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Study Of Correlation Of Craniohorizontal Angle And Sagittal Shoulder Posture With Craniovertebral Angle In Computer Science Engineering Students

Prachi Jadhav[1], Dr. Javid H Sagar[2]

[1]B. P. Th, D. Y. Patil College of Physiotherapy Kolhapur

Email ID: prachijadhav256@gmail.com

[2]Head of Department, Department of Cardiopulmonary Physiotherapy, D.Y. Patil College of Physiotherapy, Kolhapur

[*]**Corresponding author:**

Dr. Javid H Sagar

Email ID: javidsagar7777@gmail.com

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ABSTRACT

Introduction: Students commonly use computers in the modern information era. Prolonged computer use during every day work and enjoyment is frequently cited as a cause of neck pain in college students. Neck pain lead to changes in the craniovertebral angle (CVA). This study aims to determine correlation of craniohorizontal angle and sagittal shoulder posture with craniovertebral angle in Computer science engineering students.

Methods Computer science engineering students reporting neck pain underwent numeric pain rating scale (NPRS) evaluation and Kinovea software assessment. Data on age, 3rd and 4th year, and working hours per day were recorded. Participants with musculoskeletal pathologies, scoliosis, and spinal surgery were excluded.

Result in a study 77 computer science engineering students, 35male and 42female of 3rd & 4th-year with neck pain, 52 participants showed changes in craniovertebral angle (CVA) and craniohorizontal angle (CHA), While 40 participants showed changes in cranio-vertebral angle (CVA) and sagittal shoulder posture (SSP).

Conclusion According to this study, third and fourth-year computer science students with neck pain who worked on computers for five to six hours a day observed alterations in their craniohorizontal angle, craniovertebral angle and sagittal shoulder posture. However, no significant correlation was observed between craniohorizontal angle and sagittal shoulder posture with craniovertebral angle.

Keywords: *Computer science engineering students, neck pain, numeric pain rating scale (NPRS), kinovea software, Sagittal shoulder posture, craniohorizontal angle, craniovertebral angle.*

1. INTRODUCTION

Proper posture can be explained as the capacity to keep a suitable body position that is aligned and requires little effort and this permits the musculoskeletal system to remain balanced and aids in the development of various tasks in a coordinated manner [1]. College students frequently attribute their neck problems to extended computer use for both daily work activities and recreation [2]. Accessing computers for even three hours a day has been linked to psychological stress, low back discomfort, tension headaches, and Computer Vision Syndrome. [3] Poor lighting, glare, an improperly configured workstation, and uncorrected refractive problems can all exacerbate eye issues [3]. Computer users are known to experience neck-shoulder pain, which is primarily brought on by prolonged, repetitive work. A person who has neck pain has a subjective sensation of stiffness and a restricted range of motion (ROM). With prolonged neck movements and postures, the symptoms get worse [4].

The term "neck pain" refers to pain that radiates laterally to the outer and superior borders of the shoulder blades from the base of the skull (occiput) to the upper back [4]. Neck pain and the amount of time spent sitting and typing on a computer were substantially connected [4]. There is a definite link between neck pain and computer users and prolonged sitting in one posture without taking pauses to stretch the neck muscles [2]. Due to pain, disability, decreased productivity at work, and a lower quality of life, neck pain is extremely uncomfortable for individuals. Undergraduate students frequently use computers,

smartphones, and other technological gadgets. Numerous epidemiological studies have demonstrated a connection between neck pain and the condition. Students at universities who worked with computers for extended periods of time displayed symptoms related to their upper extremities [5]. Extended usage of computers, rounded shoulder and adopting bad neck posture disturbs the neck's natural lordotic curve, causing muscular

imbalance and thus neck pain [2]. College students have observed a higher frequency of musculoskeletal issues in recent years and the increased usage of computers could be one of the risk factors for this [2].

Function of the Cervical Region-Although the cervical region of the vertebral column exhibits the greatest degree of flexibility, head support and the preservation of the spinal cord and vertebral arteries depend on the cervical region's stability, particularly that of the atlantoaxial and atlantooccipital joints [6].

Using Kinovea software, the sagittal shoulder posture, cranio-horizontal angle, and cranio-vertebral angle will be assessed. Kinovea Software- One such low-cost technology is Kinovea,a free 2D motion analysis program available under the GPLv2 license that was developed in 2009 by a global non-profit consortium of researchers, athletes, coaches, and programmers. Kinovea is a portable, free tool and easy to use that can be used in real field situations; no previous experience is required to obtain reliable and accurate measurements [7]. The ICC value of kinovea software is 0.997[7]. The concurrent validity was high: $r = 0.94$, $p < 0.001$[1]. Craniohorizontal angle(CHA) represents the upper cervical flexion and extension [8]. An increase in CHA indicates the extension of the upper cervical spine. Craniovertebral angle(CVA) represents the forward translation of the head. The decrease in CVA indicates Forward head posture and/or decrease in normal lordotic curve of the cervical spine [8,9]. Sagittal shoulder posture(SSP) represents forward movement of shoulder in reference of C7 spine [12]. A decrease in SSP indicates rounded shoulder and /or thoracic kyphosis [10].

2. METHODOLOGY

Materials: Numerical pain rating scale, Kinovea software.

An observational correlational study conducted at D. Y. Patil College of Engineering & Technology with Sample size-77 using Simple random sampling for the duration of 6 Months

The present study is done in 77 participants. The study type here is observational type of study. Participants were selected as per the criteria for inclusion and exclusion and all the participants who were fulfilling the inclusion criteria were assessed using Numeric pain rating scale. The participants who fulfilled the inclusion criteria were selected for the study and those who couldn't meet the inclusion criteria were not included in the research.

The research was conducted from December 2024 - February 2025. The study was conducted in 3rd & 4th year Computer Engineering Students in D. Y. Patil College of Engineering & Technology, Kasba Bawda, Kolhapur. After approved the study protocol by Research Ethics committee of D.Y. Patil Education society Kolhapur. The whole research / research protocol was explained to the participants. After receiving their written and verbal consent participants were included in the study. Participants who had neck pain were chosen to participate in the research. The patient was initially informed about the study. Prior to beginning the study, written approval was obtained from the patients in the language in which the patient is comfortable. Patients privacy was maintained here in this study. Numeric pain rating scale (NPRS) was taken to assess the pain. The patients were instructed to rate their pain on the scale of 10. The pain was rated on rest and on activity as well. The amount of pain patient experiences when on rest and while doing activities. Detailed pain history was taken in which few questions were asked to the patient regarding her pain. Questions such as- i) Onset of pain ii) Precipitating factor iii) Quality of pain iv) Relieving factor v) Site of pain vi) Temporal variation.

Inclusion criteria All genders, Age group 18-25years, Computer science engineering students- 3rd and 4th year. Subjects with mechanical neck pain, Subjects using computer, laptop for more than 3 hours a day. **Exclusion criteria** Scoliosis, musculoskeletal pathologies (History of thoracic or cervical fractures, or shoulder surgery) Spinal surgery, mraumatic or early degenerative conditions such as Spondylolisthesis or spinal tumor of infection of skeletal system, congenital deformities.

3. PROCEDURE

The protocol committee and institutional ethical committee of the D. Y. Patil Educational Society Kolhapur. The subject was screened according to inclusion and exclusion criteria. Participants were informed of the study's goal and asked for their written consent before beginning. The intensity of pain and angles was measured. Using Kinovea software, we measured the cervical and shoulder angles. The subject was instructed to stand in a typical position with their arms by their sides. They were instructed to balance equally on both feet. The subject's head turned to face forward. In a comfortable, upright standing position, a series of assessments of postural alignment in the sagittal plane were obtained using left-sided profile photographs. Shoulders were exposed due to the arrangement of clothing. Photographically detectable adhesive skin markers were used to designate palpable bony features. The following bony landmarks used were: the spinous process of C7; a position equidistant between the left shoulder's posterior side of the acromion process and the humerus' greater tuberosity. A tripod-

mounted camera was positioned approximately 1.5 meters away from the subject. The height of the camera was set to match the subject's C7 spinous process. Three assessments of the posture of the head and shoulders were taken: Craniohorizontal Angle(a)- A line that connects the lateral canthus of the eye and a line that passes through the tragus of the ear intersect to form an angle. Craniovertebral Angle (b): The angle formed by the intersection of a line that travels to the tragus of the ear and a line that runs through the spinous process of C7. Sagittal Shoulder Posture(c)- The angle created by joining a line through C7 to the midway of the humerus's greater tuberosity and the posterior aspect of the acromion.

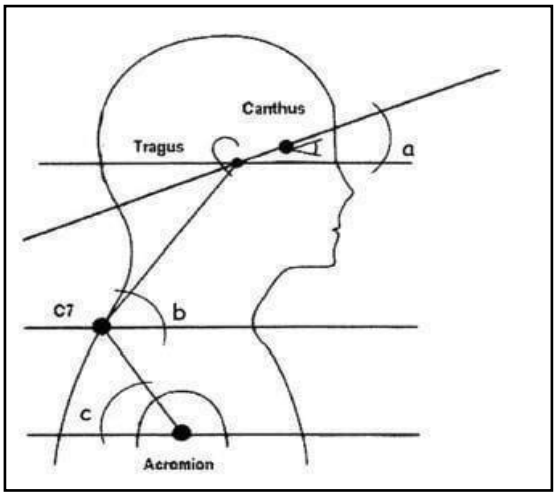
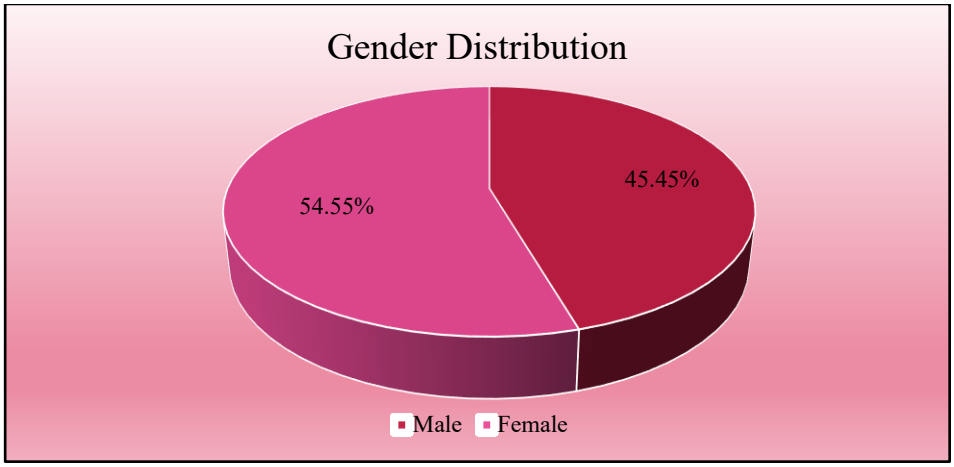


Figure 7:Cervical and shoulder angles

https://images.app.goo.gl/tY5PaLqQaNbCEFpx8

4. RESULTS

A total of 77 participants, 35male and 42female, 3rd & 4th-year computer science engineering students with complaints of neck pain, were selected for the study from Engineering College. The participants with any musculoskeletal pathologies, traumatic or early degenerative conditions that caused their neck pain were excluded.



Graph 1: Gender of participants.

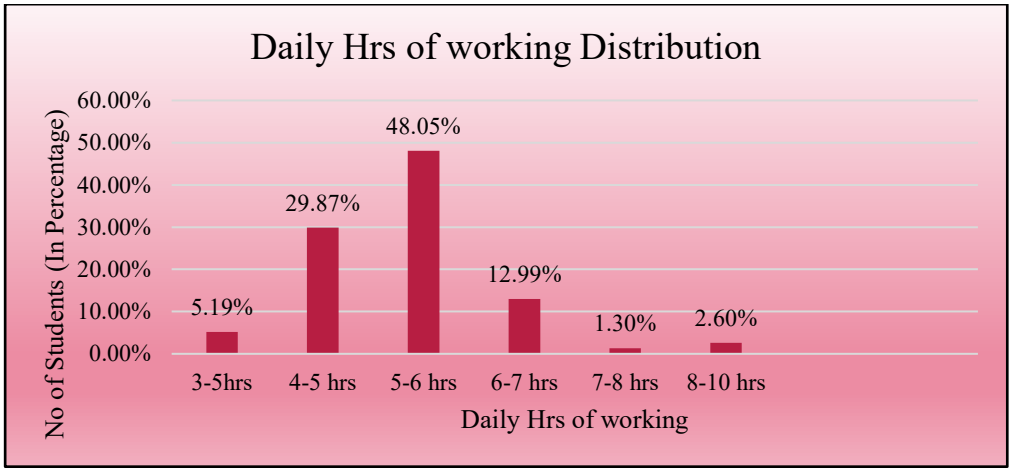
Most subjects were aged from 21 to 23 years. Participants from 3rd & 4th year with mechanical neck pain using laptops and computers for more than 3 hours a day.

In our study, subjects experiencing mechanical neck pain at rest ranged from 1 to 3 and during activity from 2 to 5 on NPRS.

In the given population, 5.19% (4) students is using them for 3 to 5 hours, 29.87% (23) are using them for 4 to 5 hours, 48.05% (37) are using them for 5 to 6 hours, 12.99% (10) are using them for 6 to 7 hours, 1.30% (1) is using them for 7 to 8 hours, and only 2.60% (2) are using them for 8 to 10 hours [fig. 2].

Daily Hrs of working	No of Student	Percentage
3-5hrs	4	5.19%
4-5 hrs	23	29.87%
5-6 hrs	37	48.05%
6-7 hrs	10	12.99%
7-8 hrs	1	1.30%
8-10 hrs	2	2.60%
Total	77	100.00%

Table 2: Daily hours of working on laptops and computers by students.



Graph 2: Daily hours of working on laptops and computers by students.

		Craniohorizontal Angle (CVA)	Craniovertebral Angle (CHA)
Spearman's rho	Correlation Coefficient	-0.011	
	Sig. (2-tailed)	0.9360	
	N	52	

Table 3: Correlation Coefficient of Craniohorizontal Angle and Craniovertebral Angle using spearman's Correlation Coefficient.

Among 77 participants, 52 participants were found to have a change in craniohorizontal angle and craniovertebral angle. In the correlation of CHA with CVA, the coefficient (r) is -0.011, having a P value (0.9360). It suggests a significant negative correlation, which states that there is a decrease in CVA and an increase in CHA [Table:3].

		Craniovertebral Angle (CVA)	Sagittal Shoulder Posture (SSP)
Spearman's rho	Correlation Coefficient	0.117	
	Sig. (2-tailed)	0.936	
	N	40	

Table 4: Correlation Coefficient of Craniovertebral Angle and Sagittal Shoulder Posture using spearman's Correlation Coefficient.

40 participants were found to have a change in craniovertebral angle and sagittal shoulder posture. In the correlation of CVA with SSP, the coefficient (r) is 0.117, having a P value (0.936); it suggests there is no significant correlation, which states that there is a decrease in CVA and a decrease in SSP[Table:4]. In our study, we found out there is a change in values of the craniohorizontal angle, craniovertebral angle, and sagittal shoulder posture.

5. DISSCUSSION

Computers have become an absolute requirement in recent years. Office workers and students are using it at an increasing higher rate. Numerous educational institutions have produced an increasing amount of research identifying the discomfort that college students experience when using computers. College students usually link neck problems to excessive computer use for both work and recreation [2].

A previous study by Bhardwaj Y et al. on the frequency of pain in the neck and impairment in computer users reported neck pain is particularly common among students who use computers for an extended period of time, and the prevalence of neck pain is 99.2% [2].

Long-term, recurrent adaptation to bad posture can cause muscular imbalance, shortening and elongating the cervical spine muscles. Eventually, muscular imbalance may cause the cervical spine to be positioned anteriorly, resulting in decreased craniovertebral angle [11]. A study by Ruivo RM et al. concluded that subjects suffering from neck pain had a higher forward head posture.

Earlier research on adults with forward head posture, the impact of cervical range of motion and craniovertebral angle by kim DH et.al indicated forward head posture is a major cause of neck pain in adults, particularly among those with extended periods of screen use. This posture problem not only caauses strain on the muscles and joints but can also lead to chronic spinal issues over time [9].

A previous literature by Ranganatha SC et al. on Prevalence of computer vision syndrome and related risk factors among Bengaluru engineering college computer science students suggested that computer science students exhibit a notably high prevalence of computer vision syndrome symptoms related to digital eye strain. These issues are strongly associated with extended screen time, which is a regular part of computer science students, daily activities due to their academic workload and coding tasks [3]. Normal value of Cranio-Vertebral Angle is 48°-50° represents the forward translation of the head. The decrease in CVA indicates Forward head posture and/or decrease in normal lordotic curve of the cervical spine [8,9]. An increase in CHA (more than 20°) indicates the extension of the upper cervical spine. A decrease in sagittal shoulder posture less than 52° indicates rounded shoulder and /or thoracic kyphosis [10]. A previous study on the relationship between elevated thoracic kyphosis, rounded shoulders, and forward head: an overview of the litreature by Singla D et al. indicates a link between thoracic kyphosis, FHP, and FSP [10]. In this study, we used kinovea software to determine quantitative craniohorizontal angle, craniovertebral angle and sagittal shoulder posture. In the literature, several software applications have been documented. The majority of them are not feasible for everyone because to their high cost, need for skilled workers to run, and lack of English translations. A previous study on validity and reliability of the kinovea program in obtaining angles and distances using coordinates in 4 perspectives by puig-Diví A suggested that Kinovea is a valid, precise, and trustworthy application for obtaining angles and distance information from coordinates, both within and between raters [7]. Therefore, our study aimed at finding the correlation of craniohorizontal angle and sagittal shoulder posture with craniovertebral angle in Computer science engineering students. Our study, which comprised 77 3rd and 4th year Computer science engineering students, revealed that they worked on computers for five to six hours, exhibiting alterations to craniohorizontal angle, craniovertebral angle and ssagittal shoulder posture. In our study, subjects experiencing mechanical neck pain at rest ranged from 1 to 3 and during activity from 2 to 5 on NPRS. 52 participants were found to have a change in craniohorizontal angle and craniovertebral angle. 40 participants were found to have a change in craniovertebral angle and sagittal shoulder posture. In this study, we found that there is change in angle but statistically revealed there is no correlation between craniohorizontal angle and sagittal shoulder posture with craniovertebral angle. Therefore, it is recommended that colleges incorporate preventive measures such as ergonomic counsel, posture advice, and neck exercise demonstration. Neck pain can be effectively reduced by encouraging computer users to engage in physical activity as part of their workday. Frequent 30-second micro-breaks, spaced out every 20 to 40 minutes, have no negative impact on worker productivity. Neck pain may be avoided by using proper chairs, relaxation periods, and computer workstations that are set up to minimize neck flexion (e.g., document stands, screen height, etc.). For people who have experienced neck pain, neck muscle exercises are also helpful.

6. CONCLUSION

This study was conducted among 3rd & 4th-year computer science engineering students with complaints of neck pain who were selected for the study from Engineering College. It reveals that computer science students work for a maximum of 5 to

6 hours a day, and there is a change in values of the craniohorizontal angle, craniovertebral angle, and sagittal shoulder posture.This study also identified that there is no significant correlation of craniohorizontal angle (CHA) with craniohorizontal angle (CHA) and sagittal shoulder posture (SSP) with craniovertebral angle (CVA).As there are alterations in angles, it impacts an individual's quality of life along with poor posture and disability. In order to avoid malalignment and further complications, awareness about normal posture and proper techniques for using laptops or computers for long hours, maintaining the neck's natural lordotic curve, and preventing neck pain is necessary.

7. CONFLICT OF INTEREST

The writers reveal no potential conflicts of interest regarding study authorship and or publishing of this work.

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