

Comparison of Shoulder Muscles Activation for Shoulder Abduction between Forward Shoulder Posture and Asymptomatic Persons

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Abstract. [Purpose] This study investigated the differences in shoulder muscles activities during shoulder abduction between a forward shoulder posture group and asymptomatic group. [Subjects] Seven males with forward shoulder posture (FHS) and seven asymptomatic males were recruited. [Methods] We measured the upper and middle trapezius (UT and MT), serratus anterior (SA), and clavicle portion of the pectoralis major (cPM) in the right side during shoulder abduction. [Results] The activities of the UT and cPM in the FHS group were significantly more increased when compared with the asymptomatic group. The activities of the MT and SA in the FHS group were significantly more decreased when compared with the asymptomatic group. [Conclusion] We suggest that forward shoulder posture may become a potential risk factor evoking the various shoulder disorders.

Key words: Forward shoulder posture, Scapular, Shoulder abduction

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INTRODUCTION

Some evidence now links a prolonged flexed trunk posture to increased muscle loading and a subsequently increased risk for adverse symptoms in the upper body¹⁾. Abnormal alignment or posture, such as forward head, kyphosis, and forward shoulder postures, are potential risk factors associated with chronic shoulder disorders^{2, 3)}. Deviation from normal alignment suggests the presence of imbalance and abnormal strain on the musculoskeletal system³⁾. Alignment has been considered “poor” when the head or shoulder is held forward in relation to the trunk, and the characteristics referred to as poor include forward head, poked chin, and forward shoulders¹⁻³⁾. Among these posture changes, the forward shoulder posture is associated with changes in scapular position and alignment in the sagittal and frontal planes^{3, 4)}. A slumped posture for prolonged periods leads to abnormal scapular position²⁾. The scapula is an important link between the trunk and the upper extremity, and it also provides proximal stability for functional activity of the upper extremity⁴⁾. An abnormal scapular position changes the muscle length attached to the scapula and eventually results in shoulder pathology such as impingement^{5, 6)}. We investigated the differences in shoulder muscle activities during shoulder abduction between a forward shoulder posture group and an asymptomatic group.

SUBJECTS AND METHODS

Seven males with forward shoulder posture (FHS) and

seven asymptomatic males were recruited. Subjects were excluded if they reported a history of shoulder surgery, 6 week or more of shoulder pain, or musculoskeletal, neurological, or cardiopulmonary diseases that could interfere with shoulder elevation. We evaluated the subjects using a forward head shoulder test during recruitment. For this evaluation, each subject lay in a supine position with knees bent and arms relaxed at the sides. The linear distance from the treatment table to the posterior aspect of the acromion was then measured. We decided that a positive sign in this test was 3 cm or more. All EMG signals were amplified, band-pass filtered (20 to 500 Hz), and then sampled at 1,000 Hz using the Acqknowledge 3.9.1 software. The amplitude was normalized against the maximal voluntary isometric contraction. We measured the upper and middle trapezius (UT and MT), serratus anterior (SA), and the clavicle portion of the pectoralis major (cPM) on the right side during shoulder abduction. We used a horizontal bar for the scapular plane and had the subjects perform a 120-degree shoulder abduction with a 2 kg wrist cuff weight in the scapular plane. The Statistical Package for the Social Sciences (SPSS, Chicago, IL, USA) was used to perform the independent t-test to analyze the differences in shoulder muscle activities between groups. The alpha level for statistical significance was set at 0.05.

RESULTS

The activity of the UT in the FHS group ($45.0 \pm 10.2\%$) was significantly more increased when compared with the asymptomatic group ($36.3 \pm 7.0\%$) ($p < 0.05$). The activity of the cPM in the FHS group ($32.0 \pm 13.6\%$) was significantly

more increased when compared with that of the asymptomatic group ($12.3 \pm 8.9\%$) ($p < 0.05$). The activity of the MT in the FHS group ($16.0 \pm 9.3\%$) was significantly more decreased when compared with that in the asymptomatic group ($25.3 \pm 7.9\%$) ($p < 0.05$). The activity of the SA in the FHS group ($21.0 \pm 10.6\%$) was significantly more decreased when compared with that in the asymptomatic group ($29.3 \pm 12.5\%$) ($p < 0.05$).

DISCUSSION

This study investigated the differences in shoulder muscles activities during shoulder abduction between a forward shoulder group and asymptomatic group. The results showed that the UT and cPM in the FHS group were significantly more increased when compared with those in the asymptomatic group. The activities of the MT and SA in the FHS group were significantly more decreased when compared with those in the asymptomatic group. A previous study reported that increased upper trapezius muscle activity creates scapular elevation and inferior angle tipping⁷. Ludewig et al.⁸ described that middle and lower trapezius weakness cause the forward shoulder posture with scapular anterior tilt. Moore⁹ reported that a slumped posture produced weakness of the neck flexor, middle and lower trapezius, and rhomboid and shortness of the upper trapezius, levator scapular, pectoralis major, and pectoralis minor. However, in the clinic, the forward shoulder posture is regarded as simply an abnormal posture associated with pectoralis major or minor muscle shortness. We suggest that forward head posture causes imbalance of shoulder muscles and scapular instability. This posture could produce the weakness of the MT and SA muscles associated with scapular stability¹⁰. Also, the muscles must be activated strongly during shoulder abduction based on the scapulohumeral rhythm. The weakness of the MT and SA muscles causes the excessive activation of the UT¹¹. Also, activation of the cPM disturbs arm elevation and causes the shoulder head to rotate medially during shoulder abduction¹⁰. Therefore, the changes in the shoulder muscles due to forward shoulder posture may become potential risk factors for evoking

many shoulder disorders, such as impingement syndrome, winging or tipping scapulas, shoulder joint arthritis and tendonitis, and myofascial pain syndrome.

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