

Comparison of Cervical Range of Motion and Cervical FRR between Computer Users in Their Early and Late 20s in Korea

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Abstract. [Purpose] This study compared the cervical range of motion and cervical FRR between computer users in their early and late 20s in Korea. [Subjects] Eleven male and 7 female computer users in their early 20s and 10 male and 6 female computer users in their late 20s participated in this study. [Methods] All cervical ROM measurements were taken with a Cervical Range of Motion Instrument. Electromyographic (EMG) data were obtained for analyzing the FR ratio. [Results] Cervical extension, right and left lateral flexion, and right and left rotation in the late 20s computer users were significantly lower compared with the cervical motions in the early 20s computer users. The cervical FRR in the late 20s computer users was significantly lower compared with the cervical FRR in the early 20s computer users. [Conclusion] This study was conducted to be prepared that the possibility for young computer generations in Korea could easily develop chronic neck pain.

Key words: Cervical erector spinae, CROM, Neck pain

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INTRODUCTION

Sedentary job tasks are associated with significant amounts of computer usage. There is mounting evidence indicating that the static neck posture frequently assumed by computer workers using a computer is a risk factor for work-related neck and upper-limb disorders^{1,2)}. During computer work, use of the cervical erector spinae (CES) muscles is important for efficient muscle activation and support for the task being performed, as well as for the upper trapezius¹⁾. A previous study reported that pain-related activation of the CES muscles could not be relaxed, even after an arm task²⁾. Recent findings indicated that the flexion-relaxation (FR) ratio in the CES muscles may be a significant criterion of neuromuscular impairment and function³⁾. Also, a previous study reported that the cervical extension and flexion angles could be a predictive factor for changes in head and neck posture after long-term visual display terminal work⁴⁾. Korean household Internet and computer distribution rates have rapidly increased since 2000, and Korea has now been identified as the country with the highest distribution of Internet and computers in the world, with the rates exceeding 80%. A review of the rates of use of the Internet using computers by age indicated that teenagers and people in their 20s use the Internet the most frequently⁵⁾. Therefore, as of

2013, Korean males and females in their 20s are thought to be exposed the most to diseases related to computers. Therefore, this study compared the cervical range of motion and cervical FRR between computer users in their early and late 20s in Korea.

SUBJECTS AND METHODS

Eleven male and 7 female computer users in their early 20s (20–24 years) and 10 male and 6 female computer users in their late 20s (25–29 years) participated in this study. The early 20s group's average age, weight, and height were 21.6 ± 1.5 (mean \pm SD) years, 60.8 ± 10.1 kg, and 168.3 ± 8.5 cm, respectively. The late 20s group's average age, weight, and height were 27.8 ± 2.1 years, 62.8 ± 10.4 kg, and 169.5 ± 6.8 cm, respectively. The subjects used computers for 5.0 ± 1.5 hours/day (mean \pm SD) as full-time student workers in a university office. All subjects were right-dominant, and free of any neck or back pain for a minimum of 1 year prior to the study, and they did not have upper limb or cervical spine pathologies or rheumatological or neurological conditions. Each subject provided informed consent before participating in the study. This study was approved by the Inje University Faculty of Health Sciences Human Ethics Committee. All cervical ROM measurements were taken with a Cervical Range of Motion Instrument (CROM) (Performance Attainment Associates, St. Paul, MN, USA). The intra-test reliability of the CROM instrument was 0.89, and the inter-test reliability was 0.91. The cervical ROM measurements were taken by an investigator. Each participant began this phase by sitting on a standard folding chair and being fitted with the CROM. After measuring the cervical

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active ROM, electromyographic (EMG) data were obtained for analyzing the FR ratio. Surface electrodes were placed on the right sides of the CES muscles, 2 cm lateral to the C4 spinous process. The EMG data were analyzed using a program created with AcqKnowledge (ver. 3.9.1). The neck flexion and re-extension task comprised flexion, relaxation, and re-extension periods. Each movement period lasted 3 seconds. The trunk flexion and re-extension task comprised relaxed standing, forward flexion, full flexion, and re-extension periods. Each movement period lasted 3 seconds. The cervical flexion-relaxation ratio (FRR) was calculated by dividing the maximal muscle activation during the 3-s re-extension period by the average activation during the 3-s relaxation period. The paired t-test was used for comparison of the cervical range of motion and cervical FRR between the early and late 20s computer users in Korea. Significance was accepted for values of $p < 0.05$.

RESULTS

The cervical extension, right and left lateral flexion, and right and left rotation ($72.5 \pm 12.7^\circ$, $39.6 \pm 6.5^\circ$ and $42.6 \pm 6.6^\circ$, $63.7 \pm 7.8^\circ$ and $64.7 \pm 11.3^\circ$) in the late 20s computer users were significantly lower compared with the cervical extension, right and left lateral flexion, and right and left rotation ($83.5 \pm 13.7^\circ$, $46.7 \pm 8.0^\circ$ and $49.5 \pm 8.6^\circ$, $72.5 \pm 8.5^\circ$ and $73.5 \pm 7.2^\circ$) in the early 20s computer users. Cervical flexion showed no significant difference between the early 20s computer users ($65.4 \pm 11.9^\circ$) and late 20s computer users ($59 \pm 8.3^\circ$). The cervical FRR in the late 20s computer users (1.2 ± 4.8) was significantly lower compared with the cervical FRR in the early 20s computer users (2.2 ± 1.0).

DISCUSSION

Reduced CROM can result from inactivity and structural changes in the tissues in the cervical spine, and the shortening of collagen tissue and muscle fibrosis results in an increased connective-tissue density⁶. There are many methods of evaluating the cervical region, including assessing CROM, posture, muscle tenderness, pressure pain, neck-muscle power, and the subjective experience of pain. The results of the present study showed that the cervical extension, right and left lateral flexion, and right and left rotation in the computer users in their late 20s were significantly lower compared with the cervical motions in the computer users in their early 20s. The FRR obtained by dividing the maximal muscle activation during the re-

extension phase by activation during the relaxation phase was most highly associated with the cervical active ROM, which was considered a major clinical feature of the anticipatory dysfunction and neck posture in previous studies⁴. This result showed that the cervical FRR in the late 20s computer users (1.2 ± 4.8) was significantly lower compared with the cervical FRR in the early 20s computer users (2.2 ± 1.0). In a previous study, the cervical FRR values were relatively lower in the symptomatic population than in the controls³. The cervical FRR, which is expressed as a numerical value, is a sensitive marker for measuring neuromuscular changes associated with even mild discomfort. In recent Korea society, computer work is clearly the most threatening element that causes neck and shoulder pain for young computer users. Although it is difficult to classify them as chronic patients given their ages, they may show tendencies of being chronic in terms of neck pain because they have been exposed to computers since childhood. This study was conducted to prepare for the possibility that young computer generations in Korea could easily develop chronic neck pain, and the results of this study are thought to be very helpful clinically in determining neck pain in young computer users in their late 20s in Korea, who could easily develop chronic neck and shoulder pain.

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