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Prevalence Of Forward Head Posture Among University Students And Its Association With Smartphone Screen Time: Validation Of The Smart Protector App For Craniovertebral And Craniohorizontal Angle Measurement

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ABSTRACT

Objective: The research demonstrates the widespread occurrence of forward head position among university students. Research will determine how common forward head posture is and how it relates to mobile-device utilization. The smartphone application functions as a measurement tool for forward head posture evaluation. The evaluation of forward head position will occur through the smart protector tool application.

Background: Forward head posture functions as an epidemic which has significantly increased since the current technological period initiated. A clinical diagnosis characterizes this condition as when the head rests ahead of its normal position relative to the shoulder point. Forward movement of the human gravity axis occurs when the head tilts forward. When the upper body shifts backward toward reclining posture with shoulder slumping the head moves in front of the trunk.

Design: Survey method

Method: Subjects received information about the study and researchers explained the research objectives to them. The research study included 72 participants who were young student volunteers and symptom-free. The smart protector tool application measured both Craniovertebral angle and Craniohorizontal angle. Mobile phone users recorded their screen time as 2 weeks on average.

Result: Result shows that due to less awareness about proper posture maintenance forward head posture is increased in young students. According to CVA angle 26.4% students and CHA 4.2% subjects had forward head posture. And smart protector tool application is a reliable tool for measuring craniohorizontal and craniovertebral angles to assess forward head posture.

Conclusion: FHP occurs frequently amongst young age learners, so smart protector tool provides a suitable method to assess posture through craniovertebral and craniohorizontal angle measurements from photographs.

Keywords: *Forward Head Posture, Craniovertebral angle, Craniohorizontal angle,Slump, Screen time, Smart protector tool application.*

1. INTRODUCTION

i) The positioning of cervical spine in an anterior direction makes up what experts classify as Forward head posture (FHP). FHP becomes a diagnosis when the cervical spine extends beyond its regular position towards the front of the head. The location of body weight moves forward from the spine axis. The cervical musculature experiences exposed stress because of

this abnormality that leads to muscle imbalances. (Naz and Salman Bashir,2018).

Anatomy: When wearing FHP devices someone experiences increased external flexion torque that stretches cervical spine vertebrae which produces intense tension on neck extensor muscles and related connective tissues. The spinal tissue structure becomes progressively more strained until spinal malformation becomes permanent. Proprioception sense of the cervical spine becomes impaired during movements specific to FHP. The FHP posture leads to reduced EMG activity in middle trapezius muscle and splenii and sternocleidomastoid muscle because muscle length changes restricts their force generation capability. Numerous studies proved that therapeutic training surpassed kinesio taping (KT) in treating FHP but both interventions produced positive results. Deep cervical flexor muscle strength training and exercise of shortened upper trapezius together with sternocleidomastoid and levator scapulae shows maximum benefit for FHP treatment. The main objective of this research examined the pattern in which FHP affects university students. (Naz and Salman Bashir,2018).

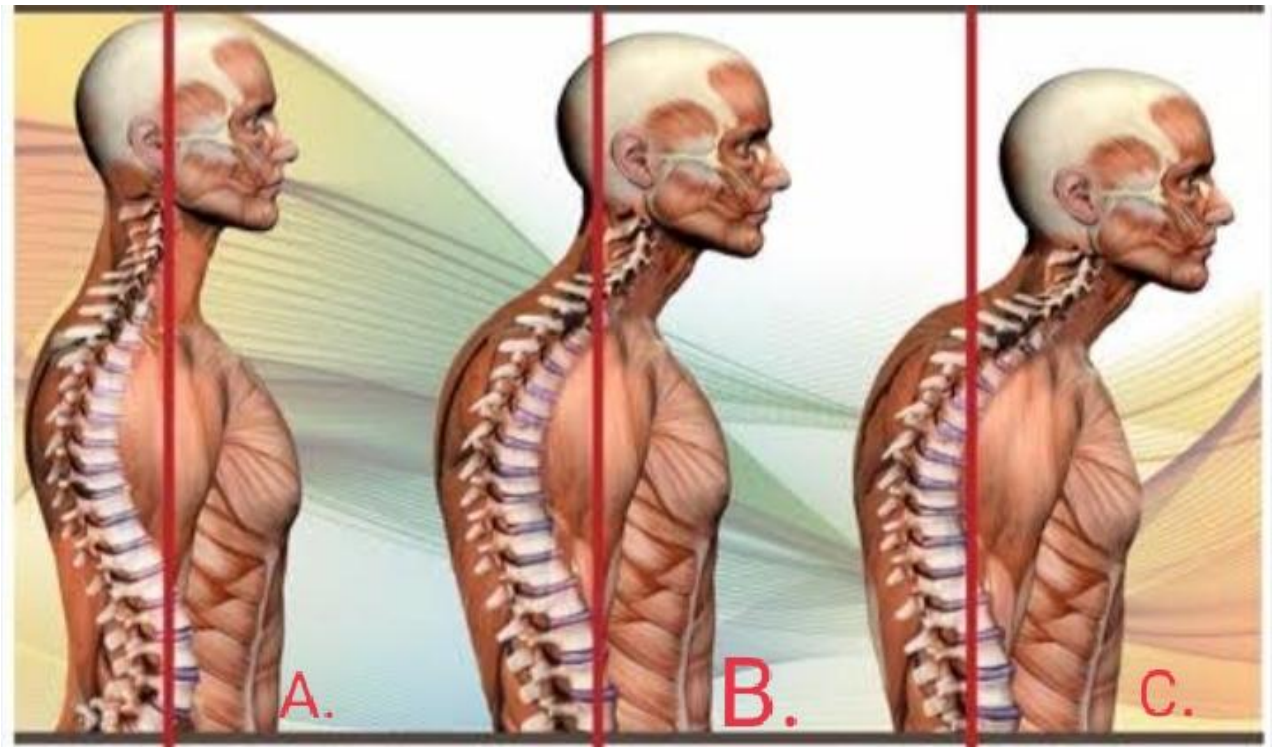


Fig 1.1 A) Normal posture B) Mild forward head posture C) Severe forward head posture

iv) Effects of forward head Posture include:

1. The study indicates that cervical range of motion decreases with age and also that thoracic Kyphosis causes increased cervical flexion with patients who have forward head posture showing reduced measures of cervical flexion and rotation ROM. This data agrees with findings from five other research projects.

2. Daily tasks through laptop use keep expanding especially within the educational sector along with business fields and publishing industries as well as banking operations and recreational activities. The majority of laptops have their screens built into the keyboard sections which means screen height and distance settings are not separable.

3. Cervical spine remains prolonged in flexion position thus increasing activity in cervical erector spine and upper trapezius muscles while they are sideviewed through cables in a slightly backwards inclined trunk. The combined effect of the situation results in both head and trunk movements forward before they become permanent postural patterns.

4. The use of laptop devices produces negative effects on cervical spinal health because improper laptop usage results in musculoskeletal problems. When monitor viewing occurs below the eye height a person must tilt their head forward thereby intensifying the cervical spinal curve in front and the thoracic spinal curve at the back creating forward head position or turtle neck syndrome.

5. The C-shaped formation of the spine results from laptop usage which establishes itself as a cause of poor spinal postures. Prolonged laptop usage leads to pain development in the neck along with the shoulder area and the arm region. The cervical spine suffers 30 pounds of unwanted pressure when the head maintains forward posture since this misalignment forces the whole spine out of its natural position.

6. If you perform frequent forward head posture events then you end up losing thirty percent of your vital capacity. The evaluation of spinal postures includes five main methodologies with radiography as one category and three-dimensional motion analysis tools based on electromagnetic and optical detection and raster stereography and photographic examination and manual assessments.

vi). Assessments for the forward head posture rely on measuring two angles which include craniovertebral angle and craniohorizontal angle.

a) Craniovertebral angle: Researchers measured the craniovertebral angle through an assessment that compared the angles of a horizontal C7 spinous process line to a line extending from the tragus to C7 spinous process by using ear tragus as a visible reference point combined with C7 spinous process as the second measurement reference point.. The spinous process of C7 served as the selected reference point because it stands out through palpatory touch during measurement of lower cervical spine angle. A head posture with an angle below 50 degrees shows forward deviance. (Naik and Ingole,2018)

b) Craniohorizontal angle: Measurement of craniohorizontal angle involved a horizontal line through tragus and another line from tragus to external canthus of eye on the same side. The measurement gives an estimate about both head on neck angulation and the position of the upper cervical spine region. Researchers define the usual craniohorizontal angle between 16.3 and +/- 6.0 degrees. (Naik and Ingole,2018).

2. AIM AND OBJECTIVE OF THE STUDY

AIM: The study determines the frequency of forward head posture among students attending university.

OBJECTIVE:

1.To find out the prevalence of forward head posture among university students.

2. To assess the relation of forward head posture with screen time.

3.To assess forward head posture using smart protector tool application.

HYPOTHESIS :

Alternate hypothesis:

a) Smart protector tool application is a reliable tool to assess forward head posture.

b) Screen time and it's correlation with forward head posture.

Null hypothesis:

a) There is no relation between screen time and forward head posture.

b) Smart protector tool application is a reliable tool to assess forward head posture.

NEED OF THE STUDY:

Time spent on smartphone devices produces mostly forward head posture in students which results in various muscle disorders. Forward head posture assessment matters clinically for medical diagnosis together with rehabilitation therapy since this posture weakens respiratory muscles.

3. METHODOLOGY

Methodology is the description of the procedure undertaken to solve the research problem.It is an important section wherein procedure, methods and techniques of collecting data are being discussed. Methodology section provides systematic theoretical description of methods and procedures adopted to complete the study.

The present study was conducted to assess the Prevalence of forward head posture using smart protector tool application among young students.

3.1 STUDY DESIGN : Survey based study

3.2 SOURCE OF DATA COLLECTION: Jagannath University students having age group between 18 to 25 years.

3.3 SAMPLE SIZE :72

3.4 SAMPLING METHOD : Survey based study.

3.5 SELECTION CRITERIA:

Inclusive criteria:

1.Students of Jagannath University.

2.Subjects having age group between 18 – 25years.

3.Both male and female subjects are included .

4.Only asymptomatic healthy subjects are included.

Exclusive criteria:

1.Subjects who had neck pain.

2.Subjects who undergo any major surgeries 6 months prior.

3.Subjects who have any musculoskeletal, cardiovascular and neurological disorder.

4.Subjects who had any trauma around cervical and shoulder joint 6 months prior.

3.6 INDEPENDENT VARIABLE: Forward head posture

Craniovertebral angle

Craniohorizontal angle

DEPENDENT VARIABLE: Mobile screen time

3.7 MATERIAL REQUIRED: Pen, pencil, informed consent form, mobile camera.

3.8 PROCEDURE:

A study took place at Jagannath University to determine the frequency rate of forward head posture in young student populace. The research excluded participant subjects who had any medical issues with their musculoskeletal system or neurological system. Every participant filled a written consent. Students participated in the study while researchers clearly explained the purpose of the research after recruitment. The method for measuring forward head posture used digital imaging techniques that measured two angles through the "Smart protector tool" application. The two measurement angles are craniovertebral followed by craniohorizontal.

1. Craniohorizontal angle

Measurement of craniohorizontal angle occurred between a horizontal tragus line and the line that connected tragus to the external canthus of the ipsilateral eye. Through this measure doctors can obtain information about either the head on neck angle or exact cervical spine position. Medical professionals agree that the standard range for craniohorizontal angle measurement stands at 16.3+/-6.0°. (Naik &. Ingole,2018).

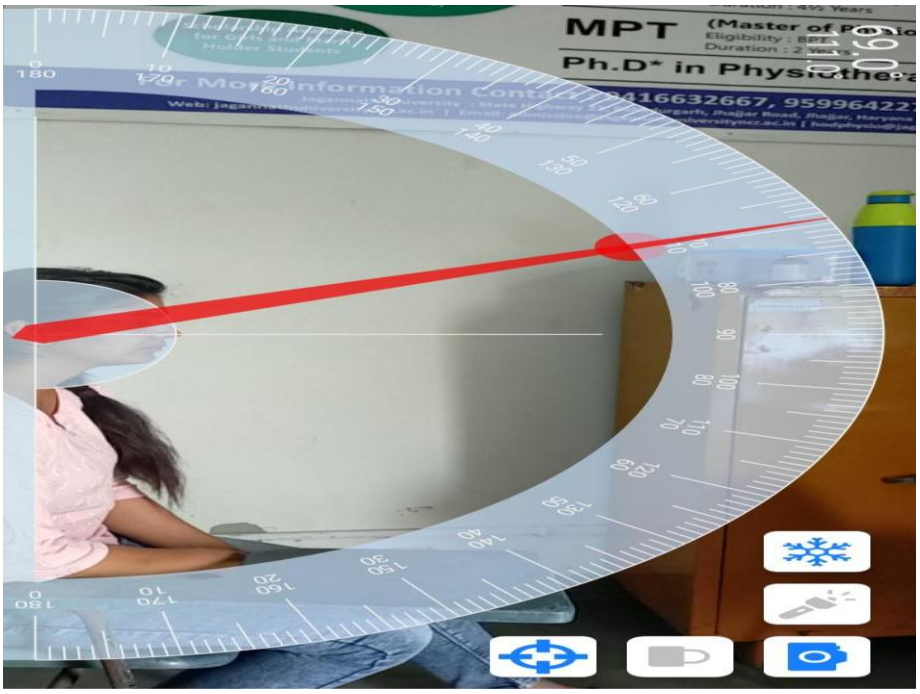


Fig : 3.2 Shows Craniohorizontal angle

Craniovertebral angle

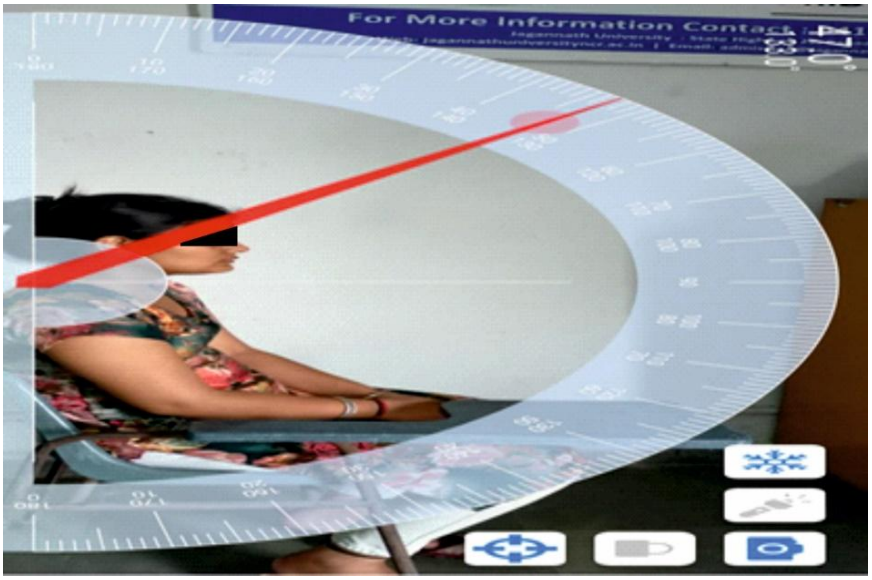


Fig :3.1 Shows Craniovertebral angle

Healthcare practitioners use the spinous process of C7 as well as the tragus of ear and the spinous process of C7 when measuring craniovertebral angle in degrees. People use the ear tragus as an observation point since the face and skull anatomy naturally move together with this specific structure. The healthcare provider can easily detect the C7 spinous process during manual examinations to indicate the lower cervical spine region. Posture reveals its nature when the head tilts as an angle below 50° forwards. (Naik &Ingole,2018).

Throughout the photo sessions the subject should wear a dress without any collar features. Subjects were positioned on a high back chair to maintain comfortable sitting while their feet rested flat on the floor with 90 degrees flexed hips and knees and their buttocks resting on the chair back. The subjects maintained normal sitting posture while the researcher directed them to place their hands on their lap with the subjects looking at a specific wall point.

Adhesive markers were placed on the anatomical points:

a)First point from the external canthus of the eye,

b)Tragus of the ear,

c) Spinous process of C7.

When the camera was set with 50% of the zooming power and flash activated the image capture was required. Using the camera mount, measurements could be made at 110cm between the lens and floor and between the lens and subject's tragus of the ear at 150cm. Camera-to-floor height and camera-to-subject distance were kept the same by each shoot throughout and camera focus orientation was also retained. Due to the camera positioning, all the needed anatomical markers could be seen on one single picture. The craniovertebral and craniohorizontal angles were recorded from one single lateral view snapshot, in which patient was sitting. (Vilas kadu&Shetyevijay,2022).

The participants allowed researchers to monitor their phone screen usage during the subsequent two weeks. And final data was analysed

4. DATA ANALYSIS

The collected data was analysed with the help of software SPSS 26 .For analysis of the collected data repeated measures of the''frequency'',"Correlation test", "Descriptive Statics" were applied. Mean of groups was calculated as per requirement and graphs are made with help of software and the MS Excel.

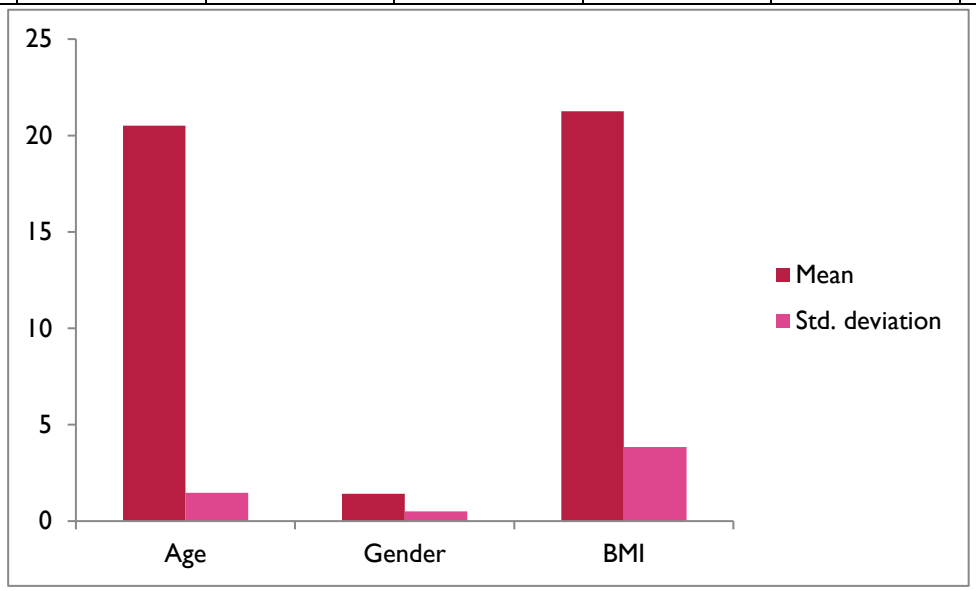
5. RESULT

This study was conducted on 72 subjects which includes patient age (20.51±1.463) and BMI (21.258±3.8387) and gender (1.42±0.497).

TABLE No. 5.1 Descriptive Data

		Mean.		Std.Deviation		

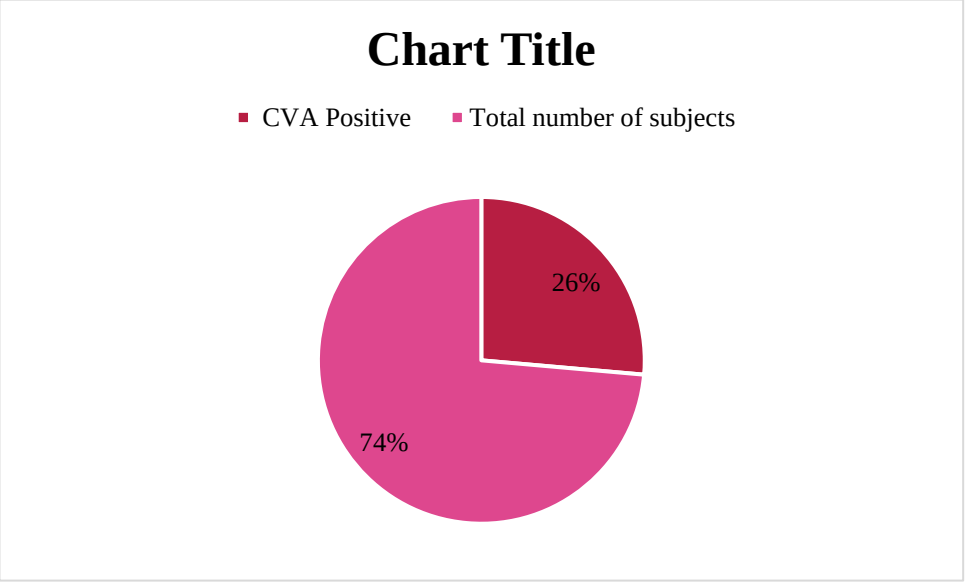
Age			20.51			1.463
Gender		1.42			0.497	
BMI			21.258		3.8387	



GRAPH 5.1 Represent the mean and standard deviations of Age, Gender and BMI

TABLE No. 5.2 Prevalence of forward head posture through Craniovertebral angle (CVA)

CVA			Mean				1.74
			SD.				0.444
			Frequency			19	
			Cumulative percent	26.4			

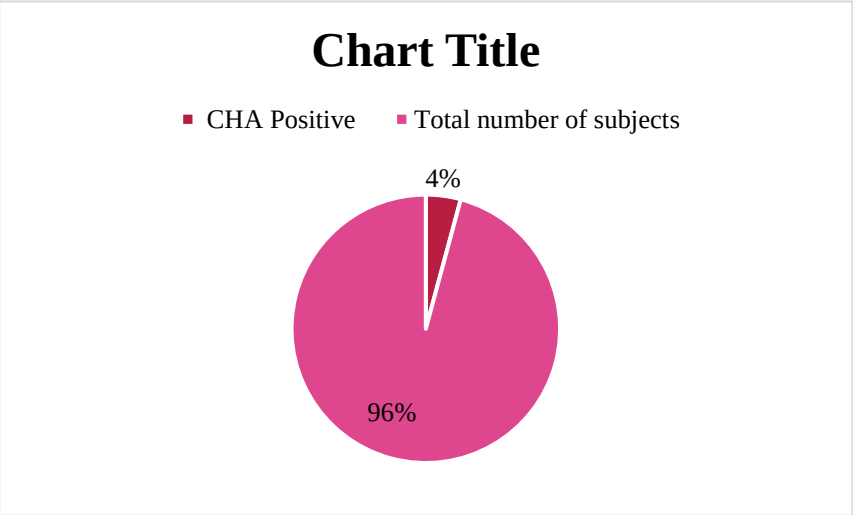


GRAPH 5.2 Prevalence of forward head posture through Craniovertebral angle (CVA)

This shows that forward head posture through craniovertebral angle are 26.4% positive in total number of population.

TABLE No. 5.3 Prevalence of forward head posture through Craniohorizontal angle (CHA)

CHA Mean	1.96
SD	0.201
Frequency	3
Cumulative percent	4.2



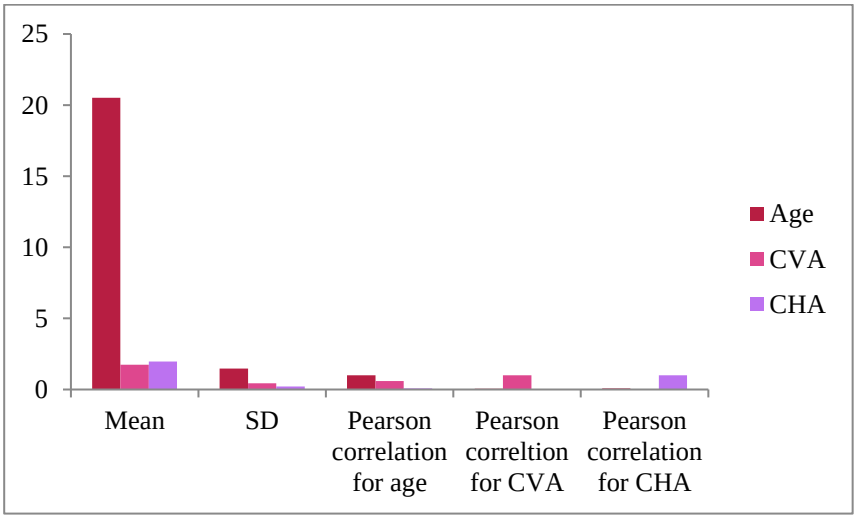
GRAPH 5.3 Prevalence of forward head posture through Craniohorizontal angle (CHA)

The analysis indicates forward head posture affects 4.2% of the population at large when measured through craniohorizontal angle.

TABLE NO. 5.4 Correlation between Age, Craniovertebral angle (CVA), Craniohorizontal angle (CHA)

	Mean	SD.	PC.	PC	PC
			For age	for CVA.	For CHA
Age	20.51	1.463	1	0.06	0.074
CVA.	1.74	0.444	0.6	1	0.348**
CHA.	1.96	0.201	0.074 .	.348**	1

** At the 0.01 level, there is a significant correlation. (1-tailed).



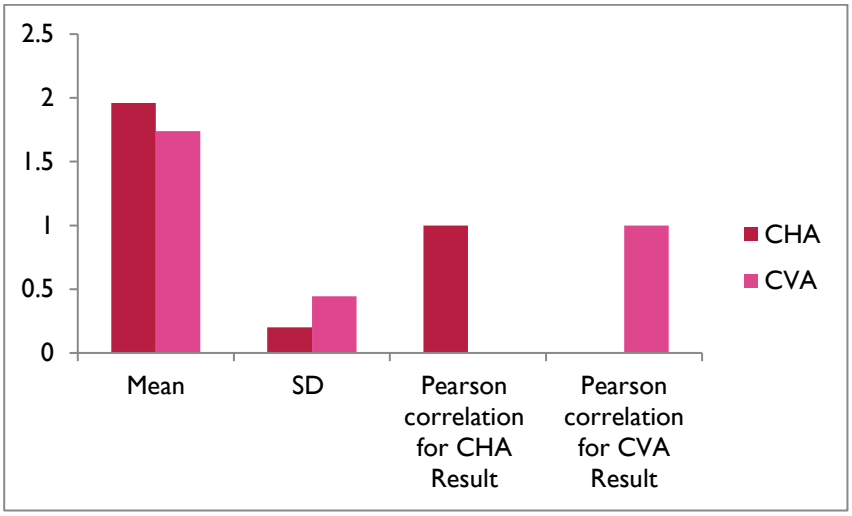
GRAPH 5.4 Correlation between age, Craniovertebral angle, Craniohorizontal angle

This graph represents the Pearson correlation between age, craniovertebral and craniohorizontal angle.

TABLE NO. 5.5 Correlation between Craniohorizontal angle(CHA) and Craniovertebral angle (CVA).

	Mean	SD	PC	PC
			for CHA	for CVA
CHA	1.96	0.201	1	.348**
CVA	1.74	0.444	.348**	1

** At the 0.01 level, there is a significant correlation. (1-tailed).



GRAPH5.5 Represent the correlation between Craniohorizontal angle(CHA),Craniovertebral angle (CVA).

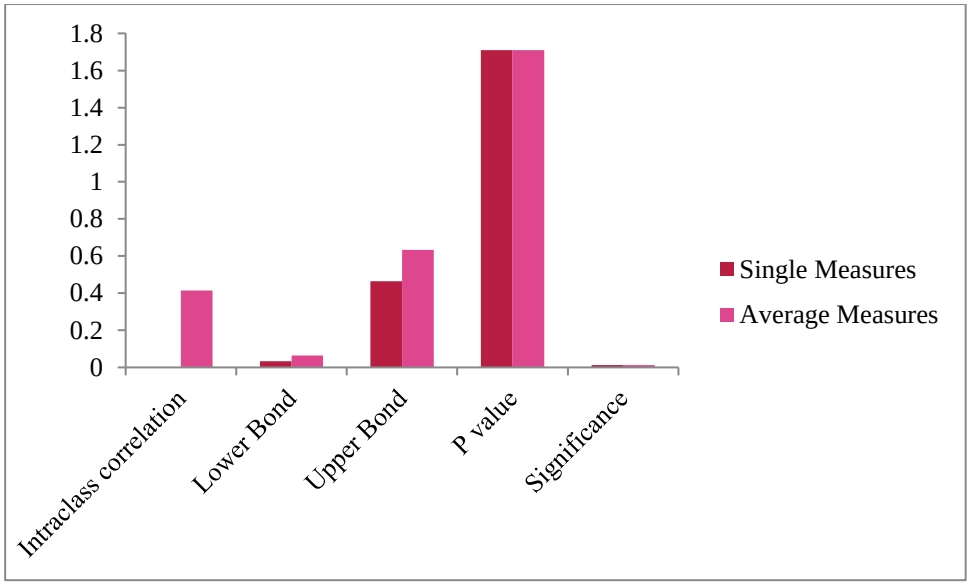
TABLE NO. 5.6 Intraclass correlation coefficient for Craniovertebral angle (CVA)and Craniohorizontal angle (CHA)

	Intraclass	Lower Bond	Upper Bond	P value	Significance
	Correlation				
SM	.262*	0.034	0.464	1.71	0.013
AM	0.415	0.065	0.634	1.71	0.013

A two–way random affects model shows random nature to both people factors and measurement elements.

*The estimator maintains the same value irrespective of whether the interaction effect exists or not exists in the model.

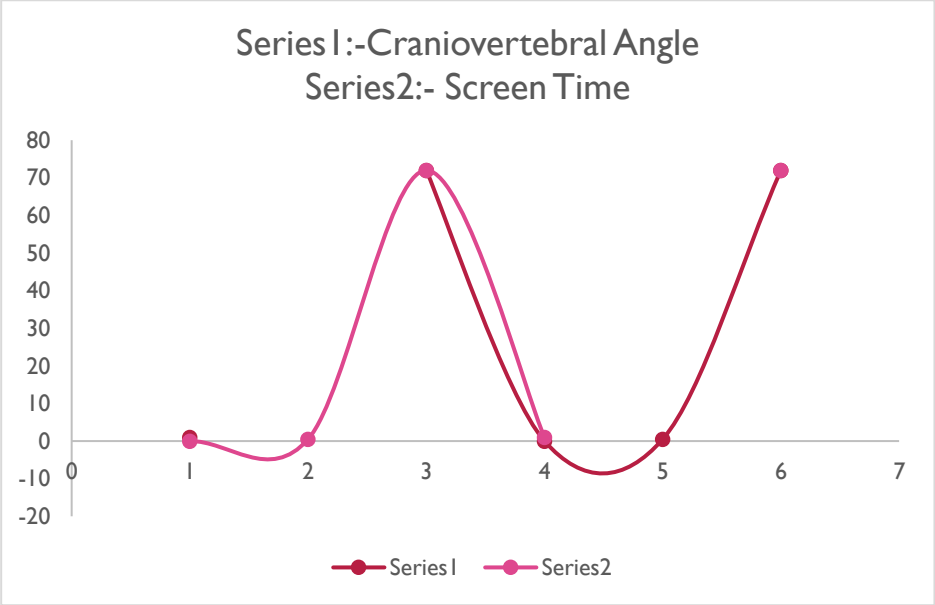
** Intraclass correlation coefficients of Type C using a consistency definition. What we are excluding from the denominator variance is the between – measures variance.



GRAPH 5.6 Intraclass correlation coefficient for Craniovertebral angle (CVA)and Craniohorizontal angle (CHA)

TABLE NO.5.7 Correlation between Screen time and Craniovertebral (CVA) result.

	Mean	SD	Screen time	CVA	
			P C	P C	
Screen time	5.0949	1.73902	1	-0.062	
CVA	1.74	0.444	-0.002	1	

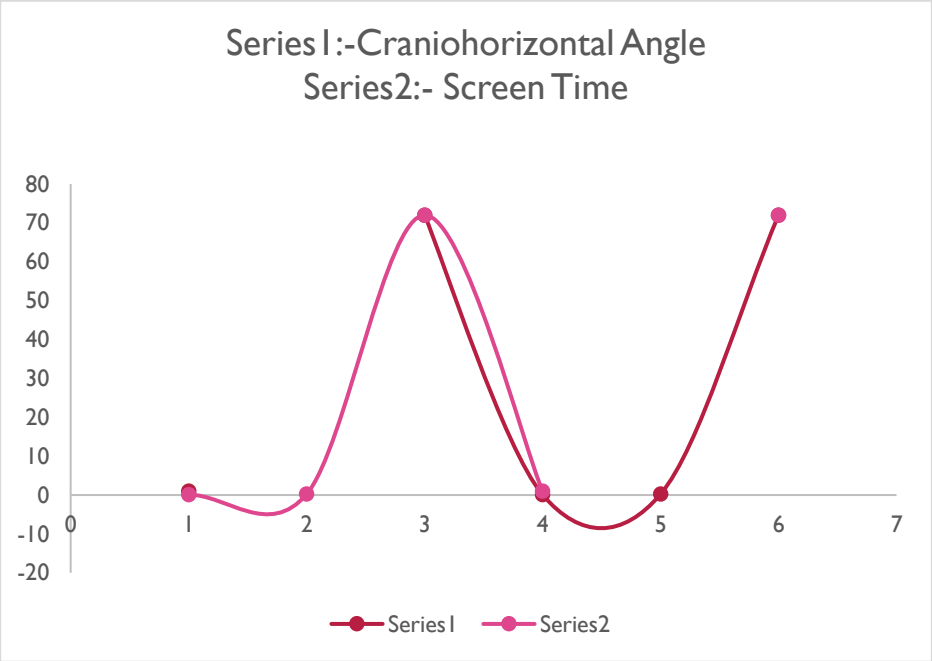


GRAPH 5.7 Correlation between screen time and craniovertebral angle(CVA)

TABLE NO.5.8 Correlation between Screen time and Craniohorizontal angle (CHA

	Mean	SD	Screen time	CHA Pearson correlation			

			PC				
Screen time	5.0949	1.73902	1		0.092		
CHA		1.96		0.201		-0.089	1



GRAPH 5.8 Correlation between Screen time and Craniohorizontal angle (CHA)

6. DISCUSSION

As the main research question of this study, this was to find out the frequency of forward head posture amongst university students.

72 were chosen who satisfied the study admission standards.

Forward head posture refers to the position where the cervical spine is located anterior from the usual position. Unfortunately, forward head posture (FHP) gets its name from the medical fact that the cervical spine moves forward in front of the normal position. This adaptation shifts human body balance centre towards the front from its spinal position. The disturbance in the muscle function is due to its reaction with the abnormal stress acting on the cervical muscles. (Naz&Salman Bashir,2018).

Forward head posture prevalence and screen time checks were studied in random sampling out of 72 subjects. There after, written permission from all the subjects was sought before participation. Craniohorizontal and craniovertebral angles were measured using smart protector tool application and subject reports their mobile phone screen time last two weeks.

Data revealed 72 subjects 26.4% forward head posture seems to exist among the subjects when the craniovertebral angle measurement is considered but only 4.2% showed forward head posture on the basis of craniohorizontal angle measurement.

The research which Shivani Patil (2020) did was on “Prevalence of smartphone addiction and it’s correlation with forward head posture and neck disability among physiotherapy students”. The number of female subjects examined was higher than male participants in 75.88% against 24.12% respectively. Of all the physiotherapy students analyzed, 58.79% of the population suffered from smartphone addiction. It was found that 62.50% of male students, while 57.62% of female students were found to be affected by the levels of smartphone addiction. Most of the students who were addicted to the smartphone had consumed their devices for more than 3 hours each day (47.00%), which included 32.42 per cent that had less than 3 hours and 20.51 per cent that spent more than 7 hours.

Prevalence of forward head posture among university students’, by Arfa Naz et al., (2018) faults that 63.96% of both male and female university students were effected by forward head posture. Those who have forward head posture also tend to have their shoulders forward rolling. A cross-sectional study of 197 students taking different universities participated in the research and their posture was analyzed through a plumb line. Data was obtained using modified questionnaire by the investigators. Usuarios de la universidad presentan una alta prevalencia de postura del cuello hacia delante según los

resultados del análisis con SPSS v.21. This position also associates with forward rotation actions from the shoulders.

There is a significant correlation between age and craniovertebral angle, as the age is increased the craniovertebral and craniohorizontal angle is decreased that leads to forward head posture.Age (Pearson correlation for age is 1),(Pearson correlation for CVA is 0.06),(Pearson correlation for CHA is 0.074) ;CVA (Pearson correlation for age is 0.6),(Pearson correlation for CVA is 1),(Pearson correlation for CHA is 0.348);CHA (Pearson correlation for age is 0.074),(Pearson correlation for CVA is.348**)(Pearson correlation for CHA is 1).

Forward Head Posture (FHP) is an excessive anterior positioning of the head relative to a vertical reference line, that induces cervical spine lordosis which elongates upper cervical segments and flexes the lower cervical areas and coincides after the shoulders round with thoracic kyphosis at later stages (Shivani Goswami et al., 2022). Their extensive use of mobile phones and laptops is the reason why the number of childhood and adolescent individuals with forward head posture is very high.

Results of screen time show a meaningful correlation relationship with craniohorizontal angle results as well as a negative correlation coefficient with this angle. Such use of the screen leads to forward posture of the head as the craniovertebral joint is forced to be clinched at an upward angle, which decreases in proportion to the climatization of the presented screen use. Screen Time correlations are studied using the following (-0.062) CVA Pearson correlation with screen time, (-0.002) screen time Pearson correlation with CVA, (-0.089) correlation coefficient of screen time with CVA and (0.092) CHA Pearson correlation with screen time.

Kholoud T Alsiwe et al. (2021)as asserted stated that Fishman D was the first to introduce what would later be referred to as text neck syndrome. Neck pain which is caused by stress injuries resulting from excessive flexing of the neck related to the use of phones is called text neck syndrome. Of the participants, 68.1% was suffering from the Text neck syndrome and; 49.5% of them reported to have mild disability, whereas 16.1% having moderate and 2.6% severe neck disabilities. The Spearman correlation coefficient of the studies was found to be of moderate positive correlation with SAS-SV and the NDI ($r_s = 0.328$, $P<0.001$). It was shown in the present research that neck disabilities were observed among medical students more often. The research showed that there was a meaningful relationship between the use of smartphone device and diagnosis of the text neck syndrome.

Since CVA angle shows the head posture in higher increased detail, it is more accurate in measuring forward head posture than CHA. Results of this statistical analysis present a direct correlation between these different angles measurement so those decreases of CVA (Conics Vectors Angle) are associated with the same decreases of CHA (Chronic disease mellitus Hemoglobin A1c).

By way of research, Zahra Salahzadeh et al., (2014) assessed “Assessment of forward head posture in females” in which it was found that the craniovertebral angle methods were more discriminative with moderate severe and non FHP than head position angle and head tilt angle. When photogrammetric method was used to measure posture of cervical and head between the same rater and between different raters, the reliability results were exceptional.

Results from this study also confirmed that application of smart protector tool is a trusted solution to measure head position angles to access forward head posture.

Jinal A. Mamania, et al, (2017) in the scientific research showed that the use of ON Protector by smart phones through its mobile application is a reliable method of measuring both craniovertebral and craniohorizontal joint angles.

The result of this investigation is in that University students have forward head posture which weakens respiratory muscle and deteriorates the quality of student’s life.

6.1 LIMITATION OF STUDY:

This study can be done on large sample size.

It can be done with taking average screen time for one month.

It can be done with taking screen time of phone as well as screen time of laptop.

This study can be done by using software to measure craniovertebral and craniohorizontal angles.

6.2 FUTURE RECOMMENDATIONS

The findings might get influenced significantly by the age of participants. Future research should consider studying different age ranges beside the 18-25 age group that this study examined since healthy adults of various ages were not included.

The presented results along with their limitations justify conducting future assessments with extended participant numbers.

6.3 CLINICAL SIGNIFICANCE

The forward head posture causes both the upper and lower thorax parts to be directed at different angles, which makes it contracted in the lower part and expanded in the upper part, leading to impaired respiratory function.

Long-term forward head posture generates important adverse effects for the body. The weight of the head then applies higher stress to both the neck and cervical spine because of which the body becomes unbalanced.

Posture-related kyphosis defines this issue as it impacts the shoulders to become rounded. Stretching exercises combined with postural strengthening exercises along with proper posture practice will generally solve the condition while simultaneously improving your posture.

7. CONCLUSION

1. Research indicates that forward head posture affects a significant proportion of young people as this study displays 26.4% among total participants demonstrate this posture.
2. More screen time also lead to forward head posture that causes many musculoskeletal disorders due to lack of awareness about proper posture .So proper ergonomic advice is given to the subjects.
3. Smart protector tool application functions as a dependable system to evaluate craniovertebral and craniohorizontal angles.

Smart protector tool is a reliable and easily available tool with the help of which we can easily assess forward head posture.

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