

Effects of Wrist and Fingers Postures on the Median Nerve at Proximal Carpal Tunnel

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(手関節および手指の姿勢が手根管の正中神経に及ぼす影響)

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論 文 内 容 の 要 旨

Thesis Summary

Carpal tunnel syndrome (CTS) is one of the most common work-related upper limb compression neuropathies that affects the median nerve at the carpal tunnel. Biomechanical factors such as intensive wrist-finger movements and work duration are associated with CTS prevalence. The main aim of this thesis is to improve existing prevention guidelines and ergonomics interventions on work-related CTS from the perspective of morphological changes in the median nerve. The main objectives are to investigate changes of the median nerve cross-sectional area (MNCSA) and the median nerve diameter: (1) At different finger postures and wrist angles; (2) At different grip conditions and wrist angles; (3) After continuous typing on two keyboards with different slopes.

The median nerve at the wrist was examined in six finger postures and three grip conditions, namely finger relaxation, unclenched fist, and clenched fist, with the wrist at 30° flexion, with a neutral wrist (0°), and with the wrist at 30° extension to address objectives (1) and (2). Main effects of finger postures, grip conditions, and wrist angles are significant ($p < 0.01$) in changes of the MNCSA. First, the MNCSA became significantly smaller ($p < 0.05$) as the finger posture changed and fists were unclenched or clenched. Subsequently, wrist flexion and extension cause higher deformation of the MNCSA at different conditions. Lastly, changes of the median nerve after continuous typing tasks with 0° and 20° keyboard slopes were examined to address objective (3). Keyboard typing caused a significant increase in the MNCSA at both wrists ($p < 0.05$) in comparison to the baseline measurement. Subsequently, changes of the MNCSA when typing on keyboard of 20° slope is higher than that of 0° slope.

In summary, this thesis presented the impact of biomechanical stresses that arise from the wrist and finger postures as well as continuous keyboard typing on the median nerve in the carpal tunnel region. Following an in-depth analysis and interpretation of the results, the findings offer deeper insights into relevant factors that associate with median nerve deformation. Overall, a neutral wrist posture and less force exertion at work tasks are recommended to prevent stresses on the median nerve. Moreover, the results suggest that continuous computer work such as keyboard typing should be avoided. To conclude this thesis, general recommendations for CTS prevention and implications on current ergonomics interventions for work-related CTS are discussed.