

# Association of forward head posture with neck pain, cervicogenic headache, neuropathy, and neck mobility among university students: a cross-sectional study

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## ABSTRACT

**Background:** With the rising popularity of media devices, frequent users often exhibit poor habitual neck posture and suffer from a forward head deformity that may lead to neck and upper limb dysfunctions.

**Objective:** To determine the association of forward head posture (FHP), neck pain, cervicogenic headache, neuropathy, and neck mobility among university students.

**Methods:** An observational cross-sectional survey was conducted on students. There were four hundred participants in this study who were divided into two groups, Group 1's (G1) study hour was >6hrs and Group 2's (G2) study hour was <6hrs. The craniovertebral angle was measured by using a mobile app Photogrammetry Maneuver to evaluate head neck alignment. A digital camera of 12 megapascals was placed approximately 5 feet away from the participant. The camera's height was adjusted parallel to the participant's shoulder level, and they were asked to stand in their anatomical posture barefooted. Outcomes were measured as headache, local tenderness, neuropathy and range of motion associated with FHP. Data was collected through questionnaire and analyzed by using SPSS version 23.

**Results:** There was significant association of duration of study with forward head posture ( $P < 0.05$ ). A strong positive correlation was found between forward head posture neck pain ( $r = 0.78$ ), cervicogenic headache ( $r = 0.54$ ), and neuropathy ( $r = 0.29$ ). Students also presented with decreased cervical range of motion.

**Conclusion:** Students with prolonged study hours suffered more from forward head posture, neck pain, headache, hypomobility and neuropathy as compared to students with less study duration.

**Keywords:** Craniovertebral angle, Forward head posture, Headache, Hypomobility, Neuropathy, Photogrammetry.

**DOI:** <http://doi.org/10.33897/fujrs.v3i2.336>

## Introduction:

Head posture is considered ideal when the skull is neutral, not tilted, extended, rotated, or retracted. Forward head posture deformity is the most common deviation from ideal posture and is characterized by the forward projection of head into sagittal plane such that it is anterior to trunk.(1, 2) The cervical spine aims to

contain and protect the spinal cord, support the skull, and enable diverse head movement.(3) Forward head deformity (FHD) is the most common postural fault that may be a source of neck pain, described by muscle imbalance as neck muscles become shortened and tighter, it is hard to hold neck straight, producing round shoulder, and may be associated with an upper crossed syndrome that affects the range of movement.(4) Individuals with neck pain found it a frequent source of disability and economic burden, that carries essential health issues impacting general life activities, moods, and daily work.(5)

According to the literature, work-related stress may contribute to musculoskeletal disorders.(6) According to gender male: female ratio, 4:5 suffered from neck pain and tension-type headache.(7) Prolonged sedentary activities like indulging in TV, computer, video games, and smartphone texting can cause forward

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**Received:** February 20<sup>th</sup>, 2023; **Revision:** May 14<sup>th</sup>, 2023

**Acceptance:** June 7<sup>th</sup>, 2023

**How to Cite:** Basharat A, Qamar MM, Afzal H, Gondal KS, Tanveer S, Saleem T. Association of forward head posture with neck pain, cervicogenic headache, neuropathy, and neck mobility among university students; a cross-sectional study. Foundation University Journal of Rehabilitation Sciences. 2023 July;3(2): 72-76.

head anomaly.(8) Different types of athletic activities may be considered a source of faulty neck disorders.(9) Movements related deformity were seen more in massage therapists (10), and hairstylist, and computer developers.(11) Its pathogenesis was not known; however, it was suggested that it has links with peripheral myofascial and central mechanisms.(12)

Different maneuvers were used to measure head and neck alignment. Radiographic techniques have been used to measure different postural angles, including spinal angles. Photogrammetric angle measurement is a simple and objective technique for measuring the posture of different parts of the body.(12,13) Exercises relax sternocleidomastoid and scalene muscles, relieve pain, disability, and improve CV angle.(13) Kinesio tape, myofascial release stretching exercises relieved round shoulder and FHD. Pharmacological treatment was used to relax muscles and associated deformities in chronic neck pain.(5,14). The widely used treatments are physical therapy, medication, Soft tissue manipulations, relaxation, and cognitive therapy. (15, 16)

This was a prime study, in which craniovertebral angle was calculated by the photograph method used to determine the prevalence of moderate to severe postural deformity of the cervical spine, and to rule out the relation between deformity and associated symptoms.

#### Methods:

A comparative cross-sectional survey was conducted at the University of Sargodha from January 2022 to December 2022. Ethical approval for study was obtained from Ethics Review committee, Sargodha Medical College, Sargodha Pakistan (UOS/SMC/6644) Data collected by the photogrammetric method and a self-administered questionnaire contained demographics, and health history questions. The actual calculated sample size was 386 for a total population of almost 8000 Sargodha university students by using the Yamane formula of sample calculation. Purposive sampling technique was used and four hundred students from different departments were selected and divided into two groups based on study hours (Group 1 > 6 hours, and Group 2 <6 hours).

Students suffering from rheumatology disorder, neck and head surgery history were excluded. Students with prolonged working hours and faulty mechanics and deformity were separated and remaining data of associated symptoms was taken from these students through a structured questionnaire that was developed based on previously available literature. Informed consent was taken after explaining the whole study procedure.

After positioning in anatomical standing, two points were marked, one at C7 (that was located by asking the participants to flex and then extend the cervical spine as C7 is more prominent on flexion) and the other was on external auditory meatus. A digital camera was used to take photographs, and angle was measured by drawing a line from external auditory meatus to the seventh cervical vertebrae and a horizontal line at the seventh vertebrae level (Figure 1 and 2).

Data was analyzed using SPSS 21. Descriptive data was calculated in the form of mean and standard deviation. The relation between different variables was assessed by using Pearson correlation.



Figure 1: Normal angle between C7 and tragus

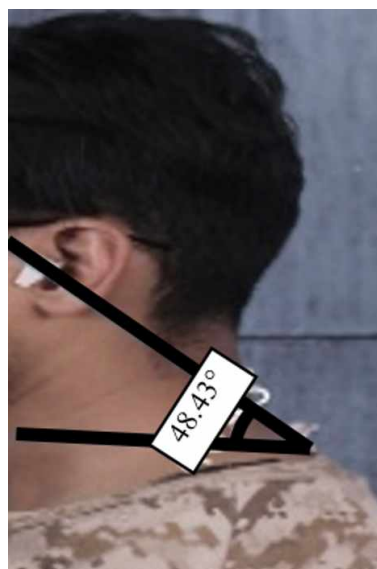
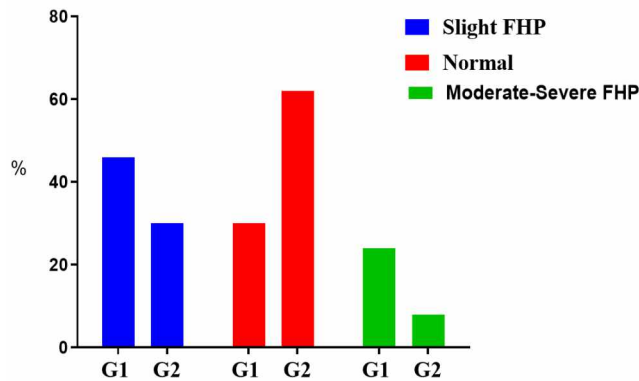


Figure 2: Craniovertebral angle showing forward head posture

## Results:

Student's average age in years was  $22 \pm 2.0$  years. Craniovertebral angle was measured and interpreted according to values: Normal alignment angle =  $53.2^\circ - 56.8^\circ$ , Slight deformity =  $46.9^\circ - 49.1^\circ$ , Moderate-severe forward head deformity =  $40.7^\circ - 43.02^\circ$ .



**Figure 3: Forward Head Posture in both Groups**

Prevalence of deformity found 70% in G1, out of which 46% suffered from slight, and 24% suffered severe forward head posture deformity. Students in G2 determined 38% prevalence (with 30% and 8% suffered from slight to severe neck malalignment respectively) and 62% had normal alignment.

A strong positive correlation was found between FHP and neck pain assessed by local muscle tenderness ( $r=0.78$ ;  $p<0.05$ ), between FHP and cervicogenic headache ( $r=0.54$ ;  $p<0.05$ ), FHP and cervical neuropathy ( $r=0.29$ ). There was strong positive, moderate positive and mild positive correlation between forward head posture and neck rotation right and left ( $r=0.61$ ;  $p<0.05$ ), extension ( $r=0.57$ ;  $p<0.05$ ) and neck flexion ( $r=0.45$ ;  $p<0.05$ ).

## Discussion:

As the usage of media devices such as computers and smartphones is expanding with study purposes, the regular users often exhibit incorrect postures which is considered a common visual display terminal syndrome, mostly found in individuals working for prolonged hours with visual activities in a consistent position. Pocking chin is a poor habitual neck posture, which often coexists with the upper crossed syndrome. It may also be characterized by hyperextension of upper vertebrae; it may also be complicated with thoracic kyphosis that was a combination of forwarding shoulders and round upper back. Current literature provides knowledge about the occurrence of mechanical

neck deformity, which was produced silently without producing noticeable symptoms, but once developed produces major health issues, disturbing life activities.

Digital X-rays and other radiographs have been used for diagnostic purposes by drawing different angles to see bony alignments. Observational and photographs methods were also in tradition in clinical practice.(16) Previous studies applied three methods; craniovertebral, head tilt and head position angle.(17) It was provided that the craniovertebral angle's outcome of head malalignment was more accurate than head position and head tilt angle maneuver, and also there is no dramatic difference between last two methods.(18) Situation matched in the study as a non-invasive photographic method was used to evaluate the FHP in students.

This assessment's reliability has been reported satisfactory in the sagittal view in previous studies.(17, 19) Although radiographic techniques are more helpful to validate the surface measurements of posture angles as landmarks were visible and fixed on radiographs, it provides more accurate information for spinal normal or abnormal alignments.(20) But because it is an expensive and time taking procedure, thus it could not be implemented in the current study. Radiations have hazardous effects on health and cost issues; they are not always practical. The photogrammetric technique for measuring the cervical spine posture deviations is an affordable method and provides numerical values. The study included two groups depending on study hours, suggesting whether the prolonged hours of study causes a strain on neck muscle and led to permanent deformity or not. In this method, lateral pictures were taken for both groups and angle of cervical curve was measured. Maintaining balance depends on vision, proprioception, vestibular function, feet touch surface, and aging.(21) Result similarity found in the study showed that due to prolonged study, visual activities had reduced postural control ability temporarily but recovered with time. Postural control was checked through the kinesthetic sense test perceived disturbed but that was not well-marked.

The relation between head posture and chronic neck pain of non-traumatic origin was determined in symptomatic and asymptomatic individuals through video images and showed that patients with chronic pain had more deviated head alignment than pain-free participants.(22) The existence of tenderness in sub occipital muscles and head posture in individuals with



chronic tension headaches and healthy individuals was compared and found a positive relationship between trigger points, tension headaches, and faulty neck posture.(23) Neck pain prevalence and associated symptoms were found in direct relation to neck mal-alignment and reduced neck angle in dentists, who worked in a flexed neck position for extended time compared to dental students who is working hours are less. It was also found that range of movement decreased more in dentists as compared to dental students.(24) Neck flexion produces more compression on the cervical spine than neck extension, which caused deviation of normal curve posteriorly. This continuous mechanical stress is harmless for a short period, but if this stress is continuous and repetitive, it will produce permanent structural changes in spine resulting in faulty head deformity. It was determined that students who had FHD suffered more with cervical pain and headache. Although there was a positive relation between FHP and cervical neuropathy, as students complained of radiating pain due to nerve compression, the ratio of sufferers was low as compared to local cervical pain and headache. Students agonized from FHD showed decreased mobility and range of all cervical spine movements.

Although the study was conducted on Sargodha university students, but data was collected by evidence based structured questionnaire and interpreted carefully so results could be generalized.

#### **Conclusion:**

It was concluded that most of the students with prolonged study hours may lead to forward head deformity. Forward head deformity is associated with neck pain, cervicogenic headache, and hypomobility of cervical spine.

**Acknowledgement:** Special thanks to Department of Allied Health Sciences, University of Sargodha, Pakistan for facilitating the study.

**Disclaimer:** None to declare.

**Conflict of interest:** None to declare.

**Source of Funding:** None to declare.

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**Authors contribution:**  
**Basharat A:** Conceptualization, Design and drafting.  
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**Afzal H:** Collection and assembly of data, drafting.  
**Gondal KS:** Discussion & Conclusion.  
**Tanveer S:** Analysis & Interpretation of data.  
**Saleem T:** Critical revision of article and drafting.

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