Evaluation of the Effectiveness of Vestibular Rehabilitaion in Patients with Vestibular Dysfunction

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SUMMARY

Introduction: Generally, daily activities and quality of life are hampered by dizziness/vertigo. Vestibular Rehabilitation aims at promoting or accelerating the compensation of vestibular dysfunction, by diminishing or eliminating the vestibular symptoms. The Dizziness Handicap Inventory was developed to assess patient´s perception on the impact of vestibular problem in the quality of life.

Objective: Quantify the effectiveness of Vestibular Rehabilitation in 39 subjects.

Method: Application of Dizziness Handicap Inventory, prior to and after Vestibular Rehabilitation. This inventory regards the treatment as effective when there is a difference higher or equal to 18 points between the beginning and the end of therapy.

Results: Twenty-nine patients had a score equal or over 18 points, after being discharged from treatment. In 50% of the cases, the post-treatment Dizziness Handicap Inventory score was zero, indicating no dizziness damage to patient's quality of life.

Conclusion: Vestibular Rehabilitation benefited patients and showed to be effective, regardless of their age, otoneurological diagnosis and gender.

Key words: dizzinness, rehabilitation, quality of life.

Bibliography Introduction and Revision

For human beings, in order to move themselves and feel comfortable in a space, there is a set of systems to keep the balance in all circumstances (1).

Posture is dependent on vestibular, spinal-vestibule and visual systems (1). Disorders in one of those systems and specific lesions within peripheral and/or central vestibular system can cause dizziness and/or vertigo, as well as balance disturbance, in dynamic and statistical conditions (2,3).

After being hurt, there is compensation and so, patient can have a gradual reduction of vestibular symptoms. Interrupting compensation mechanism might lead to unbalance and chronic vertigo (3).

Dizziness/vertigo usually makes daily activity difficult and also affects the quality of life of any person (2). It can raise emotional, physical problems, anxiety (4).

Vertigo development on labyrinth diseases shows that the its improvement or cure occurs in only 17% of the cases with no therapy, in 40% due to placebo therapy and in 85% proper combined therapy (5).

Among all dizziness therapies, vestibular rehabilitation has been successfully applied on body balance improvement.

Rehabilitation aims at: raise visual stabilization during head movement; improve visual-vestibule interaction during head movement; expand static and dynamic posture stability and, reduce individual sensitiveness to head movement. Eye, body and head exercises cause sensorial conflict, which accelerates vestibular system compensation and rehabilitation (6), leading to a reduction or voidance of symptoms, body balance restoration and besides, improvement on quality of life (7).

Vestibular rehabilitation is not only a palliative, alternative or even "psychiatric" therapy, by holding precise limits and well defined indications (6).

The analysis of VR program is important mainly because it helps foretelling the proper use of VR exercises and their results. Therefore, evaluating if such targets were achieved is challenging and requires two aspects: evaluate patient's perception on damage of dizziness/vertigo and patient's development on daily activities (8).

Studies that show the effectiveness of VR make use of different methods in order to quantify symptoms and functions. Those methods cover self-evaluation, functional performance evaluation, everyday activity report and surveys. Although those do not measure the same thing, they have been showing many patients do rehabilitation exercises, but not all of them suffer from vestibular disorder (4), regardless age (9).

According to Jacobson and Newman (1990), diagnosis tests are not proper to evaluate harmful effects caused by vestibular system diseases (10,11). Thus, the Dizziness Handicap Inventory (DHI) was developed. It is composed by 25 questions in order to evaluate patient's perception on impacts of vestibular problems in their lives (12,3).

DHI investigates how much dizziness interferes in patient's quality of life by analysing the following: physical aspects (relation between appearing, development and/or aggravation of symptoms and eye, head and body movement); emotional aspects (fearing of going out, frustration, embarrassed about their symptoms, concentration disturbance, depression, family behaviour changes, felling of incapacity) and functional aspect (developing housework, social, professional activities and some everyday activity such as walking with no help or in the dark) (13).

DHI is trustworthy and does not require a lot of time to be applied. It is easy to be conducted, scored and explained. Besides, it can show improvement results on physical, functional and emotional aspects (14). It is applied prior to and after rehabilitation program. The score difference between pre and post therapy should be, at least, 18 points, so changes can be considered expressive at self-perception of the damage caused by dizziness by the patients who were submitted to rehabilitation program (10).

The first translation into Portuguese language was done in 2000 (14).

Several studies show that VR causes expressive changes on patients with vertigo by using DHI as a method of evaluation (15,16). Improvement can be noticed in the 3 categories of diagnosis (peripheral, central or mixed one) (3), and age was not a significant factor when predicting VR results (1,12).

VR was recommended for peripheral-origin problems for long time. Therefore, Briend and cols., in 1974 (17) suggested labyrinth exercises to central or mixed vestibular disorders (18).

VR usually helps patients with central vestibular disorder, but recovery is slower than peripheral one. The difference in the results between them is short. There is a

hope on recovery, but it can be partial. Functional change might occur, but cure is never comprehensive (12,19).

The main reasons, in decreasing order, for the success of partial VR are: difficulty in following therapy protocol (i.e. not able to do vestibular rehabilitation exercises at home; not following nutritional recommendations; habits changes, correction of eventual addiction, etc); non-identified etiological agent; drug sensitiveness; multimedication (specially for the elderly); stress; anxiety; depression and panic. Results always depend on how patients go into the therapy program. Patiens should be persistent in order to see any improvement and follow therapy instructions to achieve success (20).

The target of this research is quantify the effectiveness of Vestibular Rehabilitation by comparing results with Brazilian DHI application prior to and after VR in patients with vestibular complaints.

METHOD

The current study was done at *Laboratório de Pesquisas Otoneurológicas do Centro de Pesquisas Audiológicas (CPA) - Hospital de Reabilitação de Anomalias Craniofaciais- USP.* It was performed and approved by Committee of Ethics in Research of the *Hospital de Reabilitação em Anomalias Craniofaciais (HRAC) da Universidade de São Paulo,* number 94/2004-*UEP-CEP,* and all patients signed the post-informed consent term.

39 male and female patients, aging from 16 to 82 years were examined. They presented any type of body balance alteration (vertigo; dizziness; walking unbalance; neurovegetative symptoms, such as nauseas, vomiting, cold sudoresis, paleness; all might be associated to hearing symptoms such as hearing loss, tinnitus, ear fullness and autophonia) and diagnostic hypothesis of peripheral and/or central vestibular syndrome, vestibular exam in either normal or non-conclusive condition.

Patients with alteration on the middle ear, Meniere disease (due to frequent recurrence of symptoms) and with some neurological disorders, such as Cerebral Vascular Accident were not included in this study.

Before starting VR, all patients underwent ENT evaluations, aiming to verify any of possible alterations that could influence results on the vestibular system and audiological evaluations and vestibular test. Such exam consisted of the following steps: specific anamnesis, researches on position nystagmus (with no record), positioning nystagmus (with record), biological calibration of eye movement (Berger, model TB-115), spontaneous nystagmus, semi-spontaneous nystagmus, horizontal pendular tracking (Berger, model TB-113), optokinetic nystagmus, pre and post rotatory nystagmus and pre and post caloric nystagmus (Otothermometer Berger Water, model OC 114). The last two tests were performed according to critera by MANGABEIRA ALBERNAZ et al (1976) (21).

DHI was applied during pre-rehabilitation period, aiming to evaluate patient's perception on the impact of vestibular problems in their lives.

For each of the 25 questions of the DHI, patients scored 4 for 'yes' answers, 0 for 'no' answers and 2 for 'sometimes' ones. Though, the highest score is 100 (hundred), situation in which is possible to observe the maximum damage caused by dizziness; the lowest score is 0 (zero), which reveals no damage. So, it is evaluated each of the individual aspects, the higher the score, the higher the damage caused by dizziness.

The evaluated aspects are: physical (questions 01, 04, 08, 11, 13, 17 and 25); emotional (questions 02, 09, 10, 15, 18, 20, 21, 22 and 23) and, functional (questions 03, 05, 06, 07, 12, 14, 16, 19 and 24).

A patients went through specialized phonoaudiological therapy after being sent to perform VR.

Before starting therapy, patients were interviewed in order to obtain information on otoneurological signs and symptoms, which help on therapy planning and examination of which factors could interfere on therapy results.

Therapy consisted of body balance orientation, exercise physiology, orientation on habits that might make improvement difficult, relaxation and personalized exercises.

The use of medicine was recommended in order to ease symptoms in some cases, due to intense neurovegetative symptoms which made the start of therapy impossible.

The proposed exercises were chosen according to patient's need, in order to obtain better results, and then a personalized therapy.

Proposals by CAWTHORNE, (1944) (22) and COOKSEY (1945) (23); GANANÇA and cols (1989) (24); BRANDT & DAROFF (1980) (25), SEMONT, FREYSS and VITTE (1988) (26) and ZEE (1985) (27) were used.

All patients were instructed to do the exercises at home, 3 times a day at least, everyday. Patients were

weekly seen in order to be followed up and have new exercises according to their needs.

After patients being discharged from VR, DHI was applied once again to have results and statistical analysis compared, and then to check therapy effectiveness.

RESULTS

Only 30 patients achieved the end of the research, and the reasons why the others did not were different, from not suiting the exercises to no explanations at all. Thus, their information will not be in the result analysis.

Table 1 displays how those patients were placed according to gender, age, otoneurological diagnosis and presence or not of tinnitus.

Table 2 displays distribution of scoring regarding minimum and maximum value of the total score and of the physical, functional and emotional aspects, besides average scoring of each item. Wilcoxon test was used in order to check if there was a significant statistical change between pre and post VR values.

Regarding the 18-figure difference or over between post and pre-rehabilitation scoring, treatment is considered effective. Table 3 displays if therapy was effective or not for each of the patients.

Friedman test was used in order to calculate if there was significant statisitcal difference on decreasing values between evaluated aspects (physical, functional and emotional).

Table 4 displays the average of the difference between final and initial total score and for the final and initial subscores according to diagnosis categories (peripheral or central).

Mann-Whitney test was used in order to see if there was significant statistical difference on the average between peripheral and central diagnosis categories.

Table 5 displays comparison between gender in relation to the average of difference between post and pre VR total score and subscores. Mann-Whitney test was used in order to verify if there was significant statistical difference between genders.

Correlation test bt Spearman was used to verify if there was significant correlation between age and difference between pre and post VR total score and subscores (Table 6).

53% of the 30 patients who underwent VR made use of medication during therapy.

Table 7 displays distribution of active substances of medication used by patients during therapy.

Table I. Distribution of patients according to gender, age, otoneurological diagnosis and presence or absence of tinnitus.

	n	%
Gender		
Female	24	80
Male	6	20
Age		
15 |- 30	4	13
30 |- 45	4	13
45 |- 60	15	50
60 and +	7	24
Vestibular Diagnosis		
Peripheral	18	60
Central	6	20
Non-concluded	2	7
Normal	4	13
Tinnitus		
Yes	15	50
No	15	50

Table 2. Distribution of score regarding minimum and maximum value of the total score and of physical, functional and emotional aspects, besides average score of each item.

	Pre			Post			
	Average	Minimum	Maximum	Average	Minimum	Maximum	p
Physical	16.4	4	28	1.7	0	10	< 0.001*
Functional	18.1	4	32	2.0	0	10	< 0.001*
Emotional	14.1	0	32	1.9	0	16	< 0.001*
Total	48.6	18	82	5.5	0	24	< 0.001*

p<0.5* statistical difference

Table 3. Distribution of absolute values of total score and subscore, considering the difference between initial and final DHI scoring, average, standard deviation of such values and distribution regarding therapy effectiveness ($p<0.05$* significant statistical difference).

Patients	FPh - IPh	FFu - IFu	FEm - IEm	FT - IT	Effectiveness
1	24	24	14	62	Yes
2	14	12	6	32	Yes
3	8	4	8	20	Yes
4	22	28	8	60	Yes
5	14	6	5	20	Yes
6	16	22	16	54	Yes
7	18	10	22	54	Yes
8	10	24	20	54	Yes
9	10	8	10	28	Yes
10	4	16	20	40	Yes
11	8	4	6	18	Yes
12	14	14	2	30	Yes
13	4	8	6	18	Yes
14	14	14	0	28	Yes
15	2	4	12	18	Yes
16	28	28	26	82	Yes
17	6	28	36	70	Yes
18	16	20	8	44	Yes
19	20	22	20	62	Yes
20	10	8	6	24	Yes
21	20	12	4	36	Yes
22	6	4	2	10	No
23	18	26	24	68	Yes
24	26	22	14	62	Yes
25	10	28	20	58	Yes
26	22	26	16	64	Yes
27	16	4	0	20	Yes
28	20	12	12	44	Yes
29	20	22	14	56	Yes
30	22	20	14	56	Yes
X	15	16	12	43	
DP	6.977468	8.678153	8.535861	19.76227	
P	0.336000	0.336000	0.336000		

Subtitle: FT = Final total; IT = Initial total; FPh = Final Physical; IPh = Initial Physical; FFu = Final Functional; IFu = Initial functional; FEm = Final emotional; IEm Initial Emotional; X = average and SD = Stard Deviation.

The average of total score and subscore was calculated for patients who were under medication and ofr those who were not. Mann-Whitney test was used to in order to see if there was significant statistical difference when scoring patients under medication and patients with no use of that. The results are displayed in Table 8.

Therapy varied from 4 to 15 sessions. 12 patients (40%) improved within 3 months, 27% in three months and 33% over three months.

Discussion

Regarding patients' age, 50% were from 45 to 58 year old (table 1). The average age was 51. Although dizziness can affect people of all ages, aged people are more likely to suffer from it.

24 of patients (80%) were female and 6 (20%) were male.

Table 4. Distribution of averages when the difference between final and initial total score was evaluated and for subscores. (p<0.05* significant statisitcal difference).

	Peripheral	Central	p
FT - IT	46.2	41,3	0.84117
FPh - IPh	16.5	12.5	0.29903
FFu - IFu	17.5	15.3	0.66263
FEm - IEm	12.1	13.3	0.94650

Subtitle: FT = Final total; IT = Initial total; FPh = Final Physical; IPh = Initial Physical; FFu = Final Functional; IFu = Initial functional; FEm = Final emotional and IEm Initial Emotional.

Table 5. Comparison between gender in relation to the average of difference between post and pre VR total score and subscores (p<0.05* = significant statisitcal difference).

	F	M	p
FPh - IPh	15.75	10.70	0.10083
FFu - IFu	17,75	9.00	0.02667*
FEm - IEm	13.30	8.30	0.17582
FT - IT	47,00	28.00	0.04274*

Subtitle: FT = Final total; IT = Initial total; FPh = Final Physical; IPh = Initial Physical; FFu = Final Functional; IFu = Initial functional; FEm = Final emotional, IEm Initial Emotional, F= Female and M= Male.

Table 6. Correlation between age and difference between pre and post VR total score and subscores (p<0.05* = significant statistical difference).

	Spearman	p-level
	R	
FPh - IPh	0.39508	0.03071*
FFu - IFu	0.23539	0.2105
FEm - IEm	0.072	0.70534
FT - IT	0.30247	0.10425

Subtitle: FT = Final total; IT = Initial total; FPh = Final Physical; IPh = Initial Physical; FFu = Final Functional; IFu = Initial functional; FEm = Final emotional, IEm Initial Emotional.

Table 7. Distribution of active substances of medication used by patients during therapy.

Use of medication	Active substances of medication
1	flunarizine
2	cinarizine
3	flunarizine
4	flunarizine
5	betahistine dihydrochloride + ginkgo biloba
6	flunarizine
7	flunarizine
8	cinarizine
9	flunarizine
10	betahistine dihydrochloride betahistine
11	flunarizine
12	dihydroergocristine + flunarizine
13	dihydroergocristine + flunarizine
14	flunarizine
15	dihydroergocristine + flunarizine
16	flunarizine

Regarding diagnosis, 18 patients (60%) suffered from peripheral vestibular disorder, 6 (20%) of them from central vestibular disorder, 4 (13.3%) patients had normal vestibular results and 2 (6.7%) of them obtained non-conclusive exam (Table 1).

Out of the 15 (50%) patients who suffered from tinnitus associated to vestibular dysfunction, 20% of them reported a decrease of discomfort after VR program. Knobel et al (2003) had already stated that tinnitus improvement can be related to the control or the decrease of possible psychiatric alterations, due to both improvement of dizziness by VR exercises and through symptom understanding and therapy.

All patients reported damage in their quality of life due to dizziness (Table 2). The same results were already shown by Ganança (2004). Total score of pre-therapy DHI ranging from 18 to 82 scores, and average was 48.6. The functional aspects had the highest pre-VR average among the three evaluated ones (physical, functional and emotional) (Table 2). This result shows that dizziness does interfere in performing everyday activities, though people tend to limit them to prevent symptoms. Physical aspect varied

Table 8. Distribution of the average of the pre and post difference of patients under medication and no medication ones and of the p value (p<0.05* = significant statistical difference).

	Yes	No	p-level
IPh	18.5	14	0.083
IFu	19.75	16.14286	0.287
IEm	13.875	14.28571	0.884
IT	52.25	44.42857	0.252
FPh	2.375	0.857143	0.053
FFu	3.125	0.714286	0.057
FEm	2.25	1,428571	0.056
FT	7,75	4.285714	0.244
FPh - IPh	16.125	13.14286	0.278
FFu - IFu	16.5	15.42857	0.661
FEm - IEm	11,625	13.21429	0.707
FT - IT	44.375	41,57143	0.723

Subtitle: FT = Final total; IT = Initial total; FPh = Final Physical; IPh = Initial Physical; FFu = Final Functional; IFu = Initial functional; FEm = Final emotional, IEm Initial Emotional.

from 4 to 28 scores (average 16.4) and emotional aspect average was lower (14.1 scores), ranging from 0 to 32 scores (Table 2).

After therapy, total score of DHI ranged from 0 to 24 scores (average 5.5). 15 patients (50%) scored 0 (Table 2), showing dizziness did not disturb their quality of life any longer.

When statistical analysis among the three aspects (physical, functional and emotional) was done, there was a significant statistical difference when comparing scores between pre and post VR (Table 2).

By considering that scoring 18 was the figure to obtain an expressive change after therapy, 29 patients reported improvement, and only 1 of them scored less than 18 (Table 3). The average of alteration on total score between post and pre therapy was 43 scores (Table 3).

Amá and Oliveira (1994) stated in their study that all patients reported expressive improvement at the end of therapy.

In the study by Cowand et al. (1998), 29 out of 37 patients reported improvement, 3 of them had no improvement and 5 worsened.

It was not possible to notice significant statistical difference on reduction of pre and post VR scoring among the three subscales (p=0.336) (Table 3). That means, there was value decrease in all aspects evaluated in the survey, but none of them was reduced more than the other. The average difference between post and pre VR was higher for funtional aspect (16 scores), followed by the physical aspect (15 scores) and then emotional one (12 scores) (Table 3). The same results were also found by Mantello (2006) and Silveira, Taguchi and Ganança (2002).

Cowand et al (1998) found significant statistical difference of pre and post DHI total score and of scores of functional and physical subscales.

Out of the 30 patients who took part in this study, 50% of them scored 0 in the end. 10 patients suffered from peripheral vestibular dysfunction, 3 of them from central dysfunction and 2 ones were in normal conditions. It shows that such patients, after therapy, did not report dizziness influence in their quality of life, by considering the evaluated aspects. Total recovery is more likely in peripheral cases, but in the current study, 50% of central dysfunction cases improved after VR program. According to Badke, Shea and Miedaner (2004), patients suffering from peripheral dysfunction achieve better results than the ones suffering from central dysfunctions after therapy.

By considering categories of central and peripheral diagnosis, the average difference between initial and final total was 41 and 46 scores respectively (Table 4). Functional and physical aspects had higher average scoring between pre and port VR for peripheral vestibular dyfuncitons than the central cases (Table 4).

Regarding emotional aspects, the average difference between post and pre VR was higher (13 scores) in the central cases than the peripheral ones (12 scores) (Table 4). This can show that, for those patients, any improvement means a huge change in their everyday lives, consequently improving their emotional aspect. Patients reported no more restrictions on their everyday activities and then they could recover self assurance when walking by themselves even when vertigo was not totally eliminated.

It was not possible to notice significant statistical difference on total score orsubscores according to diagnosis category. VR can be recommended for both peripheral vestibular dysfunction and central ones.

When comparing gender in relation to the difference average between pre and post VR scoring, females had higher average of total score (47), while male scored 28. The same situation occurred on functional, physical and emotional subscales (Table 5). Mann-Whitney Test showed expressive change when male and female were compared, for total score (p= 0.04274) and for functional subscale (p= 0.02667). It was not possible to notice if there was significant difference for physical and emotional subscores according to gender (Table 5).

According to Ribeiro (2000), dizziness affects women more often than men in a 2:1 ratio, and that can also be seen when studying all dizziness causes in the literature. Besides, there is the fact that hormone variation influences the function of the inner ear.

When the correlation between age and improvement of total score post VR and of the evaluated aspects (physical, functional and emotional) were verified, it was only possible to verify that the older the patient gets, the more physical aspect improves better (p= 0.03071) (Table 6). It was not possible to examine if there was correlation between age and improvement of functional and emotional aspects (Table 6). Black and Pesznecker (2000) found out that age does not interfere on VR results. Mendel, Bergenius and Langius (1999) found out that age is a negative effect, as dizziness/vertigo causes more damages for the young who are limited on work and also worsening on psyco-social factors.

Table 7 displays active substances of medication used by 16 patients during therapy.

Statistic calculation for patients who used medication during therapy (Table 8) showed that there was no significant statistical difference either between physical, functional and emotional aspects or regarding total result of therapy when using medication or not.

Regarding therapy period of the 30 patients, 12 (40%) improved within 3 months. 27% of patients finished it in 3 months and 33% over 3 months. Mantello (2006) reported in her study that the therapy period ranged from 4 to 10 months. According to her, the differences found in literature on time and duration of VR can be justified by the use of several protocols, which can be applied in longer or shorter period, depending on the difficulty to performe exercises and on patient's improvement.

Cawthorne (1994) and Amá (1994) consider that VR has been improving patient's quality of life, by raising healthy life and by guiding patients to know how to control their symptoms. Besides improving patient's balance, there is still the prophylactic function, helping them to recover self-confidence, by reducing anxiety and improving social life. However, for the authors, VR program does not always achieve satisfactory results, even when well conducted. Some patients little or hardly improve their symptoms even with great effort from both patient and therapist.

Conclusion

In the current study, Vestibular Rehabilitation provided benefits to patients, by being effective regardless age, otoneurological diagnosis and gender.

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