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Association Between Forward Head Posture and Scapular Dyskinesis in Patients with Non-Specific Chronic Neck Pain

Nonspesifik Kronik Boyun Ağrısı Olan Hastalarda Baş Önde Postür ile Skapular Diskinezi Arasındaki İlişki

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ABSTRACT Objective: The role of scapula on the shoulder problems is well-established and scapular dyskinesis (SD) has been evaluated especially in sports involving overhead activities. However no study have evaluated the connection between abnormal neck posture and scapula. The study aimed to found an association between 2 different postural abnormalities in which axioscapular muscles affected. **Material and Methods:** According to the craniovertebral angle, 90 non-specific chronic neck patients with forward head posture (FHP) and 90 non-specific patients with chronic neck pain with normal posture conducted in the study. SD test was performed to investigate the presence of SD on both groups. Neck Disability Index (NDI) was used to assess neck-related disability and Visual Analog Scale (VAS) was used to assess neck pain. **Results:** In the FHP group, SD diagnosed (9.44%) nearly two times more of normal posture group (4.44%). Twenty five (13.8%) patients were diagnosed with SD with chronic neck pain totally. While the medial margin type SD was most common in the FHP group, the inferior angle type SD was most common in the control group. This study found high risk for SD in FHP group compared to the normal group (odds ratio 1.23, 95% confidence interval, 0.87-1.61; p=0.003). The study found no significant difference between groups compared to NDI and VAS (p=0.102, p=0.285 respectively). **Conclusion:** There is a high prevalance of SD in chronic neck pain patients with FHP. SD should be evaluated in chronic neck pain, especially with abnormal posture.

Keywords: Forward head posture; neck pain; posture; scapular dyskinesis

ÖZET Amaç: Omuz problemlerinde skapulanın rolü iyi bilinmektedir, skapular diskinezi (SD) özellikle baş üstü aktiviteleri içeren sporlarda değerlendirilmiştir. Ancak hiçbir çalışma baş önde postür (BÖP) bozukluğu ile skapula arasındaki bağlantıyı değerlendirmemiştir. Çalışmamızda, aksiyoskapular kas gruplarının etkilendiği 2 farklı postüral anormallik arasında bir ilişki bulmayı amaçladık. **Gereç ve Yöntemler:** Kraniovertebral açı ölçülerek BÖP tanısı alan 90 nonspesifik kronik boyun hastası ve normal postürlü olarak değerlendirilen 90 nonspesifik kronik boyun hastası çalışmaya alındı. Her iki grupta da SD varlığını araştırmak için "SD testi" uygulandı. Tüm hasta gruplarında boyunla ilgili disabiliteyi değerlendirmek için Boyun Disabilite İndeksi (BDİ) ve boyun ağrısını değerlendirmek için Görsel Analog Skalası (GAS) kullanıldı. **Bulgular:** BÖP grubu (%9,44) normal postür grubuna göre (%4,44) yaklaşık 2 kat daha fazla SD tanısı aldı. Toplam 25 (%13,8) hastaya nonspesifik kronik boyun ağrısı ile birlikte SD tanısı kondu. BÖP grubunda en sık mediyal kenar tip SD görülmüşken, kontrol grubunda en sık inferior açı tipi SD görülmüştür. Bu çalışmada, normal gruba kıyasla BÖP grubunda SD için yüksek risk bulundu (göreceli olasılıklar oranı 1,23, %95 güven aralığı, 0,87-1,61; p=0,003). Çalışmada, BDİ ve GAS açısından gruplar arasında anlamlı bir fark bulmadı (sırasıyla p=0,102, p=0,285). **Sonuç:** BÖP'lü kronik boyun ağrılı hastalarda, SD prevalansı yüksektir. Nonspesifik kronik boyun ağrısında, özellikle anormal postürde SD değerlendirilmelidir.

Anahtar Kelimeler: Baş önde postür; boyun ağrısı; postür; skapular diskinezi

Chronic neck pain is a common musculoskeletal complaint that affects nearly half of the adult population worldwide.[1] These patients with no specific cause of neck pain symptoms were defined as non-specific chronic neck pain and there is still unexplained mechanisms involved in non-specific neck

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pain as often there is no structral pathology can be found in majority of the patients.[2-4]

Forward head posture (FHP) is a forward tendency of the head with cervical spine hyperextension and is associated with elongation of sternocleidomastoid and scalen muscles.[5] Along with elongated flexor muscles, weakened and shortened trapezius, levator scapula and serratus anterior musculature can lead to extra flexor torque and permanent contraction of the dorsal cervical muscles resulting FHP.[6] FHP may change the position of scapula and decrease the ability of scapula to rotate upwardly.[7] FHP is often assosiated with shoulder problems, especially with impingement syndrome and researches have shown that FHP is significantly greater in individuals with shoulder pain when compared to healthy population. Likewise, the role of scapula on shoulder problems in over-head athletes is well-established.[8] On the other hand, the studies still search for a connection between neck pain and the scapula as they are adjacent through axioscapular muscles.[9-13]

Scapular dyskinesis (SD) is a static and dynamic movement problem of the scapula, first described by Kibler. "Floating scapula", "lateral scapular slide" or "sick scapula" are the other names given to this postural defect.[14,15] Three different types of SD are described; inferior, medial and superior. Upper and lower trapezius, serratus anterior, pectoralis minor and levator scapula muscles are affected in SD.[16] SD is often associated with shoulder problems and impingement syndrome, especially in over-head athletes.[16] A recent study showed that there is still a raised risk of shoulder pain in asymptomatic SD patients.[17]

Increased cervical and thoracic curves and a slouched posture are known to affect scapular orientation as well as shoulder muscle strength and shoulder range of motion.[18] FHP can contribute to the alterations in scapular kinematics resulting in shoulder pain.[13] Studies have shown that scapula is also associated with neck movements and postural disorders and it is important to include scapular stabilization exersises for who suffer from FHP.[12] For all these reasons, it is important to reveal the assosication between FHP and SD.

Since the affected muscles are similar, we aimed to find an association between these 2 postural problems. We also aimed to determine FHP as a risk factor for SD in chronic neck pain patients without shoulder pain.

MATERIAL AND METHODS

DESIGN AND SUBJECTS

The study was a descriptive cross-sectional design study and was approved by the Ankara Training and Research Hospital Ethics Committee with reference number 2017-03/30 (dated 05.04.2017) and followed all relevant dictates of the Helsinki Declaration as revised in 2013. All participants who signed an informed consent form were included in the study. Hundred and eighty patients with nonspecific chronic neck pain (defined as pain in the cervical region with no specific anatomopathological diagnosis with or without arm pain, for at least 3 months), and aged 18-65 years old who applied to the hospitals' outpatient clinic between May and September 2017 were included in the study. The patients were excluded if they had a specific cause of neck pain (e.g. pathology, trauma or surgical operation story of any kind around neck region, acute neck pain and inflamation), congenital postural deformities, pathology in neurogical examination or cervical provocation tests, positive impingement tests with shoulder pain, story of any kind of physical therapy past 3-month, pregnancy, and additional diseases such as torticollis, vertebrobasilar insufficiency, vertigo, chronic heart disease and hypertension. Voluntary patients who signed the proclamation form following oral information were taken into the study.

The patients were divided into 2 groups according to craniovertebral angle (CVA). Patients diagnosed with FHP constituted Group I, while patients with normal posture constituted Group II (Figure 1).

Association between FHP and SD was the primary outcome of the study which was evaluated with CVA and SD test (SDT). Secondary outcome of the present study was searching for a relationship between demographic features, disability using Neck Disability Index (NDI), pain levels using Visual Analog Scale (VAS) and SD using SDT in patients with and without FHP.

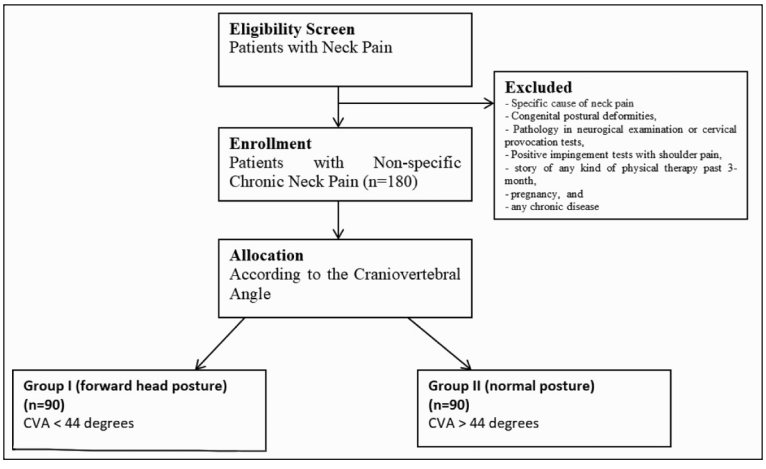

FIGURE 1: Flowchart of the study.
CVA: Craniovertebral angle.

FORWARD HEAD POSTURE

A variety of methods have been proposed in order to diagnose FHP; these include measuring the horizontal distance between tragus and spinous process of C7 vertebra, measuring the horizontal distance between tragus and shoulder, and measuring the CVA. There was no significant difference between these methods in the studies.[19-21] The most important of these methods is measurement of the CVA. CVA is defined as the angle between the horizontal line passing through spinous process of C7 vertebra and the line drawn from tragus to spinous process of C7 vertebra. If CVA is less than 44 degrees, FHP is present. FHP is often associated with mechanical neck problems. Patients with neck pain has tendency to have FHP and recent studies show that 60-85% of chronic neck pain patients have FHP.[22]

In the present study, CVA was measured using a digital camera (Canon Powershot g16, Canon Inc., Tokyo, Japan) the photographs of the patients were taken from the same distance (1 meter) and height (1.5 meters). They were asked to stand and look exactly across (Figure 2). The resting posture was tried to be provided by being told to perform the flexion and extension movements 5 times in a row. Care was taken to clearly capture the spinous process of C7 vertebra, cantus, tragus and acromion. The MB-ruler 5.1. program, Markus Bader, Berlin, Germany used for the measurements and repeated for each patient.

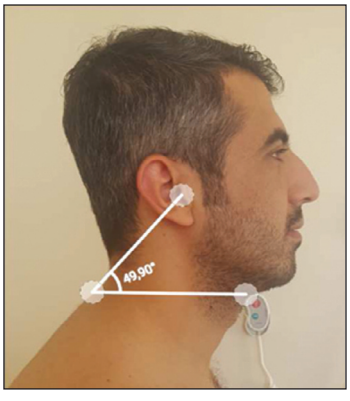

FIGURE 2: Craniovertebral angle measurement.

SCAPULAR DYSKINESIS TEST

SDT is a reliable and valid dynamic assessment method that is visually-based and clinically applicable. During SDT, the patient performs recurrent bilateral flexion and abduction movements while the examiner stands behind the patient and observes the scapulohumeral rhythm. SD is dysrhythmias during these movements (early or excessive elevation or prolapse, loss of flow during movements during shoulder lift or lowering), or winging (medial side and/or inferior angle of scapula shifting away from posterior thoracic spine).[23] Patients were asked to get undressed during the test so that the thorax was completely open. Patients were shown how bilaterally shoulder abduction and flexion movements and examination should be done. Afterwards they were told to perform bilateral shoulder abduction and flexion movements. Tests were initiated with arms of participants on side

of the body, with elbows straight and neutral rotations of shoulders. It was said that they should take their shoulders to top of their heads while elbow is extended and again back to their first positions. The examination was made 2 meters behind the patient. The patient was considered as SD when asymmetrical conditions such as abnormal movement, winging, etc., which were clearly visible on scapula during flexion or abduction, were observed (Figure 3).[24]

The scapular patterns were classified as described by Kibler. Type I was characterized by the dorsal prominent of inferior medial angle of the scapula. Type II was characterized by the dorsal prominent of entire medial border of the scapula. Type III was characterized by the elevated superior border of the scapula, and the scapula could also be anteriorly displaced from posterior thorax. Type IV was characterized by the symmetry of bilateral scapulae.[25]

NECK DISABILITY INDEX

In patients with neck pain, NDI, one of the methods measuring disability associated with disease, was used. NDI is a 10-question questionnaire developed by Vernon in 1991 that investigates how neck pain affects daily life of a patient.[26] NDI consists 10 different titles and these topics include pain severity, personal care, transportation, reading, headache, concentration, work life, driving, sleeping and recreational activities. Each division was given a raw score from 0 to 5 (0: best condition, 5: worst condition). The score can range from 0 to 50 and classifies individuals as having no disability (0-4), mild disability (5-14), moderate disability (15-24), severe disability (25-34) and complete disability (≥35). The validity and cross-cultural reliability of NDI in Turkish version was done by Telci et al. in 2009.[27]

VISUAL ANALOG SCALE

VAS is used to assess the severity of neck pain. Subject is asked to mark on a ruler which divided into equal intervals of 10 centimeter in length according to the severity of the pain felt by oneself over the last week.

STATISTICAL ANALYSIS

For statistical analysis, SPSS software, version 20.0 (IBM Corporation, Armonk NY, USA) was used. Arithmetic mean, standard deviation and frequency were calculated for descriptive statistical analyses. The normal distribution suitability of the data was examined by Shapiro-Wilk test. Comparison of two independent group averages, unpaired t-test was used for data with normal distribution and Mann-Whitney U test was used for non-normal distributional data. The homogeneity of the distribution of the two groups of nominal data was determined by Shapiro-Wilk test. Chi-square (Fisher's exact test) test was used to compare the nominal data. Pearson correlation test was used for correlation analysis. Logistic regression analysis was performed to identify the prognostic effect of multiple variables. The level of error (alpha) was defined as 0.05.

The sample size required for this study was calculated using G-Power software (version 3.1.9.3; Franz Faul, Germany). For an effect size of 0.63 with an alpha value of 0.05 and (1-α)=0.80, the sample size was calculated as 90 subjects for both groups.

RESULTS

There was no statistically significant difference in terms of demographic characteristics between two

FIGURE 3: Scapular dyskinesis test.

TABLE 1: Demographic characteristics of Group I and Group II.

		Group I (n=90)	Group II (n=90)
*Gender	Woman	72 (80%)	75 (83.4%)
	Man	18 (20%)	15 (16.6%)
*Age	38.62±11.8	37.8±11.7	
*Height (cm)	164.67±9.2	163.87±7.4	
*Weight (kg)	73.66±12	68.57±12.4	
*BMI (kg/cm^2)	27.21±4.3	25.51±4	
*Educational status	Primary school	45 (50%)	41 (45.5%)
	Middle school	9 (10%)	14 (15.5%)
	High school	15 (6.7%)	21 (23.3%)
	College	21 (23.3%)	14 (15.7%)
*Occupation	Working	29 (32.2%)	25 (27.7%)
	Retired	3 (3.3%)	4 (4.4%)
	Student	2 (2.2%)	4 (4.4%)
	Housewife	56 (62.2%)	57 (63.5%)
*Marital status	Married	72 (80%)	68 (75.5%)
	Single	18 (20%)	22 (24.5%)

*For all values p>0.05. Group I: Patients with forward head posture, Group II: Patients with normal head posture; BMI: Body mass index.

groups (Table 1). Twenty five (13.8%) of the patients were diagnosed with SD. Type 1 (inferior angle) SD was found in 12 (48%) of patients with SD, Type 2 (medial margin) SD was present in 11 (44%) and Type 3 (superior angle) SD was present 2 (8%) of patients. While 17 (68%) of the patients diagnosed with SD using SDT were in FHP group, 8 (32%) of the diagnosed patients were in the control group (Table 2).

The mean of the VAS values in FHP group was calculated as 5.75±2.5. The mean VAS in control group was 5.35±2.6. There wasn't any statistically significant difference between two groups in terms of VAS averages (p=0.322). The average of the NDI was 15.56±6.2 in the FHP group and 15.51±4.7 in the control group. There was also no statistically significant difference between the groups in terms of NDI score (p=0.777). There was no significant relationship between NDI and VAS values of both groups and CVA scores (p>0.05).

We searched for possible risk factors associated with chronic neck pain using logistic regression analyses for different types of SD and demographic features, CVAs, pain and disability assesments. We found high risk for SD in FHP group compared to the control group (odds ratio 1.23, 95% confidence interval, 0.87-1.61; p=0.003).

DISCUSSION

The present study searched to find an assosication between SD and FHP in patients with chronic neck pain, because the affected muscles are similar on both SD and FHP, and the scapula is an important bridge between shoulder and cervical spine. In this observational study, we found higher risk for SD in patients with chronic neck pain with FHP compared to the normal posture patients with chronic neck pain.

In studies conducted in recent years, as main causes of neck pain and FHP; excessive workload, postural and structural abnormalities, unsuitable posture, excessive stress can be adressed.[28,29] For this reason, FHP was associated with many other musculoskeletal and neuromuscular problems.[30] In the present study, we found a relationship between SD and FHP in patients with non-specific chronic neck pain using regression analysis. But there was no significant difference between pain and disability scores of the groups. SD presence was not a risk factor for pain and disability in these patients.

The relationship between scapula and FHP has been searched in various studies. Kataria et al. searched for scapular position changes in patients with FHP, and found altered scapular protaction.[31] In our study, we compared FHP with normal posture and we found higher risk for SD in chronic neck pain patients with a FHP. A case control study revealed that FHP related to atrophy of serratus anterior muscle

TABLE 2: Distribution of patients according to scapular dyskinesis type.

		FHP group (n=90)	Control group (n=90)	Total
Scapular dyskinesis	Inferior angle (Type I)	8 (10%)	4	12
	Medial margin (Type II)	9	2	11
	Superior angle (Type III)	0	2	2
Total	17	8	25	

FHP: Forward head posture.

which contributes scapula and shoulder problems.[32] In our study, we excluded patients with shoulder problems, future studies should evaluate the effects of both head forward posture and SD on shoulder problems.

In the literature, SD is studied for shoulder problems especially with over-head athletes.[33] But recent studies have shown that even non-asympthomatic patients can have SD and it is important that SD increases the risk of shoulder problems.[17] There are different studies in the literature that reveal the relation between SD and neck pain.[3] The incidence of SD in patients with neck pain was found to be lower than the patients with shoulder pathology.[34] We inclueded patients without any shoulder pathology, and found that FHP may be a risk factor for SD in patients with non-specific chronic neck pain.

LIMITATIONS

In our study, we included only patients with chronic neck pain. Considering the importance of the SD in shoulder problems and the existence of asymptomatic SD, we think that a study with both patients with shoulder problems and healthy controls may be more instructive in future studies.

CONCLUSION

This study was first to investigate the relationship between FHP and SD in chronic neck pain. The findings of the study suggest that FHP is a risk factor for SD. This shows that scapular movements should be evaluated in patients with clinically bad posture and scapular movement disorders should be taken into account when treatment of FHP patients is planned.

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Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

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