GENDER-BASED POSTURAL RESPONSES TO SEATED EXPOSURES

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INTRODUCTION

Extensive research has attempted to determine the "optimal" seating position for the human spine to reduce the risk of low back pain. Thus, different chair designs have emerged to allow individualized optimal seated postures while maintaining comfort and functionality of the chair. However, individuals may respond differently to different chair designs and the factors that influence these sitting behaviours are not well understood. In particular, anecdotal observations of potential gender-specific sitting behaviours led to the primary purpose of this project which was to test the influence of gender on the responses to different seated postural conditions. A secondary purpose included determining if and/or how males and females respond to different seated computer-based tasks.

METHODS

Sixteen healthy university students (8 males and 8 females) were tested on 4 different chair configurations, each on a separate day. The four chairs included: 1) a fixed chair with no back rest, 2) a pivoting chair with no back rest, 3) a pivoting chair with a back rest and 4) a freely pivoting spring-post stool. Participants performed three 15-minute intervals of simulated office work (mousing, typing and a combination of the two; Figure 1). Kinematics were recorded using OPTOTRAK; spinal angles and upper body centre of mass (CoM) were calculated. The seat pressure profile was collected using a pressure mapping device (XSensor) and was used to obtain the location of the centre of pressure (CoP), peak pressure over time and the average peak pressure for each 15-minute interval. Ratings of perceived discomfort (RPD) were taken 9 times at 7.5 minute intervals.

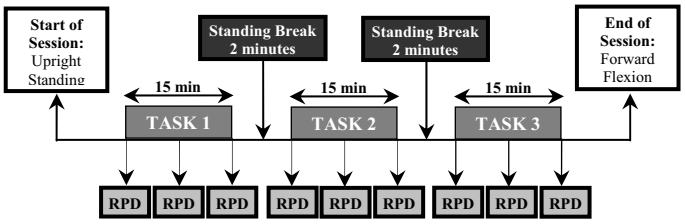

Figure 1: Study Design – For each testing session, participants completed three tasks (mousing, typing, or combination). Ratings of perceived discomfort (RPD) were taken at the beginning, middle and end of each of the three tasks.

RESULTS & DISCUSSION

Regardless of the chair used or the task performed, average lumbar and trunk angles were significantly more flexed for males than for females (Table 1). The pelvis was posteriorly rotated for males and anteriorly rotated for females (Table 1). The task performed had an effect on the average lumbar angle of all subjects ($p = 0.0029$); the lumbar spine was the least flexed during the typing task (52.5° ± 20.8°), followed by the combination task (57.9° ± 22.1°) and the mousing task (62.1° ± 20.7°). Significant gender*chair interactions of the location of the individual on the chair seat were most marked for the pivoting chair with a back rest. Females positioned their CoM and hip joints anterior to the chair pivot point while males' CoM and hip joints were located posterior to the pivot point. Females also sat with their CoM closer to the seat pan CoP than males when a back rest was present. Average ratings of perceived discomfort for each chair were analysed, revealing a significant chair effect for the upper back and overall discomfort. Both male and female participants had significantly less upper back discomfort ($p = 0.018$) and overall discomfort ($p = 0.012$) using the pivoting chair with a back rest when compared to all other chairs.

Table 1: Thoracic, lumbar, trunk and pelvis angles averaged over chair and task.

Measurement		Male	Female	P-value
% max flexion	**Thoracic**	**8.6** *(12.0)*	**3.1** *(8.1)*	p = 0.201
	Lumbar	**65.4** *(16.2)*	**49.6** *(23.1)*	p = 0.047
	Trunk	**29.8** *(28.3)*	**-3.3** *(20.4)*	p = 0.0026
Deviation from vertical (degrees)	**Pelvis**	**7.6** *(8.2)*	**-5.5** *(9.3)*	p = 0.0008

Taken as a whole, these findings suggest that men tended to slouch against the back rest while females perched closer to the front of the seat pan. It follows that males and females may be exposed to different loading patterns and may experience different injury pathways. Maintaining spine postures near neutral alignment, avoiding excessive spine flexion, and minimizing joint loading by adopting an upright posture are important factors in maintaining back health and preventing low back pain. Accordingly, males may be more susceptible to developing low back pain from prolonged sitting due to the adoption of a more flexed spine posture that increases the risk of disc herniations (1), and the increased probability of exhibiting seated flexion relaxation (2). Females may be more susceptible to back muscle pain since upright sitting postures require higher muscle activation than slumped sitting (2) and prolonged low level activation has been linked to muscle pain (3).

The identification and exploration of gender differences in seated work has implications for the differential prevention and treatment of injuries as well as the alteration of chair designs to accommodate both genders and knowledge of safe levels of exposure to prolonged sitting in occupational settings.

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