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Smartphone addiction and its impact on knowledge, cognitive and psychomotor skills among dental students in India: An observational study

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Abstract:

BACKGROUND: Addictive behavior toward the use of smartphones has turned out to be a commonly present phenomenon in this digital era. An individual's overindulgence in smartphone devices has turned into an obsessive and compulsive disorder. This addiction has been found to influence the physical, social, and psychological wellbeing of the studied population. This observational study aimed to assess smartphone addiction and its impact on knowledge, cognitive, and psychomotor skills in students pursuing dentistry in India.

MATERIALS AND METHODS: This prospective and cross-sectional survey-based study comprised 100 dental undergraduate students who were selected by a random sampling technique. The age range of subjects ranged between 18 and 22 years with equal gender distribution (50 each male and female). A prevalidated questionnaire containing 30 items encompassing five variables, that is, applications related to healthcare, entertainment, shopping, communication, and education were used to assess the response. Based on scores, patients were categorized as addicted or with no addiction. For evaluating the knowledge, cognitive, and psychomotor skills of students, theory-based examinations were held in different subjects as per the semester year of selected students while psychomotor skills were assessed by conducting clinical or preclinical examinations conducted by two separate examiners who following mutual agreement were assigned appropriate scores. All scores were categorized into four grades, that is, from grades I to VI.

RESULTS: Students with smartphone addiction exhibited lower performance in both theory-based and clinical/preclinical assessment examinations with a majority of them scoring grade III or IV.

CONCLUSION: Smartphone addiction reduces the academic knowledge, cognitive, and psychomotor skills of dental students.

Keywords:

Addiction, behavior, cognitive, skill, smartphone, psychomotor

Introduction

Smartphones have evolved into a vital andan integral part of school and college culture. A brief observation of day-to-day collegiate life can show the routine use of smartphones. Its use has both physiological and psychological impacts. A smartphone is a type of mobile cell phone equipped with an advanced operating software system. It possesses combined characteristics of a personalized computer's operating system combined with essential features that show usefulness for mobile and/or hand-held

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use. Smartphones are generally pocket-sized and typically combine features of mobile or cellular phones, for example, the ability for placement along with the reception of voice calls, typing, and receipt of textual messages when combined with numerous other features such as personal digital assistantsor PDAs, for instance maintaining an event calendar, GPS navigational apps, digital camera, media player systems, and video games among various other mobile applications. Most of the commonly used smartphones have internet accessibility and also, efficiently handle different "third-party" software or "apps." All smartphones are usually having a colored display screen along with a graphic user interface that comprises approximately 70% of its face. The smartphone display is mostly a "touch" screen that can enable its user for using a virtual keyboard for typing words and numbers along with simply pressing on-screen icons for activation of various app-based features.[1]

Smartphones are now increasingly being seen as hand-held computers than only as simple cell phones with"on-board" capability for computing, memory space, and large-sized screens along with modern operating systems.[2]

With technological advancements in smartphones, this small device is playing an important role in the contribution of changes involving thought processes and behavioral patterns of humans. For instance, a smartphone provides immediately available and portable accessibility toward educational enhancement that is equivalent to that of any computer that has internet connectivity. Various tasks that can be performed on smartphones include retrieval of information from the internet, sharing of files, and instant interaction with one's teacher along with other students.[3] On the other hand, studies have shown that most college-going students use their smartphones as leisurely devices. The most common use of smartphones includes accessing various social media networking sites, exploring the Internet, accessing videos, and playing games.[4,5]

Smartphone has been hypothesized as a disrupter. In a study conducted by Lepp *et al*.[5] (2013), it was found that excessive use of smartphones has a negative association with the measurement of cardio-respiratory system fitness as it results in disruption of physically based activity and the encouragement of a sedentary lifestyle. Also, frequent use of smartphones can disrupt one's behavior which is required for achieving academic enhancement.

Increased dependence on smartphones constitutes behavioral addiction. These addictions are very different from addictiveness to a variety of chemicals, for example, alcohol or recreational drugs. In behavioral addiction, there is a constant compulsion for involvement in self-reinforcing activities that are not related to drug abuse or any type of interest or particular behavioral pattern despite an individual knowing concerning negative aspects concerning one's social, personal, or professional life.[6]

By reviewing the previous studies, it was noted that research on smartphone addiction was rare among the dental undergraduate students; hence, on the basis of above mentioned facts, this questionnaire-based survey was planned with an aim of analyzing smartphone addiction and its impact on knowledge, cognitive, and psychomotor skills among dental students in India.

Materials and Methods

Study design and setting

This was a prospective, cross-sectional, questionnaire-based survey performed on dental undergraduate students in 2020.

Study participants and sampling

This study comprised of 100 dental undergraduate students selected by means of a random sampling technique. The age range of selected subjects was between 18 and 22 years. The calculated mean age was found to be 20 years. The study sample was equally distributed among 50 male and 50 female students. A self-designed prevalidated study questionnaire was provided to all the study respondents. The questionnaire contained 30 items that encompassed a total of five variables, that is, use of healthcare-based applications, applications related with entertainment, shopping applications, communication application, and applications related to education.

Overall scores of the test measured an individual's addiction with use of smartphone. All participants had been instructed for marking their responses on rating score as considered appropriate. Based upon the obtained scores, the maximum obtained score was considered as addictive while the minimum score was found to be 0 (no addiction).

Data collection tool and technique

Theory-based examinations were held in different subjects as per the semester year of selected students. These examinations included examination series comprising of question papers which consisted mainly of short answers, short length essays, and multiple-choice questions for evaluating knowledge and cognitive skills of all students. On the other hand, assessment of psychomotor skills was done by means of clinical examinations consisting of both preoperative and operative procedures such as preparation of cavity, restorations, and management of time. All students

were examined by two faculties who were qualified as examiners. They scrutinized the students separately and after reaching a mutual agreement students were assigned scores as per predetermined departmental rubrics. All scores were categorized into four grades, that is, from grade I to VI. Grade I scores were ranging between 90% and 100%, grade II scores ranged between 80% and 89%, grade III scores were between 70% and 79%, grade IV scores ranged between 60%and 69%, while grade VI comprised of students who scored 59% marks or less.

Statistical analysis was done by use of SPSS (Statistical Package for Social Sciences) version 20 software. Collected data were entered in Microsoft (MS)-Excel 2010 work sheet. Descriptive statistical analysis was performed separately for the total number of study participants categorized into male and female subjects. Two-sample *t*-test was used for assessment and for making statistical comparison.

Ethical consideration

The ethical clearance for the study was obtained from concerned Institute's Ethical Review Board committee (EC/MMU/067/2020). A written informed consent was obtained from all the selected study participants.

Results

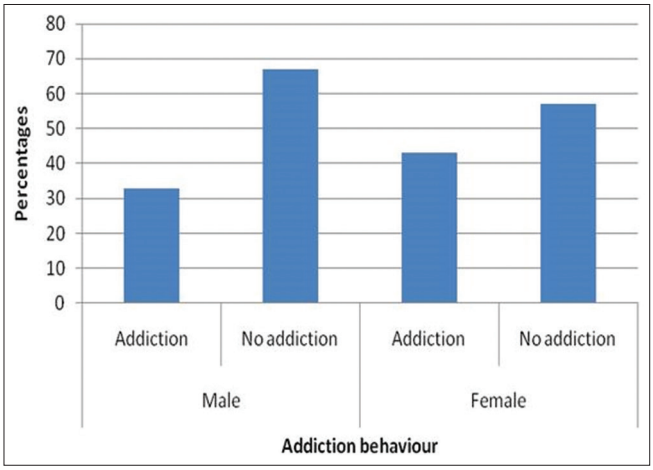
The results of the present study showed that 33% (n = 16) of male subjects and 43% (*n* = 21) of total female students were found to have addiction of smartphone use. Although the female subjects were found to exhibit greater smartphone addiction, no statistical significance (*P* = .12) was seen [Table 1 and Graph 1].

Examination conducted was divided into a) theory based assessment (examination A) and b) clinical assessment (examination B) in selected subjects as per year of study. On analyzing the grades of addicted students, it was found that in examination A, 22% of students were categorized undergrade III while 78% of students were categorized under grade IV [Table 2]. On the other hand, while analyzing the students with addictive behavior in examination B, it was observed that addicted students (100%) received grade IV [Table 3]. However, no statisticallysignificant difference (*P* = .06) was obtained on comparing both the addicted and nonaddicted students [Table 4].

On analyzing cumulative scores of both the examination, that is, examinations A and B, 75% of students with addiction received lowest grades. Nevertheless, the results were not statistically significant.

In examination A, male dental students' examination performance was reported as better (mean = 70.12) when compared to female dental students (mean = 68.5); while in examination B, performance of male subjects (mean = 77.56) was comparatively lesser than female candidates (mean = 82.57).

On analyzing the combination of both examinations (A and B) results, the female participants (76.4%) were found to be relatively better performer as compared to male participants (72.43%). Although on performing



Graph 1 : Graph showing percentages of students having addiction for smart phone usage

Table 1: Table showing students with addiction of smart phones

Gender	Addiction present/absent	Percentage	Chi-square test	*P*
Male	Addiction	33%		
	No addiction	67%	0.16	0.12
Female	Addiction	43%		
	No addiction	57%		

Table 2: Grades of Examination A and comparison with smartphone addiction

Addiction status	Grade I	Grade II	Grade III	Grade IV	Grade V	Grade VI
Addicted	0%	0%	22%	78%	0%	0%
Not addicted						

Table 3: Grades of Examination B and comparison with smartphone addictive behavior

Addiction status	Grade I	Grade II	Grade III	Grade IV	Grade V	Grade VI
Addicted	0%	0%	0%	100%	0%	0%
Not addicted						

Table 4: Comparison between smartphone addiction behavior and examination scoring

	Examination A	Examination B
Chi-square test	6.23	0.12
P	0.06	

statistical analysis, no statistical significance was observed.

Discussion

Smartphones constitute a particular class of cell phones that have multiple purposes. For example, they can be used as devices for computation. They are equipped with variety of softwares, connectivity with internet, various multimedia features, and applications for educational purposes, etc., The use of smartphones started to gain popularity from initial 2010s with fast communication aided by a wireless technology. This has resulted in a wider use of smartphones all around the world as it allows its users easy accessibility due to ease of touch screen.[7] As per released data by Telecom Regulatory Authority of India or TRAI, India's total number of users of cell phone has increased up to a staggering figure of 1.16 billion individuals in year 2019. There are numerous advantageous facilities associated with smartphone usage that include ability to communicate instantly, surfing on internet, availability of digital camera, readily accessible entertainment sources, various applications related to education, and maintenance of privacy.[8]

Most of the students especially those in professional courses such as medicine and dentistry have access to use of a personal smartphone which is equipped with internet facility. They use these devices for social networking and for the purpose of learning. Hence, one of the beneficial usage of smartphones is through use of e-learning portals. However, students have also reported various drawbacks related to the use of smartphones as educational sources. These include use of small screens, no internet availability or accessibility of wireless facility, and lesser awareness regarding usability of internet-based resources that act as a barrier toward facilitation of smartphone use.[9]

Bhuvaneshwari *et al*.[10] (2021) in their study found that the use of smartphones acted as a source of distraction among students. Saxena *et al*.[9] (2018) in their study observed that a large number of students (89%) both of which were pursuing either undergraduate or postgraduate education were found to be distracted.

Frangos *et al*.[11] in 2010 concluded that behavioral addiction related to usage of smartphone serves as a major distraction source resulting in poor performance in academics.

Usage of smartphones has been found to exhibit deleterious effects over cognition-related abilities associated with education-based, occupation-based, and social functional behavior. This impact of smartphone use has been broadly classified by Hitti *et al*.[12] (2021) into a) negative and b) positive effects based on social and psychological constituents.

Jeong *et al*.[13] in 2020 observed that the highest percentage (proportion) of students who demonstrated maximum dependency or show visible signs over dependency regarding use of smartphones were in the health sciences stream (i.e. 77.8%).

All the above studies are in support with our study, wherein students who were found to have addictive behavior toward smartphone usage reported with lower academic performances both in theory and practical examinations. In present study, female students showed better performance in preclinical or clinical assessment examination; however, the reverse was found to be true in male subjects. Although, no statistical correlation was seen on comparing the gender-based academic performances either separately or cumulatively.

Similarly, in a study conducted by Thapa and Rima (2020) for the purpose of determination of overall prevalence of dependency regarding smartphone usage in students who were following undergraduate courses, 21.8% of students were demonstrated to be addicted to smartphone use. This particular addictive behavior or dependency was attributed to number of different variables, for example, total time that was spent over use of mobiles, average calls made each day, and the total number of years that a particular student carried or owned a cell phone along with total expenditure or amount of money that was spent over monthly recharge.[14]

Addictive use of smartphones has been demonstrated to have an impact over both children's and young individual's health (mental and physical and emotional) and psychological wellbeing. These abnormalities in one's behavior are triggered as a result of various factors such as time of exposure or time spent on use of smartphones; availability of internet connectivity which can lead to development of obsessive compulsive behavior.[15,16] Cell phones are now a fact that is associated with one's occupational requirements.[17]

Both professional work and education-based environments require implementation of tools that are largely based upon smartphone use.[18] In addition, extra advantageous factors regarding use of smartphone remains to be the usage for organization of daily tasks calendar, maintaining communicability with one's relatives and friends, and 24-hour availability of sources of entertainment. This has shown an increase in ubiquitous nature of these devices in day-to-day life routine.[19] Among all available digital gadgets or tools, there are total of three features regarding the use

of smartphones: a) easy accessibility; b) repetitively consistent performance; and c) user-friendly interactive interface. These typical features develop high affinity of an individual toward smartphones specifically.[20,21]

Limitation and recommendation

The sample size of the present study was limited to 50 female and 50 male students; therefore, the sample size should be increased for better statistical evaluation. The present study did not examine perceptions of the teaching faculty; future studies can be planned including both the student and faculty to evaluate the perspective of smartphone addiction and its impact on knowledge, cognitive, and psychomotor skills.

Conclusion

Addictive use of smartphones has been shown to have a negative association with neural pathway of inhibition, ability to make decisions, memory enhancement, and difficulty in sleeping. In present study, it was found that students who were categorized into ones with addiction for smartphone use demonstrated lower grades in their examination assessment irrespective of theory or practical or clinical nature of the examination. Hence, it can be concluded from this study that addiction for smartphones has an adverse impact over academic performance and learning capabilities.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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