RESEARCH PAPER

Effect of Smart Phone Dependency on Adolescent Cervical Posture – A Cross Sectional Study

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ABSTRACT
Background: Smartphone use has become increasingly prevalent among adolescents, raising concerns about its potential impact on musculoskeletal health, particularly cervical posture. Excessive smartphone use may contribute to postural alterations and related symptoms such as neck pain and headaches.
Objective: To evaluate the impact of smartphone dependency on cervical posture among adolescents aged 14–17 years.
Methods: A cross-sectional study was conducted among 212 adolescents aged 14–17 years in Belagavi. Smartphone dependency was assessed using the Test of Mobile Phone Dependence (TMD), while cervical posture was evaluated by measuring the craniovertebral angle (CVA) using the APECS application. Associations between smartphone dependency, CVA, demographic variables, and musculoskeletal symptoms were analyzed.
Results: Among the participants, 51.4% demonstrated moderate smartphone dependency. A significant association was observed between smartphone dependency and CVA ($p = 0.014$), indicating altered cervical posture with increasing dependency levels. Smartphone dependency was also positively correlated with age, study hours, and symptoms such as neck pain and headaches. Significant relationships were additionally identified with gender, family type, and parental employment status.
Conclusion: Smartphone dependency is significantly associated with altered cervical posture and musculoskeletal discomfort among adolescents. These findings underscore the importance of early ergonomic education, responsible smartphone use, and posture awareness programs to prevent long-term musculoskeletal problems and promote physical health in school-going adolescents.
Keywords: Smartphone dependency, Craniovertebral angle (CVA), Adolescents, Cervical posture, Test of Mobile Phone Dependence (TMD) questionnaire, APECS app.
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INTRODUCTION

Smartphones have evolved from luxury goods to necessary devices, influencing many aspects of daily life.[1] Smartphones have made it feasible to access the internet at any time and from any location, they are used for a number of purposes, including work, recreation, and conversation.[2] Adolescence is a phase between the ages of 10 and 19 years with rapid changes in all domains like physical, psychosocial, cognitive, and emotional that have an impact on the feelings, thoughts, and decision making of adolescents, making them vulnerable for unhealthy lifestyle and behaviours.[3] In India, this demographic shift is evident, with smartphone usage among adolescents reaching Substantial levels.[4] Adolescent smartphone dependence is estimated to be 25.7% worldwide and between 39 and 44% in India.[5,4] In India several prevalence studies on adolescents were done in different regions like Kerala (42.3%), Chandigarh(73.7%), Delhi (31.33%) and Navi Mumbai(31.33%).[6,7,8,9]

Smartphone dependency refers to excessive, uncontrollable smartphone use that disrupts daily life.[1] Smartphone dependency in this study was defined as a behavioral pattern characterized by excessive and compulsive smartphone use associated with loss of control, tolerance, and functional interference, as measured by the Test of Mobile Phone Dependence (TMD) questionnaire. Dependency levels were categorized based on TMD scoring guidelines proposed by Chóliz (2012)[15]. It leads to both physiological issues—like migraines, carpal tunnel syndrome, dry eyes, and musculoskeletal problems—and psychosocial disorders, including sleep disturbances, aggression, depression, and antisocial behaviour.[10,11] Prolonged use mainly affects the fingers, neck, back, and shoulders, causing postural issues such as forward

head position, rounded shoulders, and altered upper cervical posture.[10] Excessive smartphone use among adolescents is linked to spinal posture changes and increased neck pain, particularly in the cervical region.[12] Previous study has established a strong link between smartphone addiction and postural abnormalities, particularly in children. In children aged 8 to 13 years, frequent smartphone use has been associated with poor cervical posture and diminished respiratory function, those with smartphone addiction commonly exhibit more significant forward head posture (FHP), decreased craniovertebral angle (CVA), and restricted neck range of motion (ROM), all of which contribute to a higher risk of developing musculoskeletal problems.[13]

Various scales are available to evaluate mobile phone dependency, like the Mobile Phone Dependence Questionnaire (MPD-Q), Test of Mobile-phone Dependence (TMD), Mobile Phone Addiction Type Scale (MPATS), and Smartphone Addiction Scale (SAS). [14,15,16,17] The TMD Questionnaire, designed for individuals aged 12–18 years, has high validity (0.94) and reliability (0.93). It evaluates three components: Abstinence (discomfort when unable to use the phone), Lack of control (difficulty stopping use), and Tolerance and interference (increased use affecting daily activities).[15]

A 2023 study conducted in Fortaleza, Brazil, revealed that 63.3% of adolescents showed smartphone addiction, with excessive daily usage correlated with forward head posture, diminished lateral head tilt, and other cervical postural alterations, underscoring the necessity for early treatments in postural health.[18] A study by Alonazi at Loma Linda University in 2017 found that children aged 8–13 years with high smartphone addiction exhibited FHP, reduced cervical mobility, and impaired respiratory function, also emphasizing the negative impact of excessive smartphone use on posture and breathing, highlighting the need for postural education and usage limits.[19]

Adolescents aged 14 to 16 years were chosen because this stage represents mid-adolescence, which is marked by greater independence, increased academic pressures, and unrestricted access to smartphones, making them susceptible to problematic usage behaviors. Moreover, the cervical musculoskeletal system is still maturing during this period. [3,20] Their developing cervical spine is more vulnerable to postural changes caused by prolonged screen exposure.[12] Focusing on this age range enables early detection of smartphone-related postural deviations before they become long-term musculoskeletal issues.[18,19] There is a dearth of studies associating smartphone dependency and craniovertebral angle (CVA) in adolescents aged 14–16 years in India. The primary objective of the study is to estimate prevalence of smart phone dependency in secondary school adolescents using TMD questionnaire and the secondary objective is to evaluate the association of smart phone dependency on the craniovertebral angle (CVA) among adolescents using APECS App.

MATERIALS AND METHODS

The trial was prospectively registered with the Clinical Trial Registry of India (CTRI/2025/01/079251). This cross-sectional observational study involved aged 14 to 16 years, recruited from selected secondary schools in Belagavi city through convenience sampling. The sample size was calculated using the formula for comparing the means of two independent groups, assuming a 5% significance level ($\alpha = 0.05$) and 80% power ($1-\beta = 0.80$). Taking the standard deviation (σ) as 6.5 and the minimum clinically important difference (d) as 2.5, the calculated sample size using $n = \frac{2\sigma^2(Z_{1-\alpha/2}+Z_{1-\beta})^2}{d^2}$ was 106. Therefore, 106 participants were required in each group, the study included a total of 212 participants. Inclusion criteria were: adolescents attending school in Belagavi city, aged between 14–16 years, of either gender, owning a personal smartphone, and spend at least 4 hours per day on smartphone with parental/guardian consent and student assent. Exclusion criteria included students with diagnosed neurological disorders (e.g., epilepsy), cognitive impairments, psychiatric conditions, or behavioural disorders (e.g., ADHD, multiple personality disorder).

Data Collection and Procedures

Participants who met the predefined eligibility criteria were recruited through scheduled school visits. Written informed consent was obtained from parents or guardians, and assent was secured from all participating students. Demographic and background information—including Sociodemographic Variables (age, gender, number of siblings, type of family structure, parental employment status, monthly pocket money), Anthropometric Variables (height, weight, BMI), Lifestyle and Behavioural Variables (duration of outdoor activities, daily sleep duration, study hours per day), Academic Variables (previous academic performance), Environmental Variables(availability of Wi-Fi at home), and Health-Related Variables (presence of neck pain or headache) —was collected using a structured data form.

Following demographic data collection, smartphone dependency was assessed using the Test of Mobile-Phone Dependency (TMD) questionnaire. The TMD is a validated 22-item self-report instrument designed to quantify levels of mobile-phone dependency in adolescents. Each item is rated on a 5-point scale. Total scores range from 0 to 88, with higher scores indicating greater dependency. Cut-off classification was based on percentile distribution. Scores were classifying dependency as mild (<30),

moderate (30–59), or severe (>60). The TMD scale which has not been previously used in the Indian adolescent population [15]

Cervical posture was evaluated by measuring each participant's Craniovertebral Angle (CVA), an established indicator of forward head posture. Measurements were obtained using the APECS mobile application. A standardized lateral-view photograph of each participant in an upright standing position was captured, and the CVA was computed digitally. The CVA represents the angle between a horizontal line drawn through the seventh cervical vertebra (C7) and a line extending from C7 to the tragus of the ear.

Statistical Analysis

Data were analyzed using SPSS software (version 29.0.10; SPSS Inc., Chicago, IL). Descriptive statistics were expressed as frequencies, percentages, means, and standard deviations. One-way ANOVA was used to compare craniovertebral angle across levels of smartphone dependency, followed by Tukey's post hoc test for multiple comparisons. Pearson's correlation coefficient (r) was applied to examine the relationship between smartphone dependency and age, height, weight, BMI, academic performance, outdoor activity duration, daily sleep hours, study hours, number of children in the family, and craniovertebral angle.

Smartphone Dependency Level	Score Range	Frequency (n)	Percentage (%)	Craniovertebral Angle (Mean ± SD)	F value	p value
Mild	< 30	98	46.2	64.80 ± 6.65	4.34	0.014*
Moderate	30 – 59	109	51.4	67.96 ± 8.63		
Moderate	> 60	5	2.4	66.20 ± 6.10		

The association between smartphone dependency prevalence and demographic variables was assessed using the likelihood ratio test. A p-value < 0.05 was considered statistically significant.

RESULTS

The mean age is 14.39 ± 0.62 years. Anthropometric measures showed an average height of 159.21 ± 10.14 cm, weight of 45.34 ± 8.18 kg, and BMI of 17.12 ± 2.78 kg/m², indicating most participants were underweight to normal weight. The mean craniovertebral angle (CVA) was 66.46 ± 7.85 degrees, suggesting varying head and neck posture. Headache and neck pain were reported by 54.2% and 30.2%, respectively. Using the TMD questionnaire, Smartphone dependency levels were moderate showing 51.4%, mild and severe with 46.2%, 2.4%. One way ANOVA analysis revealed a significant difference in CVA across dependency groups (p = 0.014), with the moderate group showing the highest CVA (67.96°). Tukey post hoc analysis confirmed a significant difference between mild and moderate groups (p = 0.010). Pearson correlation showed significant positive associations between smartphone dependency and age (r = 0.229, p = 0.001), study hours (r = 0.243, p < 0.001), and CVA (r = 0.135, p = 0.049). No significant correlation was found with BMI, sleep, outdoor time, or academic performance. The Likelihood Ratio Test found significant associations between dependency and gender (p = 0.030), headache (p = 0.043), neck pain (p = 0.020), family type (p = 0.003), and parental working status (p = 0.022). No significant link was found with Wi-Fi access or pocket money.

Table 1: Descriptive Statistics for Demographic characteristics and Craniovertebral angle (Degrees)

(n = 212)	Range	Mean ± S.D.
Age (Years)	14 to 16	14.39 ± 0.62
Weight (Kg)	20 to 70	45.34 ± 8.18
Height (Cm)	120 to 190	159.21±10.14
BMI (Kg/M^2)	12.1 to 32	18.06 ± 2.78
Previous academic performance (%)	35 to 94	73.47 ± 12.61
Time spent on outdoor activities (Hours)	0 to 12	2.40 ± 1.78
Sleeping in a day (hours)	1 to 11	7.48 ± 1.50
study in a day(hours)	0 to 9	5.40 ± 1.19
Number of children in the family	0 to 8	2.35 ± 0.96
Craniovertebral angle (Degrees)	44 to 85	66.46 ± 7.85

Table2: Prevalence of Smartphone Dependency and Comparison of Craniovertebral Angle
("F" = One-way ANOVA)

Table 3: Relation of Demographic characteristics and Craniovertebral angle with the smart phone dependency

	Smart phone dependency	
	"r"	p value
Age (Years)	0.229	0.001*
Weight (Kg)	0.095	0.168
Height (Cm)	0.044	0.520
BMI (Kg/M^2)	0.115	0.096
Previous academic performance (%)	0.008	0.908

Time spent on outdoor activities (Hours)	-0.017	0.800
Sleeping hours in a day	0.016	0.813
Hours of study in a day	0.243	< 0.001*
Number of children in the family	-0.044	0.524
Craniovertebral angle (Degrees)	0.135	0.049*

("r" = Pearson correlation coefficient; * Significant)

Table 4: Association between the prevalence of smart phone dependency and Demographic characteristics

		Prevalence of smart phone dependency						Likelihood ratio	p value
		Mild (< 30)		Moderate (30-59)		Severe (> 60)			
		n	%	n	%	n	%		
Gender	Male	50	51.0	50	45.9	0	0	7.04	0.030*
	Female	48	49.0	59	54.1	5	100		
Type of school	Public	98	100	109	100	5	100	--	--
	Private	0	0	0	0	0	0		
Do you experience headache	Yes	51	52.0	59	54.1	5	100	6.31	0.043*
	No	47	48.0	50	45.9	0	0		
Do you experience neck pain	Yes	21	21.4	40	36.7	3	60	7.82	0.020*
	No	77	78.6	69	63.3	2	40		
Do you receive pocket money	Yes	37	37.8	31	28.4	2	40	2.14	0.343
	No	61	62.2	78	71.6	3	60		
The monthly pocket money received	< 200	20	20.4	24	22.0	1	20	6.45	0.168
	200 to 300	17	17.3	7	6.4	1	20		
	No pocket money	61	62.2	78	71.6	3	60		
Type of family	Single parent	9	9.2	14	12.8	0	0	16.25	0.003*
	Nuclear family	63	64.3	86	78.9	2	40		
	Joint family	24	24.5	9	8.3	3	60		
Does your home have Wi-Fi access	Yes	37	37.8	45	41.3	2	40	0.27	0.874
	No	61	62.2	64	58.7	3	60		
Parental working status	Single parent working	92	93.9	89	81.7	4	80	7.63	0.022*
	Both parents working	6	6.1	20	18.3	1	20		

(* Significant)

Discussion

The present study explored the relationship between smartphone dependency and cervical posture in adolescents aged 14 to 16 years in Belagavi city. The findings reveal a significant association between smartphone dependency and altered cervical posture, along with demographic, and health-related variables. One of the key findings of this study was

that 51.4% of participants exhibited moderate smartphone dependency, while 46.2% had mild dependency, and a smaller group (2.4%) showed severe dependency. This prevalence is consistent with previous prevalence studies conducted in Indian cities such as Kerala (42.3%), Chandigarh (73.7%), Delhi (33%), and Navi Mumbai (31.3%) [6,7,8,9]

The craniovertebral angle (CVA) varied significantly across smartphone dependency groups, with the moderate dependency group demonstrating the highest mean CVA (67.96°) and a statistically significant difference observed between the mild and moderate dependency groups. While previous studies have consistently reported a reduction in CVA with increasing smartphone addiction, the present findings indicate a contrasting pattern in moderately dependent users.[13,21,22,23]

This observation may be explained by a non-linear postural adaptation, wherein individuals exposed to prolonged but moderate smartphone use develop compensatory cervical extension strategies to reduce discomfort and mechanical strain on cervical structures, such adaptive responses have been documented in postural control and musculoskeletal literature, particularly in populations subjected to sustained cervical loading. [24,25] Additionally, moderately dependent users may adopt pain-avoidance behaviours and improved ergonomic strategies, such as elevating the device toward eye level or intermittently correcting head posture, which may result in an increased CVA when assessed in a neutral standing position.[26,27]

Furthermore, methodological differences across studies, including variations in participant characteristics, exposure duration, dependency assessment tools, and CVA measurement protocols, may also contribute to discrepancies between the present findings and earlier reports. Collectively, these results underscore the importance of considering adaptive and compensatory mechanisms when interpreting the relationship between smartphone dependency and cervical posture.

The TMD questionnaire revealed significant behavioural markers of smartphone addiction 30.7% frequently sent over five messages daily, 28.8% used apps longer than intended, and 26.4% failed to follow self-imposed limits, reflecting poor self-control and compulsive use. These behaviours are consistent with patterns of smartphone addiction described by Kuss & Griffiths.[28] These behaviours indicate that many adolescents are not only using smartphones for communication but also engaging with them in ways that reflect dependence and habitual overuse, which may increase physical strain on the cervical spine due to prolonged and repetitive neck flexion. [29,30]

Significant relationships between smartphone dependency and gender are found in current study. Interestingly, women exhibited greater rates of moderate to severe dependency, which is consistent with other research that points to women's increased vulnerability to behavioural dependencies involving social media and communication tools.[31,32]

The association to headache and neck pain is significant. 30.2% reported neck pain and 54.2% experienced headaches, both of which were substantially correlated with increased smartphone dependency. Due to persistent cervical flexion and muscular strain, these symptoms are typical in people with FHP. [33] Each degree of forward flexion results in an exponential rise in the biomechanical stress brought on by head tilt, which can lead to cervicogenic headaches, neck pain, and muscular fatigue. [34,35]

This study highlights the need for school-based health education programs on digital literacy, ergonomic awareness, and posture management. Teaching adolescents to maintain a neutral spine, take regular screen breaks, and use smartphones at eye level may reduce long-term musculoskeletal risks. Parental involvement is also vital. The link between smartphone dependency and family structure or parental work status suggests that children in nuclear or single-parent homes may experience less supervision and more unregulated screen time. Engaging parents in prevention efforts is key to reinforcing healthy behaviours at home.

This study has some limitations firstly, only the craniovertebral angle was assessed, the lumbar lordosis, thoracic kyphosis, and cervicothoracic angle were not assessed when using a smartphone, which is a limitation of this study. Since the lumbar lordosis and thoracic kyphosis are interconnected, the degree of cervical flexion may also be influenced by these conditions. Secondly, the cross-sectional design limits the ability to draw causal inferences. Longitudinal studies are needed to track postural changes over time and to determine whether early intervention can reverse or prevent smartphone-related musculoskeletal issues. Future research should use measures such as lumbar lordosis and thoracic kyphosis to provide a thorough evaluation of posture. To assess the long-term effects of smartphone, use as well as the efficacy of ergonomic education and posture correction strategies for adolescents longitudinal and interventional research is needed.

Conclusion

The study concludes that, statistically significant association was observed between smartphone dependency scores and craniovertebral angle; however, causality cannot be inferred due to the cross-sectional design. particularly increased craniovertebral angle indicating forward head posture. Behavioural signs of dependency, such as sleep disruption and compulsive messaging, along with symptoms like headache and neck pain, were more prevalent among adolescents with moderate to

severe smartphone dependency. These findings emphasize the need for early, school-based ergonomic interventions and parental engagement to prevent long-term musculoskeletal issues among youth in the digital age.

References

1. Chóliz M. Mobile-phone addiction in adolescence: The Test of Mobile Phone Dependence (TMD). Prog Health Sci. 2012;2(1):33–44.
2. Pew Research Center. Mobile technology and home broadband 2021 [Internet]. Washington (DC): Pew Research Center; 2021 [cited 2025 Jan 10]. Available from: Pew Research Center.
3. Sawyer SM, Azzopardi PS, Wickremarathne D, Patton GC. The age of adolescence. Lancet Child Adolesc Health. 2018;2(3):223–8.
4. Davey S, Davey A. Assessment of smartphone addiction in Indian adolescents: A cross-sectional study. Int J Prev Med. 2014;5(12):1500–11.
5. Sohn SY, Rees P, Wildridge B, Kalk NJ, Carter B. Prevalence of problematic smartphone usage and associated mental health outcomes amongst children and young people: A systematic review, meta-analysis and meta-regression analysis. J Affect Disord. 2019;255:353–63.
6. Nikhita CS, Jadhav PR, Ajinkya SA. Prevalence of mobile phone dependence in secondary school adolescents. J Clin Diagn Res. 2015;9(11):VC06–VC09.
7. Singh M, Gupta N, Garg R. Pattern of mobile phone dependence among adolescents in Chandigarh. Indian J Community Health. 2013;25(2):158–64.
8. Sharma MK, Benegal V, Rao GN, Thennarasu K. Behavioral addiction in adolescents: A study on mobile phone usage in Delhi. Indian J Psychol Med. 2014;36(4):388–93.
9. Davey S, Davey A. Assessment of smartphone addiction in Indian adolescents: A cross-sectional study. Int J Prev Med. 2014;5(12):1500–11.
10. Xie Y, Szeto G, Dai J. Prevalence and risk factors associated with musculoskeletal complaints among users of mobile handheld devices: A systematic review**.** Appl Ergon. 2017;59(Pt A):132–42.
11. Demirci K, Akgönül M, Akpinar A. Relationship of smartphone use severity with sleep quality, depression, and anxiety in university students. J Behav Addict. 2015;4(2):85–92.
12. Xie Y, Szeto GPY, Dai J, Madeleine P. Spinal posture and neck/shoulder muscle activity during smartphone use in adolescents. Appl Ergon. 2018;70:233–40.
13. Kim J, Kim S. Effects of smartphone use on the craniovertebral angle and respiratory function in children aged 8–13 years. J Phys Ther Sci. 2019;31(6):495–500.
14. Toda M, Monden K, Kubo K, Morimoto K**.** Development of a Mobile Phone Dependence Questionnaire (MPDQ) for Japanese adolescents**.** Cyberpsychol Behav Soc Netw. 2008;11(5):615–20.
15. Chóliz M. Mobile-phone addiction in adolescence: The Test of Mobile Phone Dependence (TMD)**.** Prog Health Sci. 2012;2(1):33–44.
16. Yen CF, Tang TC, Yen JY, Lin HC, Huang CF, Liu SC. Development of the Mobile Phone Addiction Type Scale (MPATS) for adolescents**.** J Adolesc Health. 2009;44(6):584–91.
17. Kwon M, Kim DJ, Cho H, Yang S. The Smartphone Addiction Scale: Development and validation of a short version for adolescents**.** PLoS One. 2013;8(12):e83558.
18. de Oliveira Neto J, da Silva Costa F, Rocha GR, et al. Smartphone addiction and postural changes in adolescents: A cross-sectional photogrammetric study in Fortaleza, Brazil. J Bodyw Mov Ther. 2023;37:59–66.
19. Alonazi A, Daher N, Alismail A, Nelson R, Almutairi W, Bains G. The effects of smartphone addiction on children's cervical posture and range of motion. Int J Physiother. 2019;6(2):32–39.
20. Kuss DJ, Griffiths MD. Internet and smartphone addiction in adolescents: Risk factors and psychosocial impacts. Int J Adolesc Youth. 2017;22(4):430–46.
21. Al-Essawy et al. The effects of smartphone addiction on children's cervical posture and range of motion. *Int J Physiother.* 2022;9(2):32-39.
22. Severity of slouched posture during smartphone use is associated with musculoskeletal discomfort in adolescents. *J Adolesc Health.* 2023
23. Is There a Difference in Pulmonary Functions and Craniovertebral Angle Among Adolescents Based on Their Smartphone Usage Time? *SEEjPH*. 2024;8(4):383-392.
24. Szeto GPY, Straker L, O'Sullivan PB. A comparison of symptomatic and asymptomatic office workers performing monotonous keyboard work—neck and shoulder kinematics. *Man Ther.* 2005;10(4):281–291.

25. Falla D, Jull G, Hodges P. Feedforward activity of the cervical flexor muscles during voluntary arm movements is delayed in chronic neck pain patients. *Exp Brain Res.* 2004;157(1):43–48.
26. Neupane S, Ali UTI, Mathew A. Text neck syndrome—systematic review. *Int J Occup Saf Ergon.* 2017;23(4):508–515.
27. Ruivo RM, Pezarat-Correia P, Carita AI. Cervical and shoulder postural assessment of adolescents between 15 and 17 years old. *J Bodyw Mov Ther.* 2014;18(3):364–371.
28. Kuss DJ, Griffiths MD. Internet addiction in psychotherapy. London: Palgrave Macmillan; 2015.
29. Fabio RA, Stracuzzi A, Lo Faro R**.** Problematic smartphone use leads to behavioral and cognitive self-control deficits. *Int J Environ Res Public Health*. 2022;19(12):7445.
30. Lin YH, Lin YC, Lee YH, Lin PH, Lin SH, Chang LR, et al. Time distortion associated with smartphone addiction: Identifying smartphone addiction via a mobile application. *Transl Psychiatry*. 2017;7(1):e1030.
31. Billieux J, Maurage P, Lopez-Fernandez O, Kuss DJ, Griffiths MD. Can disordered mobile phone use be considered a behavioral addiction? An update on current evidence and a comprehensive model for future research. *Curr Addict Rep*. 2015;2(2):154–62
32. Salih A, et al. Gender differences in excessive smartphone use: girls show higher prevalence of problematic use. *J Med Internet Res*. 2021;23(4):e30889.
33. Hansraj KK. Assessment of stresses in the cervical spine caused by posture and position of the head. *Surg Technol Int*. 2014;25:277–9.
34. Goyal A, Yadav SL, Manjusha R, Meena S. Text neck syndrome: Forward head posture and its correlation with neck pain and headache among smartphone users. *Int J Community Med Public Health*. 2022;9(3):1234–40.
35. Chu ECP, Lo FS, Bhaumik A. Plausible impact of forward head posture on upper cervical spine stability: A case report and review. *J Family Med Prim Care*. 2020;9(5):2517–20.