J. Phys. Ther. Sci.
25: 679–680, 2013

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

Won-gyu Yoo[1)]

[1)] *Department of Physical Therapy, College of Biomedical Science and Engineering, Inje University and Elderly Life Redesign Institute: 607 Obangdong, Gimhae, Gyeongsangnam-do 621-749, Republic of Korea. TEL: +82 55-320-3994, FAX: +82 55-329-1678*

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

(This article was submitted Dec. 11, 2012, and was accepted Jan. 11, 2013)

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 disorders[1, 2)]. Repeated and sustained working with elevated arms is especially likely to lead to neck and shoulder pain[3)], and a causal relationship has been suggested in several systematic reviews[4)]. Sustained or repetitive activity of the neck and shoulder muscles is thought to cause compromised circulation and mechanical pressure in the shoulder muscles[4)]. A long-term overhead working posture results in strain and fatigue in the shoulder muscles because arm elevation is associated with shoulder muscular fatigue[5)]. Wegner et al.[6)] 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

E-mail: won7y@inje.ac.kr

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[1]. 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 a 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)[2]. 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.

ACKNOWLEDGEMENT

This research was supported by Basic Science Research Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Education, Science and Technology (No. 2012R1A1B4001058).

REFERENCES

1) Ludewig PM, Reynolds JF: The association of scapular kinematics and glenohumeral joint pathologies. J Orthop Sports Phys Ther, 2009, 39: 90–104. [Medline]
2) Neumann DA: Kinesiology of the musculoskeletal system: foundations for physical rehabilitation. 1st ed. St Louis: Mosby, 2002.
3) Punnett L, Fine LJ, Keyserling WM, et al.: Shoulder disorders and postural stress in automobile assembly work. Scand J Work Environ Health, 2000, 26: 283–291. [Medline] [CrossRef]
4) van der Windt DA, Thomas E, Pope DP, et al.: Occupational risk factors for shoulder pain: a systematic review. Occup Environ Med, 2000, 57: 433–442. [Medline] [CrossRef]
5) Herberts P, Kadefors R, Broman H: Arm positioning in manual tasks: an electromyographic study of localized muscle fatigue. Ergonomics, 1980, 23: 655–665. [Medline] [CrossRef]
6) Wegner S, Jull G, O'Leary S, et al.: The effect of a scapular postural correction strategy on trapezius activity in patients with neck pain. Man Ther, 2010, 15: 562–566. [Medline] [CrossRef]
7) Sakakibara H, Miyao M, Kondo T, et al.: Overhead work and shoulder-neck pain in orchard farmers harvesting pears and apples. Ergonomics, 1995, 38: 700–706. [Medline] [CrossRef]
8) Grieve JR, Dickerson CR: Overhead work: identification of evidence-based exposure guidelines. Occup Ergonomics, 2008, 8: 53–66.
9) Anton D, Shibley LD, Fethke NB, et al.: The effect of overhead drilling position on shoulder moment and electromyography. Ergonomics, 2001, 44: 489–501. [Medline]
10) Page P, Frank CC, Lardner R: Assessment and treatment of muscle imbalance: the Janda approach. 1st ed. Champaign: Human Kinetics, 2010.