Influence of smartphone addiction on sleep and mental wellbeing among dental students

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Abstract

Background – In terms of connectivity and at hand accessibility to the ocean of information, smartphones could be considered a boon to the students. Yet, due their lucrative benefits, addictive behaviour is surfacing, hampering the sleep quality and mental wellbeing among individuals. **Aim:** To assess the influence of smartphone addiction on sleep and mental wellbeing among undergraduate dental students of Hyderabad and Ranga Reddy districts

Methods – A cross sectional study was conducted to assess the smartphone addiction (SAS-SV), sleep quality (PSQI) and mental wellbeing (WHO-5 Well Being Index), among 427 undergraduate dental students. Mean values and frequency distributions were used to assess the addiction levels, sleep quality and wellbeing. Multiple regression analysis was performed to assess the influence of independent SAS-SV components and smartphone related variables on sleep and mental wellbeing.

Results – Smartphone addiction was seen among 42.60% (n=190) of students. Majority of the smartphone addicts used the phone during the night and approximately for 6-8hrs/day. Also, smartphone addicts reported poorer sleep quality (8.16±3.74; p=0.00) and wellbeing (12.46±4.94; p=0.00). The components of SAS-SV ‘Daily life disturbance’ influenced PSQI (p=0.000) and WHO-5 WBI scores(p=0.009), whereas, ‘Withdrawal’ and ‘Tolerance’ had influenced the PSQI scores (p=0.000; p=0.00) alone. Smartphone related variables had no influence on sleep quality and wellbeing (p>0.01)

Conclusion – Findings of the study showed that 42% of the students were addicted to smartphone. Smartphone addiction demonstrated a positive correlation with poor sleep quality and negative correlation with mental wellbeing among this sample.

**Key words** – smartphone addiction, sleep quality, mental wellbeing, dental students
INTRODUCTION:

Being equipped with multitude of integrated features such as internet, social networking, gaming, messaging, multimedia and navigation, smartphones are ubiquitous and thus precipitate addictive behaviour. Despite facilitating multiple aspects of day-to-day life, constant use of smartphone fosters detrimental effects not only on physical health in the form of musculoskeletal disorders such as pain in the neck (OR=0.54; p=0.04), wrist/hand (OR =0.51; p=0.51) [1], but also on mental health including quality of life (p<0.001) [2], depression (p=0.01), anxiety (p=0.03) [3] and obsessive-compulsive disorder (14.2%) [4].

Mental health is an essential and indispensable part of health. It is more than the mere lack of mental disorders. Positive mental wellbeing is the state in which the individual realises his or her own abilities, can cope with the normal stresses of life, can work productively and effectively, thereby making a contribution to his or her community. Excessive smartphone usage can bring about deleterious effects on behaviour and wellbeing of individuals. Jun S reported a bi directional relationship between smart phone addiction and depressive symptoms [5]. There also exists a higher tendency among smartphone addicts toward unhealthy dietary habits, sleep disorders, minimal social circle and diminished relations with family all of which are predisposing factors to depression, thereby jeopardizing mental health. Additionally, individuals with lower levels of self-perceived emotional health tend to exhibit over usage of smart phones, making it a vicious cycle.

Recently, poor sleep quality has emerged as a relevant public health problem in technologically advanced societies. Sleep plays a significant role in sustaining health and constitutes one third of human life. Emission of blue light from the screen and the radio frequency electromagnetic waves associated with the smart phone are known to curtail the secretion of melatonin hormone which is responsible for circadian rhythm, and impede the Rapid Eye Movement (REM) sleep,
non-REM sleep and sleep wake cycle. Normal sleep cycle is associated with lower cortisol and higher growth hormone levels. Sleep deprivation leads to metabolic dysregulation thereby increasing the risk of diabetes, obesity, cardiovascular disease, etc.

Due to advances in the technological front, abusive usage of smartphone has surfaced as early as in young adolescents. Apart from equipping them with the necessary information and connectivity, smartphone addiction is posing a threat to sleep quality and mental health. Detecting the smartphone addiction behaviour at early stages can help prevent its progression and grave consequences among dental students.

Undergraduate years are a period of vulnerability when considering sleep problems and mental health. A study conducted by Chatterjee et al [6] reported higher smartphone addiction rates impaired sleep quality among medical students. Similarly, Kulkarni et al [7] identified an association between smartphone use, sleep disturbances, depression and anxiety among polytechnic students. In particular reference to dental students, Venkatesh et al [8] reported a higher percent (71.9%) of smartphone addiction levels. The addiction proneness among dental students could be attributed to social media platforms, ocean of educational content on the web, peer pressure etc., Understanding the magnitude of the issue, present study’s objectives were to assess the smartphone addiction levels, sleep quality, mental wellbeing and the influence of smartphone addiction on sleep and mental wellbeing among undergraduate dental students of Hyderabad and Ranga Reddy districts.

**MATERIALS AND METHOD:**

A cross-sectional study was designed to assess the influence of smartphone addiction on the quality of sleep and mental wellbeing among undergraduate dental students across Hyderabad and Ranga Reddy districts. With the significance level of 99%, sampling error at 1% and on using the formula $n = \frac{z^2 pq}{d^2}$ (n= sample size; z= standard normal variate; p= expected
prevalence; q = (1-p); d= margin of error), the estimated sample size was a minimum of 427 subjects. Ethical clearance was obtained from the Institutional Ethical Committee of Osmania Medical College, Hyderabad. (Ref. No. IEC/OMC/2021/M.No.(14)/Acad-148).

Undergraduate dental students across five dental colleges of Hyderabad and Ranga Reddy districts were included in the study. Individuals who have undergone or are currently undergoing treatment for mental health issues and subjects not willing to participate in the study were excluded. Demographic details, year of study, smartphone related variables (purpose of usage, time of the day and average duration of smartphone usage) were incorporated in the questionnaire. Status of addiction to smartphone was assessed using Smartphone Addiction Scale- Short Version (SAS-SV) [9]. quality of sleep was determined through Pittsburgh Sleep Quality Index (PSQI) [10] and psychological Wellbeing was evaluated by WHO-5 Well Being Index (WHO-5 WBI) [11].

SAS-SV is a ten-item questionnaire formulated by Kwon et al having five factors namely, daily life disturbance (questions 1,2,3), withdrawal (questions 4,5,6,7), cyberspace-oriented relationship (question 8), overuse (question 9) and tolerance (question 10). A six-point Likert scale (1- strongly disagree to 6- strongly agree) was used to measure the responses. The sum of scores ranged from 10 (minimum) to 60 (maximum). The cut off score for addiction was 31 for males and 33 for females. Individuals with scores above the cut off scores were considered as smartphone addicts.

The sleep quality was assessed by PSQI, a 19-item questionnaire, conceived by Buysse et al. It measures various aspects of sleep such as subjective sleep quality (question 6), latency (questions 2,5), duration (question 4), habitual sleep efficiency (questions1,3,4), sleep
disturbances (questions 6 to 14), sleeping medication (question 16) and daytime dysfunction (17, 18 questions). The questions were rated on a four-point Likert scale (0- not during the past month; 3- Three or more times a week). The sum of scores gave the Global PSQI which ranged from 0 to 21, and higher scores reflected poor sleep quality. Based on the cut off score of 6, individuals were classified based on their sleep quality as good sleep quality (<6) and poor sleep quality (>6).

WHO-5 Well Being Index is a five-item questionnaire and the responses were recorded on a six-point Likert scale (5- All of the time, 4- Most of the time, 3- More than half of the time, 2- Less than half of the time, 1- Some of the time, 0- At no time). The scores ranged from 0 to 25 with higher scores suggesting better wellbeing. The cut off score do determine well-being was 13 and the individuals who scored below the cut off score were considered to have poor wellbeing.

Data was analysed using Statistical Package for Social Sciences 20.0 (IBM SPSS 20.0). Descriptive statistics were carried out to calculate means and frequency distributions. Inferential statistics were carried out using Chi-square test. Mean value comparison was done using independent t test. Multiple linear regression analysis was performed to identify the significant influence of smart phone addiction on sleep and mental wellbeing. Level of significance was set at p <0.01.

RESULTS: 
A total of 446 undergraduate dental students completed the questionnaire, out of which 79% constituted females (n=355) and the remainder were males (n=91; 20.40%). Highest number of
responses were from first year students (n=134; 30.05%) followed by second (n=119; 26.68%), fourth (n=114; 25.56%) and third (n=79; 17.71%) year students.

Smartphone addiction was slightly higher in males (n= 46; 24.21%). However, gender (p=0.08) and year of study (p=0.51) did not show any significant difference in their smartphone addiction. It was observed that the most common reason for the smartphone usage was ‘Social networking services’ (n=85; 44.7%) among the smartphone addicts, whereas ‘Phone call/ text message’ was opted by majority of non addicts (n=96; 37.5%) but the difference between the groups was not significant (p=0.05).

Also, time of the day for smartphone usage was ‘Night’ among the smartphone addicts (n=85; 44.73%) whereas among the non addicts, it was ‘Evening’ (n=122; 47.65%) and the difference was significant (p=0.001). Though, both the smartphone addicts and non addicts used smartphone for 3-5 hrs/day, a significantly higher proportion of addicts used it for 6-8 hrs/day (28.42%; p=0.00). Furthermore, a significantly higher number of smartphone addicts had poor sleep quality (73.16%; p=0.00) and poor wellbeing (48.42%; p=0.00) compared to those not addicted (Table 1).

Likewise, the mean scores of SAS-SV and its components, PSQI were significantly higher among the addicts, whereas WHO-5 Well Being Index was significantly lower as demonstrated in Table 2.

Multiple regression analysis showed that, the component ‘Daily life disturbance’ significantly influenced sleep quality positively (p=0.00) and negatively influenced wellbeing (p=0.009). Also, the components ‘Withdrawal’(p=0.00) and ‘Tolerance’(p=0.00) significantly influenced
the sleep quality. However, none of the smartphone related variables showed any significant influence on the sleep quality and the wellbeing among this sample (Table 3).

**DISCUSSION:**

The present study was formulated to inspect the influence of smartphone addiction on sleep quality and mental wellbeing among undergraduate dental students. To the best of our knowledge, this was the first study to have assessed the influence of individual components of smartphone addiction on sleep quality and mental wellbeing.

The most common reason for smartphone usage in the present study was ‘social networking’ among smartphone addicts as well as non-addicts. Majority of the addicts reported smartphone usage during night in contrary to non-addicts. A study conducted by Cha S and Seo B [12] showed that adolescents who used smartphone till 8 p.m. in the night were at 2.56 times higher risk of being smartphone addicts. Likewise, Sohn et al [13] reported four times higher addiction rates in late night smartphone users.

Also, duration of smartphone usage was one of the significant indicators of smartphone addiction in this study. Accordingly, it was reported by Torrecillas [14] and Aljomaa et al. [15], individuals who use smartphone for four or more hours per day are at increased risk of smartphone preoccupation and overuse. The current study reported the usage of smartphone for 6-8hrs/day among higher number of smartphone addicts (p=0.00). Similarly, a study conducted by Tangmunkongvorakul et al [16] showed that high school students of Japan and Thailand who used smartphone for 5 hours and more had five times higher odds of getting addicted to it.
Likewise, Duke and Montag \cite{17} reported a significant correlation between number of hours spent on smartphone for leisure and smartphone addiction ($r=0.428$; $p<0.01$).

Smartphone addicts showed poorer mental wellbeing compared to the non addicts in this study. In a relatable study by Kaya et al.\cite{18}, university students addicted to smartphone were prone to depression ($p=0.000$). Also, Tangmunkongvorakul et al.\cite{15} and Babade-Akashe et al.\cite{19} have revealed a negative impact on interpersonal relationships and mental health among smartphone addicts. This could be attributed to the fact that, smartphone addicts could have compromised face-to-face social interactions leading to fear of missing out (FOMO) and anxiety, eventually leading to loneliness and depression. In addition, sleep disturbances among the addicts could eventually take a toll on their mental wellbeing, as shown in this study wherein 73.16\% ($n=139$; $p=0.00$) of smartphone addicts had poor sleep quality and 48.42\% ($n=92$; $p=0.00$) of addicts had poor wellbeing.

Multiple regression analysis showed that the component of smartphone addiction ‘Daily life disturbance’ influenced both sleep quality and mental wellbeing whereas the component ‘Withdrawal’ in specific, influenced sleep quality. Daily life disturbance assesses missing planned work, having hard time concentrating on tasks and physical symptoms such as pain in the wrist or back while using the smartphone. The attention span of an individual is an important factor in accomplishing day to day tasks. Smartphone addiction supposedly snatches the attention span by crippling the ability to prevent intrusive thoughts leading to loss of flow, viz absolute absorption in an activity. Sleep and attention span are complementary states of brain and high attentional demands are known to increase the need for sleep. Thus, the component ‘Daily life disturbance’, synonymous to reduced attention span might have affected the sleep quality and consequently, mental wellbeing.
Another component that influenced the sleep quality in this sample was ‘Withdrawal’. Withdrawal was represented by unpleasant psychological experience on discontinuance of the particular activity. Smartphone addiction is being considered as a subcategory of behavioural addiction, which may manifest various psychological symptoms on withdrawal such as irritability, moodiness, anxiousness etc. Thus, withdrawal might lead to stressful situations where in the Nor adrenaline containing neurons (NE- neurons) of the Locus Coerulceus (LC) which is a nucleus of pons, promote arousal response, and inhibit several vegetative functions such as feeding and sleep.

In a study by Nowreen and Farhada [20], duration of smartphone usage was associated with poor sleep quality, similar to the results of Kaya et al [18] and Sohn et al [13]. On the contrary, the present study has not shown any significant relation between smartphone related variables, sleep and mental wellbeing. The variable ‘purpose of usage’ did not significantly differ among addicts and non addicts thus explaining its non contribution towards sleep disturbance and wellbeing. Though majority of the students from both the groups used the smartphone during evening and night, ‘duration of usage’ was reported to be 3-5 hrs/day which is less than duration mentioned in the comparative studies.

The current study stands out in the scientific literature due to its in-depth analysis by taking each component of smartphone addiction into consideration. Also, in order to compensate for the incomplete responses, the questionnaire was distributed among four hundred and fifty undergraduate students from five dental colleges, mounting to a response rate of 99.1% (446/450), attributing to the strength of the study. However, the study has its own limitations. Since the study is cross sectional in design, temporal association cannot be made and the results of this study are to be exercised with caution when generalising them to other populations.
**Conclusion:**

Findings of this study revealed that 42% of the students (n=190; male=46; female=144) were addicted to smartphone. Furthermore, smartphone addiction demonstrated a significant positive correlation with poor sleep quality and negative correlation with mental wellbeing among this sample. Besides educating the students regarding the disadvantages of excessive usage, screening and interventions at an early stage could prevent them from suffering the grave consequences of smartphone addiction.

**Abbreviations:**

1. **SAS-SV** – Smartphone Addiction – Short Version
2. **PSQI** – Pittsburgh Sleep Quality Index
3. **WHO-5 WBI** – World Health Organisation -5 Well Being Index

**Ethics approval:** This study was approved by the Institutional Ethical Committee of Osmania Medical College and Hospital, Hyderabad. *(Ref.No.IEC/OMC/2021/M.No.(14)/Acad-148).*

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**Author contribution statement:** Dr. Jagadeeswara Rao and Dr. Dolar Doshi – Study conception, Study designing; Dr. Turaga Sai Susmitha – Data collection, data analysis, manuscript writing

**Acknowledgement:** None

**REFERENCES:**


TABLES

Table 1: Comparison of Demographics, Smartphone Related Variables, PSQI and WHO-5 Well Being Index Between Smartphone Addicts and Non-Addicts
<table>
<thead>
<tr>
<th>Characteristics</th>
<th>N (%)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Smartphone addicts</td>
<td>Non- addicts</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>46 (24.21)</td>
<td>45 (17.58)</td>
</tr>
<tr>
<td>Female</td>
<td>144 (75.79)</td>
<td>211 (82.42)</td>
</tr>
<tr>
<td>Year of study</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1&lt;sup&gt;st&lt;/sup&gt; year</td>
<td>52 (27.37)</td>
<td>82 (32.03)</td>
</tr>
<tr>
<td>2&lt;sup&gt;nd&lt;/sup&gt; year</td>
<td>57 (30.00)</td>
<td>62 (24.22)</td>
</tr>
<tr>
<td>3&lt;sup&gt;rd&lt;/sup&gt; year</td>
<td>32 (16.84)</td>
<td>47 (18.36)</td>
</tr>
<tr>
<td>4&lt;sup&gt;th&lt;/sup&gt; year</td>
<td>49 (25.79)</td>
<td>65 (25.39)</td>
</tr>
<tr>
<td>Smartphone related variables</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Purpose</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phone call/ text message</td>
<td>49 (25.79)</td>
<td>96 (37.50)</td>
</tr>
<tr>
<td>Gaming</td>
<td>8 (4.21)</td>
<td>8 (3.13)</td>
</tr>
<tr>
<td>Social networking services</td>
<td>85 (44.74)</td>
<td>85 (33.20)</td>
</tr>
<tr>
<td>Internet surfing</td>
<td>38 (20.0)</td>
<td>49 (19.14)</td>
</tr>
<tr>
<td>Others</td>
<td>10 (5.26)</td>
<td>18 (7.03)</td>
</tr>
<tr>
<td>Time of the day</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Morning</td>
<td>9 (4.74)</td>
<td>3 (1.17)</td>
</tr>
<tr>
<td>Afternoon</td>
<td>10 (5.26)</td>
<td>18 (7.03)</td>
</tr>
<tr>
<td>Evening</td>
<td>62 (32.63)</td>
<td>122 (47.66)</td>
</tr>
<tr>
<td>Night</td>
<td>109 (57.37)</td>
<td>113 (44.14)</td>
</tr>
<tr>
<td>Duration of usage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-2hrs/day</td>
<td>19 (10.00)</td>
<td>54 (21.09)</td>
</tr>
<tr>
<td>3-5hrs/day</td>
<td>117 (61.58)</td>
<td>170 (66.41)</td>
</tr>
</tbody>
</table>
Table 2: Mean Values of SAS-SV, PSQI And WHO-5 Well Being Index Among

<table>
<thead>
<tr>
<th></th>
<th>6-8hrs/day</th>
<th>PSQI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor sleep (PSQI &gt;6)</td>
<td>139 (73.16)</td>
<td>94 (36.72)</td>
</tr>
<tr>
<td>Good sleep (PSQI&lt;6)</td>
<td>51 (26.84)</td>
<td>162 (63.28)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WHO-5 Well Being Index</th>
<th>6-8hrs/day</th>
<th>PSQI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor wellbeing (WHO-5 &lt;13)</td>
<td>92 (48.42)</td>
<td>71 (27.73)</td>
</tr>
<tr>
<td>Good wellbeing (WHO-5 &gt;13)</td>
<td>98 (51.58)</td>
<td>185 (72.27)</td>
</tr>
<tr>
<td>Total</td>
<td>190 (42.60%)</td>
<td>256 (57.40%)</td>
</tr>
</tbody>
</table>

*p<0.01 is significant
### Addicts And Non-Addicts

<table>
<thead>
<tr>
<th>Scales &amp; components</th>
<th>Smartphone addicts</th>
<th>Non-addicts</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SAS-SV</strong></td>
<td>41.35±7.09</td>
<td>22.12±5.93</td>
<td>0.00*</td>
</tr>
<tr>
<td>Daily life disturbance</td>
<td>12.4±3.43</td>
<td>7.27±2.92</td>
<td>0.00*</td>
</tr>
<tr>
<td>Withdrawal</td>
<td>15.63±4.26</td>
<td>7.37±3.18</td>
<td>0.00*</td>
</tr>
<tr>
<td>Cyberspace oriented relationship</td>
<td>4.17±1.59</td>
<td>1.54±1.26</td>
<td>0.00*</td>
</tr>
<tr>
<td>Overuse</td>
<td>4.98±1.07</td>
<td>3.11±1.40</td>
<td>0.00*</td>
</tr>
<tr>
<td>Tolerance</td>
<td>4.15±1.03</td>
<td>2.11±1.27</td>
<td>0.00*</td>
</tr>
<tr>
<td><strong>PSQI</strong></td>
<td>8.16±3.74</td>
<td>4.87±3.15</td>
<td>0.00*</td>
</tr>
<tr>
<td>WHO-5 Well Being Index</td>
<td>12.46±4.94</td>
<td>14.91±4.67</td>
<td>0.00*</td>
</tr>
</tbody>
</table>

*p<0.01 is significant

Table 3: Multiple Linear Regression Analysing the Influence Of SAS-SV
Components and Smartphone Related Variables on PSQI and WHO-5

Well Being Index Among Smartphone Addicts

<table>
<thead>
<tr>
<th>Components</th>
<th>PSQI</th>
<th>WHO-5 Well Being Index</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coefficient</td>
<td>SE</td>
</tr>
<tr>
<td>Daily life disturbance</td>
<td>0.26</td>
<td>0.07</td>
</tr>
<tr>
<td>Withdrawal</td>
<td>0.28</td>
<td>0.06</td>
</tr>
<tr>
<td>Cyberspace oriented relationship</td>
<td>0.15</td>
<td>0.17</td>
</tr>
<tr>
<td>Overuse</td>
<td>0.22</td>
<td>0.25</td>
</tr>
<tr>
<td>Tolerance</td>
<td>0.47</td>
<td>0.17</td>
</tr>
</tbody>
</table>

Smartphone related variables

| Purpose of using smartphone         | 0.32  | 0.22 | 0.14   | 0.27  | 0.30 | 0.36   |
| Time of the day smartphone is accessed the most | 0.20  | 0.34 | 0.55   | 0.18  | 0.45 | 0.67   |
| Average duration of smartphone usage per day | 0.47  | 0.45 | 0.30   | -0.71 | 0.60 | 0.24   |

*p<0.01 is significant
Declaration of interests

☒ The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

☐ The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: