Changes in Acromion and Scapular Position after Short-term Overhead Work

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Abstract. [Purpose] This study investigated the changes in acromion and scapular position after short-term overhead work. [Subjects] Twelve males aged 20–27 years, were recruited. [Methods] We measured the acromial angle and scapular inferior distance using a palpation meter before and after overhead work. [Results] The acromion angle was significantly decreased after the overhead work compared to before. The scapular inferior distance was significantly increased after the overhead work compared to before. [Conclusion] Even though the overhead work was short-term work lasting less than one hour, it resulted in an abnormal scapular position.

Key words: Overhead work, Scapular position, Shoulder pain

INTRODUCTION

Workers with high levels of static contraction, prolonged static loads, or extreme working postures involving the neck and shoulder muscles, are exposed to an increased risk of neck and shoulder musculoskeletal disorders1, 2). Repeated and sustained working with elevated arms is especially likely to lead to neck and shoulder pain3), and a causal relationship has been suggested in several systematic reviews4). Sustained or repetitive activity of the neck and shoulder muscles is thought to cause compromised circulation and mechanical pressure in the shoulder muscles5). A long-term overhead working posture results in strain and fatigue in the shoulder muscles because arm elevation is associated with shoulder muscular fatigue6). Wegner et al.7) suggested that a postural correction strategy for the scapular position was helpful for patients with neck pain, restoring muscular activation during computer work. However, no study has investigated the influence of overhead work on scapular position. Therefore, this study examined the changes in scapular position after short-term overhead work.

SUBJECTS AND METHODS

Twelve males, aged 20–27 years and with a mean height and weight of 176.1 ± 4.7 cm and 65.0 ± 5.2 kg, respectively, participated in this study. The subjects had no history of musculoskeletal disorders or pain associated with the upper extremity in the past 6 months. A palpation meter (PALM; Performance Attainment Associates, St. Paul, MN, USA) was used to measure the distance and inclination between two bony landmarks of the body. The PALM consists of an inclinometer and two caliper arms; the inclinometer has a semicircular arc that moves within the range 0–30° in either direction from the midline at 1° intervals. The PALM was used as a body-tool interface to combine the advantages of palpation with the objectivity and reliability of caliper and inclinometer measurements. The acromion angle was determined using the PALM as the value of the inclination angle between the acromion and the C7 spinous process. The scapular inferior distance was determined using the PALM as the distance from the inferior angle to the spinal process. All subjects performed overhead work with their arms during a scheduled work session of 20 min. The overhead work was performed at a height of 25 cm above the head of each subject. The overhead work was bolt and nut assembly work. Measurements were made before and immediately after the overhead assembly work. The Statistical Package for Social Sciences (SPSS, Chicago, IL, USA) was used to conduct statistical analyses. The significance of differences in the acromion angle and scapular inferior distance before and after the overhead work was tested using the paired t-test. The alpha level for statistical significance was chosen as 0.05.

RESULTS

The acromion angle was significantly decreased after the overhead work (10.6 ± 3.3 °) compared to before (14.8 ± 4.5 °) (p<0.05). The scapular inferior distance was significantly increased after the overhead work (8.5 ± 2.2 cm) compared to before (7.2 ± 1.7 cm) (p<0.05).

DISCUSSION

Previous studies of overhead work requiring arm elevation and head extension have focused on head extension, which leads to compression of the posterior elements of the
cervical vertebra\(^7\). More recently, the relationship between upward rotation of the scapula and arm flexion has been reported as a kinesiological chain, so studies are now examining the neck and shoulder muscle activities and pain associated with overhead work\(^8,9\). A change in the scapular position and motion, in particular, changes in the lengths of muscles attached to the scapula, eventually lead to shoulder pathology\(^9\). Therefore, we focused on changes in scapular position after continuous overhead work. We found that the acromion angle significantly decreased and the scapular inferior distance significantly increased following performance of overhead work. A decreased acromion angle indicates an elevated shoulder posture, and an increased scapular inferior distance indicates an upward scapular posture. The upper trapezius is more active in shoulder abduction in flexion up to the horizontal position, after which it increases with arm elevation\(^9\). The shortening of the upper trapezius may result in scapular elevation and upward rotation during arm elevation\(^2\). Excessive and continuous scapular upward posture may also produce overstretch weakness of the rhomboid, middle, and lower trapezius muscles (activated by scapular retraction)\(^9\). When this altered activation is combined with weakness of the lower trapezius and tightness of the upper trapezius and levator scapulae, this imbalanced musculature might contribute to dysfunction of the scapulothoracic and glenohumeral joints\(^10\). The present study required subjects to perform short-term overhead work of one hour duration. However, overhead work, even of this short duration, may present a high risk of abnormal scapular position. Therefore, overhead workers must be provided with modified job conditions or ergonomic devices for prevention of excessive upward scapular rotation.

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**REFERENCES**