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Original Article

Comparison of activation and change in the upper trapezius muscle during painful and non-painful computer work

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Abstract. [Purpose] Activation and changes in parts of the upper trapezius muscle during painful and non-painful computer work were compared. [Subjects] Ten male computer workers were recruited. [Methods] Surface electromyography was used to compare upper trapezius muscle activation and changes (difference between minimum and maximum activation) during painful and non-painful computer work. [Results] Mean normalized upper trapezius muscle activity did not differ between the "feel-pain" and "non-feel-pain" muscle sections. The mean change in upper trapezius muscle activity in the feel-pain section decreased significantly compared to the non-feel-pain section. [Conclusion] Measuring changes in the activity of muscle sections was useful to study static and sustained muscle stress during computer work.

Key words: Computer user, Pain, Static posture

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INTRODUCTION

Computer users who work continuously have frequent work-related neck and shoulder problems[1)]. It is difficult to identify a clear reason for neck and shoulder pain and impairment, which contribute to a poor patient prognosis[2)]. McLean suggested that the sustained forward head posture during computer work decreases muscular efficiency and increases activity of the upper trapezius muscle[3)]. However, other researchers have reported that a flexed-relaxed trunk posture can be easily adopted to maintain posture with low muscular requirement. This posture is maintained with passive structural tension rather than active muscular effort[4)]. Park and Yoo reported muscle activity changes over time and showed a decrease in upper trapezius activation in the last phase compared to the second and third phases of sustained typing[5)]. They suggested further study to evaluate pain and changes in activation of the upper trapezius during sustained typing[5)]. Therefore, this study was conducted to compare activation and changes in parts of the upper trapezius muscle between subjects in pain and those not in pain during computer work.

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SUBJECTS AND METHODS

Ten right hand-dominant male computer workers (age, 26–32 years; mean height and weight, 173.6 ± 6.2 cm and 68.4 ± 5.5 kg, respectively) participated in this study. The subjects used computers for 6 hours/day as full-time workers. Subjects with conditions that may have affected mobility of the cervical spine injury or who had neurological deficits in the neck or upper extremities during the previous year were excluded from the study. The subjects received an explanation about the purpose and methods of the study prior to their participation and provided informed consent according to the ethical principles of the Declaration of Helsinki. All subjects performed computer work for 1 hour using the same computer workstation, in which the monitor was inclined back 20°, and their eyes were 0.8 m from the monitor. To ensure that the hips and knees were flexed at 90°, an adjustable-height table and chair without a backrest were used to set the initial sitting posture. During the experiment, all subjects performed selected keyboard typing in the Korean version of the Hansoft program. Electromyographic (EMG) data were collected using the MP150 acquisition system unit, the Acknowledge software package, and surface EMG electrodes (BIOPAC Systems Inc., Goleta, CA, USA). Maximum voluntary isometric contractions were measured for 5 sec to normalize EMG amplitude. The channel of the EMG device was used to detect activation of the right side of the upper trapezius muscle. The electrodes were placed approximately 2 cm laterally from the mid-distance between the C7 spine and the acromion on the upper trapezius muscle. The EMG system was connected to a foot switch. The subjects pressed the switch when they felt pain in the right upper trapezius muscle. The Acknowledge software provided information

on foot switch pressing using the EMG signals. The SPSS for Windows software package (ver. 18.0; SPSS Inc., Chicago, IL, USA) was used to analyze differences and changes (difference between minimum and maximum activation) in upper trapezius muscle activation in the feel-pain and non-feel pain sections during computer work. An independent t-test was utilized to detect the differences and a value of $p < 0.05$ was taken to indicate statistical significance.

RESULTS

Mean normalized upper trapezius muscle activity (33.1 ± 14.4%) did not differ between the feel-pain and non-feel pain muscle sections (29.3 ± 12.1%). The mean change in upper trapezius muscle activity in the feel-pain section (7.6 ± 4.2%) decreased significantly compared to the non-feel pain section (15.0 ± 9.5%; $p < 0.05$).

DISCUSSION

The upper trapezius is an important component of the shoulder pain associated with computer work[6]. Clinicians usually focus on the upper trapezius when treating shoulder pain in computer workers[7, 8]. We found no difference between the feel-pain and non-feel-pain sections in mean normalized upper trapezius muscle activity. Higher activity of the upper trapezius muscle can be interpreted as bad or good, and suggests muscle hypertension or postural variation, respectively. Muscle hypertension is present if more activity is needed to maintain the same posture. However, if more muscle activity is used to vary posture, this may help relieve musculoskeletal loading. Therefore, we hypothesized originally that muscle activity would not be useful to detect pain. Hägg suggested that degeneration of type-1a muscle fibers is caused by overuse, which induces pain in the upper trapezius region[9]. This hypothesis suggests that the pain is caused by a long period of low upper trapezius motor unit recruitment[9]. Sustained activation of this specific muscular region could promote muscular damage, even with a low level of muscular recruitment[9]. Either muscle fiber degenerative changes or fatigue could increase pain sensitivity. We found that the mean change in upper trapezius muscle activity decreased significantly in the feel-pain muscle section compared to the non-feel pain section. Thus, changes in the activities of the muscle sections were of more value when studying static or sustained muscle stress, such as that associated with computer work.

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