Randomized controlled trial of vestibular rehabilitation combined with cognitive-behavioral therapy for dizziness in older people

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OBJECTIVE: **To evaluate the effectiveness of vestibular rehabilitation combined with cognitive behavioral therapy in the treatment of dizziness in older people.**

STUDY DESIGN AND SETTING: **A randomized controlled design was used with patients recruited via an advertisement. Nine patients completed treatment and 10 served as waiting-list controls. The intervention lasted 7 weeks with 5 weekly group sessions and consisted of vestibular exercises. Cognitive behavioral therapy components were added to promote relaxation, reduce anxiety, and avoidance of feared situations and movements.**

RESULTS: **Statistically significant improvements on walking time, 2 dizziness provocative movements, and on the Dizziness Handicap Inventory, but no effects on the Romberg or anxiety and depression. Of the treated patients, 89% reached statistical significant improvement on the total inventory score.**

CONCLUSION: **Cognitive behavioral therapy combined with vestibular rehabilitation decreases dizziness in older people.**

SIGNIFICANCE: **These findings indicate that cognitive behavioral therapy can be combined with vestibular rehabilitation in the treatment of dizziness.** (Otolaryngol Head Neck Surg 2001;125:151-6.)

Approximately 1 in 3 elderly people have had dysequilibrium and/or dizziness at some time,[1,2] and dizziness is one of the most common presenting complaints in patients 75 years and older visiting primary care practices.[3] In the elderly, dizziness and associated falls are common causes of morbidity and mortality.[4] Moreover, chronic dizziness is often accompanied by secondary psychological problems such as anxiety, hyperventilation, or phobic avoidance of situations and movements associated with dizziness.[5,6]

Vestibular rehabilitation (VR) has been recommended as the treatment of choice for patients with persisting dizziness due to vestibular dysfunction.[7,8] The central element of VR is a set of exercises that promote central compensation by providing the central nervous system with repeated exposure to a range of eye, head, and body movements.[7-9] These exercises can be supplemented by therapy elements designed to improve balance skills and reduce anxiety arousal and avoidance behavior.[9] Although widely practiced, the empirical support for VR is still sparse, and in particular there is a lack of controlled studies of elderly populations. However, findings from studies of mixed-age samples are encouraging.[10-13] Although the majority of studies have excluded all but the most clear-cut and uncomplicated cases of position-related vertigo, Yardley et al[13] reported beneficial outcome in a controlled study where less than a third of the patients had specific audiovestibular conditions.

Cognitive behavioral therapy (CBT) is a relatively brief psychological treatment approach directed at identifying and modifying maladaptive behaviors and cognitions by means of behavior change and cognitive restructuring.[14] It has been found to be effective in treating anxiety states and phobic avoidance,[14] also in the elderly, and has been recommended in the treatment of dizziness.[5] There is some evidence that VR and CBT can be combined in the treatment of dizziness, but to our knowledge this has not been tested in elderly patients.

The aim of this study was to conduct a randomized controlled trial on the effects of a treatment combining VR and CBT in a sample of elderly with dizziness.

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Table 1. Contents of the treatment program

Week	Duration	Content
0	1.5 h	Information on the anatomy and function of the balance system, dizziness and vestibular compensation were given. Participants were taken through basic exercises and pacing and contraindications were discussed. Basic exercises: nodding and shaking head (eyes open, eyes closed, fixating finger)
1	2 h	Outcome of the homework was discussed and, information on the fight-or-flight response and arousal were given. The connection between assumptions (about dizziness symptoms), arousal and behavior were pointed out. A graded walking and balance program and applied relaxation were introduced.
2	1.5 h	The homework was followed up and the connection between thoughts, moods and behaviors was illustrated. A graded exposure program for extinction of avoidance behavior was introduced. The participants were also taught the next step in applied relaxation (relaxation without tension).
3	5-15 min	The participants were phoned to provide reassurance, advice and promote motivation.
4	1.5 h	The homework was followed up. Information about how to continue relaxation training was given. The participants were encouraged to continue the vestibular rehabilitation movements, walk- and balance-program, rapid relaxation on a daily basis and in their own pace. Discussion of graded exposure for feared movements and situations was conducted in small groups.
6	1 h	The homework was followed up and the course content was summed up. Future training was discussed. Advice on pacing of advanced exercises, applied relaxation, graded walking and balance training and graded exposure were given.

METHODS AND SUBJECTS

Subjects

The subjects in this study were recruited via an advertisement in a local newspaper and a notice at 4 health care centers and 1 senior activity center. The advertisement called for participants in a study on the treatment for dizziness, and stated that participants should be between 65- and 80-years-old and with recurrent vertigo for at least the last month. A total of 45 persons reported an interest in participation, of which 15 were excluded after screening. The criteria for exclusion were if they experienced only spontaneous attacks or were diagnosed with nonsuitable diagnoses (eg, Parkinson's disease or cerebral hemorrhage). An additional 8 subjects left the study before randomization because of diminished symptoms of vertigo or personal causes (eg, vacation).

Of the included 22 participants, 16 were females (73%). Ages ranged from 65 to 81 years (mean, 71.8; SD, 5.2), and the duration of dizziness varied from 0.4 to 50 years (mean, 11.2; SD, 13.3). Nineteen had visited a physician on account of dizziness, and 9 had received earlier treatment (7 physiotherapy; 2 acupuncture). None had received a program of VR, but a few had been informed about the importance of activity and head movements. When entering the study, the patients were seen by an ENT physician and diagnosed. The diagnoses were mixed with either vestibular dysfunction (N = 10) or tension-related dizziness (N = 6); a few patients had additional problems of cardiovascular and proprioceptive origin. Three cases had a previous diagnosis of Ménière´s disease. Informed consent was obtained from the subjects.

Design

The study was a prospective randomized controlled trial. The protocol was approved by the local institutional review board, and followed the ethical guidelines as outlined by the Swedish council for research in the humanities and social sciences. After screening, medical examination, and pretreatment assessment, patients were randomly assigned to treatment or to a waiting-list control group. One week before the follow-up assessment, questionnaires were mailed to the control group. The treatment group members were given the questionnaires at the last treatment session. The patients brought the questionnaires to the final interview when the behavioral measures were carried out. Posttreatment behavior tests were carried out by 3 psychology students unaware of the patients' status. After this assessment, the control group received a 2-session treatment similar in content to the intervention received by the treatment group. The control and treatment groups did not differ significantly on any of the demographic variables at pretreatment, by means of independent samples *t* test (age and dizziness duration) and χ^2 (gender).

Dropout

At treatment start there were 22 participants. Two in the treatment group dropped out during treatment because of flu and neck problems.

One participant in the control group dropped out because of minor problems with dizziness. The sample size was 9 in the treatment group and 10 in the control group.

None of the demographic variables differentiated dropouts from those who completed the study, but the 3 who dropped out had significantly less dizziness on 1 of the dizziness provocative movements (nodding with eyes closed) ($t[20] = -2.31$, $P = 0.032$).

Treatment

The treatment group was divided into 2 groups, and the treatment was carried out by M. J. and D. A. who attended all sessions. The treatment was delivered in 5 sessions over a period of 7 weeks. An overview of the content and timing of each session is shown in Table 1. However, given the hetero-

Table 2. Mean scores (SDs) on behavioral measures in the treatment (N = 9) and control (N = 10) groups at pretreatment and posttreatment

	Pretreatment		Posttreatment	
	Treatment	Control	Treatment	Control
Walking time	8.4 (2.0)	7.1 (1.7)	7.5 (1.9)	7.3 (1.9)
Sharpened Romberg*	31.2 (18.4)	555.7 (15.5)	37.1 (16.9)	54.0 (16.4)
Provocative movements, time taken in seconds to complete exercise(s):				
Head shaking, eyes open	10.4 (8.3)	10.8 (6.3)	9.3 (3.9)	10.5 (8.7)
Head nodding, eyes open	11.8 (2.9)	11.2 (4.3)	9.9 (4.1)	10.6 (4.4)
Head shaking, eyes closed	10.7 (2.2)	11.0 (7.1)	9.3 (4.6)	9.9 (5.3)
Head nodding, eyes closed	11.2 (3.3)	10.4 (5.4)	10.1 (6.0)	10.1 (3.3)
Head shaking, fixation	13.8 (3.8)	15.8 (5.1)	9.7 (3.8)	12.7 (4.0)
Head nodding, fixation	14.6 (6.6)	15.8 (5.9)	9.6 (4.6)	12.0 (3.3)

*Note that an elevation in scores on this test corresponds to better balance.

geneity of dizziness all treatment was individualized.[15] In brief, the treatment was derived from the work by Yardley et al[16] including components from the Cawthorne-Cooksey exercises and recent developments in physiotherapy for dizziness.[7,9,15] Exercises to stimulate vestibular compensation and improve balancing capabilities were supplemented by cognitive behavioral therapy components designed to promote relaxation, reduce anxiety, and reduce avoidance of feared situations and movements. At the end of each session the patients received a written summary and homework assignments were scheduled.

Outcome Measures

A set of outcome measures were completed before and after treatment. These included the following behavioral measures:

1. The participants were instructed to walk 10 meters as fast as possible without risking to fall. Time was taken in seconds.
2. The sharpened Romberg test (standing for up to 20 seconds with feet placed heel-to-toe); twice with the eyes open and twice with the eyes closed. The total time in seconds for which the subject maintained balance on the 4 tests were added together (score range, 0 to 80; reliability, 0.85; test-retest, 0.66).[13]
3. The minimum time in which subjects could perform 6 basic exercises in the therapy program (in seconds) (Table 2).

A set of validated questionnaires were also administrated:

1. The Dizziness Handicap Inventory (DHI)[17] composite score was used to assess handicap. The test consists of 25 items. Each item is answered with No (0 points), Sometimes (2 points), and Yes (4 points), and the maximum score is 100. The DHI has high internal consistency reliability (Cronbach´s alpha 0.89) and test-retest reliability (Pearson product-moment correlation 0.97).[17]
2. The Vertigo Symptom Scale, shortened version (VSS) assesses how frequently the participants have experienced 15 various forms of dizziness during the past month, on a scale of 0-4. Higher scores indicate more vertigo symptoms. Test-retest correlation is 0.60 and Cronbach´s alpha is 0.88.[13]
3. The Spielberger´s Trait Anxiety Inventory (STAI-t)[18] consists of 20 items ranging from almost never (0 points) to almost always (4 points). It was used to assess trait anxiety. Test-retest reliability ranges between 0.73 and 0.86.
4. The Beck Depression Inventory (BDI)[19] was used to assess depression. The inventory has 21 items, each consisting of 4 statements ranging from 0 to 3. The maximum total score is 63 and the test has good reliability and validity.

Statistical Analysis

Parametric and nonparametric statistics were used to analyze the data. Analysis of covariance (ANCOVA) was used to control for pretreatment differences on the variable sharpened Romberg, with pretreatment scores as covariate. On the other outcome measures 2×2 analysis of variance (ANOVA) was used followed by Tukeys post hoc test. Four of 6 measures of the time taken to perform the provocative movements were not normally distributed (skewness < 1). In these measures, the nonparametric Mann-Whitney U test was used to measure differences between the groups and Wilcoxon matched pairs test was used to measure within-group differences. Significance level was set at $P < 0.05$.

RESULTS

The results from the behavioral tests are presented in Table 2. A significant interaction was found for the result on walking time by ANOVA ($F[1, 17] = 6.48$, $P = 0.021$), and post hoc tests showed that the treatment group walked faster ($P < 0.05$) at posttreatment com-

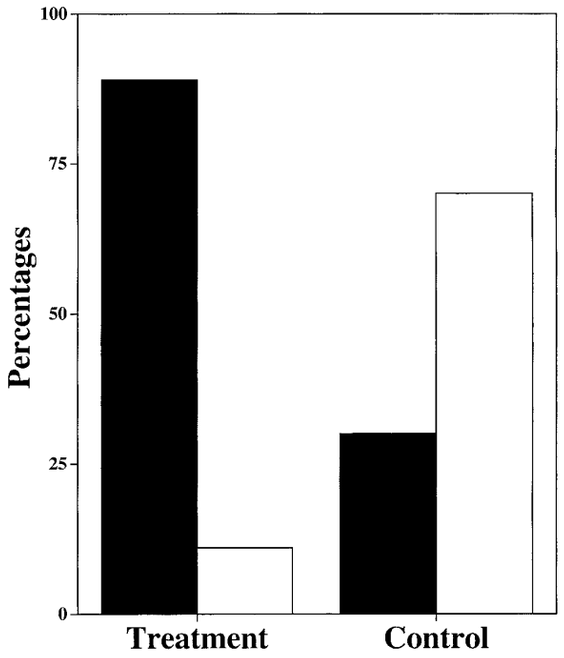

Fig 1. Percentages reaching the criterion of a prepost change of 18 points or more on the DHI (black bars) and percentages not reaching that criterion (white bars).

Table 3. Mean scores (SDs) on questionnaires in the treatment and control groups at pretreatment and posttreatment

	Pretreatment		Posttreatment	
	Treatment	Control	Treatment	Control
Dizziness Handicap Inventory	42.4 (15.0)	31.6 (7.3)	34.9 (18.0)	36.0 (17.4)
Vertigo Symptom Scale	15.7 (7.6)	14.7 (11.7)	9.9 (5.4)	10.4 (8.8)
Beck Depression Inventory	10.4 (4.4)	9.3 (8.3)	11.3 (4.5)	9.1 (8.1)
State Trait Anxiety Inventory	46.6 (5.3)	39.7 (13.4)	47.6 (3.6)	40.9 (13.4)

pared with pretreatment. Performance on the sharpened Romberg did not differ significantly between the groups.

Results from the dizziness provocative movements showed that head nodding with eyes open ($Z = 1.96$, $P = 0.05$) and head nodding with eye fixation ($Z = 2.67$, $P = 0.008$), were performed significantly faster at posttreatment by the treatment group. There was a trend for the treatment group to perform head nodding with eye fixation faster than the control group at posttreatment ($Z = 1.83$, $P = 0.067$).

The scores attained from the questionnaires before and after therapy are shown in Table 3. A significant interaction (time × treatment) was found for the DHI ($F[1,17] = 4.95$, $P < .040$). The treatment group experienced less handicap at follow-up whereas the control group experienced more. Jacobson and Newman[17] calculated that a change of at least 18 points was needed on the DHI to be considered significant change from intervention. In this study, 8 of the treated patients reached that criterion, whereas 3 did in the control group. The results are displayed in Fig 1. The difference between the groups was determined by Chi-square and was found to be significant ($\chi^2[df = 1] = 6.7$, $P = 0.009$).

For the VSS, a significant main effect for time of measurement was found ($F[1,17] = 11.44$, $P < 0.004$), but no interaction or between group differences. There were no significant differences on the STAI-t or on the BDI.

DISCUSSION

The outcome of this randomized trial gives partial support to the notion that VR can be combined with

CBT in the treatment of dizziness in the elderly. There were statistically significant improvements in the treatment group on walking time, 2 dizziness provocative movements, and on the DHI. However, no significant improvement was found on the Romberg, several of the dizziness provocative movements, or on the questionnaires measuring anxiety and depression. Both groups decreased their handicap as measured by the VSS. However, in comparison with previously reported studies, the outcome on the DHI was substantial. Of the treated patients, 89% reached statistically significant improvement on the total DHI score, whereas, for example, Cowand et al[12] only reached this criterion in 35% of their subjects following VR, although this result was obtained after 1- year posttreatment. Overall, our findings tend to support the claim that VR is effective.[7]

There are methodologic issues that hamper our enthusiasm over the results. First, the study was small, which unfortunately is a common characteristic of research on VR.[10] There is a clear need for larger trials incorporating sufficient statistical power to detect effects after treatment. Another issue pertinent to this study is the fact that we had to exclude a number of people who showed an interest in participating. Following randomization, the 2 groups did not differ on any of the background variables, but an inspection of Table 3 shows that there were trends indicating differences between the groups on pretreatment outcome measures. This could be due to randomization failure, but more likely just caused by bad luck and the fact that the small sample size makes average scores more vulnerable to subjects with more severe problems. Another caveat of the study was that it was not double-blind and that we did not compare the results of the VR-CBT combination with an alternative treatment or placebo. However, at posttreatment, assessors were blinded to patient status, and, at the present stage, we felt that it was important to establish the efficacy of the treatment against a waiting-list control group.

We included a host of outcome measures in the study, largely inspired by the research conducted by Yardley et al.[13] As seen in the tables far from all dependent measures showed any effect. It is perhaps not surprising to find effects on dizziness specific outcome measures such as the DHI, and not on psychological measures of depression and anxiety. More troublesome were the rather inconsistent findings on the behavioral outcome measures. In this context it must be stated that there are few controlled treatment trials of VR on elderly patients, and it is therefore difficult to ascertain what might have caused subjects to improve on walking time, for example, but not on the Romberg. The sample was obviously heterogeneous in terms of underlying diagnoses, and this can affect the findings. However, finding "pure" older candidates for VR would have been difficult.

The prospect of combining VR and CBT is promising since CBT techniques have been found to be effective in reducing avoidance of feared situations and curing phobias.[14] They have also been successfully applied for older individuals.[14] As there are individuals with dizziness who are afraid of the sensations caused by provocative movements, a systematic approach to fear reductions could be useful as an adjunct to VR. Indeed, a link between vestibular disorders and anxiety has been postulated and research points at its plausibility,[20] and justifies the use of CBT-techniques in VR.

In conclusion, this study found effects indicating that CBT and VR can be combined in the treatment of dizziness. Future research should replicate this finding in larger groups as well as testing CBT/VR against alternative treatments.

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