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## SMARTPHONE USAGE AND ITS ASSOCIATION WITH STRESS-RELATED BRUXISM, TEMPOROMANDIBULAR JOINT DISORDER AMONG DENTAL TUTTEES – AN ANALYTICAL INVESTIGATION

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### ABSTRACT

**BACKGROUND.** In recent times, smartphones have become a major part of our lives due to its various benefits such as easy accessibility of information, social connectivity, convenience, smaller size etc. Smartphone overuse can cause stress in a student which can invariably lead to clenching or grinding of teeth and temporomandibular disorder.

**AIM.** The aim of this study was to evaluate the association between smartphone use, stress due to over-usage, bruxism and temporomandibular disorders among dental students in a private dental institution in Chennai, India.

**METHODOLOGY.** The present cross-sectional study was conducted among dental undergraduates and postgraduates studying in a private dental institution in Chennai about smartphone usage. A self-administered pre-tested questionnaire containing 18 questions was filled out by the participants and was followed by a clinical examination for Bruxism and Temporomandibular disorder. Descriptive statistics was used and the association was assessed using Pearson's Chi-Square test. Statistics were done using SPSS version 23.0 and the p-value was set at 0.05.

**RESULTS.** Out of the total 121 participants, 80 (66.1%) were males and 41 (33.9%) were females. 99 (81.8%) were undergraduates and 22 (18.2%) were postgraduates. 90 (74.4%) felt stressed when unable to use their smartphone whereas 31 (25.6%) did not feel so. Bruxism was determined in 95 (78.5%) of the study participants, including 87 out of 90 (96.7%) in those feeling stressed and 8 out of 31 (25.8%) in those not feeling stressed when unable to use smartphone ( $p=0.0005$ ).

**CONCLUSION.** In the present study, a significant association was found between stress over not being able to use a smartphone and bruxism. Using smartphones for learning purposes definitely benefits when used appropriately.

**Keywords:** *smartphone, dental students, stress, bruxism, temporomandibular disorder*

### INTRODUCTION

A smartphone can be defined as a device that can perform all the functions of a computer. Nowadays, smartphones have got different names such as mobile phones, cell phones etc. which are used interchangeably (1). In recent times, smartphones have become a major part of our lives due to its various benefits such as easy accessibility of information, social connectivity, convenience, smaller size etc (1). In addition to being able to make calls, modern smartphones can also be used as a computer, media player, and video camera to access information at anytime, anywhere (2). Smartphone usage has been increasing recently due to its advantages, but at the same time it has its own disadvantages too. A study done by Alosaimi FD et al in Saudi Arabia (2016) revealed that 27.2% of university students use smartphones more than 8

hours per day (1). Technological developments have led to the evolution of the smartphone and it has become a fundamental part of our lives (3). Overuse of smartphones can put strain on the body's multiple systems, particularly the musculoskeletal system. When used in the same position for extended periods, mobile phones may cause repeated trauma problems (4). According to earlier research on the age-dependent prevalence of smartphone addiction, teenagers are more prone than adults to become addicted to digital media and are also more likely to be engrossed in it. Teenagers have a higher smartphone penetration rate than people in other age groups, according to a recent survey (5). At students' point of view, they may prefer using smartphones for learning purposes. A study done by Bikumalla P et al in 2017 revealed that the attitude of students was positive towards mobile learning (3).

Stress can be defined as any external physical or mental demand on physical and psychological wellbeing of an individual (6). Dentistry is a field in which students tend to work as well as study at the same time. The stress factors that can be experienced by the dental students include time pressure, patient scheduling, unmanageable patients, and highly technical works (6). Dental tutees face lots of other stress factors in addition to those related to their dental profession (7). Dental students being youngsters likely suffer from smartphone addiction that can lead to stress. Due to such stress, they might tend to develop the habit of bruxism and temporomandibular disorders.

Bruxism can be defined as movement disorder that can result in grinding and clenching the teeth in the oral cavity. It can occur due to multifactorial aetiology. One of the most important psychological factors that can lead to bruxism is stress (8). Psychosocial factors such as smoking, orofacial pain, and clicking or scraping joint noises have all been linked to bruxism (9). Bruxism's complex clinical association with a wide range of disorders and effects makes it a highly disputed topic in dentistry and several other fields (10). A study done by Tinastepe M (11) in 2024 found that compared to individuals with low anxiety and depression, those with high anxiety and depression had higher frequencies among avid smartphone users. Another study done in Italy in 2016 found a positive correlation between stress and bruxism among male university students (12). This proves the fact that bruxism can result due to stress factors in students.

The temporomandibular joint is important in opening and closing and also in protrusive and retractive movements of the mandible is one of the most complex joint that is present in the human body. Gnashing or clenching of teeth can cause temporomandibular disorders (TMD) (13). Patients with TMD usually suffer from muscle and/or joint pain on palpation and on mandibular movements, joint sounds and the mandibular range of motion may be limited (14). Bruxism is a usual oral habit that can cause overload and have detrimental effects on oral health, including TMD, fracture to the teeth and damage to dental restorations (15,16). Overload brought on by bruxism may result in orofacial pain. In result, orofacial pain can negatively impact jaw function as well as psychological health and overall quality of life (17). Previous research has shown that clenching during the day usually happens when one is focused on something (18). One of the main factors thought to be responsible for TMDs is habitual clenching (19).

Smartphone addiction can cause stress in a student which can invariably lead to clenching or grinding of teeth and temporomandibular disorder. The objectives of the study was to evaluate the smartphone usage

among dental students, determine the association between smartphone usage, stress due to its unavailability bruxism and temporomandibular joint disorders, among dental students in a private dental institution in Chennai, India.

## METHODOLOGY

**Study setting.** The present cross-sectional study was conducted for a period of three months among dental undergraduates and postgraduates studying in a private dental institution in Chennai about smartphone usage. The study consisted of a questionnaire completed by the participants and followed by a clinical examination for bruxism and temporomandibular disorder. Verbal consent was obtained from each participant before participating in the study. The study was approved and ethical consent was obtained from the Institutional Review Board of SRM Dental College, Ramapuram.

**Sample size.** A pilot study was conducted among 30 participants whose data was not included in the final analysis to pre-test the questionnaire. The sample size was estimated to be able to compare the frequency of bruxism and temporomandibular disorder among students without/with stress related to being unable to use smartphones. The overall undergraduate and postgraduate student population in a single institution to be a maximum of 550, the hypothesized percentage of stress due to inability of usage of smartphone and bruxism or TMJ disorder to be 50%, confidence limit as 5%, design effect of 1 and the significance level of 0.05 the sample size was estimated to be 127 by the Openepi. The final sample of 121 was included for data analysis after eliminating the sample with missing data.

**Study population.** The sample included 121 undergraduates and postgraduates who are students at a private dental institution in Chennai. The samples were recruited by convenience sampling based on the inclusion and exclusion criteria. The participants were between the age group of 17-35 years. Inclusion criteria in the study encompassed participants who gave consent. All the students were informed about the purpose of the study and confidentiality was assured. Undergraduate and Postgraduate students who were present during the time of examination were included in the study. Students who own at least one smartphone were included. Students who were hesitant to participate, under orthodontic treatment, and who have temporomandibular disorders previously due to any other cause were not included in the study.

**Study instrument.** A self-administered pre-tested questionnaire containing 18 questions was given to all the samples recruited for the study. First

5 questions assessing the socio-demographic details were open-ended and other 13 were close-ended to maintain uniformity in the responses obtained. Socio-demographic details of the participants were obtained from the initial 5 questions. The rest 13 questions were to assess their educational qualification, place of stay and details about their smartphone usage. The questions which were put forward to assess their smartphone usage were based on years of owning a smartphone, price of the latest smartphone, data pack in the smartphone, average monthly mobile bill, time of usage of smartphone daily, feeling when unable to use a smartphone, symptoms while staying away from the smartphone, purpose of using the smartphone, place of use of the smartphone, stressed when unable to use the smartphone, other electronic gadgets. Self-reported stress of the participants while being unable to use their smartphones was recorded using the questionnaire in the present study.

**Clinical examination.** After filling the questionnaire, a clinical examination was done. It was done according to American Dental Association type 4 dental examination with available illumination. The presence of masticatory muscle hypertrophy, indentations on the tongue, lip, and/or a linea alba on the inner cheek, as well as damage to the dental hard tissues (such as cracked teeth), repeated failures of prosthodontic constructions or restorative work, or mechanical wear of the teeth (i.e., attrition) were evaluated as clinical features of bruxism in order to confirm its diagnosis (20). If any of these clinical features were present then it was noted to be yes and if not no. In the same manner, if the participants had pain, deviation or clicking sound during opening and closing of mouth during temporomandibular joint examination, then it was noted as present and if not absent.

**Statistical tests used.** Descriptive statistics was done and the association was assessed using Pearson's Chi-Square test, and Fisher's exact test was used to assess the association between stress and bruxism. Statistics was done using SPSS version 23.0 and the significance level was set at 0.05.

## RESULTS

The present study was a single institutional cross-sectional study conducted among 121 dental undergraduates and postgraduate students. The results of the study are as below:

Table 1 shows the distribution of participants based on gender, education and place of stay. Out of the total 121 participants, 80 (66.1%) were males and 41 (33.9%) were females. 99 (81.8%) were undergraduates and 22 (18.2%) were postgraduates. 83 (68.6%) of the

participants stayed in their homes whereas 38 (31.4%) stayed in a hostel.

Table 2. shows distribution based on responses to questions on usage of the smartphone. The majority of the participants 65 (53.7%) owned a smartphone for a period of 1-5 years and the price of it was more than INR 20,000 for 50 (41.3) participants. 110 (90.1%) had data pack in their smartphone. Average monthly mobile bill for 92 (76%) participants was INR 100 – INR 500. The duration of usage of smartphones daily for majority of participants, 59 (48.8%) was 1-5 years. 47 (38.8%) of participants felt that they were not being able to communicate with others when unable to use their smartphone. 46 (38%) participants used their smartphone to check mail or social media. 55 (45.5%) use their smartphone while hanging out with friends/family.

Figure 1. shows distribution based on responses to the question stressed when unable to use the smartphone. 90 (74.4%) felt stressed when unable to use their smartphone wherein 31 (25.6%) did not feel so.

Table 3. shows distribution based on clinical examination for bruxism and temporomandibular joint disorder. 95(78.5%) of participants had bruxism and 43(35.5%) had temporomandibular joint disorders.

Table 4 shows an association between stress and bruxism. Overall 87 (71.9%) felt stressed when unable to use their smartphone and had bruxism.

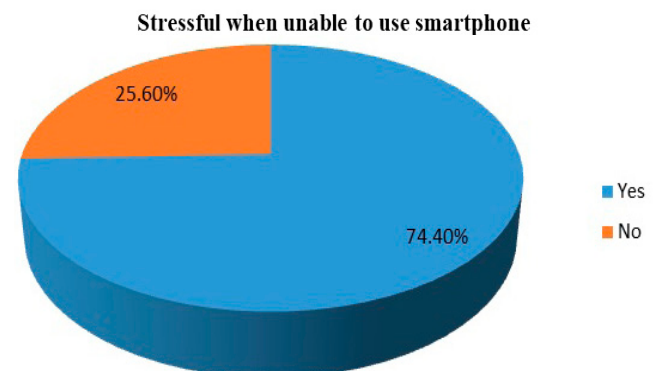


Figure 1. Distribution of participant's feeling on stress when unable to use the smartphone

Table 1. Distribution based on gender, education and place of stay

Variables	Categories	N (%)
Gender	Male	80 (66.1)
	Female	41 (33.9)
Education	Undergraduate	99 (81.8)
	Postgraduate	22 (18.2)
Place of stay	Home	83 (68.6)
	Hostel	38 (31.4)

Table 2. Distribution based on responses to questions on the usage of smartphone

Questions	Responses	N (%)
Years of owning a smartphone	Less than 1 year	11 (9.1)
	1-5 years	65 (53.7)
	More than 5 years	45 (37.2)
Price of your latest smartphone	INR 5,000 – INR 10,000	23 (19)
	INR 10,000 – INR 20,000	48 (39.7)
	More than INR 20,000	50 (41.3)
Data pack in smartphone	Yes	110 (90.1)
	No	11 (9.1)
Average monthly mobile bill	INR 100 – INR 500	92 (76)
	INR 500 – INR 1000	24 (19.8)
	More than INR 1000	5 (4.1)
Duration of usage of smartphone daily	1 – 5 hours	59 (48.8)
	5 – 10 hours	46 (38)
	More than 10 hours	16 (13.2)
Feeling when unable to use a smartphone	Not being able to communicate with others	47 (38.8)
	Losing connectedness	8 (6.6)
	Not being able to access information	16 (13.2)
	Not being able to be updated	17 (14)
	Unable to play games	6 (5)
	None of the above	27 (22.3)
Symptoms while staying away from a smartphone	Nervousness/ restless	16 (13.2)
	Uncomfortable	30 (24.8)
	Anxious	1 (0.8)
	Weird	12 (9.9)
	No symptoms	62 (51.2)
Purpose of using a smartphone	Checking mail or social media	46 (38)
	Gaming and music	24 (19.8)
	News and information	4 (3.3)
	Lecture notes and scheduling	2 (1.7)
	Texting/ chatting with friends and family	35 (28.9)
	Others	10 (8.3)
Place of use of smartphone	While watching TV, movie or dinner table	27 (22.3)
	While travelling	20 (16.5)
	While waiting for somebody	8 (6.6)
	While hanging out with friends/ family	55 (45.5)
	When alone/ bored	11 (9.1)

Table 3. Distribution based on clinical examination for bruxism and temporomandibular joint disorder

Condition	Presence / Absence	N (%)
Bruxism	Yes	95 (78.5)
	No	26 (21.5)
Temporomandibular joint disorder	Yes	43 (35.5)
	No	78 (64.5)

Table 4. Association between stress and bruxism

Stressed when unable to use smartphone	Bruxism			P-value
	No N (%)	Yes N (%)	Total N (%)	
No N (%)	23 (19.90)	8 (6.6)	31 (25.6)	0.0005 *
Yes N (%)	3 (2.5)	87 (71.9)	90 (74.4)	
Total N (%)	26 (21.5)	95 (78.5)	121 (100)	

\* p-value significant

By group, 87 out of 90 (96.7%) of those who felt stressed when unable to use their smartphone had bruxism as opposed to 8 out of the 31 (25.8%) of those who did not feel stressed. A significant p-value of 0.0005 was obtained while assessing the association between stress and bruxism.

Table 5. Association between stress and temporomandibular joint disorder

Stressed when unable to use smartphone	Temporomandibular joint disorder			P-value
	No N (%)	Yes N (%)	Total N (%)	
No N (%)	17 (14.04)	14 (11.5)	31 (25.6)	0.201
Yes N (%)	61 (50.41)	29 (23.9)	90 (74.4)	
Total N (%)	78 (64.4)	43 (35.5)	121 (100)	

Table 5 shows the association between stress and temporomandibular joint disorder. Twenty-nine out of 90 (32.2%) of those who felt stressed when unable to use their smartphones had temporomandibular joint disorder as opposed to 14 out of the 31 (45.2%) of those who did not feel stressed. The difference was not statistically significant.

## DISCUSSION

Smartphone plays a vital role in youngster's life. Its use has increased drastically among them. These new-generation smartphones enable not only youngsters but also others to talk as well as to connect with the virtual world from anywhere (21). More than half of our respondents, undergraduate and postgraduate students, reported daily use of smartphones for 5 hours or longer. Smartphones can be used also for educational purposes (22). Due to this fact, students use it for a longer duration. Studies investigating the usage of smartphones and its addiction among dental students have been done (1,21). However, this was not confirmed by our data, in which the main purpose of smartphone use was rather leisure and communication activities: 38% of participants used their smartphone to check mail or social media. 45.5% use their smartphones while hanging out with friends/ family.

In the present study, 66.1% were males and 33.9% were females. In a study done by Bernabe E et al (23) males chose dentistry than females which was in accordance with the present study. Undergraduates were 81.8% and only 18.2% were postgraduates which could be due to lesser seat availability for postgraduates than the undergraduates in dental institutions. 68.6% of the participants stayed in their homes whereas 31.4% stayed in hostels which could be due to the fact

that the institution in which the study was conducted is situated at the heart of Chennai city because of which many students would choose to come from their homes and very few staying in hostels.

The study results shows that majority of the participants i.e. 53.7% own a smartphone for a period of 1-5 years, followed by 37.2% participants own it for more than 5 years and 9.1% participants own it for a period of less than 1 year. The reason for this might be the craze of smartphones among youngsters being high just in these past 5 years. The price of their latest smartphone was more than INR 20,000 for 41.3% of participants, followed by INR 10,000 – INR 20,000 priced phones for 39.7% and INR 5,000 – INR 10,000 for 19% participants. This finding might be due to the importance given to the costly upgraded smartphones by students. About 90.1% had a data pack in their smartphone for which the blooming of internet among youngsters can be regarded as a reason. Average monthly mobile bill for 76% participants was INR 100 – INR 500, INR 500 – INR 1000 for 19.8% participants and more than INR 1000 for 4.1% participants. This could be due to availability of unlimited data packs that are available in all networks under 500 rupees. Duration of usage of smartphone daily for majority of participants, 48.8% was 1-5 hours, followed by 5-10 hours in 38% of participants and more than 10 hours in 13.2% of participants. 38.8% of participants felt that they were not being able to communicate with others when unable to use their smartphone and 14% felt that they were not being able to be updated.

In the present study, 24.8% of participants felt uncomfortable staying away from their smartphones. But the majority of them, 51.2% did not have any symptoms. In another study done in Lebanon among university students (2017) (24), results showed that 38.1% of participants experienced low sleep quality, whereas in the present study majority of them (51.2%) did not experience any symptoms. Also a study done in North Iran (2010) showed a significant relationship between smartphone usage and insomnia (25).

In this study, 74.4% felt stressed when unable to use their smartphone whereas only 25.6% did not feel so. This could be due to the overuse of smartphones by today's youngsters causing addiction to it thereby causing stress due to its unavailability.

The primary psychological factors linked to the occurrence of bruxism in both adults and children include personality traits including sensitivity to stress and anxiety (26). Since people with high levels of neuroticism and anxious expectations often use bruxism as a way to vent their emotions, it explains the pathophysiological process via which stress influences the occurrence of bruxism (27). Our data demonstrate the association between smartphone usage, bruxism

and temporomandibular joint disorders, which has not been substantiated anywhere.

The association between stress and bruxism showed that 87 out of 90 (96.7%) of those who felt stressed when unable to use their smartphone had bruxism as opposed to 8 out of 31 (25.8%) of those who did not feel stressed. A significant p-value of 0.0005 was obtained while assessing the association between stress and bruxism. A study done in Brazilian police officers in 2008 showed a positive association between stress and bruxism ( $p < 0.05$ ) which was in accordance with the present study ( $p = 0.0005$ ) (28). Another study done by Katayoun E et al. has discussed that emotional stress is one common factor that is often related to bruxism (29).

A study done by Rai B et al. in 2013 revealed higher levels of psychological distress among temporomandibular disorder patients (30), whereas in the present study, 29 out of 90 (32.2%) of those who felt stressed when unable to use their smartphone had temporomandibular joint disorder as opposed to 14 out of the 31 (45.2%) of those who did not feel stressed, and there was no significant association between temporomandibular disorder and stress.

Limitations of the present study were that since it was a single institution study, the results cannot be generalized to the Indian dental students population without caution. A limited number of dental students who expressed their willingness to participate in the study were only included. Although the intended sample size was reached, we note that there is a risk of volunteer bias. Similar studies including a larger number of participants can be conducted to obtain some generalizable conclusions.

## CONCLUSION

Smartphones have a noteworthy spot among the working as well as student population nowadays. The results of this study emphasizes the need to understand the long term effects of over usage of smartphones on bruxism. In order to minimise the effects and repercussions of bruxism, oral health care practitioners should pay special attention to young adults who get this complex behaviour due to the stress of not being able to use their smartphones.

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