI at the beginning of treatment (physical, emotional, and functional scales and total): _____
10. DHI at the end of treatment (physical, emotional, and functional scales and total): _____
11. How many sessions did you attend? _____
12. How long ago did you finish the VR treatment? _____
13. Did you have tinnitus before VR? _____
14. Did tinnitus increase after VR? _____
15. Did you undergo any tinnitus treatment? Did it improve? _____
16. Are you still doing the dizziness exercises at home, after finishing the treatment? _____
17. If not, how long ago did you stop? _____
18. Have you noticed any dizziness improvements with VR? _____
19. Have you been discharged from the speech-language-hearing outpatient center at the São Geraldo Hospital?_____
20. Current complaints: _____

IF YOU STILL HAVE COMPLAINTS:

21. Is the dizziness/vertigo spontaneous or induced by movements or changes in position? _____
22. How long ago did these symptoms reappear? _____
23. Duration of dizziness: ( ) < 1 minute ( ) 5 minutes ( ) > 30 minutes ( ) all day long ( ) Others: _____
24. Frequency of dizziness: ( ) every day ( ) 1 to 3 times/week ( ) Once/month ( ) more than once/month ( ) Others: _____
25. Have you been submitted to any other dizziness treatment? _____
26. Current visual analog scale result: _____
27. would you be interested in going back to the outpatient center for a new treatment: ( ) YES ( ) NO.

The medical history form was filled out based on information obtained via phone calls to participants and the medical records of their previous treatment at the HC-UFMG SLH outpatient center. The medical records provided demographic, social, diagnostic, and previous treatment data, including the results of a previous vestibular test performed at the same service and other possible treatments for postural imbalance symptoms. The purpose of the phone calls was to obtain information on the participants' vestibular complaints and needs at the moment.

Such information was complemented with objective data from the Dizziness Handicap Inventory (DHI), by Jacobson and Newman (1990), translated into Brazilian Portuguese and adapted by Castro, Gazzola, Natour, and Ganança (2007)[6], and from a visual analog scale (VAS).

The Brazilian DHI assesses the impact of dizziness on the quality of life, considering the physical, functional, and emotional domains. Each question is answered with "yes", "sometimes", or "no", respectively scoring 4, 2, or 0 points[7] – the higher the score, the greater the impact of dizziness on

the quality of life. The questionnaire was applied before and after VR, demonstrating impairments in all participants' quality of life.

In its turn, VAS is a tool that helps measure the symptoms described by the patients, quickly verifying in practical terms the self-perceived progress of the symptoms throughout the treatment[8]. The answer possibilities in this study ranged from 0 to 10, and participants were instructed to respond according to the intensity of the dizziness they experienced routinely – 0 corresponded to "no dizziness" and 10, to "worse dizziness, vertigo, or imbalance imaginable".

All information was collected individually between January and April 2022 in phone calls that lasted 5 to 10 minutes.

Participants signed an informed consent form when they first began the treatment at the HC-UFMG SLH outpatient center, authorizing the use of their data in future research, including possible future contact to verify their health status.

All data were digitalized, verified, and organized in an MS-Excel® database. Quantitative data underwent descriptive analysis, with frequency distribution, mean, standard deviation, median, minimum, and maximum values. The analyses were preceded by normality tests to determine the appropriate statistical tests. Descriptive statistics, including measures of central tendency (mean and median) and dispersion (standard deviation and minimum and maximum values), were used to characterize the sample. Quantitative data, such as the Brazilian DHI scores, were statistically analyzed with the paired t-test, and the dependent qualitative variables were analyzed with Pearson's chi-square test. The level of significance in all analyses was set at 5%. Statistical analyses were performed in SPSS software (Statistical Package for the Social Sciences), version 21.0.

Results

The analysis of medical records of patients who finished the VR treatment at the HC-UFMG SLH outpatient center within the previous 5 years found 47 participants. They were contacted via phone calls to answer the medical history form and clarify their current health status and possible dizziness complaints. Of these, 17 participants had changed their phone numbers and could not be reached, three had died, and one had been diagnosed with a disabling neurological disorder, which prevented them from answering the form.

The final sample comprised 26 participants, of whom 21 were females (80.8%) (Table 1). The participants' ages ranged from 39 to 90 years, with a mean age of 67 years, a median of 71 years, and a standard deviation of 13.93 years. Each participant attended a mean of 11.92 sessions, with a standard deviation of 7.41 (Table 2). As for educational attainment, incomplete middle school prevailed among the interviewees (Table 1).

Table 1. Distribution of participants regarding sociodemographic characteristics and treatment

Variables	Description	N	%
Sex	Females	21	80.8
	Males	5	19.2
	Total	26	100.0
Educational attainment	Incomplete middle school	9	34.6
	Complete middle school	1	3.8
	High school degree	5	19.2
	Higher education degree	4	15.4
	Postgraduate degree	1	3.8
	Not specified	6	23.1
	Total	26	100.0
Previous otoneurological diagnosis	No diagnosis	12	46.2
	Peripheral vestibulopathy	7	26.9
	Ventral vestibulopathy	6	23.1
	Other non-vestibular diagnoses	1	3.8
	Total	26	100.0
Previous main complaint	Non-rotatory dizziness	14	53.8
	Vertigo	8	30.8
	Imbalance	4	15.4
	Total	26	100.0
Dizziness duration before VR	< 1 minute	4	15.4
	5 minutes	6	23.1
	> 30 minutes	6	23.1
	All day	5	19.2
	Nor specified	5	19.2
	Total	26	100.0
Previous vestibular test result	Not performed	9	34.6
	Normal vestibular test results	7	26.9
	Unilateral vestibular hypofunction	9	34.6
	Bilateral vestibular hypofunction	1	3.8
	Total	26	100.0
Time since VR finished	From 6 to 12 months	5	19.2
	> 1 year to 2 years	1	3.8
	> 2 years to 3 years	10	38.5
	> 3 years to 4 years	5	19.2
	> 4 years to 5 years	5	19.2
	Total	26	100.0
Tinnitus before VR?	Yes	21	80.8
	No	5	19.2
	Total	26	100.0
Were the listed exercises done at home?	Yes	21	80.8
	No	5	19.2
	Total	26	100.0
For how long were exercises done at home?	0 months	8	30.8
	< 3 months	5	19.2
	> 3 months to 6 months	3	11.5
	> 10 months	3	11.5
	Absent	7	26.9
	Total	26	100.0
Did dizziness improve with VR?	Yes	25	96.2
	No	1	3.8
	Total	26	100.0
VR discharge before the pandemic?	Yes	16	61.5
	No	10	38.5
	Total	26	100.0

Caption: N = number of participants; % = percentage, VR = vestibular rehabilitation; > = more than; < = less than. Statistical analysis, performed with Pearson's chi-square test.

Table 2. Descriptive statistics related to age, number of sessions, and visual analog scale score

Variables	N	Median	Mean	Standard deviation	Minimum	Maximum
Age	26	71	67.31	13.93	39	90
Number of sessions	26	11	11.92	7.41	2	37
Current VAS	19	7	6.47	2.63	1	10

Caption: N = number of participants; VAS = visual analog scale.

Concerning the diagnosis before VR, 12 individuals (46.2%) did not have a definite otoneurological diagnosis, seven individuals (26.9%) were diagnosed with peripheral vestibular hypofunction, and six participants (23.1%) were diagnosed with central vestibulopathy. One participant (3.8%) was diagnosed with a neurological disease unrelated to the vestibular system.

As for the main previous complaint, 14 participants (53.8%) reported non-rotatory dizziness, eight (30.8%) described vertigo, and four (15.4%) had an imbalance. Symptoms mostly lasted 5 minutes (23.1%) and more than 30 minutes (23.1%). All participants (100%) were not undergoing any other simultaneous treatment to decrease vestibular symptoms.

Nine participants (34.9%) did not take a vestibular test before VR, and another nine (34.9%) found unilateral vestibular hypofunction in this test. Data showed that 21 interviewees (80.8%) had tinnitus before beginning VR, and 25 participants (96.2%) reported improved dizziness, vertigo, or imbalance symptoms after VR.

The Brazilian DHI results before and after VR are shown in Table 3. The paired t-test was used to compare the total scores and those in each domain (physical, functional, and emotional) and the beginning of VR and in its last session.

Table 3. Brazilian dizziness handicap inventory scores (n = 26)

DHI (aspect)	Moment	Median	Minimum	Maximum	Mean	Standard deviation	p-value*
Physical	Initial	18	0	28	18.62	2.24	0.021*
	Final	12	0	28	11.68	6.58	
Functional	Initial	20	0	36	20.08	10.24	0.034*
	Final	12	0	32	12.16	7.96	
Emotional	Initial	16	0	34	18.00	9.99	0.038*
	Final	12	0	32	12.40	9.49	
Total	Initial	56	8	94	56.54	22.81	0.015*
	Final	30	0	92	35.84	21.71	

Caption: N = number of participants; DHI = Brazilian Dizziness Handicap Inventory; *: statistically significant p-value (paired t-test).

Of the 26 participants, 16 (61.5%) had been discharged from VR before the COVID-19 pandemic, and 10 (38.5%) participants had importantly improved from dizziness symptoms and were quite near being discharged from rehabilitation; these were followed up remotely every week until their discharge.

The period from the end of VR to the time of the interview when the research form was applied was calculated to verify whether longer intervals after the treatment would influence a greater likelihood of symptom relapse. It was found that part of the sample had finished the treatment 2 to 3 years before (38.5%). Also, only seven (26.9%) of the

26 interviewees reported they were still doing the exercises at home as instructed when VR sessions were interrupted. Five of these seven participants had been regularly discharged from VR, while the other two were among those who were discharged during the pandemic. Continuing these exercises aims to stimulate the body systems responsible for postural control, improving the neurophysiological processes of compensation, habituation, and adaptation[4,5,9]. As for the 19 participants who reported not doing the exercises at home, eight (30.8%) stated they had not done them at any moment, and five (19.2%) had done them for less than 3 months after discharge from the SLH treatment (Table 1). Thus, 13 of the 26 individuals (50.0%) did not do the exercise after finishing VR as instructed.

At the end of the form, interviewees were asked whether they still had any symptoms related to body balance. Seven participants (26.9%) remained asymptomatic since they finished VR. The other 19 (73.1%) reported they still perceived symptoms, with a prevalence of dizziness complaints (38.5%) occurring spontaneously (34.6%). They predominantly lasted more than 30 minutes (26.9%) and manifested daily (30.8%). According to the information, 11 participants (42.3%) reported that dizziness, vertigo, or imbalance had not stopped since the end of SLH follow-up, though they had become less intense (Table 4) – which indicates that VR effectively diminished dizziness[7]. The mean VAS score regarding dizziness symptoms that relapsed after VR was 6.47, with a median of 7 points and a standard deviation of 2.63 (Table 2).

Table 4. Descriptive statistics of the responses of participants who had complaints at the moment of form administration

Variables	Description	N	%
Complaints	Vertigo	2	7.7
	Dizziness	10	38.5
	Imbalance	7	26.9
	Absent	7	26.9
	Total	26	100.0
Dizziness characteristics	Spontaneous	9	34.6
	Induced by movements	5	19.2
	Induced by changes in position	5	19.2
	Absent	7	26.9
	Total	26	100.0
Symptom relapse	Did not stop, but it is less intense	11	42.3
	< 1 year after VR	3	11.5
	> 1 year and < 2 years after VR	2	7.7
	> 2 years after VR	2	7.7
	Neither stopped nor improved	1	3.8
	Absent	7	26.9
	Total	26	100.0
Dizziness duration	< 1 minute	6	23.1
	5 minutes	4	15.4
	> 30 minutes	7	26.9
	All day	2	7.7
	Absent	7	26.9
	Total	26	100.0
Dizziness frequency	Every day	8	30.8
	Once to 3 times a week	7	26.9
	Once a month	1	3.8
	Sporadically	3	11.5
	Absent	7	26.9
	Total	26	100.0

Caption: N = number of participants; % = percentage; > = more than; < = less than.

The association between Brazilian DHI mean scores before and after VR showed statistically significant differences, with improvements in the physical, functional, and emotional domains and the total score (Table 2). However, there was no difference between VR discharge and vestibular symptom relapse (p = 0.346) or between the time from VR discharge and the new dizziness and vertigo complaints (p = 0.424).

The comparative analysis between doing the listed exercises at home after VR discharge and new vestibular complaints showed no differences (p = 0.547). The same result was found associating the previous diagnosis with current complaints (p = 0,265).

There was no difference in the comparison between dizziness duration before VR and the current one (p = 0.102) or between the previous and current main complaints (p = 0.054). It was also found that individuals with greater educational attainment were not the ones who did the listed exercises at home every day (p = 0.097).

Discussion

The literature on vestibular symptom relapse after VR is scarce, which hinders the discussions of some data obtained in this study. On the other hand, attention is called to the few participants in the present research, as well as the fact that data were collected at only one moment after the training program ended, without periodical longitudinal follow-up, which may have limited the analysis of the long-term VR benefits.

Another limiting factor is the absence of DHI domain values at the time of collection (some time after finishing VR) to objectively restate that even if symptoms relapse some time after discharge, these are milder and have less impact on the quality of life. The pandemic occurred while this study was being conducted, and most subjects in the sample were older adults. Hence, they were not yet confident to attend the outpatient service in a hospital setting, which made it necessary to collect data via phone calls. These circumstances prevented DHI application in this research stage.

Nevertheless, the characterization of the profile of 26 individuals seen at the HC-UFMG SLH outpatient center provided greater knowledge of their sociodemographic, assistance, and clinical data. It was verified that females prevailed among the participants submitted to VR, with a mean age above 55 years. Similar data are found in other studies[7,10,11,12].

Most participants did not have an otoneurological diagnosis. Studies indicate that although dizziness and vertigo are frequent complaints in the world population, changes may not be found in vestibular examinations. This characteristic may be justified by the sensitivity of the labyrinth to other changes in the body, such as metabolic, hormonal, and circulatory ones, causing vestibular symptoms[7]. Thus, the data gathered in the medical history survey, clinical history, and patient-reported symptoms can help reach a diagnosis and treatment prognosis.

Concerning the main previous complaint, most interviewees in this research reported non-rotatory dizziness. This result differs from what was found in some studies, in which vertigo was more prevalent[11,12]. Nevertheless, the literature does not habitually differentiate dizziness and vertigo symptoms, as the two are commonly referred to as a single symptom[7,13,14]. Even though vestibular symptoms are common in clinical practice, patients are seldom referred for such assessment examinations[15]. The literature demonstrates that drug therapy is the currently most used therapeutic method in vestibular disorder interventions. However, despite quickly relieving the symptoms, it may be harmful in the long run, delaying central compensation and intensifying the frequency of the different types of dizziness[16,17].

Of the 26 research participants, 25 (96.2%) reported improved dizziness, vertigo, and imbalance symptoms with VR, corroborating data in the literature[2,3,7,11,14,18]. It should be highlighted that VR proved to effectively reduce symptoms and improve the impact of dizziness on the quality of life even in some participants with guarded prognoses due to the presence of central vestibulopathy. In some cases, certain complaints did not cease but diminished considerably with VR, benefitting those patients (Table 4). This fact is corroborated by all Brazilian DHI mean values after VR, which were lower than those obtained at the beginning of the treatment, with a statistically significant difference in all aspects and the total score. This demonstrates that the program brings benefits to patients, as previously verified in other studies[7,9,18]. The decrease in the DHI total score by 18 or more points from before to after VR demonstrates the improvement

and decreased impact of dizziness on the subjects' quality of life[7].

The literature points out that successive exposure to the exercises during treatment helps maintain static and dynamic balance[19]. However, half of the sample did the exercises for 3 months at the most after the intervention finished, which can be considered a hindering factor to maintaining the results achieved during therapy[18]. Thus, longitudinal follow-up helps patients preserve their improved postural balance, as over time individuals stopped doing the exercises. Nonetheless, it must be highlighted that this study did not find a significant association between the two variables, making it possible to infer that external factors other than the exercises can influence vestibular symptom relapse – e.g., neurological disorders, advancing age, and metabolic, hormonal, and circulatory changes in the body, which may cause vestibular symptoms[7,20,21,22].

Dizziness duration before VR was not associated with its duration at the time the form was administered ($p = 0.102$). This variation can be explained by habituation mechanisms developed with the exercises, which help reorganize the fibers that send stimuli to the central nervous system, minimizing the perception of symptoms[5,9]. These patients also reported that symptoms appeared less frequently. The main complaint before VR in those patients who reported vestibular symptoms was not associated with the main one reported when the questionnaire was administered. This fact may be related to the presence of other systemic health conditions, the symptoms relieved after VR, or the discontinuity of the treatment prescribed for home, changing the perception of the symptoms. The absence of studies in the literature approaching this topic prevents comparing these results with other papers and generalizing the outcome to the whole population.

There were no statistically significant associations in this study between VR and vestibular symptom relapse. This indicates that the symptoms individuals had before VR may relapse regardless of the time since treatment discharge if the neurophysiological processes of adaptation, compensation, and habituation are not maintained[5]. Nevertheless, the results in question must be critically analyzed due to the few participants. Further longitudinal studies with more participants are needed to analyze VR benefits in maintaining body balance in the long run.

Conclusion

There was a prevalence in the sample of female older adults who did not finish middle school. Also, participants without an established otoneurological diagnosis predominated, whose main complaint was non-rotatory dizziness and whose vestibular test result was unilateral vestibular hypofunction. VR proved to effectively reduce symptoms of dizziness, vertigo, or imbalance during the rehabilitation. However, these symptoms, though less intense, were still present after finishing VR. The successive exposure to exercises throughout the treatment stimulates the systems responsible for body balance and helps maintain postural control. On the other hand, there was low adherence to these exercises after SLH discharge.

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