

Original Article

Artigo Original

Pâmela Garcia Morozetti¹
Cristina Freitas Ganança²
Brasília Maria Chiari³

Keywords

Dizziness
Vestibular disorders/therapy
Quality of life
Rehabilitation/methods
Treatment outcome

Descritores

Tontura
Doenças vestibulares/terapia
Qualidade de vida
Reabilitação/métodos
Resultado de tratamento

Correspondence address:

Pâmela Garcia Morozetti
R. da Paz, 42/29, Boqueirão, Santos (SP),
Brasil, CEP: 11045-520.
E-mail: pamelagarcia83@hotmail.com

Received: 2/21/2010

Accepted: 11/22/2010

Comparison of different protocols for vestibular rehabilitation in patients with peripheral vestibular disorders

Comparação de diferentes protocolos de reabilitação vestibular em pacientes com disfunções vestibulares periféricas

ABSTRACT

Purpose: To compare the therapeutic efficacy of two protocols for vestibular rehabilitation in several vestibular disorders. **Methods:** Twenty patients with chronic peripheral disorders of both genders (prevalence of females, with 60% of the sample) and mean age of 55 years and 9 months participated in this study. Group 1 carried out exercises based on stimulation of vertical and horizontal vestibulocular reflex, and Group 2 carried out exercises based on a protocol of personalized vestibular rehabilitation. Data analysis considered the complaint manifested during anamnesis and the clinical evolution of the patient during the execution of the exercises. The results obtained from the application of the Dizziness Handicap Inventory questionnaire (DHI) and the dizziness visual analog scale (VAS), both before and after vestibular rehabilitation, were also considered in the analysis. **Results:** Differences were found in the values obtained in VAS and DHI (physical and functional scales and total score), in both groups. However, the comparison of the groups after rehabilitation showed that Group 2 obtained better scores than Group 1, both in VAS and DHI (functional scale and total value). **Conclusion:** Vestibular rehabilitation allowed significant improvement in otoneurological clinical profile and in self-perception of dizziness, regardless the therapeutic method used. Personalized vestibular rehabilitation was more efficient than the vestibulocular reflex stimulation protocol in improving quality of life of individuals with chronic peripheral disorders.

RESUMO

Objetivo: Comparar a eficácia terapêutica de dois protocolos de reabilitação vestibular em diferentes disfunções vestibulares. **Métodos:** Participaram 20 pacientes com disfunções periféricas crônicas, de ambos os gêneros (prevalência do gênero feminino, com 60% da amostra), com média de idade de 55 anos e 9 meses. O Grupo 1 realizou exercícios baseados na estimulação do reflexo vestibulocular vertical e horizontal, e o Grupo 2 realizou exercícios baseados em um protocolo de reabilitação vestibular personalizado. A análise de dados levou em consideração a queixa durante a anamnese e a evolução clínica do paciente a partir da execução dos exercícios. Além disso, foram obtidos os resultados do questionário *Dizziness Handicap Inventory* (DHI) e da escala analógica e visual de tontura (EVA), pré e pós reabilitação vestibular. **Resultados:** Houve diferença nos valores da EVA e do DHI (escala física, funcional e no valor total), pré e pós-reabilitação vestibular, em ambos os grupos. Porém, na comparação dos dois grupos no momento pós-reabilitação, o Grupo 2 obteve melhores resultados que o Grupo 1, tanto na EVA quanto no DHI (escala funcional e no valor total). **Conclusão:** A reabilitação vestibular possibilita melhora significativa do quadro otoneurológico clínico e na auto-percepção da tontura independentemente da terapêutica empregada. A reabilitação vestibular personalizada mostra-se mais eficaz do que o protocolo de estimulação do reflexo vestibulocular na melhora da qualidade de vida de indivíduos com disfunções periféricas crônicas.

Study carried out at the Speech-Language Pathology and Audiology College, Universidade Federal de São Paulo – UNIFESP – São Paulo (SP), Brazil.

(1) Vestibulometry and Vestibular Rehabilitation Ambulatory of the Otoneurology Discipline, Universidade Federal de São Paulo – UNIFESP – São Paulo (SP), Brazil.

(2) Hearing Disorders Discipline of the Vestibulometry Department of the Otoneurology Discipline, Universidade Federal de São Paulo – UNIFESP – São Paulo (SP), Brazil.

(3) Human Communication Disorders, Post-graduation Program in Human Communication Disorders Discipline, Universidade Federal de São Paulo – UNIFESP – São Paulo (SP), Brazil.

INTRODUCTION

The vestibular system is considered as a reference in relation to others that also participate in function of body balance maintenance, which are the visual and somatosensitive system⁽¹⁾. Body balance and dizziness can manifest when the set of visual, labyrinth and proprioceptive information are not integrated correctly at the Central Nervous System (CNS)⁽²⁾.

Vestibular rehabilitation (VR) is based on mechanisms related to neuron plasticity of CNS, which is applied in patients with disorders of body balance with the purpose to improve vestibule-visual interaction during cephalic movement and promote visual stabilization, to amplify static and dynamic posture stability in conditions that produce conflicting sensory information^(3,4).

VR has shown to be an important and effective strategy to treat patients with body balance disorders, providing increased improvement in quality of life⁽⁵⁾. Authors affirm that this method of treatment is efficient, adequate and with benefits to patients, with the advantage of no side effects^(6,7). The utilization of VR is an appropriate conduct, and its results must be interpreted as positives due to patient and therapist expectative⁽⁸⁾.

Results obtained in studies with VR highlighted changes in diagnosis and quality of life in patients evaluated, and also helped vestibular compensation process in elderly patients^(9,10).

Most protocols used in VR are unique protocols, and the most used are: Cawthorne & Cooksey exercises, vertical and horizontal vestibuloocular stimulation reflex, optovestibular stimulation, exercises to improve vestibular adaptation, exercises to improve gaze stabilization, exercises to improve stabilization of static and dynamic posture, Norré rehabilitation⁽¹¹⁻¹⁶⁾.

Personalized VR must be organized and adapted to patient specific needs and must be directed to functional disorders, found in a broad otoneurological evaluation⁽¹⁷⁾. This therapeutic resource has shown to be effective to diminish and also to extinguish symptoms and with an improvement of quality of life in patients with different clinical profiles⁽¹⁸⁾.

It was observed a significant improvement in symptoms, in deficiencies, in balance and postural stability in patients with unilateral vestibular disorder after personalized VR therapy, with also the improvement of quality of life in all patients⁽¹⁹⁾.

According to researched articles, the combination of different therapeutical resources recommended and available to each patient produces better results, with fewer recurrences, and by that reason there is the interest to quantify and observe if the efficacy of personalized VR is better when compared to a protocol that uses only one type of exercise to all patients⁽¹⁷⁻¹⁸⁾.

The objective of this study was to compare therapeutic efficacy of two VR protocols in different vestibular disorders.

METHODS

This study was conducted in Ambulatory of Vestibular Rehabilitation of the Universidade Federal de São Paulo (UNIFESP), from 2006 to 2007. It was analyzed and approved by the Ethics Committee of the same institution, under number 1599/06.

Twenty adult patients were evaluated, from both genders, 12 patients (60%) of the sampling group were female, and eight (40%) were male, with an average of 55 years and 9 months, with chronic peripheral vestibulopathies, that were sent by the otorhinolaryngologists of the ambulatory of Otoneurology of the same institution. These patients did not use any anti-dizziness medication to dizziness control during VR.

Patients with diagnosis of any central vestibulopathy, benign paroxysmal positional dizziness (BPPV) and unstable Menière Disease were excluded from this study, since they demand specific treatments and those that had a clinical background of cervical alterations and/or those that had any disease which would prevent them from doing the exercises were also excluded.

Patients were submitted to otoneurological evaluation, through: anamnesis, audiological evaluation and vestibular evaluation by means of the digital vectoelectronistagmography (VENG) of Neurograff Eletromedicina Ltda. All patients answered a questionnaire about quality of life, the Brazilian Dizziness Handicap Inventory (DHI), and also the visual analogue scale (VAS), before and after VR, so it was possible to observe the improvement of patients after treatment^(20,21).

DHI is composed by 25 questions, and it verifies if there are losses in functional, emotional and physical aspects of day-to-day patients' routine. Nine questions are about functional aspects, nine are about emotional aspects, and seven questions are about losses in physical aspects.

This questionnaire evaluates self-perception on impairing effects of dizziness. Patients answered the questions with "yes", "no" and "sometimes". "Yes" answers received four points, "no" answers were zero, and "sometimes" answers received two points.

VAS varies from zero to ten. In this one, patients evaluated their dizziness, from zero (mild) to ten (severe). In this scale, patients quantified the intensity of their symptoms, such as dizziness and imbalance.

Sampling group was formed by twenty patients with peripheral vestibular syndrome (PVS), randomly split in two groups with ten patients each. Group 1 did exercises based on vertical and horizontal vestibuloocular reflex stimulation (VRS) (Appendix 1)⁽¹³⁾. Group 2 did exercises based on the protocol proposed by the VR department of this institution, which is based on exercises done in a personalized way (Appendix 2).

VR was composed of eight 10-minute sessions each, with weekly ambulatorial follow up to patients in group 1, and eight sessions of 45 minutes each, with weekly ambulatorial follow up to patients in group 2. Besides, patients from both groups were taught and oriented to exercise at home, three times every day.

In first group, patients performed vertical and horizontal VRS. Fixing the gaze at a point before them, patients had to do a series of cephalic movements, horizontally (simulating a "no" with the head), gradually faster until reaching maximum frequency of the movement, and the procedure was repeated ten times. Then movements were realized at the same way, but vertically (simulating a "yes" with the head). Patients did this series of exercises from the first session to the last, with no modifications.

In second group it was used VR standardized by UNIFESP, based on the selection of different exercises, which were done and selected according to clinical background and complaints told at anamnesis, the diagnostic hypothesis and discoveries in otoneurology evaluation. In this group, exercises were modified according to patients' improvement, and also speed and difficulty were increasing gradually over time. Initially were taught all exercises described in VR protocol with personalized exercises, and patients were asked to perform only the exercises that would provoke a minimum threshold of discomfort, i.e., mild dizziness and/or imbalance. After each new session, exercises were repeated and modified as it would be easier, thus enabling that the patient performed only the exercises that were more stimulating.

Group 1 was formed by 80% women and 20% men, with ages varying from 32 to 73 years, (average of 51 years and two months). In relation to conclusion of VENG, 60% presented Irritative Peripheral Vestibular Syndrome (IPVS), being 30% bilateral IPVS and 30% unilateral IPVS (20% right-sided, and 10% left-sided). The remaining 40% had Deficitary Peripheral Vestibular Syndrome (DPVS), with 10% bilateral DPVS and 30% unilateral DPVS.

Group 2 was formed by 60% men and 40% women, with ages from 34 to 88 years (average of 60 years and two months). In relation to conclusion of VENG, 70% of patients had IPVS and 30% had DPVS.

Data analysis was done considering the complaint during anamnesis and clinical evolution of the patient while performing the exercises, apart from the results obtained from DHI questionnaire adaptation on brazilian version by Castro 2003 (appendix 3) and VAS before and after vestibular rehabilitation, in order to compare the therapeutical efficacy of both protocols⁽²⁰⁾.

With the purpose of quantifying the impact of dizziness in quality of life of each patient, it was considered as mild impact DHI scores from zero to 30 points, moderate impact from 31 to 60 points, and severe impact from 61 to 100 points, and also a reduction of 18 or more points resulting from the difference of DHI before and after treatment and an improvement of more than 50% in VAS^(22,23).

To complete the descriptive analysis, the confidence interval technique was used for averages. To analyze the results, it was defined a confidence level of 0.05 (5%) and statistical confidence was constructed with 95% confidence intervals. When there was any significant statistical difference, it was used an asterisk (*) to indicate it. Otherwise, it was considered insignificant.

RESULTS

In relation to patients with IPVS in group 1, 33% of them had severe impact, 50% had moderate impact and 17% had mild impact in pre-VR; in post-VR, 67% of patients had moderate impact and 33% had mild impact. Of the patients with DPVS in the same group, 75% had severe impact and 25% moderate impact in pre-VR, and in post-VR, 50% had severe impact, 25% had moderate impact and 25% had mild impact (Figure 1).

Of the patients with IPVS diagnosis of group 2, 28.5% had

severe impact, 43% had moderate impact and 28.5% had mild impact in pre-VR; in post-VR, 86% had mild impact and the remaining 14% had severe impact. It was observed that 67% patients with DPVS from this group had moderate impact, and 33% had mild impact in pre-VR; in post-VR, all patients had mild impact (Figure 2).

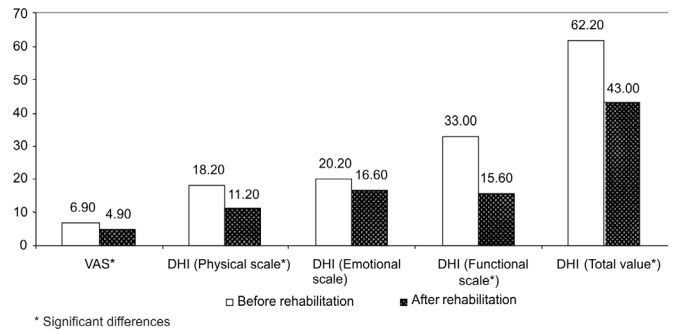


Figure 1. Comparison of the results from Group 1

Regarding DHI, group 1 presented a difference between pre and post-VR equal or higher than 18 points, in 40% of the patients. Group 2 presented a more significant difference, with 70% of the patients⁽²³⁾.

Seventy percent of patients from group 2 had pre and post-VR difference equal or higher than 50% at VAS, and this difference was statistically significant when compared to group 1, which obtained a difference of only 10% of patients (Figure 3).

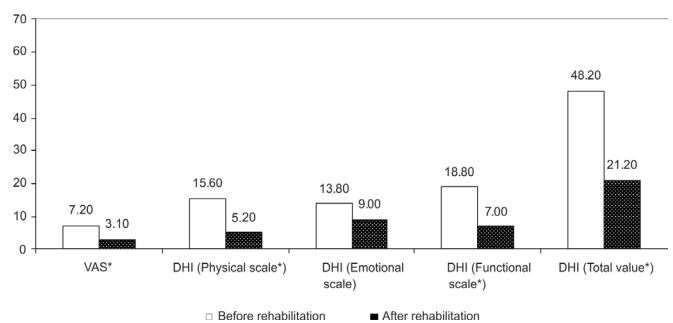


Figure 2. Comparison of the results from Group 2

Group 2 had an improvement (when compared to group 1) in all aspects, in VAS and DHI (physical, functional, emotional and total value scales), but only VAS showed a significant difference, highlighted in Figure 4.

DISCUSSION

Several authors point benefits of VR to improve vestibular and balance symptoms^(5-7,9,17).

In this study, 60% of samples were female, and 40% were male, a data that coincide with authors that had described the prevalence of vestibular symptoms in women, what can be due to several reasons, such as: menopause, osteoporosis, cardiovascular and metabolic diseases, which causes symptoms of dizziness^(17,24,25).

Due to etiology variability, it is needed to characterize and recognize vestibular disorder⁽¹⁷⁾. In this study, we found

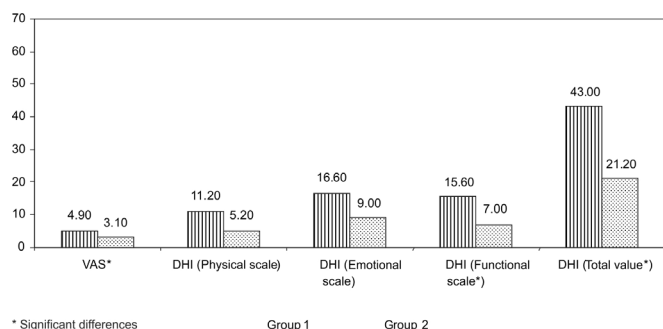


Figure 3. Comparison of the results from groups 1 and 2

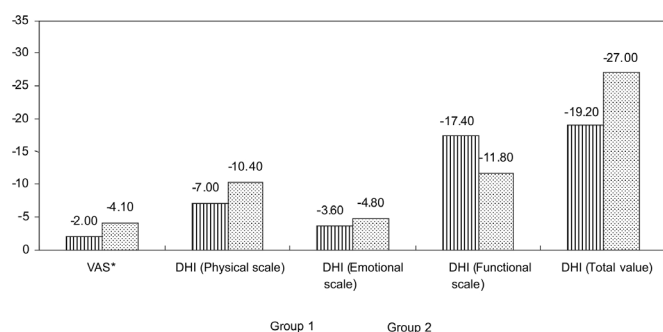


Figure 4. Gain comparison after rehabilitation

65% of patients with IPVS (45% of patients with unilateral lesion and 20% bilateral) and 35% of patients with DPVS (30% with bilateral lesion and 5% unilateral). In Group 1, most of them had unilateral IPVS; in Group 2, most of them had bilateral IPVS.

One study reported that patients with unilateral lesion had a better prognosis when compared to patients with bilateral lesions, a fact that was not observed in our study, as compared in pre and post-VR, with Group 2 showing a more significant improvement when compared to Group 1, in which most patients had bilateral lesion⁽²⁵⁾.

Evaluation of quality of life can be used in daily practices to measure contribution of clinical handling to diminish the impact of chronic diseases to daily routine of patients⁽³⁾. DHI is an effective instrument to study benefits of VR⁽²⁶⁾.

In one study, patients with IPVS and patients with DPVS showed moderate impact according to quality of life, before VR. After VR, patients with IPVS obtained more benefits, when compared to patients with DPVS, and that study is similar to results obtained in this research⁽²²⁾.

Usually patients with DPVS show a bigger loss in quality of life in functional aspects to Brazilian DHI application, when compared to patients with IPVS, regardless if it is a bilateral or unilateral vestibular disorder⁽²⁷⁾. In this study, the most compromised pre-VR DHI scale was functional scale, in patients with IPVS and also in patients with DPVS, and both types of disorders had similar scores.

It was possible to verify dizziness self-perception of each patient; however, in Group 1 only 10% of them showed a difference of 50% or higher, in pre and post-VR, and in Group 2, most patients (70%) showed a difference of 50% or higher,

highlighting that personalized VR provided better results to this group.

According to the analysis of the present study, it was verified that, according to each patient, dizziness sensation has improved significantly, independently of the protocol used, but we identified better results with personalized VR when compared to general VR.

The evaluation of physical aspects identifies the relationship among cephalic movements, eye movements and body movements with the arising or worsening of dizziness. The functional aspect allows identifying losses related to performance in professional, domestic, leisure and social activities. The emotional aspect allows evaluating the presence of frustration, fear, depression, losses in relationship with family and friends, among others⁽²⁸⁾.

Regarding dizziness intensity before VR, Group 1 had, in average, a total score considered “severe” and, after rehabilitation, moderate; Group 2 had, in average, a pre-VR total DHI score considered “moderate” and after it was mild, showing an improvement in comparison after VR⁽²²⁾.

The only scale that did not show significant improvement was the emotional scale. In this scale, no patient from Group 1 presented a difference between pre and post-VR higher than 18 points, and only 10% of patients from Group 2 presented that difference.

Our results show a higher commitment of functional scale in both groups, and these findings are similar to a study that reported higher scores in physical and functional aspects in patients with vestibular disorders⁽²⁹⁾.

Group 2 had a higher gain in visual analogue scale when compared to Group 1, and so personalized VR was more efficient.

At the end of data analysis, we observed that both protocols provided a significant improvement in clinical profile of patients, when compared separately in pre and post-VR, showing significant benefits in quality of life. One study compared two general protocols and concluded that both forms of VR helped in vestibular compensation process and improving quality of life⁽²⁹⁾.

The comparison of both groups pre-VR did not show any statistically significant difference. When comparing after VR, there was a significant difference in visual analogue scale and in DHI (functional scale and total score), showing that personalized VR has been more effective in patients' improvement, when compared to the other protocols in these analysis parameters. Several authors showed that VR, when performed in a personalized way, has better results when compared to generic VR, and it is an effective therapeutics resource to diminish and extinguish symptoms, with a consequent improvement in quality of life of patients with different otoneurological clinical profiles, conclusions similar to results obtained in this study⁽¹⁸⁾.

CONCLUSION

After vestibular rehabilitation, both groups obtained a significant improvement in otoneurological clinical profile and in self-perception of dizziness, according to the analogue

scale. In DHI, personalized vestibular rehabilitation has shown a higher therapeutical efficacy when compared to the protocol of vestibuloocular reflex stimulation, to improve quality of life.

ACKNOWLEDGEMENTS

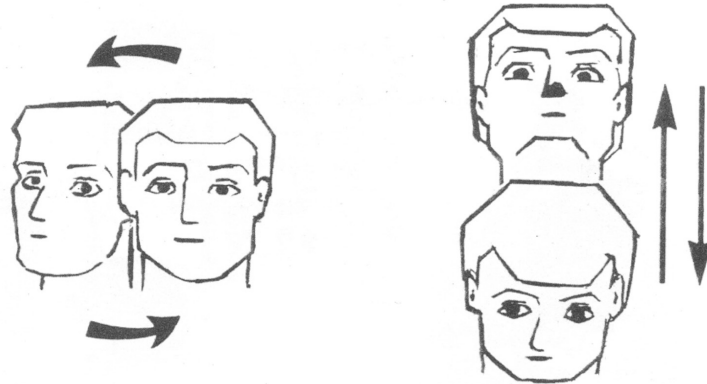
We thank the Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP), for the survey financing supporting, under process number 06/59633-9.

REFERENCES

1. Woollacott MH. Systems contributing to balance disorders in older adults. *J Gerontol A Biol Sci Med Sci.* 2000;55(8):M424-8. Comment on: *J Gerontol A Biol Sci Med Sci.* 2000;55(8):M429-33.
2. Barbosa MSM, Ganança FF, Caovilla HH, Ganança MM. Reabilitação labiríntica: o que é e como se faz. *Rev Bras Med Otorrinolaringol.* 1995;2(1):24-5, 28-30, 32-4.
3. Ganança MM, Munhoz MSL, Caovilla HH, Silva MLG, Ganança FF, Perracini MR, et al. Conceitos e algoritmos terapêuticos. In: Ganança MM, Munhoz MSL, Caovilla HH, Silva MLG, editores. *Conduitas na vertigem.* São Paulo: Grupo Editorial Moreira Jr; 2004. p. 60-75.
4. Norré ME. Rationale of rehabilitation treatment of peripheral vestibular disorders. *Acta AWHO.* 1990;9(3):121-3.
5. Shepard NT, Telian SA, Smith-Wheelock M, Raj A. Vestibular and balance rehabilitation therapy. *Ann Otol Rhinol Laryngol.* 1993;102(3 Pt 1):198-205.
6. Traldi L, Pedalini MEB, Bittar RSM, Bottino MA. Relação entre os resultados da prova calórica e a evolução de pacientes submetidos à reabilitação vestibular. *Arq Int Otorrinolaringol.* 2004;8(4).
7. Konrad HR, Tomlinson D, Stockwell CW, Norré M, Horak FB, Shepard NT, Herdman SJ. Rehabilitation therapy for patients with disequilibrium and balance disorders. *Otolaryngol Head Neck Surg.* 1992;107(1):105-8.
8. Bittar RSM, Bottino MA, Pedalini MEB, Ramalho JRO, Carneiro CG. Arreflexia pós-calórica bilateral: aplicabilidade clínica de reabilitação vestibular. *Rev Bras Otorrinolaringol.* 2004;70(2):188-93.
9. Patatas OHG, Ganança CF, Ganança FF. Qualidade de vida de indivíduos submetidos à reabilitação vestibular. *Braz J Otorhinolaryngol.* 2009;75(3):387-94.
10. Zanardini FH, Zeigelboim BS, Jurkiewicz AL, Marques JM, Martins-Bassetto J. Reabilitação vestibular em idosos com tontura. *Pró-Fono.* 2007;19(2):177-84.
11. Cawthorne T. The physiological basis for head exercises. *J Chart Soc Physiother.* 1944;30:106-7.
12. Cooksey FS. Rehabilitation in vestibular injuries. *Proc R Soc Med.* 1946;39(5):273-8.
13. Davis LL, O'Leary DP. Combined treatment as an effective method of vestibular rehabilitation. *An Otorrinolaringol Mex.* 1994;39 (Suppl 6):19-24.
14. Ganança MM, Mangabeira-Albernaz PL, Caovila HH, Ito YI, Ganança FF, Pontes PAL, et al. Reabilitação do paciente labiríntico por meio de exercícios optovestibulares. In: 87º Encontro de Especialistas Ache - Atualização Diagnóstica e Terapêutica. 1989;35-7.
15. Herdman SJ, Clendaniel RA, Mattox DE, Holliday MJ, Niparko JK. Vestibular adaptation exercises and recovery: acute stage after acoustic neuroma resection. *Otolaryngol Head Neck Surg.* 1995;113(1):77-87.
16. Norré ME, De Weerd W. Treatment of vertigo based on habituation. 1. Physio-pathological basis. *J Laryngol Otol.* 1980;94(7):689-96.
17. Ganança MM, Caovilla HH. Reabilitação vestibular personalizada. In: Ganança MM, editor. *Vertigem tem cura?* São Paulo: Lemos; 1998. p.197-225.
18. Nishino LK, Ganança CF, Manso A, Campos CAH, Korn G. Reabilitação vestibular personalizada: levantamento de prontuários dos pacientes atendidos no ambulatório de otoneurologia da I.S.C.M.S.P. *Rev Bras Otorrinolaringol.* 2005;71(4):440-7.
19. Giray M, Kirazli Y, Karapolat H, Celebisoy N, Bilgen C, Kirazli T. Short-term effects of vestibular rehabilitation in patients with chronic unilateral vestibular dysfunction: a randomized controlled study. *Arch Phys Med Rehabil.* 2009;90(8):1325-31.
20. Castro ASO. Dizziness Handicap Inventory: adaptação cultural para o português brasileiro, aplicação e reprodutibilidade e comparação com os resultados à vestibulometria [dissertação]. São Paulo: Universidade Bandeirante de São Paulo; 2003.
21. Whitney SL, Herdman SJ. Avaliação fisioterapêutica da hipofunção vestibular. In: Herdman SJ, editor. *Reabilitação vestibular.* 2a ed. Barueri: Manole; 2002. p.329-59.
22. Whitney SL, Wrisley DM, Brown KE, Furman JM. Is perception of handicap related to functional performance in persons with vestibular dysfunction? *Otol Neurotol.* 2004;25(2):139-43.
23. Jacobson GP, Newman CW. The development of the Dizziness Handicap Inventory. *Arch Otolaryngol Head Neck Surg.* 1990;116(4):424-7.
24. Gazzola JM, Ganança FF, Aratani MC, Perracini MR, Ganança MM. Caracterização clínica de idosos com disfunção vestibular crônica. *Rev Bras Otorrinolaringol.* 2006;72(4):515-22.
25. Bento R, Bohadana SC, Lima S, Silveira JAM. Sintomas vestibulares e alterações no exame eletroneistagmográfico: estudo de 230 casos. *Rev Bras Otorrinolaringol.* 1999;64(4):71-9.
26. Segarra-Maegaki JA, Taguchi CK. Estudo do benefício da reabilitação vestibular nas síndromes vestibulares periféricas. *Pró-Fono.* 2005;17(1):3-10.
27. Ganança FF, Castro ASO, Branco FC, Natour J. Interferência da tontura na qualidade de vida de pacientes com síndrome vestibular periférica. *Rev Bras Otorrinolaringol.* 2004;70(1):94-101.
28. Handa PR, Kuhn AMB, Cunha F, Schaffeln R, Ganança FF. Qualidade de vida em pacientes com vertigem posicional paroxística benigna e/ou doença de Ménière. *Rev Bras Otorrinolaringol.* 2005;71(6):776-83.
29. Silveira SR, Taguchi CK, Ganança FF. Análise comparativa de duas linhas de tratamento para pacientes portadores de disfunção vestibular periférica com idade superior a sessenta anos. *Acta AWHO.* 2002;21(1).

Appendix 1. Vertical and horizontal stimulation of vestibuloocular reflex from Davis & O'Leary (1994)⁽¹⁷⁾

"Patient must perform a series of head movements horizontally, gradually faster, as if expressing a "no", keeping a fixed gaze on a point ahead. When the maximum frequency of the movement is reached, the patient stops and, 10 seconds later, restarts the procedure, that must be repeated ten times. Next, the series of movements must be done vertically, as if the patient expresses a "Yes" with the head.



Font: Davis LL, O'Leary DP. Combined treatment as an effective method of vestibular rehabilitation. *An Otorrinolaringol Mex.* 1994;39(Suppl 6):19-24 apud Ganança MM, Caovilla HH. *Reabilitação vestibular personalizada.* In: Ganança MM, editor. *Vertigem tem cura?* São Paulo: Lemos; 1998. p.214.

Appendix 2. Vestibular rehabilitation standardized protocol

Fazer os exercícios todos os dias, duas vezes ao dia, e anotar como esta sendo a evolução nos exercícios.

➤ Laying down:

- Move eyes up and down, slowly and then quickly. (Three minutes).
- Move eyes to left and right, slowly and then quickly. (Three minutes).

➤ Siting:

- Move eyes up and down, slowly and then quickly. (Three minutes).
- Move eyes to left and right, slowly and then quickly. (Three minutes).
- Move head up and down, keeping a fixed gaze ahead, slowly and then quickly. (Three minutes).
- Move head to left and right, slowly and then quickly. (Three minutes).
- Contract your shoulders and do circular movements with them. (Three minutes).
- Follow an object, putting it on the floor and then lifting it. (Ten times).

➤ Standing:

- Move eyes up and down, slowly and then quickly. (Three minutes).
- Move eyes to left and right, slowly and then quickly. (Three minutes).
- Move head up and down, keeping a fixed gaze ahead, slowly and then quickly. (Three minutes).
- Move head to left and right, slowly and then quickly. (Three minutes).
- Contract your shoulders and do circular movements with them. (Three minutes).
- Change seating position to standing position and then seating again, first with eyes open and after, closed. (Ten times each).
- Throw a ball from one hand to the other, following it with the eyes. (Thirty times).
- Throw a ball from one hand to the other below the knee, alternating knees. (Three minutes).
- Seat, then stand up and twist to one side, seating again, standing up again and twisting to the other side. (Fifteen times).
- Walk in a hallway with eyes opened. (Three minutes).
- Walk in a hallway with eyes closed. (Three minutes).
- Walk up and down a ladder with eyes opened. (Ten times).
- Walk up and down a ladder with eyes closed. (Ten times).

- Lean your body forward and throw a ball inside a basket. (Twenty times).
 - Stay with a fixed gaze ahead, eye level, move the head quickly horizontally (from one side to the other), and then vertically (up and down), in a speed that causes dizziness. (For two minutes).
 - Stay with a fixed gaze on a card ahead, which has a figure and move it horizontally (from left to right) progressively faster, and then vertically (up and down); follow the movement with eyes, without moving your head. (Two minutes each).
- Perform each exercise for two minutes.
- Keep balance while standing, initially holding heads on a wall with feet parallel and apart.
 - Keep balance while standing, initially holding heads on a wall with feet together.
 - Keep balance while standing, initially holding heads on a wall with one foot in front of the other.
 - Keep balance while standing, with arms extended along the body with feet parallel and apart.
 - Keep balance while standing, with arms extended along the body with feet together.
 - Keep balance while standing, with arms extended along the body with one foot in front of the other.
 - Keep balance while standing, with arms crossed over the chest with feet parallel and apart.
 - Keep balance while standing, with arms crossed over the chest with feet together.
 - Keep balance while standing, with arms crossed over the chest with one foot in front of the other.
 - Keep balance while standing, with eyes closed, initially holding hands on a wall with feet parallel and apart.
 - Keep balance while standing, with eyes closed, initially holding hands on a wall with feet together.
 - Keep balance while standing, with eyes closed, initially holding hands on a wall with one foot in front of the other.
 - Keep balance while standing, with eyes closed, with arms extended along the body with feet parallel and apart.
 - Keep balance while standing, with eyes closed, with arms extended along the body with feet together.
 - Keep balance while standing, with eyes closed, with arms extended along the body with one foot in front of the other.
 - Keep balance while standing, with eyes closed, with arms crossed over the chest with feet parallel and apart.
 - Keep balance while standing, with eyes closed, with arms

continues...

...continuation

| | |
|--|--|
| <ul style="list-style-type: none"> crossed over the chest with feet together. ▪ Keep balance while standing, with eyes closed, with arms crossed over the chest with one foot in front of the other. ▪ Keep balance while standing, on a foam pillow, initially holding hands on a wall with feet parallel and apart. ▪ Keep balance while standing, on a foam pillow, initially holding hands on a wall with feet together. ▪ Keep balance while standing, on a foam pillow, initially holding hands on a wall with one foot in front of the other. ▪ Keep balance while standing, on a foam pillow, with arms extended along the body with feet parallel and apart. ▪ Keep balance while standing, on a foam pillow, with arms extended along the body with feet together. ▪ Keep balance while standing, on a foam pillow, with arms extended along the body with one foot in front of the other. ▪ Keep balance while standing, on a foam pillow, with arms crossed over the chest with feet parallel and apart. ▪ Keep balance while standing, on a foam pillow, with arms crossed over the chest with feet together. ▪ Keep balance while standing, on a foam pillow, with arms crossed over the chest with one foot in front of the other. ▪ Walk next to a wall, reducing supporting base, until walking | <ul style="list-style-type: none"> with one foot in front of the other. ▪ Walk next to a wall, with eyes closed, reducing supporting base, until walking with one foot in front of the other. ▪ Walk parallel to a wall, moving head left and right and with fixed-gaze to left and right. Spin your head, progressively faster. ▪ Walk in a straight line and spin 360 ° (a complete turn), in both directions (clockwise and counterclockwise). ▪ Walking in place, standing over a pillow, with fixed gaze ahead. First with eyes opened, and then closed, for two minutes. Initially with holding hands on a wall, then with no support. ▪ Seating, on the edge of a bed, lay down quickly to the right, leaning your head 45° to the opposite side (left), remain this way for 10 seconds, and then sit down quickly. Repeat to the left, leaning your head 45° to the right. Do ten times each side, progressively faster, until doing it straight, from one side to the other, with no stops. ▪ Seating in front of a optokinetic drum, follow the movement of black stripes that pass on the middle, first horizontally, then vertically, in both directions (clockwise and counterclockwise), for two minutes to each stimulation. |
|--|--|

Appendix 3. Brazilian DHI⁽²⁰⁾

| | Yes | No | Sometimes |
|---|-----|----|-----------|
| 01. PH – Looking up worsen your condition? | | | |
| 02. EM – Do you feel frustrated due to your condition? | | | |
| 03. FU – Do you restrain your work or leisure travels due to your condition? | | | |
| 04. PH – Walking on a supermarket hallway worsen your condition? | | | |
| 05. FU – Because of your condition, is it difficult to lay down or stand up from the bed? | | | |
| 06. FU – Do your condition significantly restrain your social activities, such a going out to dinner, go to the movies, dancing or going to parties? | | | |
| 07. FU – Because of your condition, is it difficult to read? | | | |
| 08. PH – Do your condition worsen when you perform difficult activities, such as sports, dancing, working on home activities such as brooming or putting the dishes away? | | | |
| 09. EM – Because of your condition, are you afraid of getting out of home without someone with you? | | | |
| 10. EM – Because of your condition, are you embarrassed in the presence of others? | | | |
| 11. PH – Quick movements with your head worsen your condition? | | | |
| 12. FU – Because of your condition, do you avoid high places? | | | |
| 13. PH – Turning on your side, in bed, worsen your condition? | | | |
| 14. FU – Because of your condition, is it difficult to perform heavy house activities, or gardening? | | | |
| 15. EM – Because of your condition, are you afraid that people might think you are junky or drunk? | | | |
| 16. FU - Because of your condition, is it difficult to going out for a walk without someone with you? | | | |
| 17. PH – Walking on the sidewalk worsen your condition? | | | |
| 18. EM – Because of your condition, is it difficult to concentrate? | | | |
| 19. FU – Because of o your condition, is it difficult to walk on your home with no lights? | | | |
| 20. EM – Because of your condition, are you afraid of staying home alone? | | | |
| 21. EM – Because of your condition, do you feel disabled? | | | |
| 22. EM – Do your condition prejudice your relationship with family or friends? | | | |
| 23. EM - Because of your condition, are you depressed? | | | |
| 24. FU – Do your condition interfere with your work or home responsibilities? | | | |
| 25. PH – Do leaning forward worsen your condition? | | | |

Legend: FU = functional aspect; PH = Physical aspect; EM = emotional aspect