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ORIGINAL ARTICLE

The prevalence of scapular dyskinesia in patients with back, neck, and shoulder pain and the effect of this combination on pain and muscle shortness

Sırt, boyun ve omuz ağrısı olan hastalarda skapular diskinezi prevalansı ve bu kombinasyonun ağrı ve kas kısalığı üzerine etkisi

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Summary

Objectives: The aim of the study was to evaluate the prevalence of scapular dyskinesia in patients with neck, back, and shoulder pain and examine the variations in clinical parameters cause by this combination.

Methods: A total of 121 patients with neck, back, or shoulder pain were included in this prospective cross-sectional study. Demographic and clinical data of the patients were recorded. It was evaluated the intensity of pain with the visual analog scale (VAS), the presence of muscle shortness with muscle shortness tests, and scapular dyskinesia with the Lateral Scapular Slide Test.

Results: The prevalence of scapular dyskinesia was 41.9% in the study population. Patients were divided into groups, with or without scapular dyskinesia for evaluation, and compared. The presence of scapular dyskinesia was significantly higher in patients with back and shoulder pain ($p<0.05$). When the distribution of scapular dyskinesia pathological types was evaluated, it was found that Type 1 was the most common in the study population. No significant difference was observed in pain intensity at rest and during activity between the groups ($p>0.05$), but the VAS score at night was significantly higher in patients with scapular dyskinesia ($p<0.05$). The pectoral, latissimus dorsi, and rhomboids muscle shortness were significantly higher in the group with scapular dyskinesia ($p<0.05$).

Conclusion: The evaluation of the presence of scapular dyskinesia in a physical examination in patients with neck, back, and/or shoulder pain will be a guide for the diagnosis and treatment of pain-related problems.

Keywords: Back pain; dyskinesia; neck pain; scapula; shoulder pain.

Özet

Amaç: Bu çalışmada, boyun, sırt ve omuz ağrısı olan hastalarda skapular diskinezi prevalansının değerlendirilmesi ve bu kombinasyonun neden olduğu klinik parametrelerdeki varyasyonların incelenmesi amaçlandı.

Gereç ve Yöntem: Bu prospektif kesitsel çalışmaya boyun, sırt veya omuz ağrısı olan toplam 124 hasta dahil edildi. Hastaların demografik ve klinik verileri kaydedildi. Görsel analog skalası ile ağrı şiddeti, kas kısalık testleri ile kas kısalığı ve lateral skapular slide testi ile skapular diskinezi varlığı değerlendirildi.

Bulgular: Çalışma popülasyonunda skapular diskinezi prevalansı %41,9 idi. Hastalar değerlendirme için skapular diskinezi olan veya olmayan gruplara ayrıldı ve karşılaştırıldı. Sırt ve omuz ağrısı olan hastalarda skapular diskinezi varlığı anlamlı olarak daha yüksek bulundu ($p<0,05$). Skapular diskinezi patolojik tiplerinin dağılımı değerlendirildiğinde, çalışma popülasyonunda en yaygın tipin, tip 1 olduğu tespit edildi. Gruplar arasında istirahat ve aktivite sırasında ağrı şiddeti açısından anlamlı fark gözlenmezken ($p>0,05$), skapular diskinezili hastalarda gece görsel analog skala skoru anlamlı olarak daha yüksek saptandı ($p<0,05$). Pektoral, latissimus dorsi ve rhomboids kas kısalığının skapular diskinezi olan grupta anlamlı olarak daha yüksek olduğu belirlendi ($p<0,05$).

Sonuç: Boyun, sırt ve/veya omuz ağrılı hastalarda fizik muayenede skapular diskinezi varlığının değerlendirilmesi ağrıya bağlı sorunların tanı ve tedavisi için yol gösterici olacaktır.

Anahtar sözcükler: Boyun ağrısı; diskinezi; omuz ağrısı; sırt ağrısı; skapula.

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Introduction

Mechanical neck, back, and shoulder pain which are common musculoskeletal disorders that affect the patient's quality of life and interacts in socioeconomic problems are defined as pain in the cervical, thoracic, and shoulder regions without any underlying pathology. The muscles, joint structures, ligaments, neural and non-neural structures, and the intervertebral disc can cause mechanical neck, back, and shoulder pain.[1,2]

The scapula is the large triangular-shaped bone behind the thoracal region and an important link between the trunk and the shoulder complex with a key role for the upper limb kinematic chain. Many muscles in the neck, back, and shoulder area use the surfaces of the scapula for attachment and the alignment of the scapula is related to proper cervical, thoracal, and shoulder functions. Therefore, functional disorders of these muscles and the asymmetric alignment of the scapula can be seen in patients with a painful neck, back, and shoulder disorders.[3,4] Scapular dyskinesia is characterized by the abnormal position of the scapula during rest or abnormal scapula movements with the upper extremity movements and impaired scapulohumeral rhythm.[5] Bone/soft tissue injury, muscle weakness/imbalance, and nerve injuries are defined as the most common causes of scapular dyskinesia. Clinical identification of scapular dyskinesia is difficult and relies especially on inspection and palpation evaluation.[6]

Scapular dyskinesia may contribute to neck pain, shoulder pain, back pain, headaches, upper cervical laxity, and even thoracic outlet syndrome. Therefore, it is important to analyze the surrounding muscles and the movement of the scapula to determine whether or not they are a probable cause of neck, back, and shoulder pain.[7] The main purpose of this study is to evaluate the relationship between scapular dyskinesia and neck, back, and shoulder pain and to identify the influence of scapular dyskinesis on pain severity.

Material and Methods

This is a cross-sectional study that was conducted in a State Hospital Physical Medicine and Rehabilitation Clinic. This study included 124 patients with neck, back, and shoulder pain (more than 1 month) who were admitted to a State Hospital Physical Medicine and Rehabilitation Clinic between the ages of 18 and 79 and agreed to participate in the study. Participants with a history of cervical trauma or spine injury, a history of surgery on the neck, back, and shoulders, unable to perform shoulder abduction >90°, progressive neurological deficit and/or neuromuscular dysfunction, and rotator cuff disorders were excluded from the study.

This study was approved by a Local Ethics Committee and the individuals signed informed consent form before participating in the study. Sociodemographic and pain characteristics were noted in a case report form. Visual analog scale (VAS) was used to assess the intensity of pain during rest, activity, and night. Accordingly, in a line of 10 cm, the 0 points were accepted as the absence of pain and the 10 points as the maximum pain. The patients were asked to mark the severity of their pain on this 10 cm line. Then, the point between the marked point and point 0 was measured with the help of a ruler.[8] Neck, back, and shoulder range of motion (ROM) were measured with a universal goniometer. Lateral Scapular Slide Test (LSST) which is used to determine the position of the scapula in the abduction position of the arm in the coronal plane was performed for the diagnosis of scapular dyskinesia and was evaluated according to the Kibler scapular dyskinesia classification guide.[4,9,10] In LSST, the bilateral distance from the inferior angle of the scapula to the nearest vertebral spinous process is measured in three different positions (Fig. 1). The dyskinesis side would exhibit a greater scapular distance than the normal side. A bilateral difference of 1.5 cm is considered as a threshold for the presence of scapular asymmetry.[5] The presence of shortness in the pectoralis, latissimus dorsi, and rhomboids muscles was evaluated using muscle shortness tests (Fig. 2).[11]

Sample Size

To determine the sample size; the "G Power Analysis" analysis program was used.[12] According to the data of the studied studies, the size of the effect size was evaluated as 0.68. We reached the conclusion that we could obtain meaningful data when we included a minimum of 70 and a maximum of 162 patients in the evaluations where we received Type I error amount (alpha - α value or p-value) 0.05 and

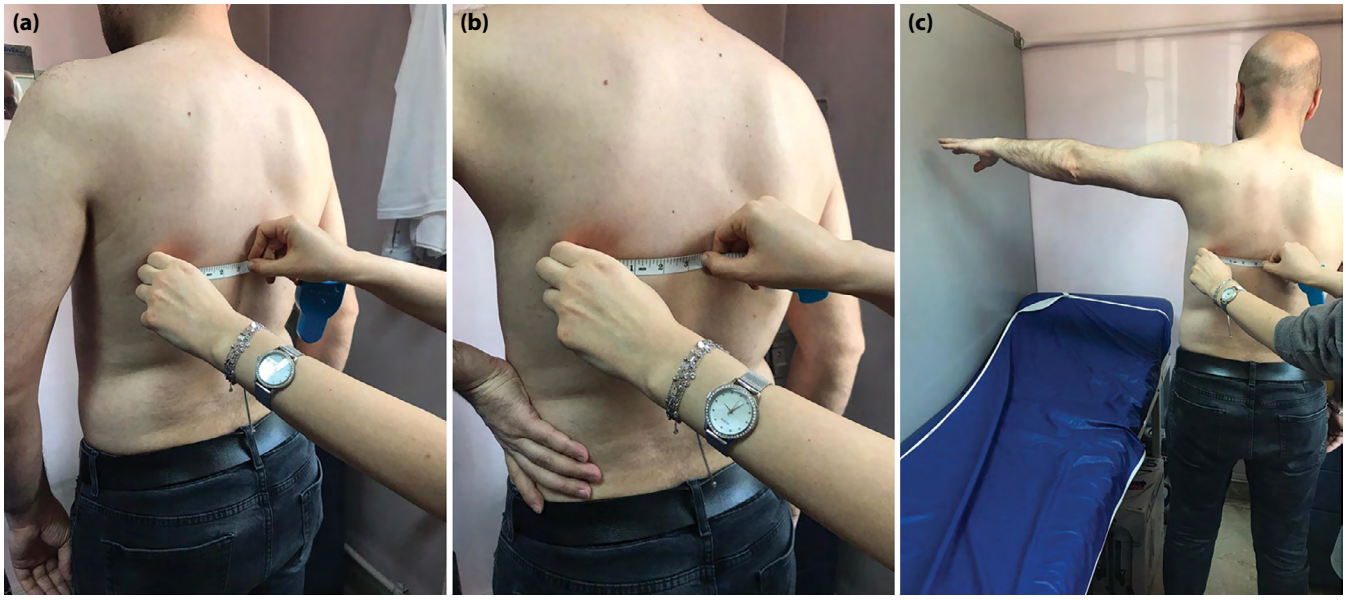

Figure 1. "Lateral Scapular Slide Test" – Measuring the distance from the inferior angle of the scapula to the nearest vertebral spinous process using a tape measure: In the neutral shoulder position **(a)**. The shoulder abduction position which a coronal plane of 40–45° with the hands on the hips **(b)**. The shoulder abduction position which a coronal plane of 90° with the arms in full internal rotation **(c)**.

Figure 2. "Pectoral, latissimus dorsi, and rhomboids muscles shortness test" – The patient is the supine position with the knees that are semi flection. While his hands clamped at the back of the neck, the elbows should be free in contact with the bed **(a)**. If the elbows do not touch the bed, it is stated that there is shortness in the pectoral muscles. While the arms are extended on both sides of the body with the palmar part facing down, the elbows are kept in extension and both shoulder joints are brought to the flexion position on both sides of the head **(b)**. The arms should touch the bed. If the arms do not touch the bed, it is stated that there is shortness in the latissimus dorsi and rhomboids muscles.

Type II error amount (beta - β value) 0.20. According to these data, it was decided to enroll 124 patients in the study to reach meaningful results.

Statistical Analysis

In the representation of descriptive statistics, numbers and percentages were used for categorical variables and mean±standard deviation or median minimum and maximum values were used for continuous variables depending on the normal distribution. Non-parametric tests were used for the ordinal data and parametric tests were used for continuous data. Chi-square as a non-parametric test and the independent samples t-test as a parametric test were used. Results were evaluated at a 95% confidence interval at a significance level of $p<0.05$. The analysis was per-

Table 1. Comparison of demographic data between the groups

Demographic data	n	SD (%)	No SD (%)	p
Age	124	44.76±10.80	46.09±11.11	0.39
Height (cm)	124	165.40±7.33	165.51±9.15	0.10
Body weight (kg)	124	76.05±11.94	75.05±10.98	0.50
BMI (kg/m^2)	124	27.76±3.84	27.45±3.86	0.66
Gender				
Female	88	39 (31.4)	49 (39.5)	0.50
Male	36	13 (10.4)	23 (18.5)	
Education level				
Illiterate	14	9 (7.2)	5 (4)	0.44
Primary school	52	24 (19.3)	28 (22.5)	
Middle - High school	43	15 (12.1)	28 (22.5)	
University	15	4 (3.2)	11 (8.9)	
Occupation				
Housewife	70	33 (26.6)	37 (29.8)	0.69
Worker	25	10 (8.06)	15 (12.1)	
Officer	14	5 (4)	9 (7.2)	
Retired	15	4 (3.2)	11 (8.9)	

Data presented as mean (SD) or number (n/%) of patients. The p-value refers to the difference between the groups. SD: Scapular dyskinesia; BMI: Body mass ındex.

formed on International Business Machines (IBM) Statistics Statistical Package for the Social Sciences version 22.0 for Windows (IBM, Armonk, NY, USA).

Strengthening the reporting of observational studies in epidemiology guidelines has been implemented in this manuscript.

Results

One hundred and twenty-four patients with mechanical neck, back, and/or shoulder pain were included in the study. The presence and type of scapular dyskinesia were determined using the LSST. As a result of these evaluations, scapular dyskinesia was observed in 52 patients (41.9%). Scapular dyskinesia was observed in 33 (26.6%) of the study population on the right side and in 19 (15.3%) of them on the left side.

Patients were divided into groups, with or without scapular dyskinesia, and then compared. There was no statistically significant difference between the groups in terms of gender, height, body weight, body mass ındex, age, education, or employment (p>0.05). Demographic data are shown in Table 1.

All of the patients included in the study had neck pain. The patients with neck pain, 16 (12.9%) had pain on the right side, 11 (8.9%) had pain on the left side, and 97 (78.2%) had pain on both sides. There were shoulder pain complaints in 42 (33.9%) of the patients included in the study. The patients with shoulder pain, 10 (8.1%) had pain on the right side, 15 (12.1%) had pain on the left side, and 17 (13.7%) had pain on both sides. There were back pain complaints in 67 (54%) of the patients included in the study. The patients with back pain, 16 (12.9%) had pain on the right side, 20 (16.1%) had pain on the left side, and 31 (25%) had pain on both sides.

Comparisons were performed between the groups in terms of the neck, back, and shoulder. The presence of scapular dyskinesia was significantly higher in patients with back and shoulder pain. When the distribution of scapular dyskinesia types is evaluated, Type 1 was found in 24 (19.4%) participants, Type 2 scapular dyskinesia was found in 21 (16.9%) participants, and Type 3 scapular dyskinesia was found in 7 (5.6%) participants. The findings are shown in Tables 2 and 3.

When VAS scores were analyzed, the VAS score at night was significantly higher in patients with scapu-

Table 2. Comparison of scapular dyskinesia and pain site

Musculoskeletal pain	n	SD (%)	No SD (%)	p
Shoulder pain				
No	82	27 (33)	55 (67)	<0.001
Yes	42	25 (59.5)	17 (40.4)	
Neck pain				
No	0	0	0	0.176
Yes	124	52 (41.9)	72 (58.1)	
Back pain				
No	57	14 (24.6)	43(75.4)	<0.01
Yes	67	38 (56.7)	29 (43.3)	

Data presented as number (n/%) of patients. The p-value refers to the difference between the groups. SD: Scapular dyskinesia.

lar dyskinesia. The findings are shown in Table 4. In the evaluation of muscle shortness/weakness in the individuals with neck, back, and shoulder pain, statistically significant muscle shortness/weakness was found in the group with scapular dyskinesia. When the relationship between the type of scapular dyskinesia and muscle shortness was evaluated, the presence of Type 1 and Type 2 scapular dyskinesia was significantly higher in those with muscle shortness. The findings are shown in Tables 5 and 6.

Discussion

Despite the fact that scapular motion is an important link in the kinetic chain, the role of the scapula is often ignored by clinicians and this can result in the incomplete evaluation of painful neck, back, and shoulder disorders. Researches investigating scapular dysfunction suggest that it may be a factor in the etiology of shoulder and neck pain and scapular dyskinesia has been associated with a wide variety of shoulder injuries.[13–15] However, prior studies remain insufficient to provide scientific evidence for the role of scapular dyskinesia in neck and back pain.

The association of scapular dyskinesia during the evaluation of neck, back, and shoulder pain is dependent on clinical assessments.[16,17] Pekyavas et al.[15] evaluated the relationship between the presence of scapular dyskinesia, pain, and ROM in patients with neck and shoulder pain. They concluded

Table 3. Comparison of scapular dyskinesia type and pain site

Musculoskeletal pain	n	SD Type 1 (%)	SD Type 2 (%)	SD Type 3 (%)	SD Type 4 (%)	p
Shoulder pain						
No	82	16 (19.5)	9 (11)	2 (2.4)	55 (67)	<0.05
Yes	42	8 (19)	12 (28.6)	4 (9.5)	17 (40.5)	
Neck pain						
No	0	0	0	0	0	0,30
Yes	124	24 (19.3)	21 (16.9)	7 (5.6)	62 (50)	
Back pain						
No	57	9 (15.8)	3 (5.2)	2 (3.5)	43 (75.4)	<0.001
Yes	67	15 (22.4)	18 (26.9)	5 (7.4)	29 (43.3)	

Data presented as number (n/%) of patients. The p-value refers to the difference between the groups. SD: Scapular dyskinesia; Type IV: Normal scapulohumeral motion with no excess prominence of any portion of the scapula and motion symmetric to the contralateral extremity.

Table 4. Pain characteristics between groups

Characteristics of pain	SD	No SD	p
VAS score (mean±SD)			
At night	35.32±36.16	13.36±27.17	<0.001
During activity	74.94±15.72	68.68±15.82	0.96
At rest	51.94±30.95	32.18±30.07	0.73
Pain duration (months) (mean±SD)	26.53±28.10	20.12±20.80	0.14

Data presented as mean (SD). The p-value refers to the difference between the groups. SD: Scapular dyskinesia; VAS: The visual analog scale.

Table 5. Comparison of muscles shortness data between the groups

Muscle shortness	SD (%)	No SD (%)	p
Pectoral muscles shortness/weakness			
No	32 (32.7)	66 (67.3)	<0.001
Yes, on the right side	6 (75)	2 (25)	
Yes, on the left side	5 (71.4)	2 (28.6)	
Yes, on both sides	9 (91.8)	2 (18.2)	
Latissimus dorsi, rhomboideus major and minor muscles shortness/weakness			
No	19 (32.6)	60 (67.4)	<0.05
Yes, on the right side	8 (72.7)	3 (27.3)	
Yes, on the left side	6 (55.6)	4 (44.4)	
Yes, on both sides	10 (66.7)	5 (33.3)	

Data presented as number (n/%) of patients. The p-value refers to the difference between the groups. SD: Scapular dyskinesia.

Table 6. Comparison of scapular dyskinesia type and muscle shortness/weakness

Muscle shortness	n	SD Type 1 (%)	SD Type 2 (%)	SD Type 3 (%)	SD Type 4 (%)	p
Pectoral muscle shortness/weakness						
No	98	15 (18)	12 (10.1)	5 (4.5)	66 (67.4)	<0.001
Yes	26	9 (34.6)	9 (34.6)	2 (7.7)	6 (23.1)	
Latissimus dorsi, rhomboideus major and minor muscles shortness/weakness						
No	89	16 (17.9)	9 (10.1)	4 (4.5)	60 (67.4)	<0.001
Yes	35	8 (22.8)	12 (34.2)	3 (8.5)	12 (34.2)	

Data presented as number (n/%) of patients. The p-value refers to the difference between the groups. SD: Scapular dyskinesia; Type IV: Normal scapulohumeral motion with no excess prominence of any portion of the scapula and motion symmetric to the contralateral extremity.

that 48.5% of those with neck pain, 47.6% of those with neck-shoulder pain, and 54.8% of those with shoulder pain had scapular dyskinesia. In the evaluation of scapular dyskinesia types, they stated that there were a significant results in LSST Positions 1 and 2, but no significant results of Position 3 were achieved. In our study, scapular dyskinesia was observed in 41.9% of those with neck pain, 59.5% of those with shoulder pain, and 56.7% of those with back pain. In addition, similar to the study of Pekyavas et al., Type 1 and Type 2 scapular dyskinesia is more common in patients with neck, shoulder, and back pain in our study population.

In our study, when VAS scores were evaluated, all VAS scores were high in the group with scapular dyskinesia. In contrast to our study, Pekyavas et al.[15] found no significant correlation between VAS scores and the presence of scapular dyskinesia.

The studies that performed to analyze the scapular orientation and axioscapular muscle function in neck pain have demonstrated that the correction of scapula position and functions should be a part of neck pain treatment.[18–21] Laudner et al.[22] have been identified both the muscles that surround the scapula and rotator cuff muscle as important factors in the development of altered scapular mechanics. In recent studies, especially the shortness/stiffness of the muscles around the scapula has been shown to be effective in the development of scapular dyskinesia. In a study, the stiffness of the latissimus dorsi has been reported to affect the rotation of the scapula and pull the scapula upward.[23] Lopes et al.[24] have stated the trapezius and the serratus anterior muscles have been linked to the development of scapular dyskinesis in both shoulder impingement and shoulder instability. Borstad stated that the shortness of the muscles in the pectoral region leads to

the forward translation of the shoulder girdle and thus the scapula.[25] Zakharova-Luneva et al.[26] found that voluntary activation of the trapezius muscle in cases with neck pain decreased and showed clinical signs of scapular dysfunction. As a result of this study, the authors emphasized that it would be beneficial for clinicians to include appropriate treatment approaches for the redevelopment of scapular function in patients with chronic neck pain. Wegner et al.[21] showed that scapular postural correction exercises provide optimal muscle activity in trapezius muscle in patients with neck pain.

Similarly, Falla et al.[27] reported that patients with mechanical neck pain had decreased trapezius muscle activity. Shahidi et al.[28] have shown that patients with neck pain have rhomboids and moderate trapezius muscle weakness, as well as a significant tension in the pectoralis minor muscles compared to healthy individuals. Sheard et al.[29] compared individuals with neck pain and healthy individuals and stated that patients with neck pain had alterations in serratus anterior muscle activity, especially during upper limb movements. In addition, Helgadottir et al.[16] reported that there was significant lateness in serratus anterior muscle activity in patients with neck pain. In our study, statistically significant shortness and weakness were found in the pectoral, latissimus dorsi, and rhomboids muscles in the group with scapular dyskinesia.

Several studies have confirmed that the strategies used to correct the position of the scapula result in the improvement of cervical symptoms which affected by the relationship between scapular symmetry and neck kinematics.[30,31] In another study has been evaluated, the effectiveness of scapular mobilization and physical therapy in patients diagnosed with neck pain and scapular dyskinesia. It has been shown that scapulothoracic mobilization in combination with physical therapy resulted in better clinical outcomes such as reducing pain scores, maximizing grip strength, and improving functions in mechanical neck pain in comparison with physical therapy alone.[32] Seo et al.[33] have reviewed the literature to determine the effect of scapular stabilization exercises on pain and dysfunction in patients with chronic nonspecific neck pain. In their study as a result of these evaluations, they stated that scapular stabilization exercises can improve neck functions and decreased pain.

Physical examination is important to evaluate mechanical shoulder, neck, and back pain and to guide treatment. Scapular dyskinesia which is diagnosed by physical examination is one of the biomechanical factors underlying neck, shoulder, and back pain, which are common musculoskeletal problems. The results of this study show that the presence of scapular dyskinesia increases the intensity of pain by negatively affecting muscle functions in patients with neck, back, and shoulder pain. Therefore, it draws the attention of clinicians to the assessment of scapular dyskinesia in the physical examination of patients with neck, shoulder, and back pain.

Limitations

One of the limitations of our study is that the patient groups with shoulder, neck, and back pain contain a different number of participants. Furthermore, we included multiple diagnoses represent with back, shoulder, and neck pain in our study because of purposing to emphasize the association of scapular dyskinesia in all back, shoulder, and neck pathologies. Limiting patients to a specific neck, back, or shoulder pathology can offer a detailed assessment of the relationship between different pathologies and scapular dyskinesia. Another limitation of our study is the use of visual observation of the abnormal scapular rhythm created by Kibler and Sciascia to define scapular dyskinesia. This technique has shown only moderate specificity and sensitivity, which are limited by the reliance on subjective interpretation and the examiners' level of experience.

Conclusion

The scapula is a component of the shoulder kinematic chain located in the thoracal region. scapular dyskinesia characterized by impairment of scapula resting position and functions appears to be associated with shoulder pain as well as neck and back pain. Therefore, clinical evaluation of scapular rest position and function in patients with shoulder, neck, and back pain is very important for the prescription of the necessary physical therapy exercises. While determining the treatment protocols of the neck, back, and shoulder pain, the combination of scapular dyskinesia and neck, shoulder, and back

pain should be kept in mind and strengthening of scapular stabilizers should be considered as part of the rehabilitation program.

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