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REVIEW ARTICLE

PREVALENCE OF MUSCULOSKELETAL DISORDER IN SMARTPHONE USERS: CROSS SECTIONAL STUDY

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ABSTRACT
The smartphone supersedes the capability of the cellular phone, as it offers the user internet access, in addition to various applications for social, finical, entertainment, and healthcare needs. So, the aim of the study prevalence of the musculoskeletal disorder in people using smartphones ranging from the age group of 18 to 30 years. Objective: To find out musculoskeletal disorders occurring due to smartphone use. A total of 500 participates were screened according to the inclusion criteria all the participants were assessed for pain using the visual analogue scale in who use a smartphone. In the age group 18-30 years, 3 groups were made. The first group was between 18-21 years, the second group was 22-25 years, and the third group 26-30 years respectively. 18-21 years age group had 169 affected respondents. Area A represents the index, middle and lateral half of the ring finger. Area B represents the medial half of the ringer finger and little finger, Area C represents Thumb, Area D represents the central palmar aspect, Area E represents the Thenar eminence and Area F represents the Hypothenar region of the hand. The present study shows that the overall prevalence of the musculoskeletal disorder in smartphone users is 68%. Males are more affected than females. In this study neck and thumb were more affected regions compared to other parts of the body, secondary to the neck and thumb, the wrist is the affected region. Long-time use of smartphones leads to the repeated strain injury of the wrist and thumb, long time flexion of the neck during smartphone use leads to neck pain.
KEYWORDS: Smartphone, Upper limb disability, musculoskeletal disorder.

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INTRODUCTION
In everyday human life, modern technology plays a vital role1. Among all of its gizmos, the smartphone is a wonderful advancement in digital technology. For the past few years, it has been one of the most widely used communication devices2. Smartphones are described as "hand-held computing devices that can make phone calls over cellular networks, transfer data, and run applications over a mobile computing network."3Smartphones significantly changed the way people interact with one another and with the world around them. Smartphone users are used to carrying their devices with them everywhere they go. The mobile outperforms the cellular phone in terms of functionality, as it provides users with internet connectivity as well as a variety of applications for social, financial, entertainment, and healthcare needs4. It is also a compact and available device that can be used anywhere and at any time.

According to a report, there would be 2.87 billion mobile phone users worldwide in 20202. In 2015, a median of 54 percent of people in 21 emerging and developing countries, including Malaysia, Brazil, and China, reported using the internet or owning a smartphone at least occasionally. A median of 87 percent was the same across 11 industrialized economies, including the United States and Canada, large Western European nations, and developing Pacific nations5.In the next four years, India, the world's second-largest smartphone market, is predicted to see a massive increase in the number of phone users, with over 650 million compared. College students use smartphones eight out of ten times [86 percent] of the time, up from 83 percent in 20146.

It's more accurate to conclude that it's become a necessary part of daily life. As a result, malicious users have found it to be an ideal tool2.SMS, WhatsApp, Viber, Line, BBM, and social networking apps like Facebook, Twitter, and Skype require mobile phone users to communicate in ways other than by voice. Texting is the most commonly used mobile data service, with 74% of all mobile phone users using it7.

Biomechanical load, which is the force that must be applied to tasks, the length of the force applied, and the frequency at which tasks must be performed causes musculoskeletal disorders8. Individuals who are using smartphones often flex their neck downwards to look at the lowered item [smartphone] and keep their head in a forward position for long periods, which may lead to musculoskeletal disorders9. Doing activities with a lot of force, repetition, or maintaining a non-neutral posture are both risk factors for musculoskeletal disorders. The combination of a lot of force and repetition is particularly concerning10.

Phone use has risen in recent years, according to a report by Fiaq and Huseyin et al 2018, and it can cause a variety of hand diseases. By affecting the median nerve, it may cause carpal tunnel syndrome. It also reported that De Quervain's disease is

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more common in smartphone users that text more frequently. Furthermore, since smartphones are used to send and receive messages, researchers discovered a disease known as bilateral extensor pollicis longus tendinitis, also known as whatsappitis2. Smartphones are easy to find, and people who stroll down the street looking at their phones provide us with many benefits. However, mounting evidence suggests that repeated smartphone usage, combined with an incorrect wrist posture, may result in wrist repetitive strain injury, especially when the fingers, hands, and wrists are overused11.

In everyday life, it has an effect on both the visual and musculoskeletal systems, causing headaches and stress. Excessive smartphone use can eventually lead to musculoskeletal disorders. As a result, now is a critical time to conduct a study to determine the percentage of the population that suffers from musculoskeletal disorders as a result of smartphone use.

PARTICIPANTS AND METHODS

MGM School of Physiotherapy Aurangabad Maharashtra conducted a cross-sectional analysis. The total sample size was 500, with 248 men and 252 women included in the analysis. The ethical review board of the concerned institutes gave their approval for this report. An informed consent form was required to validate the study's progress in the institute.

Inclusion criteria
•Age ranging from 18 to 30 years.
•Participants who have a mobile phone.
•Participants who are willing to participate.
Exclusion criteria
•Age more than 30 years.
•Participants who don't have mobile phones.
•Participants who are not willing to participate.
•Participants who already have an upper limb, neck, or spinal problems.

After the informed consent form was completed, the data collection protocol was given to the number of participants who met the inclusion and exclusion criteria. Before data collection, participants were given background information on the researcher in question, as well as answer to any questions they had. The pain severity is measured using a visual analog scale, which is commonly used in the adult population.

RESULTS

In the distribution of respondents according to age group 18-30 years, 3 groups were made. The first group was between 18-21 years, the second group was 22-25 years, and the third group between 26-30 years respectively. The 18-21 years age group had 169 affected respondents, 22-25 years age group had 150 affected respondents index, middle and lateral half of ring finger.

Area B represents the index, middle and lateral half of the ring finger. Area B represents the medial half of the ring finger and little finger, Area C represents Thumb, Area D represents the central palmar aspect. Area E represents Thenar eminence and

Area	18- 21 years [n= 262]	Prevalence	22-25 years [n= 210]	Prevalence	26- 30 years [n=28]	Prevalence
Affected	169	65 %	150	71%	20	71%
Neck	98	58%	74	49%	7	35%
Shoulder	29	17%	30	20%	5	25%
Upper back	25	15%	18	12%	0	0%
Upper Arm	13	8%	12	8%	0	0%
Low Back	16	9%	22	15%	5	25%
Forearm	23	14%	13	9%	3	15%
Wrist	39	23%	38	25%	6	30%
Area A	27	16%	31	21%	3	15%
Area B	21	12%	26	17%	2	10%
Area C	53	31%	53	35%	8	40%
Area D	25	15%	28	19%	1	5%
Area E	31	18%	36	24%	5	25%
Area F	30	18%	23	15%	0	0%

Table-1: Distribution of Respondents According to Age Group

Area F represents a Hypothenar region of hand [Table no. 1] Observation results show that the prevalence of neck was most in the age group 18-21 years [58%], shoulder in the age group 26-30 years [25%]. Area A had the highest prevalence 21% in the age group 22-25 years.[Table 2] shows that distribution according to years of smartphone use. Most people were having smartphones for ± 4 years. And distribution according to a number of hours per day highest shows 5-8 hours [49%].

Years of smartphone use	No. of respondents	Percentage	No. of hours per day	No. of respondents [500]	Percentage
< 2 years	28	6%	1-4 hours	205	41%
2-4 years	273	55%	5- 8 hours	245	49%
5-7 years	184	37%	9-12 hours	50	10%
>7 years	15	3%	-	-	-

Table 2: Distribution According to Years of Smartphone Use

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	No. of respondents [n=500]	Prevalence
Overall	339	68%.
Neck	179	53%.
Shoulder	64	19%.
Upper back	43	13%.
Upper arm	25	7%.
Low back	43	13%.
Forearm	39	12%.
Wrist	83	24%.
Index, middle and lateral half of ringer finger	61	18%.
Medial half of ring finger and little finger	49	14%.
Thumb	114	34%.
Central palm region	54	16%.
Thenar eminence	83	24%.
Hypothenar eminence	53	16%.

Table- 3 Overall affected respondents

No. of Hours per Day

There was total 500 respondents out of which 339 had one or more musculoskeletal disorders. Number of respondents having neck pain were highest [n=179], shoulder pain [n=64], upper back pain [n=43], upper arm pain [n=25], low back pain [n=43], forearm pain [n=39], wrist pain [n=83], area A-index, middle and lateral half ring finger [n=61, area- B- medial half of ring finger and little finger [n=49], Area C-thumb [n=114], area D- central palm region [n=54], Area E- Thenar eminence [n=83], area F- Hypothenar eminence and wrist [n=53]. All describe in [table 3]. Among the overall affected parts in respondents most affected part was neck 53%, after that thumb 34%. Least affected part was upper arm 7%. According to the intensity of pain 4-6 on VAS and number of respondents [n= 233] shows high prevalence [69%] and duration of pain ≤ 1 year 286 respondents 84%. [table 4].

Intensity of pain	Number of respondents	Percentage	*Duration of pain*	Number of respondents	Percentage
1-3 on VAS	59	17%	≤ 1 year	286	84 %
4-6 on VAS	233	69%	1-3 years	48	14%
7-9 on VAS	47	14%	> 3 years	5	1%

Table-4 intensity of pain and duration of pain

DISCUSSION

The present study was conducted to find out the prevalence of musculoskeletal disorders in smartphone users. The study was conducted on 500 participants in the age group of 18-30 years which were selected randomly. This study revealed that the most affected age group is 26-30 years. These findings of this study are similar to the study conducted by Kim et al 2014 which reveals cellular phone addiction and age seem to be inversely proportional, with younger people using their smartphones for the camera, MP3, and other entertainment functions; people in their 30's and 40's typically manage their schedules, contact list, e-mail, and other business-related functions. Such findings may be because this age group has a student or private job workers who are more prone to smartphone use12. This study reveals overall prevalence is more in men than women. Statistically with a male: female ratio the present study contradicts one of the studies by Gustafasson et al which was in accordance with reported pain general Swedish population of comparable age and the gender difference were seen with women reporting more pain than in men. The present study showed that in specific areas like neck and thumb female participants have more prevalence while in the wrist region13.

The present study showed the maximum duration of smartphone use in a day was 12 hours. 245 participants used it for a maximum 5-8hour. In another study shows that a developed country in Asia found that almost all people in the Republic of Korea have smart mobile phones [97.4%], spending an estimated 4.1hours a day on the devices while the heavy smartphone users spent even longer, reaching around 5.4 hours daily14. The study also supported the relationship between smartphone use and subjective musculoskeletal symptoms and university students who found that those who use smartphones for searching the internet and chatting had the highest complaint rate and that those who used a smartphone for less than 2 hours each day had a lower complaint rate than the other groups15.

The findings revealed by this study showed that the neck is the most affected part which is supported by the Sojeong lee et al concluded that repetitive or prolonged head flexion posture while using a smartphone is one of the risk factors for pain symptoms in the neck16. The findings of the present study were supported by Issac C et al in a USA survey of university students revealed that 40% of participants faced text neck or spinal pain using mobile device17. The present study showed that the involvement of fingers, palm, and wrist is more compared to arm and shoulder which was supported by Ewa Gusta fasson alehouse study revealed that the hand and fingers are highly exposed when text messaging. Thumb is affected area in 34% of smartphone users as per the results of this study13, 18. So, the present study was done to find out the prevalence of developing musculoskeletal disorders due to the excess use of smartphones.

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CONCLUSION

The present study shows that the overall prevalence of the musculoskeletal disorder in smartphone users is 68%. Males are more affected than females. In this study neck and thumb were more affected regions compared to other parts of the body, secondary to the neck and thumb, the wrist is the affected region. Long-time use of smartphones leads to the repeated strain injury of the wrist and thumb, long time flexion of the neck during smartphone use leads to neck pain.

LIMITATIONS

The design of the phones used by the participants was not taken into account in this study and the different types of phone types could have influenced the presentation of symptoms in these participants. Secondly, the posture of participants while the smartphone was not considered in this study which elicits some symptoms.

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