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Research Article

Investigating the Relationship Between Kinesiophobia, Catastrophizing, Pain Intensity, Disability, and Gait Performance in Chronic Neck Pain

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ABSTRACT

Introduction: There is little evidence regarding the relationship between gait performance and psychological factors in people with chronic neck pain. This study evaluates gait performance in patients with neck pain and explores the relationship between gait performance and kinesiophobia, pain catastrophizing, pain intensity, and disability.

Materials and Methods: A cross-sectional study was conducted on 34 patients with chronic neck pain and 29 age- and sex-matched controls were recruited for this study. The participants performed timed up-and-go (TUG), and 10-m walk tests (TMW) with and without head-turning tests. The associations between clinical gait tests, kinesiophobia (Tampa scale of kinesiophobia (TSK), pain catastrophizing scale, pain intensity (visual analog scale), and disability (neck disability index) were assessed.

Results: People with neck pain had significant differences in the TUG, and TMW with and without head-turning tests compared to controls ($P<0.01$). Kinesiophobia and pain catastrophism were significantly correlated with TMW tests (r range=0.45 to 0.71, and 0.40 to 0.47, respectively). Pain intensity and disability were not correlated with gait tests.

Conclusion: The gait performance, as represented by TUG and TMWs test scores, altered in patients with chronic neck pain in comparison controls. Fear of motion and pain catastrophizing thoughts correlated with clinical gait test scores.

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Introduction

In recent years, knowledge regarding gait alteration in people with neck pain has grown. Previous research demonstrated reduced trunk rotation, diminished similarity index values, and an asymmetrical gait in adults with chronic neck pain [1-3]. In addition, studies reported a narrower step width, shorter step length, longer gait cycle, and slower gait speed during walking in individuals with chronic idiopathic neck pain [4-6]. Observed gait deviations in these patients increased in more challenging walking conditions. The neck pain group showed a significantly slower speed, lower cadence, and reduced variability of trunk rotation during walking with the head rotated and at the maximum speed compared to asymptomatic populations [5, 7]. These results were obtained by examining gait using three-dimensional motion analysis; however, they are expensive and not available in physical therapy clinics. There is a need for effective simple quick tools that can easily identify a decline in gait performance for people with neck pain.

The 10-m walk test (TMW) and the timed up-and-go test (TUG) are simple, quick, and reliable performance-based clinical measures that are commonly used for assessing gait speed and dynamic balance deficit during walking [8, 9]. Gait speed is a reliable measure of health and functional status. Previous studies described a 0.1 m/s reduction in gait speed as related to adverse health outcomes [10, 11]. Thus, information in these easy tests can help clinicians in planning specific treatment programs; however, there is little evidence concerning the evaluation of gait by performance–based clinical measures in people with neck pain.

Individuals who experience long-lasting neck pain often tend to have a fear of movement and catastrophic thoughts in response to pain sensations [12]. These feeling hinder their physical activity and contribute to the maintenance, recurrence, and elevated functional disability [13]. Nevertheless, there is no evidence of the correlation between fear of movement and pain catastrophizing with clinical tests of evaluation of gait performance among individuals with chronic neck pain. Therefore, this study compares gait performance in individuals with or without chronic non-specific neck pain using the performance-based clinical gait tests and determines the relationship between gait performance and kinesiophobia, pain catastrophizing, neck pain intensity, and disability.

Materials and Methods

Study participants

A total of 34 subjects with chronic neck pain and 29 controls of a similar age, sex, weight, and height were recruited from local hospitals in Ahvaz City, Iran, using the simple random sampling method between September 2022 and February 2023. The patients were included if they had non-specific neck pain, were aged between 18 and 50 years, had a history of neck pain for at least three months, and had a score of ≥10/100 on the Persian version of the neck disability index (NDI) [5]. The control group had no report of neck pain during the past six months. Meanwhile, the exclusion criteria for the two groups were having a history of trauma or surgery in the neck, cervical radiculopathy, vestibular pathology, neurological or rheumatology disorders, cognitive impairments, musculoskeletal problems affecting walking performance, and uncorrected visual or hearing problems [6]. All subjects signed the informed consent form before data collection.

Outcome measures

A general questionnaire was used to collect demographic (age, sex), and anthropometrics (height, weight, and body mass index) information of the participants. Then, gait performance, kinesiophobia, pain catastrophizing, neck pain intensity, and disability were assessed in a random order.

The TMW test is a reliable and valid measure that is commonly used to examine walking speed [14]. For this test, the participants were requested to walk at a comfortable speed through a 14-m walkway that was marked on the floor. Time was recorded when the participant passed the 10-m middle of the path by a stopwatch. Two meters at the beginning and 2 m at the end of the path were eliminated due to acceleration and deceleration. The test was done under two conditions as follows: Head facing straightforwardly and rotating the head from side to side. Each condition was repeated three times and the average speed of three trials was calculated.

TUG is a clinical test to assess gait and balance functions [15]. For this test, the participants were instructed to stand up from a chair 45 cm in height, walk 3 m at a preferred speed, turn around, and return to a seated position. It repeated three times for each participant. The time recording started with a stopwatch when the examiner said “Go” and stopped when the participant sat down on the chair. The participants used their regular footwear in both the TMW and TUG tests [16].

Tampa scale of kinesiophobia (TSK) was used to quantify fear of movement or (re)injury. It is a self-report questionnaire that has 17 items based on a 4-point Likert scale. The 17-item TSK total score ranges from 17 to 68, where the lowest score means no or negligible kinesiophobia and the higher scores indicate an increasing degree of kinesiophobia. The Persian version of TSK has been shown to have acceptable reliability and validity for measuring fear-related movement among Persian-speaking people with neck pain [17].

Pain catastrophizing scale (PCS)

It is a self-report measure that evaluates catastrophic thinking among people who experience pain. It has 13 items scored from 0 (completely disagree) to 5 (completely agree) with a total possible score of 52. A total score of >30 represents a clinically significant level of pain catastrophization [18]. Satisfactory psychometric properties of this questionnaire had been shown in the Iranian population with chronic persistent pain [19].

Pain intensity was measured by the visual analog scale (VAS). It is a 100 mm line where 0 indicates “no pain” and 100 shows “the worst pain imaginable”. The patients were asked to mark the intensity of their pain on the line.

Functional disability related to neck pain was assessed by the Persian version of NDI. It is a self-reported questionnaire, including 10 items, and each item scored from 0 to 5 value. The scoring range of that is from 0-50 and usually, the percentage of disability is stated. NDI is a reliable and valid instrument for the measurement of disability in Persian-speaking patients [20, 21].

Statistical analysis

Normal distribution of the data was determined using the Kolmogorov–Smirnov test. Independent samples t-tests and the Mann-Whitney U test, depending on data distribution, were used to compare subject characteristics and clinical gait tests between the two groups. Associations between the gait performances (TUG and TMWs), and subjective measures (TSK, PCS, VAS, and NDI) were evaluated using the Pearson (normally distributed variables) or Spearman correlation test (non-normally distributed variables). The correlations were interpreted according to Dancey and Reidy. An r value of ±1 interpreted as a perfect correlation, ±0.7 to ±0.9 showed strong, ±0.4 to ±0.6 indicated moderate, ±0.1 to ±0.3 showed weak, and 0 inferred no correlation [22]. SPSS software, version 25, was used for the statistical analysis. Statistical significance was set at the significance level of $P<0.05$.

The sample size was obtained= from 19 subjects for each group via on lime sample size calculator [23] correlation-hypothesis testing, power=80%, 10% dropout, and significance level=0.05.

Results

Demographic and clinical characteristics of neck pain and healthy groups are presented in Table 1. There was no significant difference in age, weight, height, and body mass index between the two groups.

Comparison of gait performance between the neck pain and control groups

There was a significant difference in TUG, and TMW with and without head turning (TMW with head turn) tests between neck pain and control groups ($P<0.01$). People with neck pain took more time to complete all tests when walking than controls (Table 2).

Correlation between gait parameters and subjective measures

Table 3 presents the correlations between the TSK, PCS, self-report VAS, NDI, and gait tests. The fear of motion showed a moderate negative significant correlation with TMW (r=-0.45) and a strong negative significant correlation with TMW with head-turning (r=-071). There was no significant correlation between fear of movement and TUG. Pain catastrophism was moderately significantly correlated with 10MW tests (r range=0.40 to 0.44). Pain intensity and disability were not correlated with any of the gait tests.

Discussion

This study examined the effect of neck pain on gait, using performance-based clinical measures in people with and without neck pain. To the best of our knowledge, there is a paucity of data on the assessment of gait using easy clinical tests in people with neck pain.

The results of the present study showed that neck pain affects overall gait patterns, and people with neck pain had a longer time to complete the TUG test and slower gait speed in TMW tests in comparison with healthy controls. These results are in line with published findings of others reporting that individuals with chronic neck pain have lower cadence and gait speed compared to healthy controls [2, 4-7, 21]. Differences between the study groups in gait speed could be attributed to impaired dynamic postural control of individuals with

Table 1. Baseline characteristics of the study participants

Characteristics		Mean±SD/No.		P
		Neck Pain Group (n=34)	Healthy Group (n=29)	
Demographic data	Age (y)	30.47±7.83	29.34±7.37	0.56*
	Weight (kg)	68.38±13.54	67.33±13.98	0.76*
	Height (m)	1.65±0.09	1.68±0.09	0.35**
	Body mass index (kg/m^2)	24.43±4.11	23.41±2.97	0.27*
	Sex: Men	11	9	-
	Sex: Women	23	20	
Clinical data	VAS (0-100)	40.35±0.98	N/A	-
	TSK	29.55±4.27	N/A	-
	PCS	21.47±6.46	N/A	
	Duration of neck pain (m)	21.30±15.60	N/A	-
	NDI (0-100)	36.01±6.78	N/A	-

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Abbreviations: N/A: Not applicable; TSK: Tampa scale of kinesiophobia; PCS: Pain catastrophizing scale; SD: Standard deviation; VAS: Visual analog scale; NDI: Neck disability index

*Independent samples t-test, **Mann-Whitney U test.

neck pain during walking [24]. Cervical pain, fatigue, and psychological factors alter the sensitivity of cervical mechanoreceptors in patients with neck pain. Disruption of proprioceptive afferents from the cervical region integrated with visual and vestibular systems disturbs postural control in these patients [25]. Human walking is a challenging balance task due to the need to control self-induced perturbations produced by body segments; thus, decreased gait speed might be an adaptive strategy selected by people with neck pain to compensate for their impaired dynamic balance. However, some studies found no significant differences in gait speed and cadence in the neck pain group compared to the controls [26, 27]. This inconsistency may be due to the difference between studies regarding age groups or low disability levels of individuals with neck pain.

The finding of this study showed a negative moderate to strong correlation between fear of movement and pain catastrophism with gait speed for individuals with chronic neck pain. It seems that individuals with a higher fear of movement or the tendency to magnify the pain stimulus slower their gait. Previous studies indicated that kinesiophobia and catastrophic behaviors result in changes in the somatosensory system and hinder their overall functional performance [12, 28]. In line with our results, Alsultan et al. examined the correlation between the gait speed and the neck pain intensity, level of dis-

Table 2. Mean±SD of TUG, TMW with and without head turn between two groups

Variables	Mean±SD		P
	Neck Pain (n=34)	Healthy (n=29)	
TMW (m/s)	1.21±0.13	1.34 ±0.14	<0.01
TMW with head rotation (m/s)	1.02±0.10	1.17±0.15	<0.01
TUG (s)	10.34±1.25	9.07±0.82	<0.01

TMW: 10-meter walk test; TUG: Time up and go.

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Table 3. Correlation coefficient of variables in patients with chronic neck pain

Variables	TSK		PCS		VAS		NDI	
	r	P	r	P	r	P	r	P
TUG	-0.26	0.12	-0.27	0.11	-0.27	0.11	-0.13	0.44
TMW	-0.45	0.04	-0.40	0.01	-0.30	0.07	-0.15	0.36
TMW with head turn	-0.71	<0.01	-0.44	<0.01	-0.13	0.45	-0.10	0.54

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Abbreviations: TMW: 10-meter walk test; TUG: Time up and go; TSK: Tampa scale of kinesiophobia; PCS: Pain catastrophizing scale; VAS: Visual analog scale; NDI: Neck disability index.

ability, and fear of movement in people with neck pain and demonstrated a significant moderate negative correlation between gait speed and fear of movement in people with chronic neck pain [7].

Our results showed the absence of a relationship between clinical gait test scores with pain severity, and disability. Some studies are in agreement with the current study regarding the relationship between gait performance, pain intensity, and disability [6, 7]. On the contrary, Uthaikhup et al. reported that gait speed at maximum was moderately correlated with pain intensity and disability [6]. Shehab et al. described spatiotemporal gait parameters that were measured by the biodex gait trainer system are closely linked to pain severity and disability [4]. This inconsistency in results with the present study may be explained by more challenging walking conditions or the measurement of more sensitive gait parameters in those studies.

Conclusion

The results indicated altered overall gait patterns, as represented by TUG and TMW tests in people with chronic neck pain compared to healthy controls. We suggest that clinicians assess gait in people with neck pain. Additionally, this study showed that pain catastrophizing and fear-avoidance beliefs are related to clinical gait test scores in subjects with chronic neck pain. Thus, based on these results, psychosocial factors should be taken into consideration in the assessment and management of patients with chronic neck pain.

Study limitations

This study faced some limitations that need to be considered. The participants in the neck pain group were non-specific neck pain with mild pain, thus, the findings of this study cannot be generalized to other neck pain groups for example neck pain with moderate and severe pain. Due to the cross-sectional nature of the present study, we could not determine cause and effect. It is suggested that longitudinal study design be considered in future studies.

Ethical Considerations

Compliance with ethical guidelines

This study was approved by the Ethics Committee of Ahvaz Jundishapur University of Medical Sciences (Code: IR.AJUMS.REC.1400.639). We obtained informed consent from all participants in the study

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Authors' contributions

Conceptualization and study design: Maryam Saadat, Saiedeh Monjezi, Masumeh Hessam, Mohammad Mehravar and Mersad Ery; Data collection: Mersad Ery, and Negar Amirabadi; Data analysis: Mohammad Mehravar; Writing the original draft: Maryam Saadat; Final approval: All authors.

Conflict of interest

The authors declared no conflict of interest.

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