Cervical and forearm muscle activity in using multitouch devices in different positions and performing different tasks

Grace Szeto

Department of Rehabilitation Sciences, The Hong Kong Polytechnic University, Hong Kong SAR, China

1. Introduction

Touchscreen technology has a tremendous impact on young people’s lives and may affect their health. Nowadays we can use touchscreen devices to do everything that we used to do on desktop computers, and we can use these at any time and in any place. Use of mobile “apps” has been described as “sky-rocketing”, and it is common for people to use the smartphone for internet-surfing, reading newspapers or books, listening to music and playing electronic games.

It is common to see people with their heads bent forward and their fingers tapping or stroking on their smartphones everywhere, and the neck and hand are two most affected body regions. It is important to examine the biomechanical loading in these muscles, which are affected by the inputting method, the tasks performed and the position of the mobile device. In addition, there is a large variety of sizes available for the mobile touchscreen devices, and how this may affect the joint movements in the hand and the muscle work is yet to be investigated. Whether one hand or both hands should be used in interacting with the touchscreen device is also an interesting question.

2. Method

A series of research studies are being conducted presently to examine the effects of screen size, task performed and inputting methods in using mobile touchscreen devices. For this presentation the results of 2 studies will be discussed. Healthy university students were invited to participate in these 2 studies. Study 1 compared the muscle activities during texting, web browsing and gaming in using smartphone versus the conventional keypad phone. In study 2, the electronic game was standardised and playing with a smartphone and tablet computer were compared.

In Study 1, cervical and forearm muscle activity was compared among three tasks: texting, internet browsing and gaming. In Study 2, the bilateral cervical erector spinae (CES) and upper trapezi (UT) muscles were examined during game playing with smartphone and tablet, for 10 mins each session. In this study, the effect of placing the device in a horizontal versus an inclined position was also compared.

3. Results

3.1 Effects of performing different tasks on muscle activity

The median muscle activity of the right aductor pollicis brevis (APB) was significantly higher in performing web-browsing compared to texting and gaming in using smartphone. Extensor carpi radialis (ECR) activity was significantly higher in texting with keypad phone compared to smartphone. Bilateral UT muscle activity was not significantly different among the three tasks. (Fig 1)

3.2 Effects of screen size and position of smartphone vs tablet

Playing game on the tablet computer was associated with generally higher muscle activity in the CES and UT muscles compared with same action using the smartphone. This may be related to the larger screen size and heavier weight of the device. In terms of the position effect, the muscle activities were significantly higher in the horizontal position compared to inclined position. This result confirms the importance of positioning the mobile devices in a more vertical or inclined position which can help to relieve the muscle load in the postural muscles such as CES and UT muscles. (Fig 2)

4. Discussion
The present studies have demonstrated the important effects of the size and position of the handheld touchscreen devices, as well as the tasks performed on the neck and upper limb muscle activities. More extensive research is needed to investigate these issues more thoroughly, especially to examine the muscle loading in those who are intensive users and those who are symptomatic.

Figure 1. Neck and forearm muscle activity in performing different tasks using smartphone and keypad phone

Figure 2. CES and UT muscle activity in using smartphone and tablet in horizontal and inclined positions

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