

THE EFFECT OF GENDER ON FINGER ANGLES DURING KEYBOARDING

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INTRODUCTION

Female gender has been associated with increased risk for computer-related musculoskeletal disorders of the upper extremity (WRMSD-UE). Researchers have hypothesized that this association may be related to anthropometrics, hormones, and differential exposures to occupational practices than males (Tittiranonda et al., 1999). One possible explanation is that females may work in postures which cause greater biomechanical stressors than males.

There is considerable variability in postures between computer users during keyboarding (Simoneau et al., 1999). There has been considerable research that has examined joint angles of the wrist during keyboarding, but few that have examined finger angles (Baker et al., in press; Sommerich et al., 1996). There has been almost no research, however, that compared these joint angles between genders.

The purpose of this paper is to describe the differences in male and female flexion/extension (f/e) and abduction/adduction (ab/ad) joint angles of the metacarpophalangeal (MCP) joints, and the f/e angles of the proximal phalangeal (PIP) joints during keyboarding.

METHODS

Twenty subjects, 14 females and 6 males, between the ages of 20 and 54 were recruited. All subjects reported using a computer an average of 6 hours per day. Kinematics data were collected using 5

VICON^{TM1} motion measurement system cameras positioned around a computer workstation. The finger movements were derived by tracking 21 passive markers positioned on the dorsal surface of each hand (Baker et al., in press). Data were collected at 60 Hz. Subjects were instructed to type at their normal rate, using their usual keyboarding methods. Subjects typed for 15-minutes to acclimate to the workstation. Three 1-minute trials of motion data were captured at 15-minutes, 20-minutes and 24-minutes of keyboarding.

Joint angles were derived as described in Cook et al. (in press). The three trials' data were combined together and means and standard deviations were calculated for the angles. We used 3-way ANOVAs with 2 within-subject measures, hand and digit, and 1 between-subject measure, gender, to examine the differences between MCP f/e, MCP ab/ad, and PIP f/e. If an overall ANOVA was significant, we used post hoc analyses to examine potential differences in kinematics between the males and females.

RESULTS AND DISCUSSION

Figures 1 – 3 show the mean finger joint angles during keyboarding. There was no significant differences between genders for MCP ab/ad ($p = .86$) and PIP f/e ($p = .41$). There was a significant difference between genders for MCP f/e ($p = .05$). An examination of the means suggested that males had a significantly larger mean MCP flexion angles than females, particularly for the right hand (Figure 1).

¹ VICON Motion Systems Inc, Lake Forest, CA, USA - <http://www.vicon.com/jsp/index.jsp>

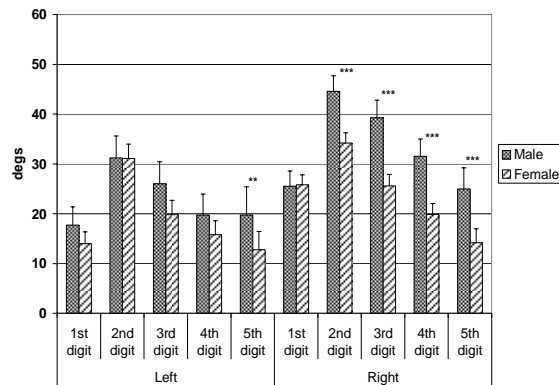


Figure 1: Mean male & female MCP flexion angles during keyboarding (** $p < .05$; *** $p < .001$)

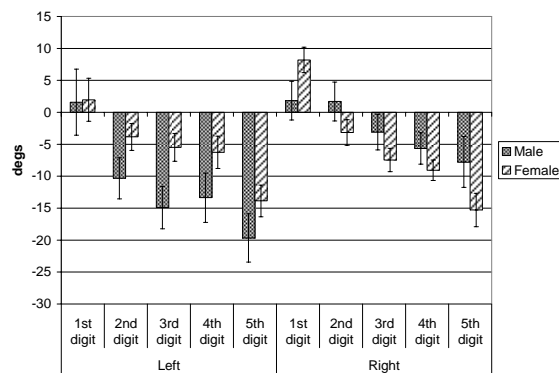


Figure 2: Mean male & female MCP adduction⁽⁺⁾ & abduction⁽⁻⁾ angles during keyboarding

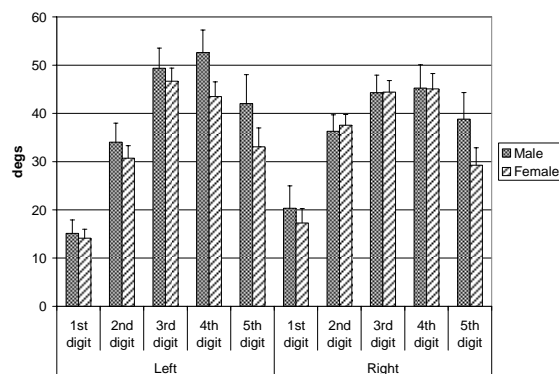


Figure 3: Mean male & female PIP flexion angles during keyboarding

Observations of keyboard users suggest that some users maintain their MCP joints in hyperextension when not striking the keys (Baker et al., in press). One possible interpretation of the greater mean flexion of the males is that females, being generally

more flexible than males, may be more likely to hold their MCP joints in hyperextension while in the resting posture. Whether this posture is a gender related risk factor for WRMSD-UE needs to be examined further.

SUMMARY

This study examined the differences in finger joint angles between genders during keyboarding. Males have significantly larger mean MCP flexion angles than females, suggesting that females may maintain their MCP joints in hyperextension more than males during keyboarding.

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