

Altered Trapezius Activation and Scapular Kinematics in Individuals with Scapular Dyskinesis

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Summary

This study examined the spatial distribution of excitation in three regions of trapezius and scapulothoracic kinematics in individuals with and without scapular dyskinesis (SD). Scapular internal rotation was significantly greater in the SD group at a specific phase of shoulder elevation, and there were significant differences in trapezius excitation patterns during that phase. These findings suggest a potential link between altered neuromuscular control and scapular kinematics in individuals with SD.

Introduction

Altered scapular position or motion, or scapular dyskinesis (SD) [1], increases shoulder pain and pathology risk [2]; however, its etiology remains unclear. Alterations in muscle excitation of the three regions of the trapezius are believed to contribute to altered scapular kinematics associated with SD [3], yet research regarding trapezius excitation in individuals with SD is limited and the influence of trapezius on SD is not fully understood. This study compared scapulothoracic kinematics of asymptomatic shoulders of individuals with and without SD during shoulder elevation to determine if kinematic variations are related to differences in the spatial distribution of excitation within each region of the trapezius.

Methods

Fifty-four healthy right-handed participants (25±8 years) were assessed for SD using the Scapular Dyskinesia Test: 27 had normal scapular motion (CON) and 27 had dyskinesia (SD). Participants completed five repetitions of weighted (1.4 kg for participants <68.1 kg, 2.3 kg for those >68.1 kg) shoulder flexion while high-density surface electromyography (HDsEMG) of the upper (UT), middle (MT), and lower (LT) trapezius, and scapular kinematics were collected. One-dimensional statistical parametric mapping (1D SPM) compared scapulothoracic kinematics (upward rotation, internal rotation, and anterior tilt) during shoulder flexion between groups. Comparison between groups on UT, MT, and LT excitation distribution was performed using two-dimensional SPM (2D SPM) where scapulothoracic kinematics differed between groups during the forward flexion task. EMG data were normalized to peak RMS.

Results and Discussion

Scapulothoracic internal rotation was significantly higher in SD compared to CON during 38.5–61.8° (max Δ = 5.7°, p =0.04) of flexion (Figure 1-A). Higher internal rotation is commonly observed in SD [3] and might be due to different neuromuscular strategies in individuals with SD. Scapulothoracic upward rotation and anterior tilt were not different between groups.

During 38.5–61.8° of flexion, 257 (67% of grid; p =0.04) pixels exceeded significance for the LT (Figure 1-B, C). This difference in LT excitation distribution highlights the key role

of LT in differences in scapulothoracic internal rotation between individuals with and without SD.

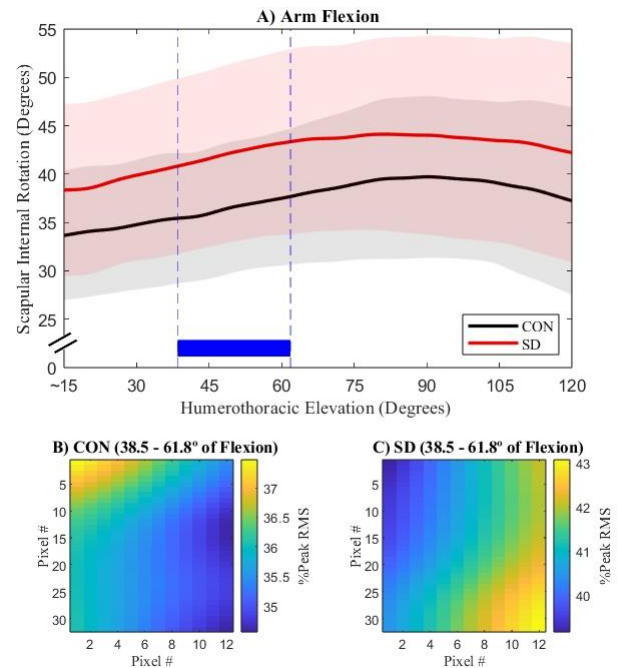


Figure 1: A, mean scapulothoracic angles with standard deviation clouds. The blue horizontal bar and vertical dashed lines represent significant differences between groups. B, C: Topographical maps of mean relative excitation (% peak RMS) of the lower trapezius during 38.5–61.8° of flexion for the CON and SD groups, respectively. Note that %peak RMS scales on the y-axis are unique to each image.

Additionally, LT excitation was higher in SD than CON during 38.5–61.8° of flexion (SD: 41.1±8.2%, CON: 35.6±8.6% peak RMS). Previous studies reported lower LT activity in symptomatic SD individuals compared to individuals without SD [2]. Since participants in the current study were asymptomatic, the higher LT activity might be a compensatory mechanism to avoid injury in asymptomatic individuals with SD.

Conclusion

Individuals with SD have greater scapulothoracic internal rotation during arm flexion than those without SD, which are accompanied by significant changes in the amplitude and distribution of LT excitation. Future work should examine the scapulothoracic kinematics and spatial distribution of excitation of several shoulder muscles in those with and without SD and shoulder pathology to define the impact of altered excitation strategies within and between muscles on scapular kinematics and their role in shoulder pathology.

References

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