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Therapeutic patient education and exercise therapy in patients with cervicogenic dizziness: a prospective case series clinical study

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The purpose of this study was to evaluate the effectiveness of a treatment for patients with cervicogenic dizziness that consisted of therapeutic education and exercises. The Dizziness Handicap Inventory and Neck Disability Index were used. Secondary outcomes included range of motion, postural control, and psychological variables. Seven patients (two males and five females) aged 38.43±14.10 with cervicogenic dizziness were included. All the participants received eight treatment sessions. The treatment was performed twice a week during a four weeks period. Outcome measures included a questionnaire (demographic data, body chart, and questions about pain) and self-reported disability, pain, and psychological variables. Subjects were examined for cervical range of motion and postural control. All of these variables were assessed pre- and postintervention. Participants received eight sessions of therapeutic education patient and therapeutic exercise. The majority of participants showed an improvement in catastrophism (mean change, 11.57±7.13; 95% confidence interval [CI], 4.96–18.17; d=1.60), neck disability (mean change, 5.14±2.27.28; 95% CI, 3.04–7.24; d=1.32), and dizziness disability (mean change, 9.71±6.96; 95% CI, 3.26–16.15; d=1.01). Patients also showed improved range of motion in the right and left side. Therapeutic patient education in combination with therapeutic exercise was an effective treatment. Future research should investigate the efficacy of therapeutic patient education and exercise with larger sample sizes of patients with cervicogenic dizziness.

Keywords: Cervicogenic dizziness, Therapeutic exercise, Education, Dizziness handicap inventory, Neck disability index

INTRODUCTION

Cervicogenic dizziness is a common condition that results in physical problems such as instability and imbalance; it also produces psychological disorders and disability (Karlberg et al., 1996; Oostendorp et al., 1993; Reid and Rivett, 2005). Wrisley et al. (2000), defined cervicogenic dizziness as "a nonspecific sensation of altered orientation in space and disequilibrium originating from abnormal afferent activity from the neck" which is thought to be caused by disorders in the upper cervical spine and commonly it is associated with cervical stiffness neck pain or headache. Some studies suggest that cervicogenic dizziness is a common symptom present in degenerative changes of the cervical spine, whiplash (Hain, 2015; Treleaven et al., 2003; Wrisley et al., 2000) or idiopathic neck pain (Kristjansson and Treleaven, 2009).

Many previous researchers have considered that a disturbance in sensory information from the upper cervical spine may be the cause of this pathology. In addition, cervicogenic dizziness can secondarily alter the inputs integration that is generated by the vestibular (VEST) and visual (VIS) systems. The somatosensory (SOM), VEST and VIS systems are responsible for maintaining balance, but these systems can be occasionally altered and result in neck pain, stiffness and headache (Pérez et al., 2000). As a result,

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some research has suggested that a disorder in afferent inputs from any of these systems can produce dizziness and instability (Andrade Ortega et al., 2010; Treleaven, 2006). Symptoms that can be recurrent or progressive in patients with chronic neck pain (Dickin and Clark, 2007; Yeh et al., 2014).

It is important to note that patients with chronic, nonspecific neck pain associated with cervicogenic dizziness hold maladaptive beliefs such as a fear of certain movements or pain catastrophizing. Moreover, both dizziness and pain produce a pronounced inability in these kinds of patients (Dickin, 2010; Jayakaran et al., 2011). At the same time, cervicogenic dizziness leads to a decrease in neck range of motion (ROM) and a disorder in postural motor control (Alahmari et al., 2014; Audette et al., 2010).

Prior scientific evidence has demonstrated the effectiveness of manual therapy in combination with exercises to improve ROM for patients with cervicogenic dizziness (Reid et al., 2014a; Reid et al., 2014b; Reid and Rivett, 2005). However, these treatments have not proven effective in improving balance and head repositioning accuracy (Reid et al., 2014a). For this reason we consider it necessary to propose new treatment alternatives for treating patients with cervicogenic dizziness, other models therapeutic exercise could be applied to improve balance and motor control craniocervical of these patients. It is scientifically proven that VEST exercises with a neurophysiological background based in motor learning require a good gaze stability and interactions between the balance system and eye-head coordination (Fischer et al., 1995; Treleaven et al., 2011).

Our hypothesis is that the combination of therapeutic exercise and education can be a good approach to treat disability, pain, balance and psychological factors involved in the cervicogenic dizziness. There is scientific evidence that the combination of both treatments are effective in the management of various chronic musculoskeletal disorders (Aasa et al., 2015; Beltran-Alacreu et al., 2015; Bennell et al., 2015; Bennell et al., 2016; Pires et al., 2015). However, there has been no research to date about the effectiveness the combination of therapeutic patient education and therapeutic exercise in patients with cervicogenic dizziness.

The primary goal of our investigation is to evaluate the effectiveness of a treatment consisting of therapeutic patient education and exercises for patients with cervicogenic dizziness; we employ the Dizziness Handicap Inventory (DHI) and the Neck Disability Index (NDI).

Our secondary objectives are to evaluate if any changes are produced in ROM, postural control and psychological variables after therapeutic patient education and therapeutic exercise treatment.

MATERIALS AND METHODS

Participants

The study protocol was approved by the ethics committee of the Centre of University Studies La Salle, Aravaca (CSEULS-PI-052). A consecutive convenience sample of seven patients with cervicogenic dizziness was recruited from the Functional Rehabilitation Institute of The Center for Advanced Studies University La Salle (Aravaca, Madrid, Spain). Prior to enrollment, all patients received explanations regarding the objectives, implications and possible complications of the study; the patients agreed to participate by signing an informed consent form. We reviewed case records dated between October 2014 and June 2015.

Evaluation criteria suggested by Wrisley et al. (2000), were established he to exclude patients with other causes of dizziness. These are based on history, physical examination, and vestibular function tests. As used vestibular tests of head impulse test with video-oculography, it is a tool valid and reliability used to measure and quantify semicircular canal function (Agrawal et al., 2014; Bartl et al., 2009), in addition an assessment of postural control and balance was performed using computerized dynamic posturography. The assessments were made by trained physiotherapists in evaluation and diagnosis of patients with vestibular disorders, according to the inclusion criteria. The inclusion criteria of this prospective case series study included the following: (a) pain and dizziness lasting for at least 3 months; (b) a pain intensity corresponding to at least 3 points on a 10-point numeric pain rating scale; (c) restricted cervical range of movement (flexion, extension, rotation and side-bending); (d) presence of neck pain associated with disability according to the NDI greater than or equal to 5 points; (e) presence of subjective dizziness associated with pain, movement, stiffness or specific postures of the cervical region; and (f) men and women between 18 and 65 yr old. The exclusion criteria consisted of the following: (a) presence of trauma or recent surgery to the head, face, neck or chest; (b) specific diagnosis of central or peripheral dizziness; (c) history of previous physical-therapy intervention for the cervical region; (d) any cognitive impairment that hindered viewing of audiovisual material; (e) difficulty understanding or communicating; or (f) inadequate understanding of the Spanish language to follow instructions for measuring and treatment.

Procedures

Each of the eligible patients was asked to complete a basic questionnaire to determine if he she met the criteria for inclusion or exclusion. This questionnaire included demographic data (gender, age, height, and weight), a body chart in which patients had to mark the location of their pain, and several questions about the characteristics of their pain. In addition, the patients completed several self-report measures related with disability, pain and psychological variables. All the patients received a manual physical examination including an assessment of the cervical and thoracic region, an evaluation of their cervical ROM and a full assessment of their postural control performed using computerized dynamic posturography. These self-reports and physical tests were conducted on the day of the first measurement (baseline) and again after the follow-up period.

Primary outcome measures

The primary outcome measures used in this prospective case series were the DHI and NDI. The DHI is a specific self-perceived questionnaire that assesses the patient's condition and the effect of dizziness on the patient's quality of life. The DHI consists of 25 questions that classify the effects of dizziness in three categories: Physical, functional and emotional. The Spanish version of the DHI is a valid and reliable questionnaire that has high internal consistency. It has been suggested that a change in score of 10% or more is clinically relevant (Treleaven, 2006).

The Spanish version of the NDI measures perceived neck disability. This questionnaire consists of 10 items (seven questions related to daily living activities, two questions related to pain and one question related to concentration); each item is scored from 0 (no disability) to 5 (complete disability) points. The NDI has demonstrated acceptable psychometric properties. It has been suggested that a change in score of 10% or more is clinically relevant, and 5 points indicates the minimal detectable change (MacDermid et al., 2009).

Secondary outcome measures

We assessed postural control via a sensory organization test (SOT) on a SMART EquiTest system (Neurocom International

Table 1. Dynamic posturography sensory organization test

Measure	Somatosensory ratio	Visual ratio	Vestibular ratio	Visual preference
Subject 1				
Baseline	1.01	0.97	0.79	0.68
Follow-up	0.99	0.95	0.81	1.00
Subject 2				
Baseline	0.92	0.85	0.90	1.00
Follow-up	0.99	0.99	0.78	1.92
Subject 3				
Baseline	0.97	0.98	0.73	0.91
Follow-up	0.95	0.97	0.80	1.01
Subject 4				
Baseline	0.99	0.97	0.66	1.06
Follow-up	0.98	0.94	0.74	0.99
Subject 5				
Baseline	0.93	0.90	0.84	0.73
Follow-up	1.00	1.00	0.78	0.98
Subject 6				
Baseline	0.94	0.83	0.73	0.84
Follow-up	1.00	0.97	0.78	1.01
Subject 7				
Baseline	0.97	0.97	0.56	0.60
Follow-up	0.90	0.43	0.45	1.02
Mean ± SD				
Baseline	0.96 ± 0.034	0.92 ± 0.06	0.74 ± 0.11	0.83 ± 0.16
Follow-up	0.97 ± 0.036	0.89 ± 0.20	0.73 ± 0.12	1.13 ± 0.34
Mean diference ± SD (95% CI)	-0.11 ± 0.56 (-0.06 to 0.04)	0.03 ± 0.23 (-0.18 to 0.25)	0.009 ± 0.08 (-0.06 to 0.08)	-0.29 ± 0.31 (-0.59 to -0.008)*
Effect size Cohen *d*	-0.28	0.20	0.087	-1.13
% > MDC	95% CI, 10.08	95% CI, 11.93	95% CI, 25.69	-

SD, standard deviation; CI, confidence interval; MDC, minimum detectable change.
*$P < 0.05$, statistically significance.

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Inc., Clackamas, OR, USA). The SOT is a component of computerized dynamic posturography that assesses the relative contributions of VIS, VEST, and SOM systems during standing by disturbing the information delivered to the patient's eyes, feet and joints (Yeh et al., 2014).

For the SOT, the subjects performed three 20-sec trials, each under six different sensory conditions of increasing difficulty (18 measurements total): (a) eyes open; (b) eyes closed; (c) eyes open with surround sway; (d) eyes open with support surface sway; (e) eyes closed with support surface sway; (f) eyes open with surround and support surface sway. A percentage score is calculated for each trial, including four ratios based on the ability to use VIS, VEST, and SOM pathways and a composite score to determine overall postural stability. The four ratios of sensory analysis are SOM, VIS, VEST, and visual preference (PREF). We found that the SOT had adequate validity and reliability when measuring different pathological conditions in both symptomatic and asymptomatic subjects (Dickin, 2010; Dickin and Clark, 2007; Jayakaran et al., 2011). In addition, the minimum detectable change (MDC) data are presented for somatosensorial, VEST, and VIS ratios in Table 1 (Broglio et al., 2008).

We measured cervical ROM using a cervical goniometer called a CROM. This device has three inclinometers, one at each plane of movement. A plastic glasses-like support houses two of the inclinometers that enables measurements of flexion, extension and side-bending of the neck. Adding another part of the device with the third inclinometer and magnets around the neck allows rotations to be measured. All movements had to be done without pain. In some of the subjects the movement had to be hand-guided to achieve a proper movement. This procedure has demonstrated its reliability in patients with neck pain (Audette et al., 2010). The MDC of cervical ROM is described in Table 2 for all movements (Fletcher and Bandy, 2008).

The Spanish version of the Pain Catastrophizing Scale (PCS) assesses the degree of pain catastrophizing. The PCS includes 13 items and a three-factor structure: rumination, magnification and

Table 2. Range of motion

Measure	Flexion	Extension	Right rotation	Left rotation	Right lateral flexion	Left lateral flexion
Subject 1						
Baseline	64.60	79.00	81.00	80.60	54.00	50.00
Follow-up	50.00	94.00†	86.60†	76.60	50.00	52.60
Subject 2						
Baseline	57.00	70.00	64.00	65.00	41.30	53.30
Follow-up	60.00	80.00†	67.30	69.00	44.60	50.00
Subject 3						
Baseline	35.00	60.00	61.0	62.00	43.00	46.00
Follow-up	55.00†	61.30	70.60†	72.00†	38.66	40.66
Subject 4						
Baseline	45.00	59.30	54.60	46.60	49.30	32.00
Follow-up	61.30†	50.00	67.00†	64.60†	28.60	30.60
Subject 5						
Baseline	53.33	89.00	72.00	74.00	48.66	54.00
Follow-up	70.00†	72.66	75.30	80.00†	42.66	54.66
Subject 6						
Baseline	49.30	41.33	50.60	58.60	31.00	36.00
Follow-up	43.30	50.00	61.00†	69.00†	32.60	42.60†
Subject 7						
Baseline	58.00	58.00	68.66	68.66	37.33	42.00
Follow-up	58.00	60.00	68.00	75.30†	42.00	43.33
Mean ± SD						
Baseline	51.7 ± 9.7	65.2 ± 15.6	65.0 ± 72.3	64.5 ± 10.4	44.7 ± 8.5	43.4 ± 7.8
Follow-up	56.8 ± 8.5	66.8 ± 16.2	72.3 ± 5.2	70.8 ± 8.17	44.9 ± 8.27	39.8 ± 7.2
Mean diference ± SD (95% CI)	-5.05 ± 13.05 (-17.12 to 7.02)	-1.61 ± 11.11 (-11.89 to 8.65)	-6.27 ± 4.68 (-10.61 to -1.94)*	-7.29 ± 6.73 (-13.51 to -1.06)*	3.6 ± 8.58 (-4.29 to11.57)	-0.16 ± 3.95 (-3.81 to 3.49)
Effect size Cohen *d*	-0.56	-0.1	0.01	-0.45	-0.02	0.48
% > MCD	6.5°	9.3°	5.5°	5.4°	5.9°	5.9°

SD, standard deviation; CI, confidence interval; MDC, minimum detectable change.
*P < 0.05, statistically significance. †MDC.

helplessness (García Campayo et al., 2008). The theoretical point range is between 0 and 52; lower scores correspond to less catastrophizing. The MDC of PCS is 9.1 points (George et al., 2010).

We used the Spanish version of the TSK-11 to assess pain-related fear of movement. The TSK-11 is a modified version with 11 items of greater importance and greater validity and reliability. The MDC of the TSK-11 is 4.8 points (George et al., 2010; Woby et al., 2005).

We assessed self-efficacy using the Spanish version of the CPSS. The scale was developed to measure the perceived self-efficacy and ability to cope with the consequences of pain in chronic pain patients. This scale consists of 19 items and three domains that assess self-efficacy for pain management, physical functioning and coping with symptoms. The Spanish version of the CPSS has been demonstrated to have acceptable psychometric properties (internal consistency, α = 0.91) (Martín-Aragón et al., 1999).

Interventions

The patients underwent eight treatment sessions, two sessions per week for four weeks with a follow-up of 10 and 15 days after the last session. The treatment was based on a combination of therapeutic exercises and therapeutic patient education. In the first four sessions, the patients were educated about chronic neck pain neurophysiology, chronic neck pain related to dizziness physiopathology, the benefits of therapeutic exercise, and active coping strategies for pain (Table 3).

During the first four sessions, motor control and ROM exercises were prescribed in order to improve muscular endurance of deep flexors muscles and to improve the ROM in flexion, rotation and inclination. These exercises were performed at a rate of 3–4 sets and an intensity of 12–15 repetitions per day (Supplementary material).

During the last four sessions, maximum strength exercises were prescribed in order to improve the strength of flexors, rotators and inclinators muscles with an intensity of 2–3 sets of 5–7 repetitions per day (isometric contraction), in addition to oculomotor exercises in order to decrease dizziness (Supplementary material 1). These exercises have been described in previous studies (Malmström et al., 2007; Schenk et al., 2006; Wrisley et al., 2000).

The patients were instructed to stretch the major muscles of their cervical spine after all exercise sessions. In addition, the patients were encouraged to remember their lessons that they had learned in the first two weeks of instruction.

The exercises were guided by a trained physiotherapist who first explained the exercises and then demonstrated the exercises

Table 3. Therapeutic patients education

Education	1st Session		2nd Session		3th Session		4th Session		5th–8th Session
	Method	Application	Method	Application	Method	Application	Method	Application	Application
Pain physiology education	Education on basic physiology and chronic pain	Explanation of causes and consequences of pain Explanation of characteristics of acute vs chronic pain and the implications of chronic pain in life	Education on basic physiology in chronic pain	Explanation of central sensitization processes Explanation of psychological factors	Education on cervical dysfunction	Explanation of neck muscle function and the upper cervical joint implications	Education on benefits of exercise	Explanation of neurophysiological effects of exercise and its effects on psychological factors	Concepts review Implementation of the exercises
Pain coping skills education	Goal setting Perform the activities and exercises daily or when prescribed Active lifestyle	Mobilization exercises Stretching	Goal setting Perform the activities and exercises daily or when prescribed Active lifestyle	Mobilization exercises Motor control exercise stretching	Goal setting Perform the activities and exercises daily or when prescribed. Active lifestyle	Mobilization exercises Motor control exercise Vestibular exercises And stretching	Goal setting Perform the activities and exercises daily or when prescribed Active lifestyle	Mobilization exercises Motor control exercise Vestibular exercises Strength exercises Stretching	

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herself. Next, the patients repeated the exercises under supervision to ensure that their form was correct.

All of the patients were given a copy of the exercise instructions on paper. Patients were instructed to complete these exercises 4 times per week.

Statistical analysis

We analyzed data from seven patients using IBM SPSS Statistics ver. 20.0 (IBM Co., Armonk, NY, USA). The normal distribution of the majority of variables was confirmed using the Shapiro–Wilk test ($P > 0.05$). We used descriptive statistics to summarize the data of continuous variables; these variables are presented as mean ± standard deviation and a 95% confidence interval. We used the Student *t*-test to compare the outcomes of continuous variables. We also calculated the percentage of change for each variable. The effect sizes (Cohen *d*) were calculated for the outcome variables. According to Cohen method, the magnitude of the effect was classified as small (0.20–0.49), medium (0.50–0.79), or large (≥0.8). A value of $P < 0.05$ was considered to be statistically significant (Cohen, 1988).

RESULTS

We evaluated 10 patients before treatment, but only seven patients (two males, five females) underwent a treatment based on education plus therapeutic exercise. The mean age of our patient cohort was 38.43 yr (range, 24–62 yr). All of the patients complained of cervicogenic dizziness and had had nonspecific chronic neck pain for at least 3 months; the average duration of pain duration prior to the procedure was 28.29 months (range, 6–60 months). None of the patients had a history of trauma (Table 4).

In terms of the individual pre-post data, the participants showed an improvement in psychosocial variables (Table 5). On the NDI questionnaire, 71.43% of the subjects showed a change over the MDC (5 points). In the catastrophizing variable, 57.14% of the sample improved their score over the MDC by reducing their score by at least 9.1 points. In the fear of movement variable, just two people exhibited a change over the MDC (4.8 points). Nearly one half of our patients (42.86%) exhibited an improvement over the MDC on the DHI.

Moreover, our mean results exhibited significant changes in fear of movement ($P = 0.20$) and catastrophism ($t = 3.154$, $P = 0.005$). Furthermore, the mean results of the PCS questionnaire showed a significant improvement ($t = 4.289$, $P < 0.01$). In addition, the mean scores of the functional and physical subscale of disability owing to dizziness showed changes that were statically relevant: $t = 2.976$, $P = 0.025$ and $t = 3.771$, $P = 0.009$, respectively. The total score of this test also revealed differences between the first and second measurements: $t = 3.688$, $P = 0.010$. The NDI suffered a significant decrease ($t = 6.000$, $P = 0.001$).

We also analyzed physical variables. We observed an improvement in the mean data of rotation comparing the results pre- and posttreatment with a statistical significance of $t = -3.543$, $P = 0.012$ in right rotation and $t = -2.865$, $P = 0.029$ in left rotation. Cervical rotation improved over the MDC (5.5° right, 5.4° left) in 71.43% of the sample, and left rotation improved over the MDC in 57.14% of the sample. For movements in the sagittal plane, the data exhibited an improvement of 42.86% for cervical flexion and 28.57% for extension. Our data did not reveal any improvement over the MDC in the frontal plane (Table 2).

Dynamic posturography that was conducted before and after treatment revealed statistically significant differences in PREF score during the SOT ($t = -2.515$, $P = 0.046$) (Table 1). Treatment with education and therapeutic exercise yielded changes in the fear of movement, catastrophizing, NDI and disability because of dizziness scores. Moreover, this treatment played a role in reported

Table 4. Descriptive variables

Case	Gender	Age (yr)	Height (cm)	Pain duration (mo)	NPRS
1	Female	35	170	6	7
2	Female	24	163	60	7
3	Female	24	162	24	6
4	Male	50	178	24	3
5	Female	31	160	12	9
6	Male	62	172	60	5
7	Female	43	155	12	7
Mean ± SD	-	38.43 ± 14.10	165.72 ± 7.93	28.29 ± 22.64	6.29 ± 1.89

NPRS, numerical pain rating scale; SD, standard deviation.

Table 5. Psychosocial variables

Measure	NDI	DHI	DHI physical	DHI functional	DHI emotional	PCS	TSK-11	CPSS
Subject 1								
Baseline	6	6	6	0	0	4	13	56
Follow-up	5	6	4	2	0	0	11	190
Subject 2								
Baseline	12	18	10	6	2	17	14	138
Follow-up	6†	14	8	4	2	3†	12	187
Subject 3								
Baseline	15	22	12	8	2	27	24	144
Follow-up	11	6†	4	2	0	4†	17†	186
Subject 4								
Baseline	9	6	2	2	2	6	21	175
Follow-up	4†	0	0	0	0	1	18	190
Subject 5								
Baseline	12	28	12	8	8	16	19	167
Follow-up	4†	18	10	4	4	2†	20	174
Subject 6								
Baseline	15	32	12	14	6	13	29	150
Follow-up	10†	20†	4	10	6	8	26	147
Subject 7								
Baseline	19	34	16	10	8	28	21	138
Follow-up	12†	14†	8	4	2	12†	16†	144
Mean ± SD								
Baseline	12.57 ± 4.27	20.85 ± 11.53	9.43 ± 4.99	6.86 ± 4.74	4 ± 3.27	15.86 ± 9.29	20.14 ± 5.55	138.28 ± 38.97
Follow-up	7.43 ± 3.45	11.14 ± 7.28	6 ± 3.65	3.71 ± 3.15	2 ± 2.3	4.28 ± 4.27	17.14 ± 5.04	174.00 ± 20.22
Mean diference ± SD (95% CI)	5.14 ± 2.27.28 (3.04–7.24)**	9.71 ± 6.96 (3.26–16.15)**	4.57 ± 3.20 (1.60–7.53)**	3.14 ± 2,79 (0.55–5.72)*	2.00 ± 2.30 (-0.13 to 4.13)	11.57 ± 7.13 (4.96–18.17)**	3.00 ± 2.51 (0.67–5.32)*	-35.71 ± 47.45 (-79.60 to 8.17)
Effect size Cohen *d*	1.32	1.01	0.78	0.78	0.62	1.6	0.56	-1.15
% > MCD	5	11	-	-	-	9.1	4.8	-

NDI, Neck Disability Index; DHI, Dizziness Handicap Inventory; TSK, Tampa Scale Kinesofobia; PCS, Pain Catastrophism Scale; CPSS, Chronic Pain Self-Efficacy Scale; SD, standard deviation; CI, confidence interval; MDC, minimum detectable change.
*$P < 0.05$, statistically significance. **Significance $P < 0.01$. †MDC.

improvements in physical variables such as neck rotation ROM and PREF during balance tests.

DISCUSSION

The main outcome of this intervention study was focused on the evaluation of the efficacy of therapeutic patient education and therapeutic exercise as interventions for physical and psychological complaints of patients with cervicogenic dizziness. Our results showed that patients with cervicogenic dizziness treated with therapeutic patient education and therapeutic exercise experienced benefits in neck disability, handicap dizziness, catastrophizing, neck pain, and self-efficacy. Fortnight lapse was left between evaluations for comparison as a clinically reasonable period of time for checking the effects of the intervention on dizziness. We measured effect sizes at follow-up at 6 weeks; the reduction was not only statically significant also clinically meaningful for ROM in the transversal plane, catastrophism, and disability associated with dizziness and neck pain.

Our results identified only three patients with a MDC (42.85%). Brugnera et al. (2015), demonstrated different results using a mechanical approach in which patients improved in physical and functional DHI. However, the emotional dimension of the test showed no difference. Moreover, these authors suggested including therapeutic patient education as a therapy in order to change the emotional construct of the DHI questionnaire. According to our results, therapeutic patient education may play a role as a treatment for emotional components related to dizziness.

When we used the DHI for severity classification, five participants (71.42%) changed from have a moderate or severe condition to a better classification by the end of the intervention. Three participants (42.85%) initially had a disorder classified as severe. These participants were all older than 43 years. We did not find any statistically significant correlations between severity of dizzi-

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ness and age, but a larger sample size might be able to identify such a trend. A study conducted by Stam et al. (2015) described severe impairments related to dizziness in older adults (at least 70 yr old). This cohort received therapeutic exercise and therapeutic patient education and exhibited improvements in DHI total score (Stam et al., 2015).

Our results are consistent with those of Tsukamoto et al. (2015). This study was conducted with patients that had reported VEST chronic dysfunction, dizziness, balance impairment, or other unspecific dizziness sensations for at least three months. It was observed in DHI when performing cervical manual therapy, exercises and balance training (Tsukamoto et al., 2015). An intervention without education yielded similar effects as our combined approach with an improvement in both variables. Larger studies must be conducted in order to demonstrate the potential therapeutic effect of education in isolation.

In terms of neck disability, 71.42% of our sample attained the MDC after an intervention based on therapeutic patient education and therapeutic exercise. In addition, we found changes in ROM. Four patients attained the MDC on the transversal plane ROM to the right (left). In terms of at cervical ROM in the sagittal plane, we observed that 42.85% showed clinically relevant difference for the flexion and 28.5% for the extension. Previous research by Reid et al. (2014a), proposed clinically relevant changes could be observed only when performing manual therapy and therapeutic exercise.

Our results related to postural control and balance showed that there were no statistical differences at a 6-week follow-up with the intervention we proposed. Similar results (eyes-closed test performed during SOT at the baseline) were consistent with the results reported by Reid et al. (2014a), but no changes were reported for SOT when performing manual therapy and therapeutic exercise for the treatment of patients with cervicogenic dizziness.

Our data related to disability and some psychosocial factors as kinesiophobia and catastrophism showed a clinically relevant improvement for kinesiophobia in two participants and same results for catastrophizing in four participants. Our findings are consistent with the findings of Stam et al. (2015), who used a therapeutic intervention of therapeutic patient education and exercise. Hillier and Hollohan (2007) also reported similar results for VEST rehabilitation and education.

According to the literature, there are no clear guidelines for evidence-based treatment planning. Manual therapy and VEST rehabilitation are the state of the art, but additional research is necessary for supporting these therapies as effective treatments.

To the best of our knowledge, this study is the first to provide preliminary evidence that therapeutic exercise associated with therapeutic patient education may play a beneficial role when the outcomes of the treatment are focused on decreasing dizziness in patients with cervicogenic dizziness.

In summary, the results of our study show that treatment with therapeutic patient education and therapeutic exercise for patients with cervicogenic dizziness seems to be beneficial in decreasing neck disability and dizziness disability. Moreover, this treatment could be useful for managing psychosocial factors in patients with high levels of catastrophizing and fear of movement. Finally, we conclude that it is appropriate to combine this treatment with another therapy when ROM is impaired. However, our study exhibited an improvement in cervical rotation, and this finding could be related to a decrease in the feeling of dizziness as reported in the HDI. We anticipate that our work will motivate long-term follow-up intervention studies with larger sample sizes in order to verify the effectiveness of therapeutic patient education and therapeutic exercise in the clinical management of patients with cervicogenic dizziness.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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SUPPLEMENTARY MATERIALS

Supplementary material can be found via http://dx.doi.org/10.12965/jer.1632564.282.

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SUPPLEMENT MATERIAL

EXERCISES

General guidelines for chronic nonspecific neck pain associated to cervicogenic dizziness.

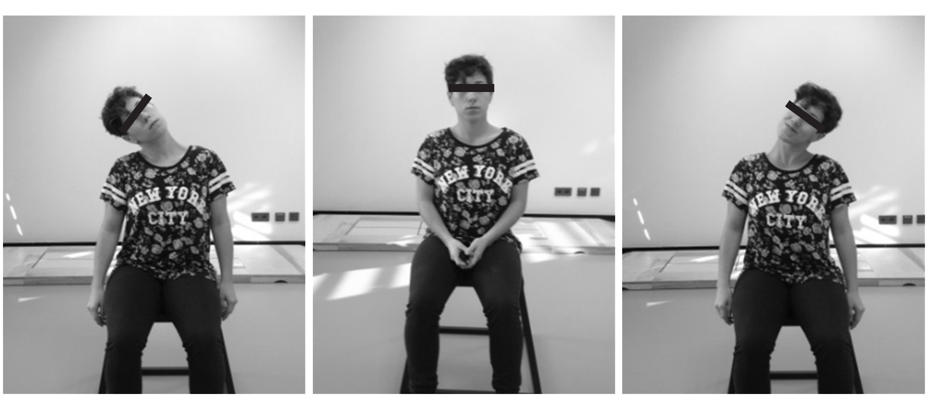
- Mobilization exercises
  - It is the first phase of exercises. The patients are trained by a physiotherapist to do a correct performance of the exercises.
  - The main goal of this phase is to increase the range of motion in a no pain condition.
- Control motor exercise
  - It is an exercise included in the second phase in which patients learned by a physiotherapist to perform the exercises in a correct way.
  - The patients are informed about the importance of having a good cervical motor control.
  - The main goal of this exercise is to increase the motor control of deep neck flexors to improve the stability of cervical spine.
- Oculomotor exercises
  - It is the third phase of exercises. Patients are taught by the physiotherapist to perform the exercises in a correct way.
  - The main goal is to reduce the dizziness symptom, the gaze control and postural control.
- Strength exercises
  - This is then fourth phase. Patients are taught to perform the exercise in a correct way.
  - The main goal of this phase is to improve the strength of cervical muscles and also their strength-endurance.

http://dx.doi.org/10.12965/jer.1632564.282

MOBILIZATION EXERCISES

1) Flexion: Try to touch your chest with your chin. This exercise should be done for 4 days/week and the frequency is 10 times × 3 sets.

2) Rotation: Turn your head to the right and left making a stop in the middle of the range. This exercise should be done for 4 days/week and the frequency is 3 sets × 10 times.



3) Lateral flexion: Tilt your head to the right and to the left making a stop in the middle of the range keeping your shoulders down. This exercise should be done for 4 days/week and the frequency is 3 sets × 10 times.

MOTOR CONTROL EXERCISE

1) Crane-cervical flexion: Put an elastic band on the occipital bone and hold it with your hands maintaining your arms in a 90° angle.
2) Bring your chin forward. Then bring it back against the band.

OCULOMOTOR TRAINING

1) Set a fixed point in front of your eyes. Turn your head to both sides keeping your eyes on your thumb.

2) Set a fixed point in front of your eyes. Close your eyes. Turn your head with eyes closed and try to put your head in the initial position. Open your eyes and check it.

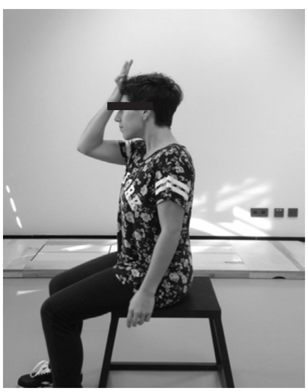
3) Extend your arm to the right side and try to turn your head to the front keeping your gaze looking at your thumb. Then repeat the exercise to the other side using your left arm.

http://dx.doi.org/10.12965/jer.1632564.282

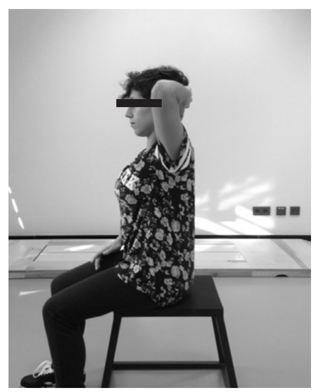
4) Extend your arms in front you with your thumbs in front of your eyes. Your thumbs should be separated by 7–10 cm. Then try to look at both thumbs at the same time making your eyes move side to side.

STRENGTH EXERCISES

Contract for 5 sec. The frequency of exercise is 3 sets × 10 times.



1) Flexion: Put one hand in the front of your head and perform the same force against your hand.



2) Extension: Place your hands behind your head and perform opposing forces.

3) Rotation: Put one of your hands in the side of your forehead and make the force in the direction that will make turn to the left or right your head.

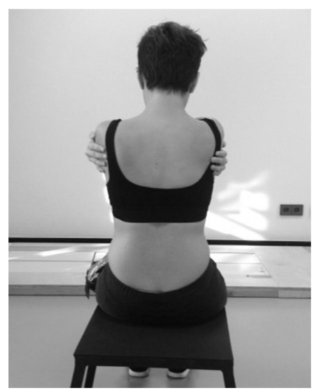
4) Lateral Flexion: Place your hand on your temporalis muscle and make lateral flexion in an isometric exercise making opposing forces.

STRETCHING

Trapezium 1: Put your hand on your head as shown in the photograph. Keep your shoulders down. Then bring your head down to stretch trapezium muscle. Then repeat it to the other side.

Trapezium 2: Put your hand on your temporal muscle as shown in the photograph. And bring your head down stretching the muscle.

Sternocleidomastoid: Put your hand on temporal bone, extend your head tilt your head and turn it to the opposite side. Then let your head fall in that position.



Rhomboid: Cross your arms and put both hands separated over the scapulae. You should make opposing forces with both hands keeping your shoulders down.

Pectoralis major: Put your hand on a wall or a door frame, then turn your body guiding your chest to the opposite side.

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