

Correlation Between Duration of Smartphone Usage and Forward Head Posture in Young Adults

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Received: November 21, 2022; **Published:** November 24, 2022

Abstract

The use of digital devices, especially smartphones and laptops/desktops is on the rise. Prolonged use of smartphones is prevalent among young adults including university students who spend a large amount of time on mobile devices for social, leisure, or school activities. Studies have shown that compared to neutral standing, neck flexion angle, head tilt angle and forward head shifting may increase during the smartphone use. The maintenance of this position leads to changes that constitute the forward head posture (FHP). Due to covid-19, work from home and online classes became the new norm. This research was conducted to study correlation between smartphone usage and FHP. This cross-sectional study was carried out with convenient sampling consisting of young adults between 20 to 22 years of age. Their average daily screen time was asked. A lateral view photograph was taken after marking the C7 vertebra and tragus of the ear. The photograph was transferred to calculate the craniovertebral angle (CVA) using a software. CVA is the angle between the line connecting the tragus of ear to seventh cervical vertebra and the horizontal plane. In this study, CVA < 50 degrees was considered forward head posture. Participants' BMI was also recorded. The study results showed no correlation between smartphone usage time and FHP. There was a weak negative correlation between BMI and FHP. Though there was no correlation found 70.2% of sample showed to have FHP. FHP may lead to long term musculoskeletal disorders like neck pain, scapular dyskinesia or postural imbalance. The study findings highlighted the need to explore further the other factors leading to FHP among these young adults.

Keywords: Forward Head Posture; Smartphone Usage; Physiotherapy; Screentime; Cranio-Vertebral Angle; Photographic Assessment

Introduction

The use of digital devices, especially smartphones and laptops/desktops, is on the rise. The number of smartphone users in India was estimated to reach over 760 million in 2021 and this number will increase to 890 million by 2022 [1]. According to a survey conducted by the "Mobile Ecosystem Forum" from November 2019 to December 2019, the highest penetration rate of smartphones was in the age group of 16 to 24 years, with 37 percent penetration [2].

Prolonged use of smartphones is prevalent among young adults and students, including university students who spend a large amount of time on mobile devices for social, leisure, or school activities [3]. Texting, calling, checking social media and internet search are the most popular ways of smartphone use among university students [4].

Smartphones and computer usage does not limit to affect the exposure but also posture. Studies have shown that compared to neutral standing, neck flexion angle, head tilt angle and forward head shifting were increased during the smartphone use [5,6] and text mes-

saging while sitting caused the largest head flexion compared to other task conditions [6]. The maintenance of this position decreases the lordosis of the lower cervical vertebrae and creates a posterior curve in the upper thoracic vertebrae to maintain balance; these changes constitute the forward head posture [7]. Additionally, studies have found that the amount of weekly computer use correlates with habitual spinal postures. Increased computer use was correlated with increased head and neck flexion angles in males [8,9]. Altered postures can have a lasting effect on the kinetics and kinematics of the spine. Hence it is necessary to assess the spinal alignment among smartphone users.

Craniovertebral angle (CVA) helps to assess the forward head posture (FHP). Lesser the CVA, more is the FHP [10]. FHP predisposes individuals to pathological conditions, such as headache, neck pain, scapula and shoulder dyskinesia, postural imbalance, decreased respiratory function, etc [7,10-12]. Varied methods have been reported in the literature for measurement of postural angles like goniometry, photography, photogrammetry and radiography. Photographic assessment of FHP using the CVA is introduced as one of the most common methods for evaluating the FHP and examines head status relative to the seventh cervical vertebra (C7). This angle is a good indicator for the FHP severity and is a reliable and valid method [13]. The standing position is more sensitive to evaluate the FHP [14].

Smartphones have become an integral part of our daily lives, be it for work, social or leisure purposes. In addition to the already growing use of digital devices, the pandemic led to an increase in screen time. In March 2020, India went into lockdown to combat the spread of COVID-19 infections and reduce the pressure on healthcare systems. Accordingly, people were confined to their homes. Online classes became the new norm. Among students, cellphone usage increased along with desktop/laptop usage to enable messaging, news feed checking, social media updates and online classes [21]. Researchers have investigated the detrimental effects of smartphone use, its addiction on various body systems. While there are studies correlating smartphone addiction scores to forward head posture, studies to find a relation between usage time and FHP were limited. The studies in the Indian population were also very limited.

Therefore, this research was designed to study a correlation between smartphone usage duration and forward head posture using the craniovertebral angle.

Methodology

The study was cross-sectional analytical where sample was drawn by convenient sampling. Fourth year and intern students were recruited from the researchers' parent institute. They were young adults between 20 to 22 years of age using smartphones every day since at least one year. Total 47 students were recruited for the study. These students were also engaged in online classes for previous year during pandemic. Students with history of migraine, head or spine injury, any other metabolic, congenital or acquired musculoskeletal or neurological condition were excluded from the study.

The study was approved by Institutional Ethics Committee of researchers' parent institute.

CVA was assessed using a digital, lateral -view photograph of the subjects in their usual standing posture taken by a digital camera. The digital camera was placed at a distance of 1.5m on a tripod. To minimize image distortion, a circular spirit level was placed at the base of the camera to ensure that the camera was positioned perpendicularly to the horizontal. The height of the camera was adjusted to the level of the subject's shoulder. The tragus of the subject's ear and the seventh cervical vertebra was marked by finding its bony landmark. This was done by asking the subject to flex and extend their head and then finding the seventh spinous process of the vertebra. The subject was instructed to stand and look straight ahead. Then a lateral-view photograph was clicked [22,23].

The photograph was transferred to the laptop. The angle of FHP was calculated using the WebPlotDigitizer software [24]. It was the angle between the line connecting the tragus of ear to seventh cervical vertebra and the horizontal plane (Figure 1). The cutoff value for

FHP is 48 - 50 degrees [14]. In this study cutoff point of 50 degrees was used. Thus CVA < 50 degrees was considered as criteria for forward head posture.

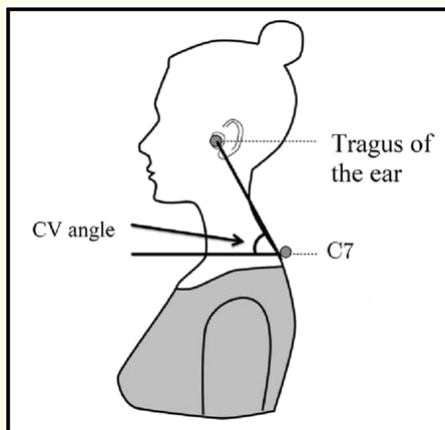


Figure 1: Measurement of craniocervical angle [25].

To analyze the correlation, average smartphone usage time per day in hours was recorded and CVA was recorded.

Results

The data obtained was analyzed using Pearson’s correlation coefficient to determine the correlation.

Total 47 subjects were recruited for the study based on the inclusion criteria.

The mean age of the participants was 20.9 ± 0.9 yrs. The mean height was 1.62 ± 0.08m and weight was 58.95 ± 10.94 kg. Mean BMI of the participants was 22.3 ± 3.7 kg/m. The mean smartphone usage duration was 5.8 ± 1.6 hours. Mean craniocervical angle of the subjects was 46.96 ± 5.87 degrees. Out of the 47 subjects, 33 (70.2%) had Forward Head Posture (CVA < 50 degrees).

Table 1 shows the analysis correlation between CVA and smartphone use. However, there was no correlation between duration of smartphone use and CVA and a weak negative correlation (r = 0.3844) between BMI and CVA (p < 0.05).

Parameters	r	p-value
Body Mass Index	-0.3844	0.0077
Duration of smartphone use	-0.052	0.7284

Table 1: Analysis of correlation between CVA and other variables.

Graph 1 depicts the scatter plot of the correlation between the CVA and smartphone usage.

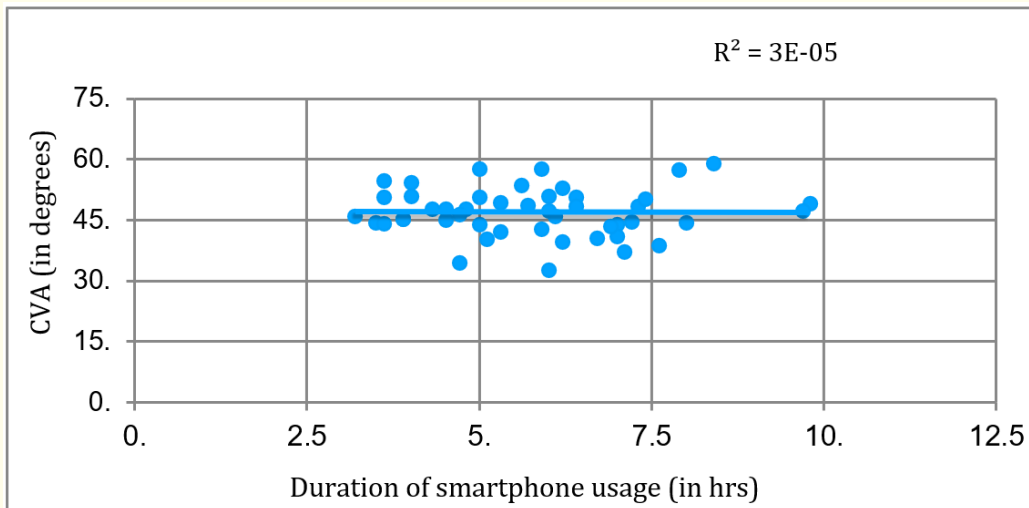


Figure 2: Graphical representation of correlation of duration of smartphone use with CVA.

Discussion

The study results found no correlation between duration of smartphone usage and forward head posture ($r = -0.0052$, $p > 0.05$) in young adult population. However, strikingly 70.2% of the subjects had a forward head posture (CVA < 50 degrees). This posture was not correlated to their screen time. Thus, duration of smartphone usage is not a noticeable factor to bring change in CVA among young adults.

The present study results are consistent with the previous study conducted by Kang, *et al.* (2012) which reported that heavy users of smartphone do not produce considerable change in CVA due to concomitant change in thoracic region based on their lower cervical spine changes while using smartphone in usual positions. However, the results contradict previous few studies where a correlation was found between these variables [7,10-12]. The primary cause for forward head posture is the muscle imbalance due to weakness of short deep cervical flexors, rhomboids, serratus anterior, middle and lower trapezius and tightness of the cervical extensors and pectorals. Other factors such as BMI, age, level of physical activity, etc. also influence the CVA. The present study shows a weak negative correlation between BMI and CVA.

Conclusion

The study results indicate there is no correlation between smartphone use and FHP. Though no correlation was found between smartphone hours and FHP; almost 70.2 percent of the sample showed FHP. Having developed FHP at this young age could result in detrimental effects on musculoskeletal health. As mentioned earlier the time spent may not be the influential factor but posture while using the phone, visual health as well as other environmental factors, quality of device may be influential on the overall effect on kinetics and kinematics. For present study the time factor was only considered and the other factors were not analyzed. However, study results highlight that there is a need to explore the other factors operating and influencing the development of FHP within this younger age group.

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Volume 13 Issue 12 December 2022

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