Effects of different computer typing speeds on acceleration and peak contact pressure of the fingertips during computer typing

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Abstract. [Purpose] This study showed the effects of different computer typing speeds on acceleration and peak contact pressure of the fingertips during computer typing. [Subjects] Twenty-one male computer workers voluntarily consented to participate in this study. They consisted of 7 workers who could type 200–300 characteristics/minute, 7 workers who could type 300–400 characteristics/minute, and 7 workers who could type 400–500 characteristics/minute. [Methods] This study was used to measure the acceleration and peak contact pressure of the fingertips for different typing speed groups using an accelerometer and CONFORMat system. [Results] The fingertip contact pressure was increased in the high typing speed group compared with the low and medium typing speed groups. The fingertip acceleration was increased in the high typing speed group compared with the low and medium typing speed groups. [Conclusion] The results of the present study indicate that a fast typing speed cause continuous pressure stress to be applied to the fingers, thereby creating pain in the fingers.

Key words: Computer typing, Computer workstation, Peak contact pressure

INTRODUCTION

Many office workers spend long hours sitting at their desks while doing their jobs1. Work-related musculoskeletal disorders, also called overuse injuries, account for a significant proportion of work injuries2. Several risk factors are associated with the development or exacerbation of work-related musculoskeletal disorders in the workplace, including physical and biomechanical factors, and the inherent predisposition of the individual2. Furthermore, work-related upper extremity disorders are the most common form of occupational disease3, 4. Keyboard use is one common type of highly repetitive daily task and is associated with musculoskeletal disorders of the upper extremity5. A previous study showed that cumulative keyboard use was associated with the occurrence of wrist disorder or pain among employees and that cumulative keyboard use remained an important factor in the development of carpal tunnel syndrome6, 7. Continuous keyboard typing could cause not only wrist pain but also constant stress on the fingers8. However, few studies have been conducted on the stress on the fingers according to the computer typing speed. Therefore, this study investigated effects of different computer typing speeds on acceleration and peak contact pressure of the fingertips during computer typing.

SUBJECTS AND METHODS

Twenty-one male computer workers voluntarily consented to participate in this study. They consisted of 7 workers who could type 200–300 characteristics/minute (low typing speed group), 7 workers who could type 300–400 characteristics/minute (medium typing speed group), and 7 workers who could type 400–500 characteristics/minute (high typing speed group). Their average age, height, and weight were 26.3 ± 2.5 years, 174.9 ± 2.7 cm, and 66.5 ± 4.7 kg, respectively. Each subject provided informed consent before participating in the study. This study was approved by the Yonsei University Faculty of Health Sciences Human Ethics Committee. The CONFORMat System (Tekscan, Boston, MA, USA) was used to measure the magnitude of fingertip contact pressure for the different typing speed groups. A sampling rate of 60 Hz was used to measure the magnitude of the acceleration of the fingers according to the computer typing speed. Therefore, this study investigated effects of different computer typing speeds on acceleration and peak contact pressure of the fingertips during computer typing.
tion. The routine computer workstation featured a 23-inch monitor, a keyboard and a mouse on a table, and a swivel chair with five wheels. To allow analysis of lumbar motion, the armrest and backrest were removed. Both the table and chair were adjustable in terms of height and were initially set to ensure that the elbows, hips, and knees were flexed at 90°. The keyboard was positioned frontally, 30 cm from the trunk, the monitor was inclined by 20°, and the top of the display was set at eye level. All subjects performed keyboard typing work consisting of 1,000 words using a keyboard. The CONFORMat System was positioned underneath the keyboard. SPSS version 12.0 (SPSS, Chicago, IL, USA) was used to assess differences in forward head and lumbar flexion angles. The paired t-test was used to explore the significance of differences in acceleration and peak contact pressure of the fingertips. Significance was accepted for values of p < 0.05.

RESULTS

The mean fingertip contact pressure in the high typing speed group (23.6±6.0 g/cm²) was significantly increased compared with the low and medium typing speed groups (15.3±5.7 g/cm², 18.2±6.4 g/cm²). The mean fingertip acceleration in high typing speed group (5.0±2.6 cm/sec²) was significantly increased compared with the low and medium typing speed groups (2.4±1.0 cm/sec², 3.2±2.7 cm/sec²).

DISCUSSION

Most computer operators complain upper extremity pain after long periods typing work⁹,¹⁰. A previous study showed that typing speed is not proportional to the severity of pain in keyboard workers with work-related upper extremity disorder and that slower or faster typing speeds do not cause statistically different levels of pain⁴. It has already been reported in previous studies that a typing speed did not influence pain in the upper extremity but that it could incur a negative effect on the wrists or fingers. So, this study investigated effects of different computer typing speeds on the acceleration and peak contact pressure of the fingertips during computer typing. The results showed that the fingertip contact pressure increased in the high speed typing group compared with the low and medium typing speed groups. Also, the fingertip acceleration increased in high speed typing group compared with the low and medium speed typing groups. Computer operators with a high typing speed showed high acceleration during fingertip movement. This high acceleration could cause the fingertips to collide with the keyboard without sufficient deceleration. It is also assumed that the fingertip pressure of computer operators with a high typing speed would be very large when their fingertips collide with the keyboard. The reason why computer work poses a threat of musculoskeletal pains is due to the high possibility of cumulative traumatic injury²,⁹. Even if a computer typing job applies a small load to the finger joints, it could incur cumulative loads because of its characteristics as a repetitive job performed for long periods of time. Normally, stress applied to fingers due to computer work is overlooked easily compared with shoulder or low back pain occurring after computer work. In addition, modern society requires a fast pace in completing computer work⁹. According to our study results, a fast typing speed causes continuous pressure stress to be applied to the fingers, thereby creating pain in the fingers. Furthermore, finger pain due to long hours of computer work is thought to be closely related to finger arthritis in the future⁹.

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