J Rehabil Med 2006; 38: 387–390

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SHORT COMMUNICATION

DIZZINESS AMONG PATIENTS WITH WHIPLASH-ASSOCIATED DISORDER: A RANDOMIZED CONTROLLED TRIAL

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Objective: **To investigate whether vestibular rehabilitation for patients with whiplash-associated disorder and dizziness had any effect on balance measures and self-perceived handicap.**
Design: **Randomized, controlled trial.**
Subjects: **Twenty-nine patients, 20 women and 9 men, age range 22–76 years.**
Methods: **The patients were randomized to an intervention group or a control group. The intervention comprised vestibular rehabilitation. All patients were assessed at baseline, after 6 weeks and after 3 months with 4 different balance measures and the Dizziness Handicap Inventory.**
Results: **After 6 weeks, the intervention group showed statistically significant improvements compared with the control group in the following measures: standing on one leg eyes open ($p=0.02$), blindfolded tandem stance ($p=0.045$), Dizziness Handicap Inventory total score ($p=0.047$), Dizziness Handicap Inventory functional score ($p=0.005$) and in Dizziness Handicap Inventory physical score ($p=0.033$). After 3 months, the intervention group showed statistically significant improvements compared with the control group in the following measures: standing on one leg eyes open ($p=0.000$), tandem stance ($p=0.033$) and Dizziness Handicap Inventory physical score ($p=0.04$).**
Conclusion: **Vestibular rehabilitation for patients with whiplash-associated disorder can decrease self-perceived handicap and increase postural control.**

Key words: balance, dizziness, physiotherapy, postural control, rehabilitation.

J Rehabil Med 2006; 38: 387–390

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Submitted September 13, 2005; accepted April 18, 2006

INTRODUCTION

Approximately 28% of people involved in road traffic collisions will develop whiplash, or whiplash-associated disorders (WAD) (1). Approximately 15–25% of these persons suffer from dizziness (2). Dysfunction in cervical mechanoreceptors and instability in the neck may cause dizziness among persons with WAD (3, 4). Abnormal electronystagmographic findings have been reported (5) and persons with WAD can exhibit disturbances in postural control (6).

Current research has focused on vestibular rehabilitation for different causes of dizziness and shows evidence of cure and relief of symptoms (7–9). When treating dizziness among persons with WAD, the vestibular organ should be considered as well as postural control (10). Thus, it is of interest to examine whether it is possible to treat dizziness related to WAD with vestibular rehabilitation.

The aim of this study was to investigate whether vestibular rehabilitation has an effect on clinical balance measures and self-perceived handicap among patients with dizziness associated with WAD.

MATERIAL AND METHODS

Patients

Patients were recruited from general practitioners and physiotherapists in primary healthcare, orthopaedic physicians in private practice, administrators of rehabilitation at the regional social insurance office and the orthopaedic hospital clinic, all in Malmö, Sweden. Criteria for inclusion in the study were a diagnosis of WAD with dizziness reported as a symptom. After initial assessment, the patients were randomized by an independent person using a random number table, into intervention or control groups. The same independent person also carried out the intervention. All assessments (at baseline and after 6 weeks and 3 months) were performed by 1 of the authors (EEH), who was blind to the randomization. Recruitment started in March 2002 and was, for practical and economic reasons, terminated in December 2004.

Measures

Four different balance measures were used; tandem standing was performed with eyes open for 30 seconds and with eyes closed for 30 seconds (11). Standing on one leg eyes open (SOLEO) and eyes closed (SOLEC) respectively were also performed for 30 seconds (12). In SOLEO and SOLEC, both left and right legs were tested and the results were summed up and then divided by 2. In tandem standing, SOLEO and SOLEC, 3 trials were allowed and the best result was used. In walking in a figure of eight (13), and in walking heel to toe on a 5-meter-long line (11), steps outside the figure and steps outside the line were counted.

To establish the level of self-perceived handicap experienced by the patients, the Dizziness Handicap Inventory (DHI) was used (14). The inventory comprises 25 different items, organized in 3 different dimensions: functional, emotional and physical. The total maximum score is 100 points.

 ISSN 1650-1977
DOI: 10.1080/16501970600768992

Intervention

The intervention comprised a vestibular rehabilitation program, at group sessions in a physiotherapy centre, for approximately 50 minutes, twice a week for 6 weeks. The program started with a 10-minute warm-up phase. This was followed by exercises aimed to stimulate the vestibular system, using eye, head and trunk movements. The exercises were, for example, standing on foam and turning the head from side to side, walking on a slope and turning the head from side to side, standing on a trampoline and moving eyes from side to side. Some exercises were performed with closed eyes, depending on what each patient was able to perform.

The control group was tested at the same intervals as the intervention group, but received no intervention. However, after assessment at 3 months, the patients in the control group were offered the same training as the intervention group.

Statistics

The Mann-Whitney *U* test was used to test for differences between the groups and 95% confidence intervals (CI) were calculated for the median differences. The results were analysed on an intention to treat basis, using last observation carried forward (15).

Ethics

The study was approved by the ethics committee of Lund University.

RESULTS

A total of 29 patients met the inclusion criteria. Sixteen were randomized to the training group and 13 to the control group. There were 8 dropouts in the training group and 3 in the control group. Background data and baseline measures for the study group are shown in Table I. Most of the patients were graded as WAD II, according to the Quebec Task Force classification of WAD (16). Twenty patients had been dizzy since the accident, 5 since 1–2 weeks after the accident and 4 since approximately 6 months after the accident. Time since accident varied from 6 months to 15 years (median one year). Fifteen subjects were working, 9 were on sick leave or retired and 5 were undergoing some form of rehabilitation.

There were a total number of 11 dropouts from the study, 6 women and 5 men, aged 22–76 years old, median 34 years. Three dropped out because of other sickness, 3 because of lack of time, one could not tolerate the treatment and the reason for dropout was unknown in 4 patients.

Statistically significant differences were found between the intervention group and the control group in SOLEO, both at 6 weeks and at 3 months (Table II). In tandem standing, there was a statistically significant difference at 3 months and in tandem standing blindfolded at 6 weeks.

Statistically significant differences were found between the groups in DHI total score as well as in DHI functional score at 6 weeks (Table II). In DHI physical score, there were statistically significant differences between the groups at 6 weeks as well as at 3 months.

An on-treatment analysis was also performed, with similar results.

DISCUSSION

In this randomized, controlled trial, vestibular rehabilitation for patients with WAD and dizziness, decreased the patients' self-perceived handicap and increased their postural control.

There were a total of 11 dropouts from this study. This may, to some extent, reflect the difficulties with which this group of patients have to cope; a variety of symptoms, of which dizziness is one. In some cases dizziness may have been a minor problem, overshadowed by other symptoms.

We were unable to provide training outside working hours, which may be the reason why 3 patients dropped out due to lack of time. Patients were recruited to the study over a period of 2 years and 9 months; using several different strategies. Despite these efforts, the sample size in this study is small and the group is heterogeneous, which makes generalization of the results uncertain.

Table I. *Background data and baseline measures (range) for the whole group, the intervention group and the control group*

	Intention to treat		
	All ($n=29$)	Intervention group ($n=16$)	Control group ($n=13$)
SOLEO (seconds)	30 (0–30)	30 (1–30)	16 (0–30)
SOLEC (seconds)	4 (0–30)	4 (1–30)	3 (0–25)
Tandem standing (seconds)	30 (0–30)	30 (4–30)	30 (0–30)
Tandem standing blindfolded (seconds)	8 (0–30)	16 (1–30)	6 (0–12)
Figure of eight (steps)	0 (0–58)	0 (0–58)	0 (0–8)
Walking heel to toe (steps)	0 (0–11)	0 (0–9)	0 (0–11)
DHI total (points)	52 (16–96)	49 (16–82)	56 (22–96)
DHI functional (points)	16 (4–32)	16 (4–30)	16 (6–32)
DHI emotional (points)	14 (2–40)	16 (2–30)	12 (8–40)
DHI physical (points)	18 (4–26)	16 (7–26)	20 (8–24)
Median age (range)	40 (22–76)	40 (22–73)	43 (23–76)
Women/Men (n)	20/9	10/6	10/3
WAD grade II/III	28/1	16/0	12/1
Median duration of dizziness (range), years	2 (0–15)	2 (0–8)	2 (0–15)

SOLEO: standing on one leg eyes open, SOLEC: standing on one leg eyes closed, DHI: Dizziness Handicap Inventory.
WAD: whiplash-associated disorder.

Table II. *Intention to treat analysis of median changes from baseline to 6 weeks and 3 months. Median differences (95% confidence interval (CI)) between intervention and control groups and statistical significance of the difference. In static balance measures, displayed in the upper part of the table, increase means improvement. In dynamic balance measures and Dizziness Handicap Inventory (DHI), displayed in the lower part of the table, decrease means improvement*

	6 weeks					3 months				
	Median changes		Intervention vs control			Median changes		Intervention vs control		
Measure	Intervention $n=16$	Control $n=12$	Median diff.	CI	p	Intervention $n=16$	Control $n=13$	Median diff.	CI	p
SOLEO (seconds)	±0	−2	+2	(0.0–3.0)	**0.02**	±0	−2	+2	(0.0–4.0)	**0.000**
SOLEC (seconds)	±0	±0	±0	(−1.0–2.5)	0.96	±0	±0	±2	(0.0–8.0)	0.15
Tandem standing (seconds)	±0	±0	±0	(0.0–13.0)	0.30	±0	±0	±0	(0.0–7.0)	**0.033**
T standing blindfolded (seconds)	±0	−1	+1	(0.0–6.0)	**0.045**	±0	±0	+1	(−1.0–6.0)	0.23
Figure of eight (steps)	±0	±0	+1	(−2.0–0.0)	0.32	±0	±0	±0	(0.0–1.0)	0.53
Walking heel to toe (steps)	±0	±0	±0	(0.0–1.0)	0.35	±0	±0	±0	(0.0–1.0)	0.27
DHI total (points)	−1	±0	−6	(−16.0–0.0)	**0.047**	±0	±0	−4	(−14.0–0.0)	0.18
DHI functional (points)	−1	±0	−6	(−10.0–2.0)	**0.005**	±0	±0	−2	(−6.0–0.0)	0.13
DHI emotional (points)	±0	±0	±0	(−6.0–4.0)	0.98	±0	±0	±0	(−4.0–2.0)	0.59
DHI physical (points)	±0	±0	−2	(−4.0–0.0)	**0.033**	±0	±0	−2	(−4.0–0.0)	**0.04**

Significant values are given in bold. One participant from the control group did not attend follow-up at 6 weeks but attended follow up at 3 months.
SOLEO: standing on one leg eyes open, SOLEC: standing on 1 leg eyes closed.

There were some differences between the groups at baseline: In SOLEO, the median value for the intervention group was 30 seconds and for the control group 16 seconds, in tandem standing blindfolded the median value for the intervention group was 16 seconds and for the control group 6 seconds. Since the sample size is small, the possibility that these differences have affected the results can not be ruled out.

However, our findings indicate differences between the 2 groups in static balance measures and in DHI. These measures are probably appropriate when assessing patients with WAD in primary healthcare. Since we measured seconds, steps and points, the CI often include zero. All measures had an upper limit, that is, the patients could not improve if they reached the upper limit at baseline. Therefore, even if the CI intervals includes zero, the results are probably valid in terms of clinical importance in those comparisons who were statistically significant (in SOLEO after 6 weeks and 3 months, in tandem standing blindfolded after 6 weeks, in DHI functional after 6 weeks and in DHI physical after 6 weeks as well as after 3 months).

In previous research, beneficial effects of vestibular rehabilitation for patients with WAD and vestibular deficiency have been described (17); however, as far as we know, not in randomized controlled trials, as other authors also have observed (2). Our study indicates the difficulty of performing such trials, with vestibular rehabilitation as intervention on this group of patients. However, we find the results in our and other studies promising enough to encourage clinicians to consider vestibular rehabilitation as a possible treatment for patients with WAD and dizziness.

ACKNOWLEDGEMENTS

We thank RPT Peter Ask for practical help with the intervention and the randomization process.

The study was funded by the Medical Faculty of Lund University, the Primary Health Care RD-Unit of region Skåne, the Council for Health and Research (HSF) and the Hemborg Memorial Fund.

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