ISSN Print: 2394-7500
ISSN Online: 2394-5869
Impact Factor: 8.4
IJAR 2022; 8(1): 271-275
www.allresearchjournal.com
Received: 12-11-2021
Accepted: 17-12-2021

Sharmik Basnet
Post Graduate Student in Orthopedic and Sport Physiotherapy, Department of Sport and Orthopedic Physiotherapy, Goutham College of physiotherapy, Mahalakshmi Layout Bengaluru, Karnataka, India

Dr. Priyesh Kumar Mishra
Assistant Professor in Orthopedic and Sport Physiotherapy, Department of Sport and Orthopedic Physiotherapy, Goutham College of Physiotherapy, Mahalakshmi Layout Bengaluru, Karnataka, India

Dr. Umashankar Panda
Assistant Professor in Cardiorespiratory Physiotherapy, Department of Cardiorespiratory Physiotherapy, KTG College of Physiotherapy, Hegganahalli Cross, Sunkudkatte, Bengaluru, Karnataka, India

Dr. Pranjal Patel
Assistant Professor in Neuro-Physiotherapy, Department of Neuro-Physiotherapy, Shrimad Rajchandra College of Physiotherapy, Uka Tarsadia University Maliba Campus, Bardoli, Surat, Gujrat, India

Corresponding Author:
Sharmik Basnet
Post Graduate Student in Orthopedic and Sport Physiotherapy, Department of Sport and Orthopedic Physiotherapy, Goutham College of physiotherapy, Mahalakshmi Layout Bengaluru, Karnataka, India

A cross sectional survey study: On upper extremities musculoskeletal disorders in subjects who extensively use hand held devices

Sharmik Basnet, Dr. Priyesh Kumar Mishra, Dr. Umashankar Panda and Dr. Pranjal Patel

Abstract
Background and Objective: Upper extremities musculoskeletal disorders and disabilities are more common in subjects who extensively using hand held devices (laptops, cell phones, digital gaming) after world digitization in daily life of people. These disorders and disabilities occurs due to trauma, overuse or repetitive injuries in abnormal posture or ergonomics and it affects biomechanics of the upper extremity. Therefore the present study aims to determine the upper extremities musculoskeletal disorders and disability in the individuals who extensively using hand held devices as assess by DASH questionnaire (disability of arm shoulder and hand).
Materials and Methods: A Cross sectional survey design was done and 250 subjects mean age group of 25-45 years were included in the study those used hand held devices more than 7 hours. The questionnaire (DASH) disability of arm shoulder and hand was taken and data was analyzed by Chi-square (x^2) test, Paired and Unpaired t test.
Results: Descriptive statistical analysis-frequency and percentage of responses has been carried out in the present study to analyze the questionnaire. 250 subjects were completed the questionnaire. It was found out that upper extremities musculoskeletal disorder (UEDs) affected with mean of 49.30 ±6.05 of DASH score, who use hand held devices (HHD) more than 7 hours.
Conclusion: The study concluded that those subjects used extensively hand held devices more than 7 hours moderately affected with upper extremities musculoskeletal disorders.

Keywords: Upper extremity musculoskeletal disorders, hand held devices, disability of arm shoulder and hand

Introduction
In modern society exposure and access of different varieties of information and communication technologies such as computers and mobile phones has intensely increased during the last decade in young individuals [1]. Devices those are used for communication and entertainment purpose such as media, internet access and gaming well-known as Hand-held devices [2]. In the mobile phones the availability of various useful options encourage the users to engage most of his time in his hand-held device [3]. The Hand held device is a piece of computing equipment that can be used in the hand such as smart phone, tablet computer or any electronic device. It can be compact and portable enough to be held and used in one or both hands for communication purpose [4].
However, while using the hand held devices the users experience discomfort, fatigue and pain in shoulder, elbow and hand due to the design and anthropometry relationship of the hand held devices [4, 5]. According to World Health Organization (WHO) 30% of the adults population affected with chronic pain, 20-25% MSDs (affecting joints, muscles, tendon, ligament and nerves), 25-30% back pain, 15-17% arthritis and 3% is believed to be vulnerable to fracture. A Study done on Canadian university population found out that 84% were having some pain in at least one part of the body, among that right hand pain was most common [6]. In India the technology is moving towards digital India, the usages of handheld devices are increasing every day more than 950 million and 190 million users of mobile phones and smart phones respectively. It is estimated that the 900 million smart phones users will be there by 2025 [7].

Due to increase usage of these devices increasing in health hazards especially the upper extremity musculoskeletal disorders. A study done in AMU found that student uses 100% mobile phones, the largest duration of time spent by them on cell phone was 14 hours for purpose of email, browsing, recreation, gaming; 12 hours follow for making call and lastly scheduling for 7 hours. The pain symptoms was evaluated through VAS scale and 27.5% of them were known to be affected by hand pain, 44.5% mild, 24.5% moderate and 3.5% severe hand pain [1].

The multiple functions varies of audible and vibratory input, and the output range from beeping and vibrating alerts, to melodies and even voice. There are many literature reported that there is an adverse impact on physical, psychological and mental health towards the user of mobile and other information technology [8]. A high incidence of these disorders of hand, wrist, forearm, arm, and neck are due to prolong, forceful, repetitive use of such devices [9]. The risk factors for these disorders related with hand held devices are sustain gripping, overuse injuries, vigorous activities, repetitive movement of wrist, thumb and fingers (PIP, DIP, MCP and wrist joints), in abnormal or stylish typing in inappropriate posture or ergonomics [10, 11]. Additional factors include small spacing in the keypad, end-range motion of the thumb during texting, increased static loading and a difference in the muscle activity between individuals with and without musculoskeletal symptoms [11]. The term musculoskeletal disorder (MSDs) used to describe overuse injuries that occurs in soft tissues and affects biomechanics of musculoskeletal system [12]. The disorder occurs when the body part is made to work harder and this directly has an impact on the function at a greater level than it is prepared for it. It includes a large group of conditions that result from injuring the body over a period of time and its severity varies according to the cause [13]. Various terminology also used to describe the term musculoskeletal disorder (MSDs) such as cumulative trauma disorders, non-specific musculoskeletal disorder or repetitive motion disorder (RMD) or repetitive stress injury (RSI) and the disorders due to improper position or overuse injuries [14]. The more effects on upper extremity of MSDs in daily life due to overuse and it may produce muscular pain to some severe conditions eg. Carpal tunnel syndrome. But none of the studies were found with regards to incidence rates of upper extremities musculoskeletal (UEDs) disorders and there are substantial differences in reported prevalence rates on UEDs. One of the main reason for this is the absence of universally accepted way of labelling or defining UEDs [15, 16]. currently, the clinicians are regularly encountering the subjects reporting with various non-specific musculoskeletal problems other than the regular conditions, and the most of the cases of non-specific MSDs are treated conventionally without considering the causative factors. Therefore there is an urgent need to find the upper extremity musculoskeletal disorder (MSDs) in subjects who extensively use hand held devices. Finding this information through this study it will be helpful to clinician in diagnosing the causative factor for non-specific upper extremity musculoskeletal disorder (MSDs) by the help of information associating the non-specific upper extremity musculoskeletal disorder with use of hand held devices and thereby beneficial in setting the goal and treatment plan in treating non-specific upper extremity musculoskeletal disorder [12]. The DASH score (disability of arm, shoulder and hand score) is a reliable and valid implement commonly used as outcome measure to evaluate the musculoskeletal disorders and disability of upper extremity [17]. Therefore the present study has been taken up to evaluate and determine the upper extremities musculoskeletal disorders and disability in the individuals who extensively using hand held devices.

Methods

A cross sectional survey design study of 250 subjects (both male and female) using convenient sampling method was done. Subjects which were using hand held devices aged between 25-45 years working population included according to inclusion and exclusion criteria of the study. The inclusion criteria for this study were both male and female using hand held devices (cell phones, laptops, computers and digital games) more than 7 hours in a day, age between 25-45 years working population with onset of symptoms and able to read and write questionnaire in English language who those willing to participate in this study and exclusion criteria for this study were any history of injury/trauma, deformity, specific musculoskeletal problems or any neurological problems in upper extremities.

Outcome Measures

Dash questionnaire: It was used as outcome measure to evaluate the musculoskeletal disorders and disability of upper extremities in subjects those were using hand held devises more than seven hours in a day. The study received approval from Human Ethical Committee of Goutham college physiotherapy research ethical committee Bangalore reference no. ECC/MPT/2016-2017/03.

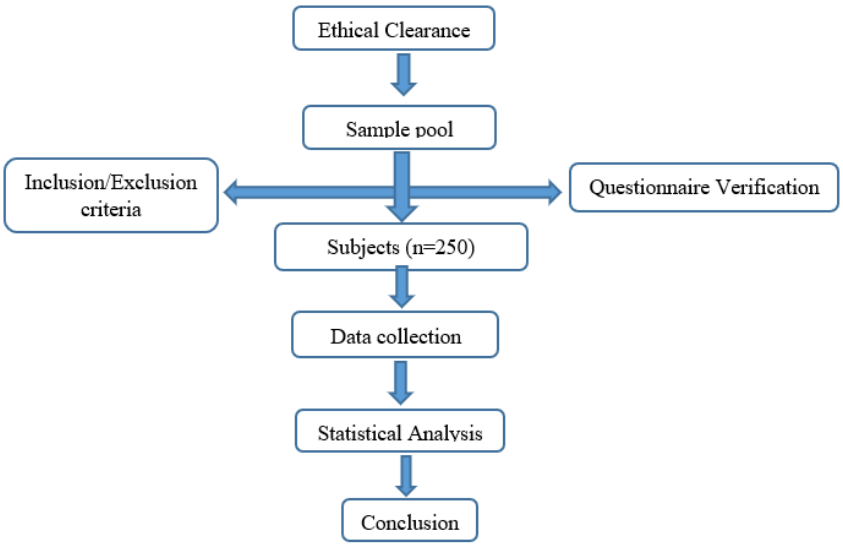


Fig 1: Flow chart representing the procedure of selection of subjects.

Results

Chi-square and parametric (coefficient of correlation) test were applied to analyze the data. All descriptive statistical analysis was done with utilizing the SPSS software16.0, Stata 8.0, MedCale 9.0.1 and Systat 11.0 (other software Microsoft word and, PASW statistics IBM SPSS Statistics) and $p< 0.05$ is considered as level of significance. The effect size is used to measure magnitude of the effectiveness of treatment (Cohen's d).

Table 1: Group characteristics

Parameters		N	Maximum	Minimum	Mean ± Std. Deviation
Age		250	25	45	31.32 ±5.21
Hours		250	7	17	9.85 ±2.48
Gender	M	163 (65.2%)	……..	…….	
	F	87 (34.8%)	…….	…….	
DASH		250	30	64	49.30 ±6.05

The study was conducted on total number of 250 subjects among them there were 163 male and 87 female subjects. The mean age of subjects were 31.32 ±5.21, the mean hours of usages of hand held devices were 9.85 ±2.48 and the mean DASH score was 49.30 ±6.05.

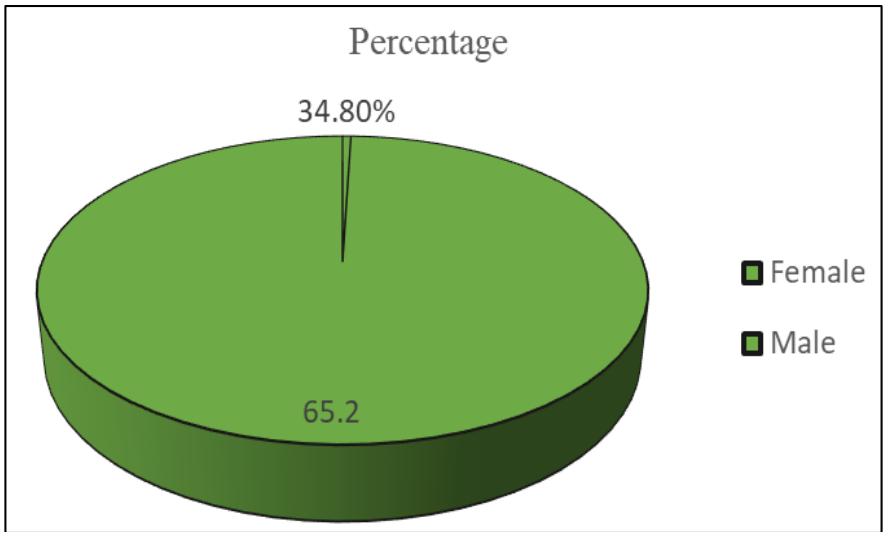
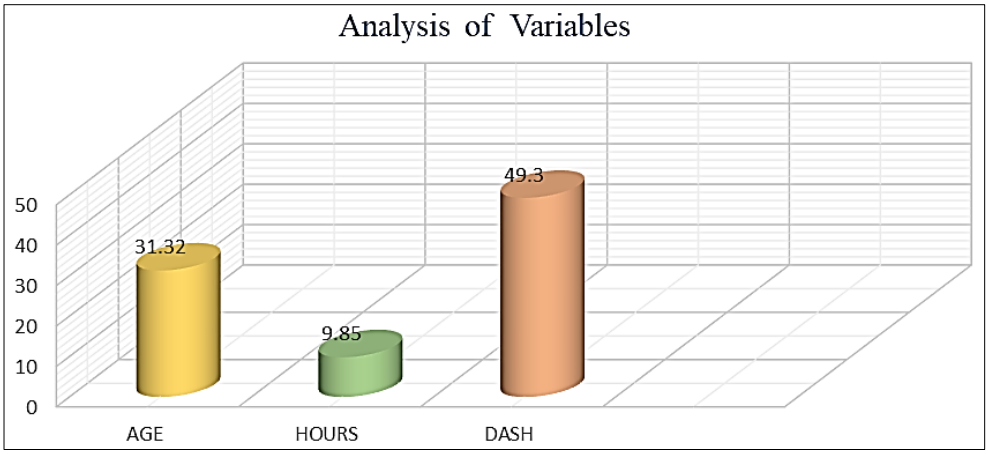


Fig 2: Percentage of male and female subjects in study



Graph 1.2: Analysis of Variables of the study

Table 2: Correlation of Basic Characteristics with DASH score

Age	Pearson Correlation	DASH 0.218**	Hours -0.076
	Sig. (1-tailed)	0.001**	0.230 (NS)
	Correlation	Significant positive weak correlation	No correlation
Hours	Pearson Correlation	-0.116	……
	Sig. (1-tailed)	0.068 (NS)	……
	Correlation	No correlation	……
	Correlation	No correlation	……

** Statistically Significant difference $p < 0.05$, NS-Not significant

The above table shows that when mean age of the subject correlated with DASH score there is a significant positive weak correlation. When mean hours of usage correlated with DASH score there is no significant correlation.

Discussion

The present study was conducted in different places (offices, colleges, schools) and different professionals (software engineer, IT profession, bank workers, teachers, house wives) were involved who extensively use hand held devices. The study was conducted on total number of 250 subjects among them there were 163 male and 87 female subjects. The mean age of subjects were 31.32±5.21, the mean hours of usages of hand held devices were 9.85±2.48 and the mean DASH score was 49.30±6.05. The mean DASH score indicates upper extremities musculoskeletal disorders are moderate effect on individuals who use hand held devices. According to DASH 0 is no effect and 100 is maximum affected with the upper extremities musculoskeletal disorders and disability. The present study found that, there is significant positive weak correlation between age and DASH. A study found that the increased risk of upper-extremity musculoskeletal disorders with age remained statistically significant (P = 0.001) after adjustment for length of service, contrary to the increased risk related to length of service after adjusting for age (P = 0.08). In the latter case, the age-adjusted odds ratios (ORs) for the whole population were 0.9 (95% CI 0.6 –1.5), 1.0 (95% CI 0.7–1.6), and 1.3 (95% CI 0.9 –2.0) for length of service of 1–2 years, 3–10 years, and more than 10 years, respectively [18]. Similar findings were observed for men (P = 0.16) and women (P = 0.14). The potential risk factors included personal factors, medical history, work history, and exposure to physical, psychosocial, and organizational work factors. For personal factors and medical history, details about age, weight, height, prior history of at least 1 of the major upper-extremity musculoskeletal disorders under study, inflammatory arthritis, diabetes mellitus, and thyroid disorders were collected during the physical examination. Exposure regarding work status and occupational risk factors was assessed with a self-administered questionnaire including information on the characteristics of the job and tasks, work organization, and the main potential risk factors for upper-extremity musculoskeletal disorders. A strong relationship was observed between age and upper-extremity musculoskeletal disorders for both sexes after adjustment for potential confounders [19]. The risk of upper-extremity musculoskeletal disorders for individuals age 30 years in 5 year increments was significantly higher (P = 0.001) than for those age is 30 years, with OR 1.8–4.9 in men and OR 1.8–5.0 in women. Individual ages 50–54 years had a significantly higher risk than all other age groups for both sexes. This study supports other investigations in finding that upper limb pain is common among adults in the general population (20–25) [20]. as it is survey study, no intervention was taken only questionnaires were asked and data was collected. During the period of data collection no known difficulties were present in distributing and re-collecting the questionnaires as all samples were given personally and noted the point they ticked in the questionnaires distributed. Moreover, no missing questionnaires were reported and this enabled a smooth process of data collection and analysis. Based upon the result obtained in this study it is obvious that a cell phone is essential in everyone's life these days. Study found that there is no correlation between age and hours, (time) of hand held devices. Also it was found that there is no significant correlation between hours of hand held devices and DASH. The mean hours of usage of hand held devices was 9.85 ±2.48. There was no study found to support article. The usage of hand held devices varies from 7-15 hours. Study conducted by Yves Roquelaure *et al.*, has shown approximately half of the workers experienced nonspecific musculoskeletal symptoms of the upper limbs during the previous year and approximately one-third

experienced these symptoms during the previous week. The physical examination performed by OPs confirmed that upper-limb MSDs were common in the working population.

Limitations of the study

1. Study was conducted in small population of 250.
2. Subjects with 25-45 years of age were considered for the study thus results cannot be generalized to all age group.
3. Sample were taken, only who knows English.
4. The degree or grade of disability affected not measured only the score of disability affected was measured.

Recommendation for future research

1. Further study need to be carried in larger population.
2. Further study can be carried in different age group.
3. Further study can be carried evaluating upper extremities musculoskeletal disorder using different evaluation tool.

Conclusion

The study concluded that those individual's used extensively hand held devices more than 7 hours significantly moderately affected with upper extremities musculoskeletal disorder. To live in accordance to the current advancements of the technology, the use of cell phone in our daily living is crucial. The size of hand held devices should be comfortable to be used. However, prolonged use of cell phone is known to cause symptoms of musculoskeletal disorder keeping this into consideration, more study should be done in the future to create awareness among cell phone user regarding the seriousness of this matter. Also while using hand held devices proper ergonomics, postures should be followed.

Competing Interests: None

References

1. Ewa Gustafsson, Peter W Johnson, Mats Hagberg *et al*. 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.
2. 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.
3. Sharan D, Mohandoss M, Ranganathan R, Jose JA, Rajkumar JS *et al*. Distal upper extremity disorders due to extensive usage of hand held mobile devices. Human Factors in Organizational Design and Management. 2012;51:1041-1045.
4. Chany AM, William S, Marras D, Burr L. The Effect of Phone Design on Upper Extremity Discomfort and Muscle Fatigue. Human Factors. 2007;4:602-618.
5. Sophia Berolo, Richard P. Wells, Benjamin C, Amick III; Musculoskeletal symptoms among mobile hand held device users and their relationship to device use: A preliminary study in a Canadian university population. Applied Ergonomics. 2011;42(2):371-378.
6. http://www.investindia.gov.in/sector/t/elecom, http://m.economicstimes.com/tec/internet users in India.
7. Gustafson E, Dellve L, Edlund M, Hagberg M at al. The use of information technology among young adults–experience, attitudes and health beliefs, Applied Ergonomics 2003;34:565-570.
8. Eapen C, Bhat AK. Prevalence of cumulative trauma disorders in cell phone users. Journal of Musculoskeletal Research. 2010;13:137-145.
9. Gold JE, Driban JB, Thomas N, Chakravarty T, Channell V, Komaroff E. Postural, typing strategies, and gender differences in mobile devices usage: An observational study. Department of public health, Tample University. 2011, 408-412.
10. Sengupta A, Grabiner S, Kothari P, Martinez G *et al*. Ergonomic aspects of personal digital assistant (PDA) and laptop use. In: Proceedings of the Sixth International Scientific Conference on Prevention of Work Related Musculoskeletal Disorders. 2007.
11. Middles worth M. Ergonomics Plus. [Online].; 2015 [cited 2015 November 27. Available from: HYPERLINK "http://ergo-plus.com/musculoskeletal-disorders-msd/" http://ergo-plus.com/musculoskeletal-disorders-msd/.
12. George Krucik MM. Healthline. [Online].; 2013 [cited 2015 November 27. Available from: HYPERLINK "http://www.healthline.com/health/musculoskeletaldisorders" \l "Definition1" http://www.healthline.com/health/musculoskeletaldisorders#Definition
13. Rouse M. Tech Target. [Online].; 2011 [cited 2015 November 27. Available from: HYPERLINKhttp://whatis.techtarget.com/definition/cumulative-traumadisorder-CTD http://whatis.techtarget.com/definition/cumulative-traumadisorder-CTD.
14. Bionka MA, Huissted, Sita MA, Bierman Zeinstra, Bart W Koes, Jan AN Venaar *et al*; Incidence and prevalence of upper extremities MSDs. 2006;7(7):1471-247.
15. Adam Burke, Erik Peper. Cumulative Trauma Disorder Risk for Children Using Computer Products; Public Health Reports 2002, 117.
16. Dorcas E Beaton, Jeffrey N Katz, Anne H Fossel, James G Wright, Valerie Tarasuk, Claire Bombardier, M. Measuring the Whole or the Parts? Validity, Reliability, and Responsiveness of the Disabilities of the Arm, Shoulder and Hand Outcome Measure in Different Regions of the Upper Extremity; J HAND THER. 2001;14:128-146.
17. Raven *et al*: Validity and reliability of DASH; The Journal of Rheumatology. 2008;35:12; doi:10.3899/jrheum.080067
18. Yves Roquelare, Catherine HP, Annete Leclerc, Annie Touranchet, Marine Sauteron, Maria Melchior *et al*; Epidemiologic Surveillance of Upper Extremity Musculoskeletal Disordersin the Working Population. Arthritis & Rheumatism (Arthritis Care & Research) October 15, 2006;55(5):765-778
19. Michelle Urain, Deborah symmons, Timothy Alison, Theresa Bramman, Helen Busby, Morven Roxby, *et al*; Estimating burden of MSDs in the community. 1998;57:649-65536.
20. Yves Roquelare, Catherine HP, Annete Leclerc, Annie Touranchet, Marine Sauteron, Maria Melchior *et al*. Risk Factors for Upper-Extremity Musculoskeletal Disorders in the Working Population. Arthritis & Rheumatism (Arthritis Care & Research) 2009;61(10):1425-1434.