Hong Kong Physiotherapy Journal (2016) 35, 37–44

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.hkpj-online.com

RESEARCH REPORT

Exercise training and postural correction improve upper extremity symptoms among touchscreen smartphone users

Abeer Ahmed Abdelhameed [a,b], **Amr Almaz Abdel-aziem** [c,*]

[a] *Department of Physiotherapy, College of Health Sciences, University of Sharjah, Sharjah, United Arab Emirates*
[b] *Department of Physical Therapy for Cardiovascular/Respiratory Disorders and Geriatrics, Faculty of Physical Therapy, Cairo University, Giza, Egypt*
[c] *Biomechanics Department, Faculty of Physical Therapy, Cairo University, Giza, Egypt*

KEYWORDS
exercise training;
hand grip;
smartphone;
upper extremity symptoms

Abstract *Background:* Repetitive movements and poor posture are associated with over-use of smartphones when texting or playing games and significantly contribute to the symptoms of pain and discomfort in the upper extremities.
Objective: This study investigated the effect of exercise training and postural correction on disabilities of the arm, shoulder, and hand (DASH), hand grip and key pinch strength among smartphone users.
Methods: One hundred university students were randomly divided into two groups; the experimental group participated in a 12-week programme of exercise training and postural corrections. The control group were instructed to follow their usual routine for smartphone utilization. Measurements of DASH scores, hand grip strength, and key pinch grip strength were conducted before and after 12 weeks for both groups.
Results: There were no significant differences between the start values of both groups for DASH scores, hand grip strength, and key pinch strength ($p > 0.05$). However, there was a significant improvement in all outcomes measured in the experimental group ($p < 0.05$), with significant changes in the outcomes of the control group.
Conclusion: Postural correction combined with a selected exercise training programme improved the hand grip, key pinch grip strength, and upper extremity disability and symptoms associated with smartphone use among university students.

* Corresponding author. Biomechanics Department, Faculty of Physical Therapy, Cairo University, 7 Ahmed Elziat Street, Bean Elsariate, El Dokki, Giza, Egypt.
E-mail addresses: amralmaz@yahoo.com, amralmaz74@gmail.com (A.A. Abdel-aziem).

http://dx.doi.org/10.1016/j.hkpj.2016.06.001

Introduction

In the past few years, touchscreen smartphones have replaced most of the keypad phone products due to their versatility and abundance of applications. However, as many people maintain their neck flexed when using portable devices, there is a growing debate about the effect of touchscreen smartphones on the musculoskeletal system among prolonged users of these devices. Similar to desktop and laptop computers, prolonged use of touchscreen smartphones may also contribute to increased risk for the development of musculoskeletal symptoms such as chronic neck and shoulder pain [1,2].

With each new generation of mobile phone, there are more built-in functions which lead to increased exposure and use of mobile phone functions. In younger persons, these exposures may be of great importance due to their developing musculoskeletal structure, their tendency to use their mobile phone for messaging and gaming, and the likelihood of greater exposure as a result of repetitive messaging and gaming activities [3].

The combination of repetitive movements, poor posture, and over-use of mobile phones for texting or playing games, without taking rest breaks, can cause injury to the nerves, muscles, and tendons in the fingers, hands, wrists, arms, elbows, shoulders, and neck, which if ignored, may lead to long-term damage [4]. The frequency and duration of use of cellular phones is increasing, and the design characteristics of these phones give rise to concerns regarding their impact upon body mechanics [5].

Gustafsson [6] showed differences in physical load between the group of mobile phone users with musculoskeletal symptoms and the group without symptoms. He also found differences in muscle activity and kinematics between different texting techniques. Preliminary studies on the effect of mobile hand-held device use among university students revealed a significant association between upper extremity symptoms and frequent utilization of a mobile hand-held device [7]. Moreover, Gustafsson et al [8] found prospective associations were established between exposure to text messaging on mobile phone and musculoskeletal pain in neck, shoulder, and arm, and numbness/tingling in hand/fingers for both men and women.

Recently, a few epidemiological studies reported a high prevalence of neck—shoulder symptoms among mobile device users. A study in Canada indicated rates of 46—52% in shoulder symptoms among 140 individuals and 68% in neck symptoms [1]. Another study in China reported over 40% of neck—shoulder pain among 2575 young mobile phone users [9].

Touchscreen tablet users are exposed to extreme wrist postures that are less neutral than other computing technologies and may be at greater risk of developing musculoskeletal symptoms [10]. Moreover, head and neck flexion angles during tablet use were greater, in general, than angles previously reported for desktop and notebook computing [11]. Gold et al [12] reported that over 90% of university students adopted a flexed neck posture, with protracted shoulders and nonneutral wrist postures on the typing side when they used their mobile devices.

Despite the reported association between mobile use and upper extremity symptoms there is a gap in the knowledge on how exercise and proper hand grasp can improve these symptoms. Considering the increased use of touchscreen mobile phones among young people it is important to identify how physical therapy interventions can reduce these symptoms. The aim of this study was to examine the effect of a training programme and postural corrections on hand grip strength, key pinch strength, upper extremity disability, and symptoms associated with touchscreen smartphone use among university students.

Methods

Participants

In this study, 217 students from Cairo University, Giza, Egypt were identified as potential participants. A total of 100 students (age, 18—26 years) who reported mild to moderate symptoms in disabilities of the arm, shoulder, and hand (DASH) questionnaire (DASH score $\geq$ 25) [13], were invited to the study. They were recruited by convenience sampling. In order to be recruited, individuals had to have at least 6 months' experience in using smartphones for at least 3 hours daily. They had to be right hand dominant and prefer to use the right hand in one handed text entry. Other essential requirements were texting and typing speeds to make sure that all participants had similar skills in texting on a smartphone and typing on a desktop computer. Individuals were asked to perform a texting speed test on an iPhone 4s (Apple Inc., Cupertino, CA, USA) using both hands as well as perform a typing speed test on a desktop computer before entering the study. Only those who achieved a minimum texting speed of 15 words per minute on the smartphone and typing speed of 30 words per minute on the computer keyboard were recruited. The exclusion criteria were: (1) history of traumatic injuries or surgical interventions of the neck or upper limbs; (2) medical conditions which may have a negative effect on the spine and upper limbs; (3) chronic diseases such as rheumatoid arthritis, osteoarthritis, and other connective tissue disorders that affect the musculoskeletal system; and (4) neurological and orthopaedic disorders as well as sensory deficits [14].

Before the start of the study participants were allocated to two groups, the experimental group or the control group, using SPSS computer programme (version 16.0; SPSS Inc., Chicago, IL, USA) to conceal group allocation. Participants in the control group were advised to keep their regular routine and avoid any unusual activities that may increase the load on the arm and hand. Participants in the experimental group were engaged in a 12-week exercise programme. The CONSORT diagram showing the recruitment, assignment and progression of patients through the study is presented in Figure 1.

All procedures had been thoroughly explained and consent forms were obtained from all participants. The study was approved by the human research ethics committee of the Faculty of Physical Therapy at Cairo University and each participant signed written consent. The participants were recruited from Cairo University. The study was run in