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Digital Habits and Postural Impact: A Study on Prevalence of Forward Head Posture Among Collegiate Smartphone Users

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ABSTRACT

Background: Smartphone usage has raised concerns about its impact on posture, especially forward head posture. It is the condition when the neck and upper back muscles are strained due to the altered forward position of head relative to the shoulder. The objectives of the present study were to find the prevalence and risk factors of forward head posture among collegiate students engaging with smartphones, also to assess its impact on musculoskeletal health, and to check the influence of smartphone utilization on postural deviation, and promote proper posture and ergonomics through awareness and education.
Methodology: A survey was conducted by using google form which include questionnaires, with components like neck disability index and Smartphone addiction scale. While the patient was sitting, the cervical vertebral angle was measured using the MB ruler software based on a single standard lateral view photograph. The smartphone camera was used to capture pictures for cervical vertebral angle as well as range of motion.
Results: The results showed that, 16.8% of collegiate students showed mild neck pain, 3.2% had forward head posture, and 30.1% utilized more than 5 hours per day with smartphones However, statically highly significant association (<0.001) was shown between the duration of Smartphone usage and the disability status of the collegiate students.
Conclusion: The findings of the study revealed that excessive smartphone use can cause forward head posture, subsequently causing musculoskeletal problems. To prevent this, students should use smartphones ergonomically, maintaining correct posture, taking frequent breaks and stretches.

Keywords: Cranio Vertebral Angle, Forward head posture, Information Technology, Musculoskeletal disorders, Neck Disability Index, Smartphone Addiction Scale, Smartphone Users.

INTRODUCTION

In today's world of advancement and automation smart-phones have a significant role in people's everyday life as they are being used for communication, internet browsing, social media platforms, app dependent appliances for various activities of daily life (ADL). In past decade, the rate

of smart-phone usage, hours spent on them and frequency of their use has been increased. This can be evaluated by their sale value. Now more than 2.7 billion individuals use smart-phones throughout the world, of which 378.88 million users are in India and it can be estimated that there will be more than 442.5 million sales of smart-phones by 2022. India is the second most populous country in the world after China in number of smart-phone users in 2017 (Statista Research Department, Oct. 2019). Widely used mobile smartphones have gained tremendous popularity owing to their ease of use and versatility (de Oliveira Fontenele et al., 2024). A heavy dependency on the smart-phones may contribute to musculoskeletal overuse injury in the users. So, the health professionals should be aware of the effect of smart-phones use on physical health (Eitivipart et al., 2018). During smart-phone usages the maintenance of head forward posture decreases cervical lordosis of the lower cervical vertebrae and creates a posterior curve in the upper thoracic vertebrae to maintain balance; this is known as forward head posture (FHP) or turtle neck posture, which may cause musculoskeletal disorders, such as "upper crossed syndrome" (Kang et al., 2012; Moore et al., 2004; Szeto et al., 2002). Forward head posture is a poor posture in the sagittal plane, may contribute to the onset and perpetuation of neck and back pain syndromes, with further loss of cervical spine extension (McEvoy et al., 2005; Burgess et al., 1998). Studies have showed that incorrect posture of head and neck has been correlated with chronic musculoskeletal pain (Lau et al., 2010; Szeto et al., 2002). Finger, hand, wrist, arm, elbow, shoulder, and neck injuries can result from repetitive motions, bad posture, and extended use of smartphones for games or texting for a longer period of time (Yaşarer et al., 2024). Many studies have reported that smart-phone users are more likely to complain of neck pain, muscle fatigue and cervical range of motion than normal phone users (Kang et al., 2012; Berolo et al., 2011). Surveys in several countries reveal that smartphone usage is rising, with an average of 2.4 hours and many users surpassing 5 hours a day (Chen et al., 2024). Static and unnatural posture during smartphone use can cause cervical spine stress, altering cervical curvature and pain threshold, leading to neck-shoulder discomfort, a phenomenon linked to smartphone addiction (Nawawi et al., 2024). Behavioural addictions are a serious issue brought on by smartphone use. Individuals with behavioural addictions are unable to stop themselves from engaging in the relevant conduct, and they may exhibit stress and unhappiness as a result of being prohibited (Azodo & Omuemu, 2017). Therefore, this study is aimed to find the level of smart-phone addiction in college going students and its correlation with pain and functional disability at neck. In fact, college going students are enormous in number and utmost health precaution is required for these future citizens of India.

MATERIAL AND METHODS

Present study is cross-sectional type of study. Total of 279 university students (165 girls, 114 boys) aged 18-25 years, were randomly selected from Chandigarh University, Punjab and Baddi University, Himachal Pradesh, India, during December, 2023 to April, 2024. The study was permitted by the Institutional ethical committee. The subjects were explained about the purpose of the study and the informed consent was taken through form.

Outcome variables

Identification of risk factors, such as incorrect postural habits, extended periods of sitting, and screen time, which contribute to the development of FHP. Examination of the effects of FHP on musculoskeletal health, encompassing variables like Cranio-vertebral Angle (CVA), Neck Disability Index (NDI), and type of pain, Smartphone Addiction Scale (SAS), Range of Motion for the cervical spine with inclinometer.

SAS

The SAS is a self –reporting scale to assess smart-phone addiction (Kwon et al., 2013). It consists of six factors and 33 questionnaires with a six-point Likert scale (1: "strongly disagree" to 6: "strongly agree"). The six factors were daily-life disturbance, positive anticipation, withdrawal, cyberspace orientated relationship, overuse and tolerance. Scores ranges from 33 to 198. The study subjects were asked to tick their smart-phone usage characteristic. Greater the score, the degree of pathological use of the smart-phone is more (Ching et al., 2015). The SAS is a reliable and valid measurement tool for the evaluation of smart-phone addiction (Kwon et al., 2013).

NDI

The NDI assessment has 10-item, 50-point index questionnaire which assesses the effects of neck pain and symptoms during various ADL activities (Vernon and Mior, 1991). Of all the 10 items, four are related to subjective symptoms (pain intensity, headache, concentration, sleeping), other four to activities of daily living (lifting, work, driving, recreation) and two to discretionary activities of daily living (personal care, reading) (Stratford et al., 1999; Westaway et al., 1998). Each item is scored on a 0 to 5 rating scale, where zero depicts 'No pain' and five depict 'Worst imaginable pain. The test score ranges from 0 to 50. Higher the score, greater the neck disability is. This index is the widely used and is most strongly validated instrument for assessing self-rated disability in patients with neck pain (Vernon, 2008).

VAS

It's a pain scale used to measure the intensity of neck pain. It's a horizontal 10 cm line graduated by different levels of pain, starting from 0 stating no pain to 10 the worst pain ever (Swartzberg, 2002).

Measurement of Cranio-vertebral Vertebra

The Cranio-vertebral angle was measured with the help of "MB ruler software" using a single standard lateral view image in a seated position and range of motion with inclinometer.

Data analysis

Data analyses were performed using SPSS 20.0. Percentage and Chi-square were used to compare various variables among the collegiate Smart-phone addiction. The Spearman correlation coefficient was used to assess the relationship between SAS, VAS neck and NDI scores. The significance level was set at $p < 0.05$.

RESULTS

Table 1 showed the distribution of the participants based on various questions. The maximum frequency of participants in the category of "Agree" was found in Q1 (31.9%), Q2 (34.1%), Q3 (36.9%), Q4 (35.5%), Q8 (31.2%), Q9 (38.4%) and Q11(27.6%) and in the category of "disagree" was observed in Q5 (25.8%), Q6 (27.2%), Q7 (24.7%) and Q10 (25.1%).

Table 1: SAS (Smartphone Addiction Scale-Short version)

	Q 1	**Q 2**	**Q 3**	**Q 4**	**Q 5**	**Q 6**	**Q 7**	**Q 8**	**Q 9**	**Q 10**	**Q 11**
Strongly Disagree	16 (5.7%)	16 (5.7%)	23 (8.2%)	24 (7.9%)	41 (14.7%)	30 (10.8%)	42 (15.1%)	31 (11.1%)	18 (6.5%)	33 (11.8%)	20 (7.2%)
Weakly Disagree	31 (11.1%)	25 (9.0%)	22 (7.9%)	23 (8.2%)	35 (12.5%)	33 (11.8%)	37 (13.3%)	32 (11.5%)	26 (9.3%)	47 (16.8%)	26 (9.3%)
Disagree	40 (14.3%)	38 (13.6%)	47 (16.8%)	47 (16.8%)	72 (25.8%)	76 (27.2%)	69 (24.7%)	37 (3.3%)	24 (8.6%)	70 (25.1%)	49 (17.6%)
Agree	189 (31.9	95 (34.1	103 (36.9	99 (35.5	56 (20.1%	69 (24.7%	53 (19.0%	87 (31.2%	107 (38.	62 (22.	77 (27.

	%)	%)	%)	%)	)	)	)	)	4%)	2%)	6%)
Weakly Agree	68 (24.4 %)	72 (25.8 %)	59 (21.1 %)	62 (22.2 %)	57 (20.4%)	49 (17.6%)	57 (20.4%)	58 (20.8%)	62 (22. 2%)	43 (15. 4%)	77 (27. 6%)
Strongly Agree	35 (12.5 %)	33 (11.8 %)	25 (9.0%)	26 (9.3%)	18 (6.5%)	22 (7.9%)	21 (7.5%)	34 (12.2%)	42 (15. 1%)	24 (8.6 %)	30 (10. 8%)

The association of disability status with the duration of Smartphone use was shown in Table 2. In the duration 1-2 hours, the maximum frequency (56.o6%) was found in the category "Mild disability", followed by "Moderate disability" (18.58%). In the duration of 3-5 hours, the maximum frequency (67.27%) was recorded in the category "Mild disability", followed by "Moderate disability" (22.30%). In the duration of >5 hours, the maximum frequency (58.03%) was registered in the category "Mild disability", followed by "Moderate disability" (19.24%) and the least (1.26%) in the category "Severe disability". However, statically highly significant association (<0.001) was shown between the duration of Smartphone usage and the disability status of the collegiate students (X^2=63.72).

Table 2: Association of disability status with the duration of Smartphone users

Duration	No Disability	Mild Disability	Moderate Disability	Severe Disability
<1 hour	4 (0.43)	0	0	0
1-3 hours	20 (9.14)	55 (56.06)	10 (18.58)	0
3-5 hours	6 (10.97)	76 (67.27)	20 (22.30)	0
>5 hours	0	53 (58.03)	31 (19.24)	4 (1.26)

X^2=63.72; p<0.001

Table 3 showed the distribution of the Cranio-vertebral angle of the participants through MB ruler software. As many as 9 participants (3.2%) were found to have forward head posture using the Smartphone for >than 3-5 hours. The remaining 96.8% of total participants showed more than 50 degrees of CVA which means they did not fall under the category of forward head posture.

Table 3: Distribution of Cranio-Vertebral Angle of the participants

Time	Frequency (N)	Point prevalence	Percentage (%)
$< 50^0$	9	0.032	3.2
$> 50^0$	270	0.968	96.8
Total	279	1	100

DISCUSSION

Smart-phones are mobile information and communicative devices that have an operating system, more powerful computing capacity and diverse software applications than low-end mobile phones that contain a limited set of functions. Frequency of use and reliance on the smart-phone has also been on the rise. A survey reports that mobile device users spend more than 20 hours a week, emailing, text messaging and using social network services, indicating their heavy reliance on smart-phones to connect and communicate with others (eMarketer, 2013). Various health applications have also been increasingly used with the increasing numbers of smart-phone usage. There are several factors that can cause a complaint on the musculoskeletal system including pain; including the factor of workload is too large and repetitive activities (Peter Vi, 2000). Indicating in Indian young adult population, smart-phone addiction is more of the moderate level addiction at this era of 21st century but as more the improvement in availability, function and automation of technology more would be dependency and

so would more be the addiction. Pain in the neck of smart-phone users, which has often been referred to 'text neck', has received more public attention recently due to the growing use of mobile devices in head forward flexion postures. In the present study, 3.2% participants had forward head posture related complications. It has been suggested that the prolonged and/or frequent use of the smart-phone with the severe head flexion posture could be one of main contributing factors to the prevalence of neck pain symptoms of smart-phone users. When using a smart-phone, most of the neck or head position of the individual bends / flexes to see the smart-phone screen. If the position is often done and with a long time (high duration) then produce considerable pressure on the cervical spine, resulting in stiffness (pain / discomfort) in the neck muscles and head (Bader et al., 2015). Compared to PC users, there is greater head flexion while using smart-phones and greater biomechanical loads on the neck musculature (Gold et al. 2012; Moffet et al. 2002; Turville et al. 1998). The longer usage duration, higher frequency of use, and more the smart-phone addiction together with the larger head flexion led to greater neck disability of smart-phone users. This result implies the importance of ergonomic interventions to reduce or eliminate either the long duration or large head flexion associated with usages of smart-phone. Periodic rest breaks with an aid by head posture monitoring applications could be an efficient low-cost recommendation to lessen the cumulative biomechanical stress from the intensive text messaging (Sojeong et al., 2015). And a study estimated the frequency of text neck complaints in college students and evaluated the anatomical factors essential to the cervical region's biomechanics. The Neck Pain and Disability Scale (NPAD) ratings were compared with those of the Text Neck Questionnaire (TNQ), a self-designed questionnaire used in the study, to validate the results. The study's findings provided important light on how text neck problems affect college students' posture and mobility, emphasizing the necessity for education and preventative actions (Nijal Parmar et al., 2024). Studies found that the smartphone application significantly improved the knowledge, attitudes, and awareness of abnormal neck posture among college students who were dependent on their smartphones. Participants showed a greater desire to adopt healthier habits and an increased awareness of the risks associated with poor neck posture. These findings are consistent with other research that has shown how mobile health applications can support positive behavioural changes (Akodu et al., 2024). In contrary, In order to cure Forward Head Posture (FHP), a cost-effective virtual reality (VR) system has been developed and evaluated. The device offers a focused set of exercises that promote proper posture in an immersive environment. The therapy involves patients in a more participatory and pleasurable way by utilizing VR technology, which may increase results and treatment adherence. In contrast to more conventional approaches, the system is more effective in lessening the severity of FHP, as the research explains and emphasizes its cost (Mohapatra et al., 2024).

CONCLUSION

The findings of the study revealed that excessive smartphone use can cause forward head posture, subsequently causing musculoskeletal problems. To prevent this, students should use smartphones ergonomically, maintaining correct posture, taking frequent breaks and stretches.

Declaration by Authors

The authors hereby declared that it was their original peace of research and had not been sent to any other journal for publication.

Ethical Approval: Approved.

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Conflict of Interest: The authors declared no conflict of interest.

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