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INVESTIGATION OF CERVICAL JOINT POSITION SENSE IN PATIENTS WITH THORACIC OUTLET SYNDROME: A PILOT STUDY

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ABSTRACT

Purpose: Thoracic Outlet Syndrome (TOS) is a common compressive lesion in the cervico-thoracic region. Although extremity involvement is known, cervical involvement has not been investigated. Our study was planned to evaluate the cervical joint position sense in TOS and to investigate its relationship with TOS symptoms.

Method: Thirteen individuals with TOS (10 women, 3 men, age: 26±4.73) and 13 healthy individuals (11 women, 2 men, age: 25.8±4.18) were included in the study. Cervical joint position sense of all participants was measured. Tampa Kinesiophobia Scale, Toronto Alexithymia Scale, and Neck Disability Index scores of individuals with TOS were recorded. Pain intensity during activity was measured with the Visual Analogue Scale (VAS) and the symptom duration was recorded.

Results: The VAS score of patients with TOS was 5.4±2.69, and symptom duration was 5.03±2.93 years. There was no difference between the cervical joint position sense of individuals with TOS and healthy individuals (right rotation (p=0.817), left rotation (p=0.209), right lateral flexion (p=0.248) and left lateral flexion (p=0.457). The kinesiophobia of individuals with TOS was 37.69±7.9, alexithymia was 44.53±13.5, and disability score was 14.61±5.45. A positive correlation (r=0.670, p=0.012) was found between kinesiophobia and alexithymia in individuals with TOS.

Conclusion: Cervical joint position sense has not affected in TOS patients. The results need to be evaluated in a larger sample size. The relationship between alexithymia and kinesiophobia may be the result of a long symptom duration. We think that detailed studies on chronic pain in patients with TOS are needed.

Keywords: Thoracic outlet syndromes, proprioception, chronic pain

ÖZET

Amaç: Torasik Çıkış Sendromu (TÇS) serviko-torakal bölgede sık görülen bir kompresif lezyondur. Ekstremite etkilenimi bilinmesine rağmen servikal bölge etkilenimi araştırılmamıştır. Çalışmamız, TÇS'de servikal eklem pozisyon hissinin değerlendirilmesi ve TÇS semptomlarıyla ilişkisini araştırmak amacıyla planlandı.

Yöntem: Çalışmamıza TÇS'li 13 birey (10 kadın, 3 erkek, yaş: 26±4,73) ve sağlıklı 13 birey (11 kadın, 2 erkek, yaş: 25,8±4,18) birey dahil edildi. Tüm katılımcıların servikal eklem pozisyon hissi ölçüldü. TÇS'li bireylerin Tampa Kinezyofobi Ölçeği, Toronto Aleksitimi Ölçeği, Boyun Özürlülük İndeksi skorları kaydedildi. Aktivite sırasındaki ağrı şiddeti Görsel Analog Skalası (GAS) ile ölçüldü ve semptom durasyonları belirlendi.

Bulgular: TÇS'li hastaların GAS skoru 5,4±2,69, semptom durasyonu 5,03±2,93 yıldı. TÇS'li ve sağlıklı bireylerin servikal eklem pozisyon hissi arasında fark bulunmadı (Sağ rotasyon (p=0,817), sol rotasyon (p=0,209), sağ lateral fleksiyon (p=0,248) ve sol lateral fleksiyon (p=0,457)). TÇS'li bireylerin Tampa Kinezyofobi Ölçeği skoru 37,69±7,9, Toronto Aleksitimi Ölçeği skoru 44,53±13,5, Boyun Özürlülük Ölçeği skoru 14,61±5,45 idi. TÇS'li bireylerde Tampa Kinezyofobi Ölçeği ve Toronto Aleksitimi Ölçeği arasında pozitif yönde (r=0,670, p=0,012) ilişki bulundu.

Sonuç: TÇS hastalarında servikal eklem pozisyon hissi etkilenmemiştir. Sonuçların daha büyük örneklem büyüklüğünde değerlendirilmesi gerekmektedir. Aleksitimi ve kinezyofobi ilişkisi uzun semptom durasyonunun bir sonucu olabilir. TÇS hastalarında kronik ağrı ile ilgili detaylı araştırmaların yapılması gerektiğini düşünüyoruz.

Anahtar kelimeler: Torasik outlet sendromu, propriyosepsiyon, kronik ağrı

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INTRODUCTION

Thoracic outlet syndrome (TOS) is a complicated disorder that arises from the compression of neurovascular elements that runs along the cervicothoracic-brachial region at the thoracic outlet. Symptoms usually appear between the ages of 20 and 50. It is more common in women. Rarely, it may also be seen in the pediatric group (1-3). Bone, fibrous and soft tissue anomalies; repeated or isolated neck traumas, imbalance between the neck and shoulder girdle muscles, upper extremity dysfunction; and rarely, pathological conditions such as tumors and osteomyelitis in the region are among the causes of TOS (1, 2, 4, 5).

Conservative treatment aims to stretch and flex the scalene muscles, ensure postural straightness, correct muscle imbalance, neural mobilization, pain control and stabilization of the cervical region (6-8). Surgical interventions aim to eliminate the pressure with treatment options such as scalenectomy, neurolysis of neural structures and excision of the 1st costa (9).

The cervical region has a complex control mechanism (10). This proprioceptive information transmitted to the central system via receptors in the cervical muscles provides neuromuscular control of the cervical region (10, 11). Cervical postural reflexes contribute to neuromuscular control with information provided by the receptors of the suboccipital muscles (rectus capitis posterior major, rectus capitis posterior minor, obliquus capitis superior and obliquus capitis inferior) that control the upper cervical region. These reflexes are cervicocolic, cervico-ocular and tonic neck reflexes. In addition to the suboccipital muscles, the splenius capitis, semispinalis capitis, longus colli and capitis also provide afferent information for cervical proprioception (12). However, the decrease in proprioceptive ability due to trauma, structural abnormalities and pain is proportional to the decrease in sensorimotor ability and causes posture disorders, muscle inhibition, muscle atrophy and loss of muscle endurance (13). Cervical joint position sense has been shown to be affected in disease groups such as cervical spondylosis, disc herniation, traumatic neck pain and whiplash injury (14-16). Muscles and neurovascular formations in the cervical region are affected in TOS. However, no study evaluating the proprioceptive function of the cervical area in TOS has been found to date. The aim of our study was to determine the possible cervical joint position sense disorder in individuals with TOS and to reveal its relationship with pain severity, kinesiophobia, disability and alexithymia. We hypothesized that cervical joint repositioning sense is impaired in individuals with TOS.

METHODS

Study Design and Subjects

The study group consisted of 13 individuals (10 females, 3 males) diagnosed with TOS who applied to Hacettepe University Faculty of Physical Therapy and Rehabilitation, Hand Surgery Unit, and the control group consisted of 13 individuals (11 females, 2 males) without symptoms who volunteered. Consent forms were collected from all participants involved in the study. TOS was diagnosed by a thoracic surgeon after physical examination and computed tomography angiography.

The inclusion criteria for the study group were having a diagnosis of TOS and symptoms (pain, paresthesia, muscle atrophy) for more than 6 months, age range of 18-60 years, volunteering to participate in the study and adequate level of cooperation.

Exclusion criteria were having one of the accompanying pathologies (cervical disc problems, fibromyalgia, rotator cuff problems, diabetes, neoplastic processes).

For the control group, the inclusion criteria were not having a pathology involving the shoulder and neck region, not having chronic pain, volunteering to participate in the study, adequate level of cooperation, and age range of 18-60 years.

Data Collection

In the study group, pain and cervical joint position sensation were measured and Neck Disability Index, Tampa Kinesiophobia Scale, Toronto Alexithymia Scale were applied. In the control group, cervical joint position sensation was measured.

Cervical Joint Position Sensation Assessment: To assess cervical joint position sense, a laser pointer mounted on a headband and a target board with x-y coordinate planes marked at 1 cm intervals were used. Subjects sat 90 cm away from the target board with their hips, knees and ankles at 90 degrees and were asked to be in a natural resting head position. A headband was applied and the laser spot was placed at the center point on the target board. They were then directed to move their head with their eyes closed and bring the laser back to the starting point. (Figure 1). The difference was recorded in cm. This procedure was performed 5 times and averaged. The same procedure was repeated for cervical lateral flexion and rotation movements. A difference of 7.1 cm or more indicated deterioration in the sense of cervical position (11).

Figure 1. Cervical joint position sensation measurement starting position, rotation, lateral flexion

Pain Intensity: The Visual Analog Scale (VAS) is an assessment used in the clinic to determine the severity of pain (17). Perceived pain level was measured in VAS. Pain intensity during activity was questioned.

Kinesiophobia: The Tampa Scale of Kinesiophobia is a 17-question questionnaire measuring kinesiophobia developed by Miller and published by Vlaeyen in 1995. The higher the score on the scale, the higher the level of kinesiophobia. The ICC value of the scale was 0.806 (95% CI = 0.720-0.867). Yılmaz et al. showed that the scale was valid and reliable in Turkish (18).

Disability: The Neck Disability Index was created to assess disability in daily life due to neck pain, includes parameters of pain intensity, self-care, concentration, weightlifting, reading, working, driving, headache, sleep and rest. The ICC value of the scale is 0.979 (95% CI = 0.968-0.986). Telci et al. showed that the scale was valid and reliable in Turkish (19).

Alexithymia: The Toronto Alexithymia Scale consists of 20 items and each question has a value between 1 and 5 points. As the number value increases, the severity of alexithymia increases. A score lower than 51 indicates no alexithymia, while a score higher than 61 indicates a high level of alexithymia. Güleç et al. showed that the scale was valid and reliable in Turkish (20).

Statistical Analysis

Descriptive analyses were presented using median, minimum/maximum values, mean and standard deviation, The conformity of the variables to normal distribution was calculated by visual (histogram and probability graphs) and analytical methods (Kolmogorov-Smirnov, Shapiro-Wilk tests). Since joint position sense values were not normally distributed, nonparametric tests were performed to compare the study and control groups. Furthermore, Spearman's rho was utilized to explore the connection between TOS symptoms and joint position sense values. Type 1 error level was taken as 5% for statistical significance. The interpretation of the correlation analysis was as follows: 0.00 to 0.25 indicates a 'very weak' correlation, 0.26 to 0.49 indicates a 'weak' correlation, 0.50 to 0.69 indicates a 'moderate' correlation, 0.70 to 0.89 indicates a 'high' correlation, and 0.90 to 1.00 indicates a 'very high' correlation. SPSS version 20.0 was used for analysis.

RESULTS

The mean ages of the individuals in the control and study groups were 25.8±4.18 years and 26.0±4.73 years, respectively. The symptom duration of the individuals in the study group was 5.03±2.93 years.

Tampa Kinesiophobia Scale, Toronto Alexithymia Scale, Neck Disability Index and VAS activity scoring are given in Table 1.

Table 1: Sociodemographic characteristics of participants

	Study Group Mean±SD	Control Group Mean±SD
Age (years)	26.0±4.73	25.8±4.18
Gender (Female n(%))	10 (76.9%)	11 (84.6%)
Symptom Duration (years)	5.03±2.93	-
Tampa Scale of Kinesiophobia	37.69±7.9	-
Toronto Alexithymia Scale	44.53±13.5	-
Neck Disability Index	14.61±5.45	-
VAS Activity (cm)	5.4±2.69	-

SD: Standard Deviation

There was no statistical difference between the control and study groups in terms of cervical joint position sensation ($p>0.05$) (Table 2).

In the study group, we found a positive moderate correlation ($r=0.670$, $p=0.012$) between Tampa Scale of Kinesiophobia and Toronto Alexithymia Scale scores. No significant correlation was found between Neck Disability Index, Tampa Kinesiophobia Scale, Toronto Alexithymia Scale and cervical joint position sense (right/left rotation, right/left lateral flexion) ($p>0.05$). The results are shown in Table 3.

DISCUSSION

Our study was conducted to evaluate cervical joint repositioning sense in patients diagnosed with TOS and to determine the relationship between cervical position sense and TOS symptoms. Cervical joint position sense, neck disability level, pain, kinesiophobia and alexithymia were evaluated. Cervical joint position sense was similar in the study and control groups. While pain intensity was moderate in patients with TOS, there was no correlation between cervical joint position sense and pain intensity. Although patients with TOS have mild to moderate disability, there is no correlation with cervical joint position sense. There was a positive correlation between alexithymia and kinesiophobia only in TOS patients.

When cervical joint position sense was compared between TOS patients and healthy subjects, it was found to be similar to that of the control group. Shortening and loss of elasticity of superficial cervical flexors may cause compression of neurovascular components at the thoracic outlet (21). The cervical region contains a high density of muscle spindles and mechanoreceptors compared to other body regions, especially in the intervertebral muscles and deep cervical muscles. Structural changes in the muscles of the cervical region, degenerative changes in the capsuloligamentous structures and mechanoreceptors could have caused impaired joint position sensation in TOS.

Table 2. Comparison of Cervical Joint Position Sensation Between Groups

	Study Group	Control Group	p
Cervical Joint Position Sensation/Right Rotation (cm)	7.16±2.73	6.69±1.77	0.817
Cervical Joint Position Sensation/Left Rotation (cm)	9.43±3.32	7.53±2.14	0.209
Cervical Joint Position Sensation/Right Lateral Flexion (cm)	7.66±3.01	6.31±2.84	0.248
Cervical Joint Position Sensation/Left Lateral Flexion (cm)	6.88±3.05	6.23±2.51	0.457

*Mann Whitney-U Test, Values are given as Mean±SD. SD: Standard Deviation

Table 3. Relationship between Cervical Joint Position Sensation and Kinesiophobia, Alexithymia and Neck Disability

			CJPS (cm)				TSK	TAS	NDI
			Right R.	Left R.	Right LF.	Left LF.			
CJPS (cm)	Right R.	r	1	0.339	0.052	0.267	-0.152	-0.006	0.058
		p	0	0.09	0.801	0.188	0.621	0.986	0.851
	Left R.	r		1	0.293	0.056	-0.187	-0.209	0.003
		p		0	0.146	0.787	0.54	0.493	0.993
	Right LF.	r			1	0.4	0.16	-0.05	0.392
		p			0	0.043*	0.602	0.872	0.647
	Left LF.	r				1	-0.008	0.278	-0.141
		p				0	0.979	0.358	0.647
TSK		r					1	0.67	0.541
		p					0	0.012*	0.056*
TAS		r						1	0.334
		p						0	0.264
NDI		r							1
		p							0

*Spearman Correlation Test, CJPS: Cervical Joint Position Sensation; LF: Lateral Flexion; NDI: Neck Disability Index; R: Rotation; TAS: Toronto Alexithymia Scale; TSK: Tampa Scale of Kinesiophobia

The inclusion criterion for control participants in our study was the presence of healthy individuals without symptoms. Even if the participants included in the control group were asymptomatic, they could have a pathology affecting the joint position sense of the cervical region.

In our study, pain severity was moderate according to the visual analog scale and neck disability severity was mild to moderate according to the neck disability index. There was no relationship between cervical joint repositioning and pain intensity and neck disability. Although the patients in our study had chronic pain, there was no relationship between pain and joint position sense. There may be several explanations for this: The localization of pain in TOS patients is very wide including shoulder, arm, axillary region, chest, cervical, scapular, occipital region (22). The wide range of pain areas and long symptom duration in patients may have caused chronic adaptation processes to occur in position sense and kinesthesia functions. In this chronic condition, joint position sense may have been affected independently of pain intensity. In our study, there was no relationship between cervical reposition and neck disability-pain scores. In the literature, the relationship between joint position sense and pain intensity has been evaluated in many studies and no clear relationship has been shown between them. Lee et al.'s research found no link between pain intensity and joint position sense (23). In the study by Reddy et al. on cervical spondylosis, a correlation was discovered between joint position sense and pain intensity (24). In contrast, Zoete et al. found no relationship between neck pain intensity, cervical sensorimotor control and disability in their study in patients with idiopathic neck pain (25). They proposed that this result could be attributed to the differing pathophysiological mechanisms underlying idiopathic neck pain compared to traumatic neck pain. Sofia et al.'s study on adolescents with idiopathic neck pain similarly found no connection between pain intensity and cervical joint position sense (26). When we look at all these studies, the fact that pain intensity is a variable factor may explain the reason for these contradictory results. In addition, pain intensity was evaluated with scales such as VAS and 5-point Likert type in the above studies. The fact that these scales are patient feedback and subjective may lead to variable results about pain intensity. Therefore, a relationship between pain data and function data may not have been found.

One of the significant findings of our study was the linear relationship between alexithymia and kinesiophobia scores in patients with TOS. Recent studies have shown that there are structural and functional changes in the somatosensory cortex in chronic pain (27, 28). The amygdala is a part of the pain neuromatrix involved in sensory processing and memory and

has been found to be involved in alexithymia and kinesiophobia (29, 30). In line with this information, chronic pain involvement in patients with TOS should be examined in a broader perspective.

Limitation

Our study has some limitations. The study should have been conducted using a larger sample size. In addition, joint position sense assessment could have been measured more objectively using a technology-based method such as an infrared camera, magnetic tracking or virtual reality systems. Finally, healthy individuals included in the control group could have been evaluated for postural disorders.

CONCLUSION

In our study, we did not find any loss of cervical joint position sense in patients with Thoracic Outlet Syndrome compared to the healthy control group. The association of alexithymia and kinesiophobia in patients with TOS suggests that disease-related affectivity is associated with chronic pain. We need future studies to evaluate the relationship between chronic pain and functional parameters in TOS with more objective methods.

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