

Musculoskeletal symptoms among mobile hand-held device users and their relationship to device use: A preliminary study in a Canadian university population

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ABSTRACT

The study aims were, in a population of university students, staff, and faculty ($n = 140$), to: 1) determine the distribution of seven measures of mobile device use; 2) determine the distribution of musculoskeletal symptoms of the upper extremity, upper back and neck; and 3) assess the relationship between device use and symptoms. 137 of 140 participants (98%) reported using a mobile device. Most participants (84%) reported pain in at least one body part. Right hand pain was most common at the base of the thumb. Significant associations found included time spent internet browsing and pain in the base of the right thumb (odds ratio 2.21, 95% confidence interval 1.02–4.78), and total time spent using a mobile device and pain in the right shoulder (2.55, 1.25–5.21) and neck (2.72, 1.24–5.96). Although this research is preliminary, the observed associations, together with the rising use of these devices, raise concern for heavy users.

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1. Introduction

The use of mobile hand-held devices to send or receive email, to send or receive instant messages, and to access the internet is on the rise (Rainie, 2010). Along with this rise in device use has come attention in the press and in the clinical literature claiming a link between hand-held device use and upper extremity musculoskeletal symptoms (Storr et al., 2007; Ming et al., 2006; Brasington, 1990). Phrases have been coined such as 'text messenger's thumb', however little evidence exists to support this association.

Although no epidemiological studies have been reported, case reports and laboratory studies indicate potential risks to musculoskeletal health as a result of mobile device use (Jonsson et al., 2007; Sengupta et al., 2007; Storr et al., 2007; Ming et al., 2006). Case reports suggest a link between high keystroke counts and hand disorders, specifically De Quervain's tenosynovitis and osteoarthritis of the joint at the base of the thumb, the first carpometacarpal (CMC) joint (Storr et al., 2007; Ming et al., 2006). Laboratory work has shown that due to small spacing on

the mini-keyboard, greater static strain may be placed on the hand and arm muscles during personal digital assistant (PDA) use as compared to during desktop or laptop use (Sengupta et al., 2007). In addition, laboratory work has demonstrated that as the thumb moves along the interface of the mini-keyboard during a task such as text messaging, it is placed toward the end of its range of motion (Jonsson et al., 2007). Jonsson et al. (2007) described typical thumb postures during text messaging and found that the thumb approaches 79% of its maximum range of motion when abducting in the adduction/abduction plane and 55% of its maximum range of motion when flexing in the flexion/extension plane. Placing the thumb in these static postures likely puts unfavourable static loads on the extrinsic and intrinsic musculature of the thumb. Furthermore, most mobile device tasks require users to look sharply downwards or to hold their arms out in front of them to read the screen; this could lead to fatigue and pain in the neck and shoulders.

Given that the use of mobile hand-held devices is on the rise, that the public has a perception that device use is associated with musculoskeletal symptoms, and that case reports and laboratory studies indicate that this may be an area of concern, an epidemiological study is warranted. The study described herein was therefore designed to: 1) determine the distribution of seven

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measures of mobile device use among a population of university students, staff, and faculty, 2) determine the distribution of musculoskeletal symptoms of the upper extremity, upper back and neck among a population of university students, staff, and faculty, and 3) assess the relationship between measures of device use and musculoskeletal symptoms among this population. It is hypothesized that measures of higher daily mobile device use are associated with more musculoskeletal symptoms in the upper extremity, upper back and neck within this population of users.

2. Methods

This preliminary study used a cross-sectional design, with an internet-based questionnaire, to collect self-reported measures of daily mobile hand-held device use and self-reported symptoms of pain in the upper extremity, upper back, and neck in 140 students, staff, and faculty (80 female and 60 male) at a Canadian university, between June 17th and August 12th 2009.

2.1. Participants

137 of the 140 participants reported using a mobile hand-held device, 104 of whom were students and 32 of whom were staff or faculty. Staff members are individuals on university payroll whose principal appointment is not faculty; faculty members are Lecturers, Assistant Professors, Associate Professors, or Professors. Participants were recruited using advertisements placed in university buildings, in university newspapers, in university club/group emails, on daily news bulletins, and on student club/group websites. There was no inclusion or exclusion criterion. Although this data was collected during the summer term, participants were representative of students, staff, and faculty on campus all year round since the university's co-operative education program brings good summer term enrollment. The study was approved by the Office of Research Ethics at the University of Waterloo.

2.2. Questionnaire

The online questionnaire consisted of three sections: 1) Your Use of Computing and Mobile Devices, 2) About Your Health, and 3) About You. Section 1 assessed how much time in a typical day last week a person spent using a mobile hand-held device for: 1) emailing, texting, and instant messaging; 2) scheduling (calendar, appointments); 3) internet browsing; 4) making phone calls and talking on the phone; 5) listening to music, watching videos, and taking pictures; and 6) gaming using a mobile phone, PDA or hand-held video game. These six measures of device use were created by grouping activities together that we believe place similar demands on the thumb. For example, emailing, texting and instant messaging would require heavier thumb use, whereas listening to music, watching videos, and taking pictures would require lighter thumb use. The questionnaire informed participants that a typical day referred to both time at work and time away from work, at home or with friends. Participants were also asked to report how much time they spent on a typical day last week: 1) using a desktop computer or laptop keyboard and mouse; 2) using a Wii Nintendo system game controller; and 3) using any other game controller (e.g. Xbox or Playstation). For each measure of mobile hand-held device, computer, and game controller use, hours and minutes were selected from dropdown menus with options for hours as all integers from 0 to 23 inclusive and options for minutes as all integers from 0 to 59 inclusive.

In Section 2 participants were asked, "In the last week, indicate how much pain you had in your hands using the diagrams below" (Fig. 1) and "In the last week, indicate how much pain you had in your neck, upper back, shoulders and elbows using the diagrams below Fig. 2." Participants reported their pain on a Likert scale where 0 indicated no pain and 10 indicated the most severe pain. Data was collected for 18 body parts: left/right tip of thumb, left/right middle of thumb, left/right base of thumb, left/right fingers, left/right front of hand, left/right back of hand, left/right elbow and lower arm, left/right shoulder, upper back and neck. Participants were also asked, "In the last week, did you have numbness or tingling in your hands?" with "yes" or "no" as possible answers.

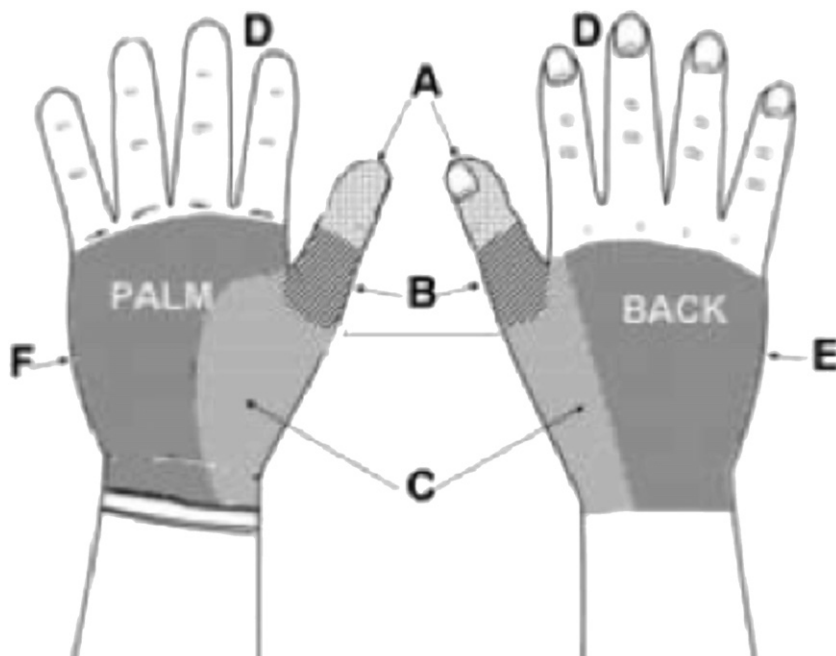


Fig. 1. Hand diagram on questionnaire.

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