

Smartphone addiction and musculoskeletal pain among medical students: A cross Sectional Study

¹Dr. Y. V. Bhagat, Junior Resident, GMCH, Aurangabad, Maharashtra, India

²Dr. S. P. Andurkar, Associate Professor, GMCH, Aurangabad, Maharashtra, India

³Dr. M. K. Doibale, Professor, GMCH, Aurangabad, Maharashtra, India

Corresponding Author: Dr. Y.V. Bhagat, Junior Resident, GMCH, Aurangabad, Maharashtra, India.

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Abstract

Introduction: The term “Smartphone” first appeared in 1977, when Ericsson described its GS 88 “Penelope” concept as a smartphone. Smartphone addiction is an emerging phenomenon in the communities which lies under behavioral addiction category. Despite the hazardous effects of smartphones on the human body, there is less literature on musculoskeletal problems associated with smartphone usage in students. Hence, the present study aimed to assess the prevalence of musculoskeletal pain and analyze associated risk factors in university students because of excessive smartphone usage.

Methodology: This is a cross-sectional study conducted at the Government medical college Aurangabad. The smartphone Addiction Scale Short Version (SAS-SV) questionnaires were used to measure the level of smartphone addiction while Nordic musculoskeletal questionnaire (NMQ) was utilized to measure existence of the musculoskeletal pain of the study participants.

Result: In this study owned mobiles (100%) & 50% medical students are smartphone addicted according to SAS-SV scale. Between smartphone addiction and number of hours using smartphone ($p=0.0008$) statistically significant association found. Neck (0.05), shoulder (0.002), elbow(0.002),wrist/hand(0.044) and lower back(0.00) were all shows significant association with smartphone addiction.

Conclusion: 50% of medical students identified as smartphone addicted. The most common sites of musculoskeletal pain were in the neck, shoulder, elbow, wrist / hand and lower back. Therefore, it is important to educate them about the effect of smartphone addiction and to prevent it.

Keywords: Smartphone, Addiction, Musculoskeletal Pain, SAS-SV, NMQ.

Introduction

Smartphone is a term for distinguishing mobile phone with advanced features from basic feature phones. The term “Smartphone” first appeared in 1977, when

Ericsson described its GS 88 “Penelope” concept as a smartphone. Smartphones are mobile phones with advanced features that are used widely for purposes other than the basic needs of communication. It is a popular device that can perform complicated tasks, which typically have a touchscreen interface.¹ It has features including internet browsing, Wi-Fi, gaming, listening, watching video and apps for online shopping. In recent years, smartphones kept evolving to be multitasking, complete and on many times to displace electronic devices such as a computer, camera and many others. Thus, smartphone has inevitably become need rather than a luxury in the life of individuals. This has led to new kind of health hazards among young population termed as smartphone addiction. Smartphone addiction is an emerging phenomenon in the communities which lies under behavioral addiction category.² Behavioral addiction produces short term reward that may lead to persistent behavior even with knowledge of adverse consequences.³

Addiction is considered by WHO (WHO Expert Committee-1964) as dependence, as the continuous use of something for the sake of relief, comfort or stimulation, which often causes cravings when it is absent.⁴ The two major categories of addiction involve either substance addiction, e.g. “drug or alcohol addiction” or “behavioral addiction such as mobile phone addiction.”⁵

Mobile phone addiction /abuse/misuse is one of the forms of compulsive use of “a mobile phone”. A new kind of health disorder in this category among adolescents, “smartphone’s addiction/abuse/misuse” is now challenging health policy makers globally to think on this rapidly emerging issue. Indians are also affected by this high smartphone engagement.⁶

The number of smartphone users reached **5.22 billion by the end of 2020, which represents 66% of the world’s population** (Data Reportal, 2021). 2020 brought in an additional 93 million users, a 1.8% increase from 2019’s year-end total. Market growth in 2021 will be led by the Asia Pacific region—India and China in particular — making up 2.1 billion or 56% of the global market share. With COVID-19-induced lockdowns, sale of smartphones through online channels increased in 2020. Following the government curbs on social distancing and lockdown, there was a 39% rise in the average time spent by an Indian user on a smartphone. As per a report by App Annie, India stood third (4.6 hours a day) on the list of average time spent by an average user on smartphones, with Indonesia (5.2 hours a day) and Brazil (4.8 hours a day) taking the top two spots worldwide.

- There were **624 million** internet users in India in January 2021.
- The number of internet users in India **increased by 47 million** (+8.2%) between 2020 and 2021.
- Internet penetration in India stood at **45.0%** in January 2021.
- There were **1.10 billion** mobile connections in India in January 2021.
- The number of mobile connections in India **increased by 23 million** (+2.1%) between January 2020 and January 2021.
- The number of mobile connections in India in January 2021 was equivalent to **79.0%** of the total population.

Smartphone addiction has been conceptualized as a behavioral dependancy^{7,8}. Studies show that this addiction is associated with behavioral problem

including inactive lifestyle, musculoskeletal problems, pain, anxiety, compulsive behaviour, control deficiency, sleep disorder, functional disorder and tolerance problem.^{9,10}

Musculoskeletal problems arise from long term exposure to certain physical factors including recurrent movements, vibration or force. These problem may be acute, chronic and recurrent, thereby accepted as public health problem.^{11,12} While several studies have investigated the relationship between smartphone addiction and musculoskeletal problems, they have focused on upper extremity problems.^{13,14} However, taking into account that parts of the body are interconnected, any problem in any part may affect another region adversely.¹⁵ Little research has been conducted about smartphone use and its consequences among Indian. This area needs to be further explored, with a focus on effect of overuse of smartphone on musculoskeletal system. Therefore, it is important to evaluate the whole body in terms of musculoskeletal problems among smartphone users. So that best prevention and treatment strategies can be worked out. Smartphone users vary in age, ranging from students to elderly people. However, students use smartphones for longer periods due to easy availability, low cost, portability, and multiple usabilities, combined with easy internet access. The combination of repetitive movements and poor posture can lead to musculoskeletal disorders, which, if ignored, may lead to long-term damage.

Despite the hazardous effects of smartphones on the human body, there is less literature on musculoskeletal problems associated with smartphone usage in students. Hence, the present study aimed to assess the prevalence of musculoskeletal pain and analyse associated risk

factors in medical students because of excessive smartphone usage.

Methodology

This was a cross-sectional study conducted at the Government medical college Aurangabad. The smartphone Addiction Scale Short Version (SAS-SV) questionnaires was used to measure the level of smartphone addiction while Nordic musculoskeletal questionnaire (NMQ) was utilized to evaluate the musculoskeletal pain of the study participants.

Assuming prevalence of addiction $P=0.5(50\%)$, $e=0.05(5\%)$ and confidence interval (CI) 95% applied on medical students population ($N=750$) sample will be 255.

Number of sample calculated through the following formulas:

- 1) $n1 = [z^2 \times p \times (p-1)] / e^2$ which gives 384 and adjusted by
- 2) $n2 = (N \times n1) / [n1 + (N-1)]$ giving the final sample estimation 255.

Study has carried out from 1st Dec 2021 to 31st Dec 2021. All medical students who give consent were included in study. In present Study participants with diagnosed musculoskeletal disorder were excluded. Predesigned, pretested semi-structured questionnaire was used. The questionnaire consists of three part. First part is demographics including age, gender, type of family, and year of MBBS etc. The second part is the scale for time spend and behavior on smartphone using Smartphone addiction Scale short version (SAS-SC) the third part consist of questions to measure the existence of musculoskeletal pain using another valid questionnaire(NMQ). SAS-SV is a well validated questionnaire consisting of 10 questions that assess the level of risk on the addiction of smartphone. Nordiac

musculoskeletal questionnaire design to screen the existence of musculoskeletal pain. NMQ contains two major parts, the general part and specific part. General part made to assess the existence of musculoskeletal pain without targeting specific anatomical locations while the specific part focusing on specific anatomical areas of body. Specific part furthermore contains questions about symptoms and duration of the symptoms in the past time.

Statistical analysis

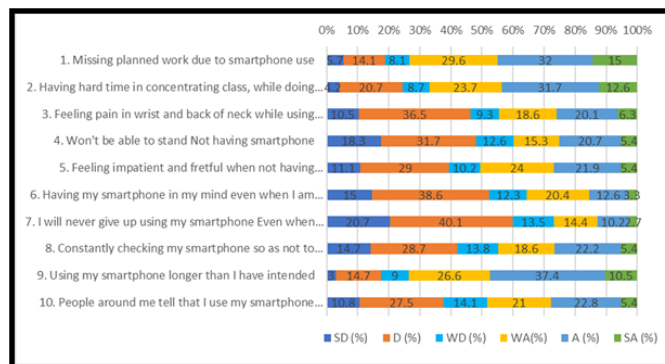
The Smartphone Addiction Scale (SAS-SV), a short version where 10 out of 33 question was selected for use in this study. As recommended by Kwon, Kim et al.¹⁶ we used smartphone addiction cut of value of 31 points in male and 33 points in females to determine non-addiction and addiction.

Data was fed in MS excel. Data was analysed. The statistical significance of the relationship between independent variables and dependent variables are calculated using Chi-square test ; $p \leq 0.05$ was considered as statistically significant. All calculations were made using the SPSS V26.0 trial version.

Results

In present study, 334 (100%) medical students were interviewed with predesigned, pretested semi-structured questionnaire. Figure1 depicts the smartphone Addiction

Scale-Short Version (SAS-SV), this questionnaire measure the smartphone addiction among medical students. This questionnaire included 10 questions. Figure 2 show the prevalence of smartphone addiction was seen among 167 medical students (50%).



(SD-Strongly disagree, D-Disagree, WD- Weakly disagree, WA- Weakly agree, A- Agree, SA- Strongly agree)

Figure 1: Smartphone Addiction Scale- Short Version (SAS-SV)

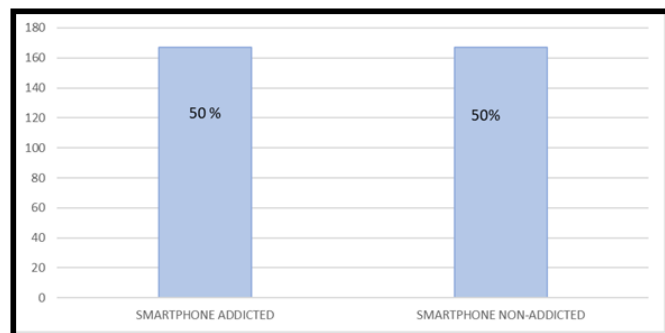


Figure 2: Prevalence of smartphone addiction among medical students

Table 1: Association between sociodemographic factor and smartphone addiction

Smartphone Users		Total	Addicted	Non addicted	P value
Age Group (years)	<19	6(1.80)	3(1.38)	3(2.56)*	0.72
	19-20	153(45.81)	92(42.40)	61(52.14)	
	21-22	154(46.11)	104(47.93)	50(42.74)	
	>22	21(6.29)	18(8.29)	3(2.56)	
Gender	Male	210(62.87)	143(65.90)	67(57.26)	0.11
	Female	124(37.13)	74(34.10)	50(42.74)	

Batch of MBBS	First year	151(45.21)	99(45.62)	52(44.44)	0.73
	Second year	121(36.23)	76(35.02)	45(38.46)	
	Third year	52(15.57)	34(15.67)	18(15.38)	
	Fourth year	10(2.99)	8(3.69)	2(1.71)	
Type of Family	Nuclear	225(67.37)	139(64.06)	86(73.50)	0.21
	Joint	80(23.95)	57(26.27)	23(19.66)	
	Three generation	29(8.68)	21(9.68)	8(6.84)	
Socio-economic Class	I	135(40.42)	99(45.62)	36(30.77)	0.11
	II	76(22.75)	43(19.82)	33(28.21)	
	III	57(17.07)	34(15.67)	23(19.66)	
	IV	36(10.78)	22(10.14)	14(11.97)	
	V	30(8.98)	19(8.76)	11(9.40)	
Number of hours of exercise doing (Daily)	NO	107(32.04)	75(34.56)	32(27.35)	0.39
	<1 Hr	178(53.29)	112(51.61)	66(56.41)	
	>1Hr	49(14.67)	30(13.82)	19(16.24)	
BMI	<18.5	66(19.76)	45(20.74)	21(17.95)	0.69
	18.5-24.9	186(55.69)	116(53.46)	70(59.83)	
	25-29.9	67(20.06)	45(20.74)	22(18.80)	
	>30	15(4.49)	11(5.07)	4(3.42)	
How many hours uses smartphone (Daily)	<1	17(5.09)	6(2.76)	11(9.40)	0.0008
	1-3	131(39.22)	76(35.02)	55(47.01)	
	>3	186(55.69)	135(62.21)	51(43.59)	

(*value are percentages)

Age range of study participants was 17-28 years old and mean age was 20.16 ±1.3 years. Majority were from 21-22 years age group (46.11%). No significant association found between age group and smartphone addiction (p = 0.72). statistically significant association not found between gender and smartphone addiction(p = 0.11). In study most of the participated medical students (45.21%) were from first year of MBBS and belong to class I (40.42%) according to modified BG Prasad's scale 2020.

Out of 334 medical students, 107(32.04%) didn't do any exercise. 178 (53.29%) do exercise <1hr daily and 49 (14.67%) do exercise for more than 1 hr daily. Mean BMI was 2 - 4.4 Kg/m² . No statistically significant association found between BMI and daily hours of exercise with smartphone addiction. On the other hand statistically significant association was found between smartphone addiction and number of hours using smartphone (p=0.0008). 55.69% medical students spend more than 3 hours daily on smartphone.

Table 2: Prevalence of Musculoskeletal pain among smartphone addicted medical students (n=167)

Musculoskeletal Parameter	No Pain	Pain (7-D)	Pain (12-M)	Both	Total Pain
Neck	107(64.07)*	28(16.77)	31(18.56)	1(0.60)	60(35.93)
Shoulder	125(74.85)	18(10.78)	22(13.17)	2(1.20)	42(25.15)
Upper Back Pain	112(67.07)	28(16.77)	24(14.37)	3(1.80)	55(32.93)
Elbow	143(85.63)	7(4.19)	13(7.78)	4(2.40)	24(14.37)
Wrist/Hand	126(75.45)	15(8.98)	24(14.37)	2(1.20)	41(24.55)
Lower Back Pain	110(65.87)	27(16.17)	29(17.37)	1(0.60)	57(34.13)
Hips/Thigh	142(85.03)	7(4.19)	17(10.18)	1(0.60)	25(14.97)
Knees	142(85.03)	7(4.19)	15(8.98)	3(1.80)	25(14.97)
Ankles/Feet	151(90.42)	6(3.59)	9(5.39)	1(0.60)	16(9.58)

(*values are percentages) M-Months, D- Days, Both pain means pain (7-D) & pain (12-M), Total pain calculated by adding pain (7-D), pain (12-M) and both pain (7-D & 13-M)

Table 2 present the prevalence of musculoskeletal pain among medical students with smartphone addiction. Most frequent pain related to smartphone addiction was in the neck (35.93%) followed by lower back (34.13%), upper back (32.93%), Shoulder (25.15%), wrist / hand (24.55%).

Table 3: Association between smartphone addiction and musculoskeletal pain

		Addicted	Non-Addicted	P - Value
Neck Pain	No	107(76.98)	126(85.71)	0.05
	Yes	32(23.02)	21(14.29)	
Shoulder Pain	No	125(83.89)	146(96.69)	0.002
	Yes	24(16.11)	8(5.30)	
Upper Back Pain	No	112(80.58)	134(85.90)	0.22
	Yes	27(19.42)	22(14.10)	
Elbow Pain	No	143(89.38)	160(98.16)	0.002
	Yes	17(10.63)	3(1.84)	
Wrist/Hand Pain	No	126(82.89)	137(90.73)	0.044
	Yes	26(17.11)	14(9.27)	
Lower Back Pain	No	110(78.57)	127(86.99)	0.0000001
	Yes	30(21.43)	19(13.01)	
Hips/ Thigh Pain	No	142(87.65)	158(98.14)	0.08
	Yes	18(11.11)	5(3.11)	
Knees Pain	No	142(88.75)	154(93.90)	0.09
	Yes	18(11.25)	10(6.10)	
Ankles/Feet Pain	No	151(93.79)	156(95.71)	0.43
	Yes	10(6.21)	7(4.29)	

We used Pearson's chi-square test to measure association between smartphone addiction and the musculoskeletal pain among medical student. Table no. 3 shows that Neck(0.05), shoulder(0.002), elbow(0.002),wrist/hand(0.044) and lower back (0.00) were all shows significant association with smartphone addiction.

Discussion

This study is conducted to estimate the prevalence of smartphone addiction and to determine its association with musculoskeletal pain among medical student. All medical student in this study owned smartphone(100%) which is in concordance to other study conducted among Indian medical students¹⁷. 50% medical students are smartphone addicted according to SAS-SV scale, this is in concordance to other studies^{18,19}. The study conducted by Vinay Jahagirdar et.al.²⁰ In Telangana, India shows 59.4% medical students were smartphone addicted and In Saudi Arabia, study conducted by Abdullah M. Asalameh et.al.²¹ among medical students shows 60.3% medical students were smartphone addicted. However, 39-44% smartphone addiction rate reported in the general Indian population, in the meta-analysis and systemic review done by Davey and Davey⁶.

In this study majority of the participant are more than 21 years and mean age is 20.6 ±1.3 years. This finding in concordance with study conducted by Dharmadikari et al.¹⁸, the mean age was 20.14±1.31 years.

In the present study most of the medical students use mobile phone for more than 3 hours / day (55.69%). This is in concordance with study conducted by Ammati et al.¹⁷ found 60% reported more than 4 hours/day of screen time and 46% reported by Dasgupta et al.²² in 2017, among medical students from West Bengal. The ongoing COVID-19 pandemic, which has shifted teaching from

lecture halls to online virtual classrooms, may be the cause for this. Longer mobile screen time was significantly associated with increased mobile phone addiction ($p < 0.0008$). This is in concordance to the study published by Pavithra et al.²³ among 200 medical students from Bangalore.

In present study most of the medical students(55.69%) have normal BMI. Similar result found in study conducted by Ozgu Inal et al.²⁴, 66.80% study participant in normal range BMI.

The results of the present study shows, higher prevalence of musculoskeletal pain in the past year and past week in the neck, lower back, upper back, shoulder and wrist/hand. Smartphone addiction was associated with duration of smartphone use on a typical day and musculoskeletal pain prevalence in neck, shoulder, elbow, lower back and wrist/hand. The neck was the most common site of pain reported by students. A recently published systematic review revealed that neck and/or shoulder symptoms are common in mobile touch screen users with prevalence rates ranging from 26.3% to 60%²⁵. A study conducted on Canadian university students revealed that the neck, followed by upper back and shoulders were common sites of pain. Also, total time spent using a smartphone was significantly associated with pain in the neck and shoulder.²⁶ Another study showed that a head flexion angle of 33–45 degrees from vertical was maintained when using the smartphone. It revealed that repetitive and prolonged head flexion posture is a major risk factor for neck pain.²⁷ University students usually adopt static and flexed spinal posture during smartphone use considering their age.²⁸ This may cause faulty posture such as forward head, slouched posture, or rounded shoulders which leads to injury to the cervical and lumbar spine, as

well as ligaments.^{29,30} A study reported that increased flexion of the head at varying degrees increases the weight borne by the cervical spine. This leads to loss of curvature, increased stress on the cervical spine, and hastens the process of degeneration of ligaments.³¹ In Egypt, the most frequent pain being experienced by the physical therapy students was neck, eyes and back region³² while in Turkey, the incidence of musculoskeletal pain were also identified in neck, shoulder and upper back³³. This result has been further validated by Yang and colleagues³⁴ which they reported neck and elbow as the most frequent body pain being suffered by the students whereas in Korea, the most common musculoskeletal pain endured by students was neck and shoulder^{35,36}.

Conclusion-

Smartphone addiction has become a public health issue worldwide. The present study shows an alarming increase in the prevalence of smartphone addiction and musculoskeletal pain among medical students. There is a pressing need for developing arrangements regarding the consequences of smartphone addiction among medical students.

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