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RESEARCH ARTICLE

Neck pain associated with clinical symptoms in dizzy patients—A cross-sectional study

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Abstract

Objective: Many patients suffer from concurrent neck pain and dizziness. The aim of this study was to describe the clinical symptoms and physical findings in patients with concurrent neck pain and dizziness and to examine whether they differ from patients with dizziness alone.

Methods: Consecutive patients with dizziness and neck pain were recruited from an ear–nose–throat department and a spine clinic. They were divided into three groups: patients with dizziness only (n = 100), patients with dizziness as their primary complaint and additional neck pain (n = 138) and finally, patients with neck pain as their primary complaint accompanied by additional dizziness (n = 55). The patients filled in questionnaires regarding their symptom quality, time-course, triggers of dizziness and the Vertigo Symptom Scale Short Form. The physical examination included Cervical Range of Motion, American College of Rheumatology (ACR) Tender Points, Cervical Pressure Pain Thresholds and Global Physiotherapy Examination 52-Flexibility.

Results: Both neck pain groups were more likely to have a gradual onset of dizziness symptoms, more light-headedness, visual disturbances, autonomic/anxiety symptoms, decreased cervical range of motion, decreased neck and shoulder flexibility and increased number of ACR tender points compared with patients with dizziness alone. The group having dizziness as their primary complaint and also reporting neck pain had the highest symptom severity and tended to report rocking vertigo and increased neck tenderness. The group with neck pain as their primary complaint was more likely to report headache.

Conclusion: Neck pain is associated with certain dizziness characteristics, increased severity of dizziness and increased physical impairment when compared with dizzy patients without neck pain.

KEYWORDS

dizziness, musculoskeletal system, neck pain, population characteristics

1 | INTRODUCTION

Dizziness and neck pain are both common complaints with negative impact on work productivity and use of health-care resources (Benecke, Agus, Kuessner, Goodall, & Strupp, 2013; Hurwitz, Randhawa, Yu, Cote, & Haldeman, 2018; Neuhauser et al., 2008). Previous studies have shown that concurrent dizziness and neck pain are common in both patients with dizziness (Iglebekk, Tjell, & Borenstein, 2013; Wilhelmsen, Ljunggren, Goplen, Eide, & Nordahl, 2009) and patients with neck pain (Humphreys, Bolton, Peterson, & Wood, 2002) as their presenting complaint. Dizziness is a complex symptom, and in the absence of other diagnosis or explanations, concurrent neck pain is sometimes suspected to play a role. Anatomically and physiologically, the vestibular and cervical proprioceptive systems are closely linked (Kristjansson & Treleaven, 2009). However, the clinical interrelations between dizziness and neck pain have yet to be established.

Patients with long-lasting dizziness have been shown to have physical impairments (Kvale, Wilhelmsen, & Fiske, 2008), and neck pain has been found to be an independent predictor of long-term dizziness (Wilhelmsen, Ljunggren, Goplen, Eide, & Nordahl, 2009). In theory, pain may lead to a disruption or alteration in the cervical afferent information, causing a sensory mismatch, resulting in a sensation of dizziness (Brandt & Bronstein, 2001; Kristjansson & Treleaven, 2009). Still, the concept of so called cervicogenic dizziness or vertigo is controversial (Magnusson & Malmstrom, 2016) as there is no international consensus on diagnostic criteria, and symptoms of patients with both dizziness and neck pain often resemble or overlap with other entities (Yacovino & Hain, 2013). Cervical dizziness is commonly reported as a more vague clinical picture than peripheral vestibular disorders, which at least in the acute phase can be recognized by a combination of spinning vertigo with nausea, vomiting, nystagmus and lateropulsion (Brandt, Dieterich, & Strupp, 2013; Devaraja, 2018; Yacovino & Hain, 2013). Considering the close physiological connections between the vestibular and cervical proprioceptive systems, it is likely that neck pain could modify the clinical picture in patients with dizziness. To the authors' knowledge, no previous studies have examined how neck pain associates with clinical symptoms and physical findings in dizzy patients. The aim of this explorative study was to describe the clinical symptoms and physical findings in patients with concurrent neck pain and dizziness and to examine whether they differ from patients having dizziness alone.

2 | METHODS

2.1 | Design and setting

We conducted a prospective cross-sectional study comparing of outpatients examined at two clinics at a university hospital. Patients with persistent dizziness were included consecutively from an ear–nose–throat (ENT) department that receives patients with dizziness of suspected vestibular origin referred by general practitioners and specialists. Patients with persistent neck pain were included from an outpatient spine clinic that admits patients with long-lasting musculoskeletal pain either causing or threatening to cause work disability. The neck-pain patients were also referred by general practitioners and specialists.

The study was given advance approval by the Regional Committee for Medical and Health Research Ethics of South-Eastern Norway (2017/783). Participation was based on written informed consent.

2.2 | Subjects

Consecutive patients with persistent dizziness or neck pain at the two clinics were included over a 1-year period. At the ENT-clinic, acute hospitalized patients were thus excluded. The secondary complaint, whether dizziness or neck pain, had to have been present over the last 14 days. The participants had to be between 18 and 67 years old. Patients with language barriers to filling in the questionnaires were excluded. As this study was part of a larger project, examining balance, patients with orthopaedic or neurologic diseases known to affect balance, such as stroke, peripheral neuropathy, hip or knee replacement or severe rheumatic disorders, were excluded. As the ENT clinic is a quaternary referral centre for patients with diving-related inner ear disorders and vestibular schwannomas, these conditions were excluded for the purpose of precluding bias. The patients were divided into three groups. The dizzy subjects at the ENT-clinic were divided into dizzy patients with complaints of neck pain (DN) over the last 14 days and patients with dizziness only (DO) and no neck complaints. The third group consisted of consecutive patients from the outpatient spine clinic whose primary complaint was neck pain, but who also reported complaints of dizziness (ND) over the last 14 days.

A total of 47 healthy controls were included and recruited among the hospital staff for the physical tests. They had to be between 18 and 67 years old, without neck pain and not suffer from any known vestibular pathology, orthopaedic or neurological diseases affecting balance during the previous three months.

2.3 | Data collection

2.3.1 | Questionnaires

The questionnaires collected data regarding the onset of dizziness, triggering events, time-course, type of dizziness, accompanying symptoms, age and gender. We assessed the severity of dizziness symptoms using a validated Norwegian version of the Vertigo Symptom Scale-Short form (VSSsf). The VSSsf has two subscales, with eight items relating to vertigo balance (VSSsf-V) and seven items relating to autonomic-anxiety symptoms (VSSsf-A). The main score ranges from 0 to 60, and a higher score indicates a more severe problem (Wilhelmsen, Strand, Nordahl, Eide, & Ljunggren, 2008).

2.3.2 | Physical tests

Cervical active range of motion was measured using a cervical range-of-motion device (CROM 3, Performance Attainment Associates, USA). The patients sat at an angle of 90° in both hip and knees and with their feet resting on the floor without leaning against the back of the chair. The CROM 3 was placed on the top of the head, and the patients were asked to move their head as far as possible within the limits of pain in the six cervical motions: flexion, extension, right and left lateral flexion and right and left rotation. Two trials of all motions were performed. For each trial all six motions were measured once, and the mean values of the trials were used in the analysis.

Neck pressure pain thresholds (PPTs) were measured in all subjects in the prone position. A Wagner FDX-25 digital force gage (Wagner Instruments, Greenwich, CT) with a linear response between 0 and 1,300 kPa and a 1 cm^2 round rubber tip was used to apply pressure to the upper four standardized and defined ACR tender points (Wolfe et al., 1990): bilaterally suboccipital, 2 cm lateral to the spinous process of the axis (upper neck) and bilaterally at the anterior aspects of the intertransverse space at C5–C7 (lower neck). The patient was instructed to immediately signal when the pressure sensation changed from no pain to a pain sensation, and the score was noted. A lower score indicates a lower tolerance of pain. Three measurements were recorded at each site, starting left at the suboccipital site and ending right on the intertransverse space at C5–C6. Because the last two measurements have been found to have the highest reliability (Knapstad et al., 2018), we used the mean of those measures in further analysis.

Last, we conducted two tests of global physical function. The American College of Rheumatology's (ACR) nine bilateral tender points (Wolfe et al., 1990) were used to assess the level of generalized pain. The tester provided a gradually increasing pressure stopping at approximately 4 kg. The patient was told to say "yes" if they experienced pain or "no" if they experienced only discomfort at each point after pressure was applied. The pressured was applied one time for each of the different points.

Flexibility is one of the subscales of the Global physiotherapy Examination-52 (GPE-52) that reflects the flexibility of the spine as well as the ability to relax. This subscale has proven to be able to differentiate healthy participants from patients with generalized and localized pain (Kvale, Ljunggren, & Johnsen, 2003).

2.4 | Procedure sequence

A study nurse at both centres recruited the patients on the same day as they appeared for their appointment at the clinic. Patients filled in the questionnaires prior to the physical tests. The tests were performed by experienced physiotherapists who were familiar with the tests. Prior to the study, the examiners had two sessions and then an additional session after 5 months for calibration of the different tests to ensure consistency.

2.5 | Statistical analysis

Categorical variables were reported as frequency and percentages and the continuous variables as mean and standard deviation. Chi-square tests (X^2) were used for the initial examination of variables (binary) independently associated with the different groups. Fisher exact was used when expected cell count was <5. The analysis was supplemented with Cramer's *V* test as a measure of strength of association. Additionally, follow-up comparison between groups of the independent variables was conducted with a univariate logistic regression with groups as the dependent variable. Differences between physical tests, the VSSsf and the different groups were examined with simple and multiple multinomial logistic regression where the DO group was used as reference category. Age and sex were used as adjustment variables as they are known to influence physical function. The alpha level was set to 0.05. A total of 14 patients did not fill out the survey due to lack of time on the day of inclusion. In the surveys, missing variables were <10%. Missing data were found to be Missing Completely at Random (Little's test, $p > 0.05$) and thus deleted listwise prior to analysis. Analyses were conducted in Stata14, StataCorp. 2015. *Stata Statistical Software: Release 14*. College Station, TX: StataCorp LP.

3 | RESULTS

The study included 100 patients in the DO group and 138 patients in the DN group, from both the ENT department, and 55 patients in the ND group from the outpatient spine clinic and 47 healthy controls. Descriptive statistics are reported in Table 1.

3.1 | Dizziness characteristics

Table 2 shows the comparison of dizziness characteristics between the three patient groups (DO, DN and ND). Characteristics of onset, duration and type of dizziness, as well as accompanying symptoms, discriminated between the three groups (Table 3).

Table 3 shows that both neck pain groups were more likely to have a gradual onset of dizziness, dizziness resembling presyncope/light-headedness and visual disturbances compared with the DO group. The ND group was more likely to report headache and less likely to report spinning dizziness, vomiting and having a constant dizziness, compared with the two other groups. The DN group differed from the DO group in being more likely to report a rocking sensation.

Figure 1 displays the differences between VSSsf total score and the two subscores (vertigo balance and autonomic anxiety) between groups.

Using multinomial logistic regression with DO as the reference group, we found a significant association between a higher VSSsf total score (OR: 1.03, 95% CI: 1.00–1.06, $p = 0.034$) and the DN group but not to the ND group (OR: 0.98, 95% CI: 0.95–1.02 $p = 0.559$). In the vertigo-balance subscore, a lower score was associated with the ND group (OR: 0.90, 95% CI: 0.84–0.96, $p = 0.003$) but no association

TABLE 1 Descriptive statistics of the three groups with dizziness, examined at two outpatient clinics and in a group of healthy controls

Groups Variables	DO (*n* = 100)	DN (*n* = 138)	ND (*n* = 55)	Controls (*n* = 47)
Age	45.5 (11.9)	45.7 (12.4)	42.5 (11.8)	40.5 (13.7)
Gender (female)	64.0%	80.3%	83.6%	65.9%
Diabetes[a,b]	3.0%	2.9%	2.9%	2.3%
Heart disease[a,b]	2.9%	0.7%	1.8%	2.1%
Hypertension[a,b]	8.9%	14.7%	10.7%	8.5%
Migraine[a,b]	11.9%	22.8%	14.3%	2.1%
Previous neck injury[a]		10.2%	18.2%	
GPE 52-flex	4.4 (SD 1.8)	4.8 (SD 1.7)	5.4 (SD 1.6)	3.5 (SD 1.8)
ACR	5.9 (SD 5.4)	11.6 (SD 5.2)	8.6 (SD 5.0)	5.2 (SD 5.7)
PPT UN	25.6 (12.9)	19.0 (SD 9.1)	21.4 (SD 12.2)	27.7 (SD 8.6)
PPT LN	21.2 (10.0)	16.6 (SD 7.1)	18.3 (SD 9.8)	25.7 (SD 7.6)
VSSsf total	13.4 (SD 9.9)	16.3 (SD 10.3)	12.5 (SD 7.2)	
VSSsf-A	4.9 (SD 4.3)	7.4 (SD 5.4)	7.1 (SD 4.2)	
VSSsf-V	8.5 (SD 6.7)	8.9 (SD 6.2)	5.4 (SD 4.5)	

Abbreviations: DO: dizzy only: Patients without neck pain examined at an ENT Outpatient clinic; DN: dizzy patients with neck pain, examined at an ENT Outpatient clinic; ND: neck pain with dizziness from an outpatient spine clinic; GPE 52-flex: global physiotherapy examination 52-flexibility sum score; CROM: Total Cervical Range of Motion; ACR: American College of Rheumatology tender points; PPT, pressure pain threshold; UN: upper neck; LN, lower neck; VSSsf total: Vertigo Symptom Scale short form total score; VSSsf-A: Vertigo Symptom Scale short form Autonomic-Anxiety sub score; VSSsf-V: Vertigo Symptom Scale short form Vertigo-Balance sub score.
[a]Self-reported.
[b]Previously diagnosed by a medical doctor.

was found with the DN group (OR: 1.01, 05% CI: 0.96–1.05, $p = 0.623$). Last, a higher autonomic-anxiety subscore was significantly associated with both neck pain groups, DN (OR: 1.12, 95% CI: 1.05–1.19, p = <0.001) and ND (OR: 1.11, 95% CI: 1.03–1.19, $p = 0.006$).

3.2 | Physical findings

Scores of physical characteristics between groups are illustrated in Figure 2.

In the adjusted multinomial logistic regression (Table 4), we found that a lower total CROM, a higher ACR-tender point count and higher GPE-flexibility score associated significantly with both neck pain groups. A decrease in PPT in both upper and lower regions of the neck discriminated the DN from the DO group. The control group discriminated from DO with significantly with higher CROM, higher PPT in the lower neck and a lower score on the GPE 52-flexibility.

4 | DISCUSSION

This exploratory study found several associations between the presence of neck pain and clinical characteristics in patients with dizziness.

In the diagnosis of dizzy patients, the description of dizziness, although sometimes unclear and overlapping (Newman-Toker et al., 2007), is thought to be of importance. The semicircular canals are constructed for precise and rapid detection of head rotations (Halterman, 2005; Schubert & Shephard, 2014) and thus, a deficit or damage to this system often manifests as a strong sense of spinning, which is often of acute onset (Magnusson & Karlberg, 2002). Contrary to this, dizziness of cervical origin is usually thought to manifest itself as an unpleasant or vague feeling of dizziness without a strong sense of rotation (Thompson-Harvey & Hain, 2019). However, there is a lack of clinical studies reporting descriptions of dizziness of suspected cervical origin. Patients with cervicogenic dizziness seem to report a feeling of drunkenness/light-headedness more often than patients with benign paroxysmal positional vertigo (L'Heureux-Lebeau, Godbout, Berbiche, & Saliba, 2014), and less likely to report spinning vertigo than patients with benign paroxysmal positional vertigo and other vestibular disorders (L'Heureux-Lebeau, Godbout, Berbiche, & Saliba, 2014; Thompson-Harvey & Hain, 2019). Interestingly, this study found that both neck pain groups were more likely to report light-headedness, which has been suggested to be related to neck-related dizziness (Devaraja, 2018; Wrisley, Sparto, Whitney, & Furman, 2000). Patients in the DN group were more likely to report a rocking sensation. A rocking or floating sensation, although describing illusory movement, has previously been associated with chronic types of dizziness (Fife & Kalra, 2015; Iglebekk, Tjell, & Borenstein, 2013) rather than ongoing vestibular dysfunction. Patients in the ND group were less likely to report a spinning type of dizziness, compared with those in the DO group. Furthermore, both groups with neck pain were more likely to report a gradual onset of dizziness. As neck pain is often of long duration (>3 months; Hurwitz, Randhawa, Yu, Côté, & Haldeman, 2018), a gradual onset of dizziness could be due to an accumulation of cervical sensory disturbances over time. Both neck pain groups described visual disturbances as an accompanying symptom. Possibly, neck disorders leading to pain might be associated with disturbances of cervical proprioception causing a mismatch between the vestibular-ocular and cervical-ocular reflexes, that usually work in conjunction to stabilize gaze (de Vries et al., 2016). In the ND group, more than 70% of the patients reported headache. A previous study found a higher prevalence of headache in chronic neck pain patients with dizziness than in those with neck pain only (Yahia et al., 2009). Additionally, headache has previously been suggested to be related to dizziness of

TABLE 2 Comparison of dizziness-related characteristics between three groups of dizzy patients with and without neck pain examined at two outpatient clinics

Groups	DO		DN		ND		X^2	Cramer's V	p
Variables	n	%	n	%	n	%			
Onset									
Acute	66	70.2	66	55.0	16	30.2	21.91	0.29	<0.001*
Gradual	26	27.6	58	48.3	34	64.2	19.80	0.27	<0.001*
Triggering event									
Head movement	12	12.9	22	17.9	8	15.1	1.01	0.06	0.603
Stress	18	19.4	27	22.1	18	34.0	4.24	0.13	0.120
Head injury[a]	0	0	4	3.4	3	5.7		0.13	0.100
Infectious disease[a]	3	3.23	5	4.1	0	0		0.09	0.466
No apparent cause	54	58.1	63	52.9	23	43.4	2.92	0.10	0.233
Time course									
Short attacks (seconds)	27	29.0	28	22.8	20	27.8	4.22	0.13	0.121
Long attacks (>20 min)	14	15.0	30	24.4	7	13.21	4.42	0.13	0.109
Constant	25	26.9	29	23.8	2	3.8	12.03	0.21	0.002*
Type of dizziness									
Spinning	57	61.3	68	55.3	16	30.2	13.83	0.23	0.001*
Rocking	33	35.5	67	55.5	21	39.6	8.48	0.18	0.014*
Unsteadiness	45	48.4	72	58.5	24	45.3	3.54	0.11	0.171
Presyncope/light-headedness	5	13.8	25	20.3	10	18.9	10.18	0.19	0.006*
Other	18	19.4	20	16.3	12	22.64	1.05	0.06	0.591
Accompanying symptoms									
Nausea	56	60.2	74	60.2	27	50.9	1.49	0.07	0.473
Headache	27	29.0	48	39.0	41	77.4	33.69	0.35	<0.001*
Light sensitivity	20	21.4	36	29.3	17	32	2.29	0.09	0.319
Tinnitus	26	28.3	49	39.8	17	32.1	3.25	0.11	0.194
Vomiting	16	17.4	19	15.5	1	7.1	7.74	0.17	0.021*
Visual disturbance	5	5.5	20	16.8	36	13.7	8.39	0.18	0.015*
Sound sensitivity	17	18.5	27	21.9	16	30.2	2.67	0.10	0.262

Abbreviations: DO: dizzy only: Patients without neck pain examined at an ENT Outpatient clinic; DN: dizzy patients with neck pain, examined at an ENT Outpatient clinic; ND: neck pain with dizziness from an Outpatient spine clinic; X^2: Chi-square statistics (3 × 2); *p*: *p*-value; *n*: number of positive (yes) responses.

[a]Fisher exact test.

*Statistically significant with *p*-value <0.05.

cervical origin (Reiley, Vickory, Funderburg, Cesario, & Clendaniel, 2017; Wrisley, Sparto, Whitney, & Furman, 2000). With more than 70% of the ND patients reporting headache, it is possible that some of these met the criteria for vestibular migraine. Further, 14.3% in the ND group and 23% in the DN group reported having migraine. Migraine is an important cause of both dizziness and headache. Whether it could also be responsible for some of the cases of neck pain would make an interesting topic for further study.

Both groups with neck pain scored higher on the autonomic/anxiety subscale of the VSSsf compared the DO group, suggesting an increased prevalence of these symptoms when neck pain is present. This is of particular interest because anxiety has been found to be a predictor for disability (Mahoney, Edelman, & Cremer, 2013). The DN group reported the highest total score on VSSsf, indicating the highest symptom severity among the three groups. Pain could perhaps work as an exacerbator for dizziness as it may alter cervical proprioception (Thompson-Harvey & Hain, 2019) even when the neck disorder is secondary to the dizziness.

Studies have found patients with dizziness to have physical impairments (Iglebekk, Tjell, & Borenstein, 2013; Kvale, Wilhelmsen, & Fiske, 2008). Our study showed that patients in the DO group had increased physical impairment, including decreased CROM, neck and shoulder flexibility and a lower PPT in the neck, compared with healthy controls, indicating that patients with only dizziness (and not

TABLE 3 Univariate logistic regression of dizziness characteristics between groups

Groups	DN vs DO			ND vs DO			ND vs DN		
Variables	OR	95% CI	*p*	OR	95% CI	*p*	OR	95% CI	*p*
Onset									
Acute onset	0.51	0.29–0.92	0.024*	0.18	0.08–0.38	<0.001*	0.35	0.17–0.70	0.003*
Gradual onset	2.44	1.37–4-35	0.002*	4.68	2.27–9.62	<0.001*	1.91	0.98–3.72	0.056
Time course									
Constant	0.84	0.45–1.57	0.602	0.10	0.02–0.47	0.003*	0.12	0.02–0.54	0.006*
Type of dizziness									
Spinning	0.78	0.45–1.35	0.376	0.27	0.13–0.56	<0.001*	0.35	0.17–0.69	0.003*
Rocking	2.17	1.25–3.78	0.006*	1.19	0.59–2.39	0.619	0.54	0.28–1.05	0.072
Presyncope/Light-headedness	4.48	1.64–12.23	0.003*	4.09	1.31–12.71	0.015*	0.91	0.40–2.06	0.824
Accompanying Symptoms									
Headache	1.56	0.88–2.78	0.128	8.35	3.81–18.28	<0.001*	5.33	2.55–11.17	<0.001*
Vomiting	0.86	0.42–1.80	0.703	0.09	0.01–0.71	0.022*	0.10	0.01–0.80	0.030*
Visual disturbance	3.47	1.25–9.65	0.017*	4.50	1.47–13.80	0.008*	1.29	0.57–2.94	0.535

Abbreviations: DO, dizzy only: Patients without neck pain examined at an ENT Outpatient clinic; DN, dizzy patients with neck pain, examined at an ENT outpatient clinic; ND, neck pain with dizziness from an outpatient spine clinic; OR, Odds Ratio; CI, Confidence Intervals.
*Statistically significant with *p*-value <0.05.

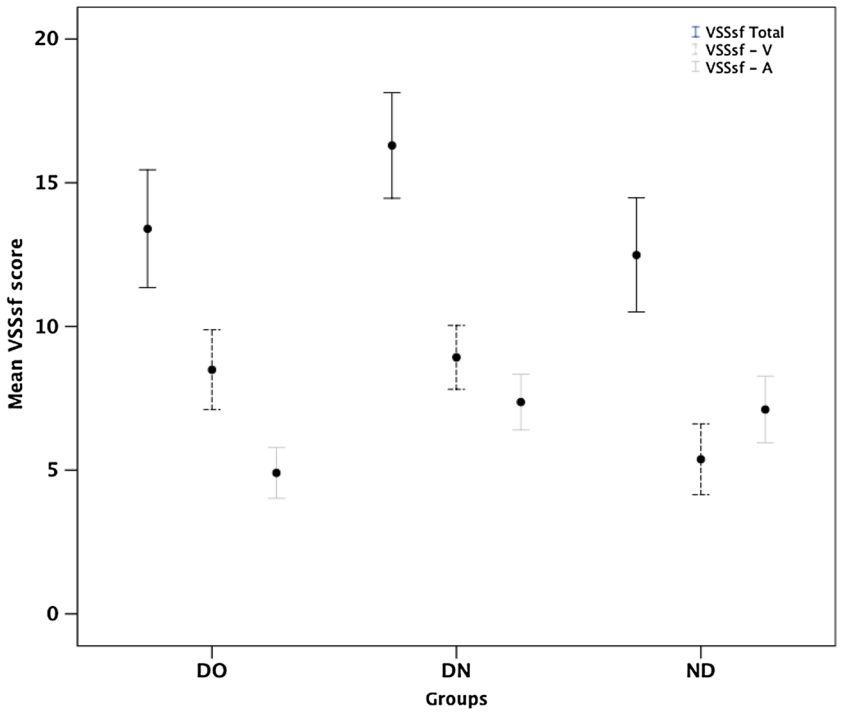

FIGURE 1 Differences between groups with error bars (95% Confidence Intervals) of the Vertigo Symptom Scale short-form (VSSsf Total), with sub-score Vertigo-Balance (VSSsf-V) and Autonomic-Anxiety (VSSsf-A). DO: dizzy only: Patients without neck pain examined at an ENT Outpatient clinic; DN: dizzy patients with neck pain, examined at an ENT Outpatient clinic; ND: neck pain with dizziness from an outpatient spine clinic

neck pain) have reduced physical function, which is usually explained by avoidance behaviour due to fear or anxiety of movement (Godemann, Schabowska, Naetebusch, Heinz, & Strohle, 2006; Lahmann et al., 2015). Both neck pain groups had increased physical impairment not only locally in the neck with reduced CROM but additionally with more generalized pain and reduced flexibility, thus suggesting that neck pain is associated with additional impairment for patients with dizziness. This may be due to increased avoidance behaviour and fear of head movements in patients with concurrent complaints. There was a trend for patients in the DN group to score highest on pain/sensitivity measures (PPT and ACR) and for the ND patients to score highest on the neck stiffness/flexibility measures (CROM and GPE-52 flexibility).

As there is a lack of clinical studies on dizziness of cervical origin, the present study was of an exploratory rather than confirmative nature. The association between different types of

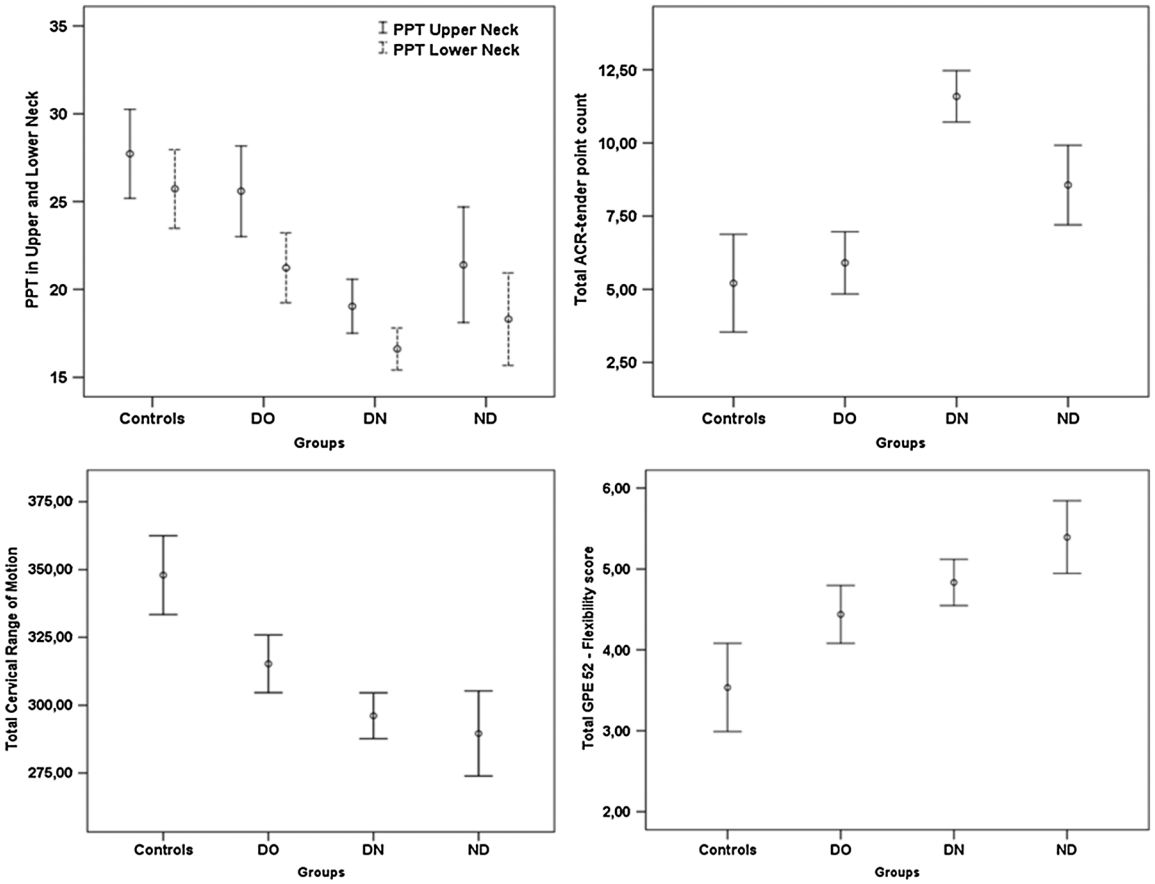

FIGURE 2 Error bars (95% confidence intervals) displaying differences between groups in physical tests. ACR: American college of rheumatology; GPE: Global physiotherapy examination; PPT: pressure pain threshold; DO: dizzy only: Patients without neck pain examined at an ENT Outpatient clinic; DN: dizzy patients with neck pain, examined at an ENT outpatient clinic; ND: neck pain with dizziness from an outpatient spine clinic

dizziness and neck pain is interesting, because a previous study (Knapstad, Goplen, Skouen, Ask, & Nordahl, 2019) found neck pain to be evenly distributed across diagnoses of peripheral and non-vestibular origin. As previous debates have focused on the premises of whether or not cervicogenic dizziness is an actual condition, it is important to consider how neck pain could influence dizziness, regardless of the origin. The two neck pain groups had similarities when compared with the group without neck pain. This is an interesting finding because it implies that patients with neck pain and dizziness have similarities irrespective of which of the two symptoms is the primary complaint. To our knowledge, this is the first clinical study on the associations between neck pain and dizziness symptoms in a larger group of patients. Instead of trying to isolate patients with dizziness of cervical origin—which is difficult due to the lack of consensus on diagnostic criteria—the approach of this study was to explore the three study populations with a priori assumption, namely, that patients with cervicogenic dizziness would be overrepresented in the two groups of dizzy patients with neck pain and underrepresented in the DO group. This explorative approach has some limitations. The populations in this study were heterogeneous. However, we examined the associations between symptoms complexes and not specific diagnoses. In addition, cross-sectional trials cannot prove causality. The findings nevertheless indicate some important symptom complexes in patients with neck disorders and dizziness that should be explored further and particularly the long-term consequences of the two conditions in longitudinal clinical studies.

5 | IMPLICATION FOR PHYSIOTHERAPY PRACTICE

Neck pain and dizziness are associated with certain dizziness symptoms and physical characteristics. Furthermore, these findings imply that neck pain may influence both dizziness symptoms and physical function. As cervical dizziness is a controversial topic, the result of this study may be helpful and could be considered when physiotherapists examine patients with concurrent complaints. The results may contribute to future longitudinal intervention studies on neck pain and dizziness.

TABLE 4 Differences in physical characteristics between groups examined with multinomial logistic regression

Variables	Crude OR	Crude 95%CI	*p*	Adjusted OR	Adjusted 95% CI	*p*
Controls vs DO						
CROM	1.013	1.005–1.021	<0.001*	1.015	1.004–1.025	0.005*
ACR	0.973	0.907–0.043	0.449	0.974	0.904–1.049	0.490
GPE 52-flex	0.757	0.619–0.925	0.007*	0.783	0.624–0.983	0.035*
PPT UN	1.01	.098–1.04	0.334	1.02	0.99–1.06	0.083
PPT LN	1.04	1.01–1.08	0.013*	1.07	1.03–1.12	0.001*
DN vs DO						
CROM	0.992	0.987–0.997	0.005*	0.985	0.978–0.992	<0.001*
ACR	1.207	1.144–1.273	<0.001*	1.208	1.142–1.279	<0.001*
GPE 52-flex	1.148	0.990–1.330	0.067	1.273	1.078–1.505	0.005*
PPT UN	0.941	0.91–0.96	<0.001*	0.94	0.92–0.97	<0.001*
PPT LN	0.93	0.90–0.96	<0.001*	0.94	0.01–0.97	<0.001*
ND vs DO						
CROM	0.990	0.984–0.997	0.004*	0.979	0.971–0.988	<0.001*
ACR	1.099	1.034–1.167	0.002*	1.083	1.015–1.156	0.015*
GPE 52-flex	1.389	1.139–1.694	0.001*	1.688	1.346–2.116	<0.001*
PPT UN	0.96	0.93–0.99	0.032*	0.97	0.94–1.01	0.227
PPT LN	0.96	0.92–1.00	0.04*	0.97	0.94–1.02	0.331

Abbreviations: CROM: cervical range of motion; ACR: American College of Rheumatology - tender points; GPE 52: global physiotherapy examination-flexibility; PPT: pressure pain threshold; UN: upper neck; LN: lower neck; DO: dizzy only: Patients without neck pain examined at an ENT Outpatient clinic; DN: dizzy patients with neck pain, examined at an ENT outpatient clinic; ND: neck pain with dizziness from an outpatient spine clinic; OR: odds ratio; CI: confidence intervals.

*Statistically significant with *p*-value <0.05.

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