



## A cross sectional survey to estimate the risk of developing upper quadrant disorders using RULA in young adults using mobile phones

**Prof. Shivani  
Chowdhury  
Salian**

Department of Electrotherapy & Electrodiagnosis, School of Physiotherapy, D.Y. Patil University, Nerul, Navi Mumbai, India

**Nidhi Chhabra**

School of Physiotherapy, D.Y. Patil University, Nerul, Navi Mumbai, India

### ABSTRACT

**Background:-** Use of handheld devices rapidly increasing worldwide. Dependency on a hand held device maybe predisposing the current generation of electronics addicts to early development of osteoarthritis and other potentially chronic joint conditions such as BlackBerry Thumb. **Methodology –** A prospective study including 500 subjects between the age group of 18 to 25 years using mobile phones was carried out with the objective to compute the risk of injury in the upper quadrant using RULA score. A validated Questionnaire targeting the demographics and the details of usage of mobile phone was designed. All the subjects were then interviewed through this Questionnaire and Postural assessment was done using RULA scale to assess the risk factors in the upper quadrant. Pictures were taken during use of mobile phone. **Results –** Statistical analysis was done using SPSS version 20. 78% of the young adults used Touch screen, 17% used QWERTY and 5 % used non- Qwerty mobile phones. Chi square was used to test the null hypothesis, to compare the observed data with expected data. **Conclusion –** From the present study it is evident that the young population of students is definitely susceptible to injuries involving the upper quadrant due to usage of mobile phones demonstrating a RULA score of 4 and 5 i.e. Action Level 2 and 3 respectively. Also there is strong association of RULA scores with occurrence of musculoskeletal pain in the upper quadrant. Students demonstrating a higher RULA score also depicted higher levels of presence of pain and affection in the upper quadrant.

**KEYWORDS :** Mobile phones, upper quadrant, RULA, Postural assessment.

### 1 Introduction

The use of hand held devices (HHD) such as mobile phones, game controls, tablets, portable media players and personal digital assistants have increased dramatically increased in past decade. Mobile phone users are able to communicate other than by voice by a wide range of text button usage by means of SMS (short message service), Whatsapp, Viber, line, BBM (blackberry messenger) and social networking applications like Facebook, Twitter and Skype. The incidence of musculoskeletal disorders (MSD) of hand, wrist, forearm, arm and neck has been increasing all over the world due to prolonged, forceful, low amplitude, repetitive use of hand held devices. Few studies in the recent years have reported about this growing problem that has a large impact globally. Hence, this study was conducted to describe the risk factors and clinical features of the MSD's due to usage of HHD and to evaluate the effectiveness of a sequenced rehabilitation programme<sup>[9,10,11]</sup>.

One of the most important causes to develop this research project is the widespread use of hand-held device across a vast majority of the population, which is exposed to the risk involved of its use; in addition, the lack of information of the problem increases the risk<sup>[8]</sup>.

In a study, done in China on children associating mobile phone use and well being through a self reported questionnaire, concluded that there was a consistent significant association between mobile phone use and fatigue in children<sup>[12]</sup>. In another study, CharuEapen et.al studied the prevalence of cumulative trauma disorders in cell phone users and found that the response rate of the survey was 91.9%. Overall prevalence of CTD in the upper limb was found to be 18.5%. Maximum symptoms were noted in thumb (52%). Pain (61.7%) and fatigue (44.3%) were the two most common symptoms reported by the respondents. They concluded that a mild form of CTD is present in students using cell phones and mainly depends on the pattern of phone usage<sup>[3]</sup>.

### 2 Material & Methodology

Cross-sectional Prospective survey including 500 subjects between the ages of 18 to 25 years using mobile phones was carried out in a period of 6 months. Subjects suffering from diabetes and any other

injury to the upper quadrant within the last 3 months were excluded. All the subjects were informed about the procedure of the study through an information sheet. A written consent was taken from all the participants. The methodology and the study procedure were approved by the Ethics Committee of PadmashreeDr.D.Y.Patil University, Nerul, Navi Mumbai. A Questionnaire targeting the demographics and the details of usage of handheld device was designed which was validated by the Director of Department of Physiotherapy and the guiding Professor. All the subjects were then interviewed through this Questionnaire and Postural assessment was done using RULA scale to assess the risk factors in the upper quadrant. Pictures were taken during use of mobile phone. RULA assessment was done using the software on the computer and the results were computed online.

#### 2.1 Survey Tool (questionnaire)

The questionnaire consisted of demographic information, information on mobile phone use, physical symptoms and possible confounding factors.

##### 2.1.1 Demographic Information

Demographic information consisted of age, gender, address and occupation.

##### 2.1.1 Information on mobile phone usage

This consisted of the type of mobile phones used, average duration of use of handset, usage of any hands free device, activities performed the most on the handset, usage of mobile phones during any activities (studying/ driving/ watching TV, others).

##### 2.1.2 Physical Symptoms

Physical symptoms consisted of pain in any region of the body and marking it on body schema diagram, type of pain, referred pain, aggravating factors, relieving factors, duration of pain, distraction due to use of mobile phones, rating pain on Visual analogue scale.

#### 2.2 Statistics

Statistics was done using SPSS version 20 with the help of a biostatistician and Chi square ( $\chi^2$ ) was used to test the null hypothesis,

to compare the observed data with expected data

### 3. Results

The present survey was conducted to estimate the risk of upper quadrant disorders using mobile phones on regular basis. 500 young students between the age group of 18-25 years participated in study comprising (82.2%) females and (17.8%) males. The subjects were interviewed via a validated questionnaire which aimed at collecting demographic information and other questions like the type of phone they use, the duration of use of mobile phone, their multitasking skills were also looked at, which showed the number and type of activities they do along using the mobile phones for various purposes. They were also questioned regarding the region of the upper body in which they experienced pain and other questions pertaining to the duration of pain, type of pain, aggravating factors and relieving factors all were noted.

Pain was quantified using Visual Analogue Scale (VAS) and other problems like headache, hearing problems, vertigo, etc were also considered in the questionnaire. Risk assessment of upper quadrant in young adults was carried by using the Rapid Upper Limb Assessment (RULA) scale.

The sample size of 500 comprised young adults of varied specialities and faculties. The various types of faculties is as mentioned in the above results.

It is quite evident from the study that most adults use touch screen i.e. (78%), whereas (16.6%) used a mobile phone with QWERTY keypad and only small percent of these young adults i.e. (5.4%) used non-QWERTY type mobile phones. Also supplementary devices like Bluetooth, earphones were used by these students. It was observed that (68.6%) students used earphones and (2.2%) used Bluetooth device.

The duration of the use of mobile phones ranged anywhere from 30 minutes to 3 hours a day. (53.4%) individuals use their mobile phones for the duration of 30 to 60 minutes/ day, (21%) individuals use it for 1-2 hours/ day, followed by (14.4%) for 2-3 hours/ day and 11.2% use it for more than 3 hours/ day.

It was evident from the observation of young students using their mobile phones maximum (69.4%) texting or chatting using various application, (17.6%) use mobile phones for making calls and (9.6%) for playing games, (3.2%) for surfing and (0.2%) others.

In the present study it was observed that a maximum of (4.2%) individuals use their mobile phones during riding/ driving vehicle. A major chunk of (34.2%) of individuals used the phone during watching TV, (8.8%) did mention the use of mobile phones while studying and (5.8%) of individuals did honestly mention that they used their mobile phones maximum while they were in classroom/ meetings. The rest of the population gave a mixed picture of using their mobile phones more than above mentioned task of which (16.6%) of the people mentioned about using their mobile phones during any of the three tasks mentioned above. Lastly, (3.4%) of the subjects mentioned that they use their mobile phones during all four tasks mentioned above.

An overall assessment showed that on an average (46.8%) of the individuals multitask i.e. use their mobile phones during various other activities of daily life.

When asked regarding the experience of pain in any part of the body (32%) of the individuals complained of pain whereas, (67.8%) of the subjects claimed to have no pain due to the use of their mobile phones. The reason that could have led us to such a finding, the targeted population was young and active population i.e. however the population of subject between the age group of 18-25 years, who positively replied for the pain, would definitely rise in huge numbers in the years to come with further more prolonged use of mobile phones. Simons et al. reported that frequent triggering of

the physiological responses may increase muscle discomfort symptoms. There are studies which revealed that design of the mobile phone and the anthropometry has an impact on the development of discomfort and fatigue in body parts like shoulder, hand, etc. while using the device [1,2].

The aim of this study was to evaluate risk factors and clinical features of the MSDs due to prolonged use of mobile phones. We also found that among the (32%) of individuals (24.8%) complained of pain in the cervical region, followed by the right thumb being affected in (21.7%) whereas the left thumb being affected in (5.5%), in agreement with the findings of studies conducted earlier [4,5,6,]. Based on this we evaluated the risk of attaining disabilities in the upper quadrant of the body by using RULA scale which calculates the rating of neck and upper limb musculoskeletal load while using mobile phones.

RULA of all the 500 subjects projected average scores of 4 and 5 only. (31.6%) of individuals presented with a score of 4 i.e. action level 2 indicating further musculoskeletal investigation is needed and changes may be required in the way they use their mobile phones. (68.4%) of total study population represented with RULA score of 5 i.e. action level 3 indicating that investigations and changes are required soon in the way they use their mobile phones.

It was quite interesting to note that despite of 100% of study population used only (74%) of the subjects mentioned that mobile phones were a big distraction in day to day basis.

It was also observed that (32.4%) i.e. 162 subjects complained of various types of headache be it frontal, temporal or occipital in this young age. Other health related problems did not project major findings.

All in all, our findings do suggest that the young population is definitely exposed to the ill effects of the prolonged use of mobile phones which should be hazardous to the musculoskeletal system in total, in the years to come. Awareness regarding the proper posture, the appropriate duration and design of the mobile phones could help these younger individuals to lessen the ill effects and reduce the musculoskeletal disabilities to the maximum.

### 4. Conclusion

From the present study it is evident that the young population of students is definitely susceptible to injuries involving the upper quadrant due to usage of mobile phones demonstrating a RULA score of 4 and 5 i.e. Action Level 2 and 3 respectively.

Also there is strong association of RULA scores with occurrence of musculoskeletal pain in the upper quadrant. Students demonstrating a higher RULA score also depicted higher levels of presence of pain and affection in the upper quadrant.

### References:

- Chany, A.M, Marras, W.S, Burr, D.L., The Effect of Phone Design on Upper Extremity Discomfort and Muscle Fatigue, *Human Factors: The Journal of the Human Factors and Ergonomics Society* August 2007 vol. 49 no. 4 602-618 doi: 10.1518/001872007X215683
- David G. Simons, Janet G. Travell, Lois Simons, Travell & Simons' Myofascial Pain and Dysfunction: Upper half of body, The Trigger Point manual, Volume 1, Lippincott Williams & Wilkins, 1999
- Eapen C, Kumar B, Bhat ,Prevalence of Cumulative Trauma Disorders In Cell Phone Users. *J Musculoskelet Res* [Internet]. 2010;13(03):137-45. Available from: <http://www.scopus.com/inward/record.url?eid=2-s2.0-79958068787&partnerID=tZOTx3y1>
- Gustafsson E, Dellve L, Edlund M, Hagberg M. The use of information technology among young adults—experience, attitudes and health beliefs, *Applied Ergonomics* 2003;34:565-570.
- Gustafsson E, Johnson PW, Hagberg M. Thumb postures and physical loads during mobile phone use - a comparison of young adults with and without musculoskeletal symptoms. *Journal of Electromyography and Kinesiology* 2010;20: 127-135
- Jonsson P, Johnson PW, Hagberg M. Thumb joint movement and muscular activity during mobile phone texting – A methodological study. *Journal of Electromyography and Kinesiology* 2011;21:363-370.
- Ming Z, Pietikainen S, Hänninen O. Excessive texting in pathophysiology of first carpometacarpal joint arthritis. *Pathophysiology* 2006; 13:269-270.
- Rainie L. Pew Internet & American Life Project: Internet, Broadband, and Cell Phone Statistics. 2010 Pew Research Center.
- Sharan D, Ajeesh PS. Risk factors and clinical features of text message injuries. *Work*.

- 2012;41Suppl 1:1145-8.
10. Sharan D, Mohandoss M, Ranganathan R, Jose J. Musculoskeletal disorders of the upper extremities due to extensive usage of hand held devices. *Ann Occup Environ Med* 2014;26:22
  11. Sharan D. Clinical features of musculoskeletal disorders due to hand-held devices. 2015;(August):1–2.
  12. Zheng F, Gao P, He M, Li M, Tan J, Chen D, et al. Association between mobile phone use and self-reported well-being in children: a questionnaire-based cross-sectional study in Chongqing, China. *BMJ Open* [Internet]. 2015;5(5):e007302–e007302. Available from: <http://bmjopen.bmj.com/cgi/doi/10.1136/bmjopen-2014-007302>