International Journal of Community Medicine and Public Health
*Misal HR et al. Int J Community Med Public Health. 2026 Apr;13(4):1930-1934*
http://www.ijcmph.com
pISSN 2394-6032 | eISSN 2394-6040

DOI: https://dx.doi.org/10.18203/2394-6040.ijcmph20261034

**Original Research Article**

# Correlation between forward head posture and cervical proprioception in physiotherapy students wearing eyeglasses in Navi Mumbai: a correlational study

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**Received:** 21 January 2026
**Revised:** 08 March 2026
**Accepted:** 13 March 2026

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## ABSTRACT

**Background:** The widespread use of digital devices in daily life has led to an increasing prevalence of forward head posture (FHP), which has emerged as a significant musculoskeletal concern among young adults. Although cervical proprioception plays an essential role in maintaining postural control, it often receives little attention until functional impairment occurs. Visual impairments represent a growing global health issue, especially among younger population. The present study aims to examine the association between cervical proprioception and forward head posture among physiotherapy students who regularly wear eyeglasses.
**Methods:** Total 48 participants were included in the study with eyeglasses. Kinovea software (2023.1.2) was used to assess forward head posture in the participants. Cervical proprioception was assessed using head laser beam device. The data was compiled in MS excel sheet (V 2021), (Microsoft Redmond campus, Redmond, Washington, united states). The study showed weak to moderate negative correlation between forward head posture and cervical proprioception in physiotherapy students wearing eyeglasses.
**Conclusions:** This study shows that forward head posture and cervical proprioception are correlated to each other in physiotherapy students wearing eyeglasses.

**Keywords:** Cervical proprioception, Eyeglasses, Forward head posture, Physiotherapy students

## INTRODUCTION

Forward head posture (FHP) has become increasingly prevalent in recent years, largely due to prolonged use of computers, smartphones, and other electronic devices. FHP is characterized by anterior displacement of the head relative to the shoulders, typically associated with sustained screen-based activities.[1] The musculoskeletal system adapts as people spend more time doing activities that encourage bad posture, which can have an effect on general health and wellbeing through a series of physiological changes.

Despite being vital to our everyday existence, cervical proprioception is often overlooked until its integrity is compromised. Cervical proprioception is the body's innate capacity to perceive and interpret the position, movement, and alignment of the head and neck in relation to the surroundings and the rest of the body.[2] The brain receives continuous sensory input from cervical muscles, ligaments, and joints via specialized receptors known as proprioceptors, which inform head and neck position.[2] Postural awareness can be adversely affected and proprioceptive function in the cervical area compromised by any damage to the muscles, ligaments, or joints.[1-3]

About 75% of adults require vision correction, with 64% using glasses and 11% preferring contact lenses.[4] Prolonged or improper eyeglass use can cause sustained activation of neck and eye muscles, leading to strain.[4] Despite frequent flexed-neck postures during study and clinical work, little research has examined this issue among Indian physiotherapy students.[5] These students often spend long hours studying or attending lectures while wearing glasses, which may contribute to poor posture. The visual and musculoskeletal systems are closely linked during visual tasks, regardless of refractive error.[6,7] The cervical region, rich in mechanoreceptors, plays a crucial role in transmitting sensory information for posture and movement. Proper head-on-trunk alignment also relies on accurate proprioceptive input from the cervical spine.[8,9]

According to recent research, students studying physiotherapy frequently have forward head posture as a result of poor ergonomics and extended usage of digital gadgets. It has been shown that postural adjustments can result from the interaction of the musculoskeletal and visual systems during visual target gazing. Accordingly, students who use glasses are more likely to have forward-leaning heads.[4] Upon reviewing the available literature, no studies were found that specifically examine the prevalence of forward head posture among physiotherapy students who wear eyeglasses.

Furthermore, there is a lack of research exploring cervical proprioception in this particular population. This study aimed to address these gaps. Hence, the objectives of the study were 1) to assess the forward head posture in physiotherapy students wearing eyeglasses by photogrammetry method, 2) to assess cervical proprioception in physiotherapy students wearing eyeglasses by joint position sense error testing in cervical flexion, extension, lateral rotation, and 3) to correlate forward head posture and cervical proprioception in physiotherapy students wearing eyeglasses.

## METHODS

This study employed a correlational research design to investigate physiotherapy students who regularly wore eyeglasses. The study was conducted over a period of six months (April 2025 to October 2025) in YMT College of Physiotherapy, Kharghar, Navi Mumbai. A total of 48 physiotherapy students participated in the study, all of whom had been using eyeglasses for at least two years and wore them for a minimum of eight hours per day. Both male and female physiotherapy students who met the eligibility criteria were included in the study.

The exclusion criteria included physiotherapy students with normal vision or those not using eyeglasses, individuals wearing eyeglasses for less than eight hours per day, those using contact lenses, students with a history of neck trauma or injury, those currently experiencing neck pain, individuals who had been using eyeglasses for less than two years, and students who were unwilling to participate in the study.

The sample size was calculated using a correlation coefficient formula with a significance level (α) of 0.01 and statistical power corresponding to β=0.20. The sample size was determined using the formula $N = [(Z\alpha + Z\beta)/C]^2+3$, where Zα represents the standard normal deviate for α and Zβ represents the standard normal deviate for β. The expected correlation coefficient (r) was taken as 0.47 based on the parent article.[1] Based on these calculations; the required sample size was determined to be 48 participants.

After taking the demographic data forward head posture was evaluated using Kinovea software (version 2023.1.2). The tragus of the ear and the C7 spinous process were identified as anatomical landmarks, and the craniovertebral angle was calculated from these reference points.

Cervical proprioception was evaluated using a head-mounted laser device secured to the participant's forehead. The joint position error (JPE) was assessed during flexion, extension, and right and left lateral rotations. All data entered into the computer but lacking encryption are checked for import errors.

The obtained data were compiled on MS Office Excel tables (v 2021, Microsoft Redmond Campus, Redmond, Washington, USA). Data were statistically analysed using the Statistical Package for the Social Sciences (SPSS v 30.0, IBM). Descriptive statistics were calculated, including frequencies and percentages for categorical variables and means with standard deviations for continuous variables.

## RESULTS

Analysis of the study population revealed that 35 out of 48 participants (73%) demonstrated forward head posture, whereas 13 participants (27%) maintained a normal craniovertebral angle. In accordance with previous research, a craniovertebral (CV) angle of ≥48.76° was classified as normal posture.[4,7] Descriptive statistics shown in Table 1.

**Table 1: Showing descriptive statistics.**

| Variables | Mean±SD |
|---|---|
| **Age (in years)** | 22.375±1.5928 |
| **CV angle** | 45.80±4.445 |
| **Flexion (in degrees)** | 5.521±2.303 |
| **Extension (in degrees)** | 6.464±2.653 |
| **Right lateral rotation (in degrees)** | 6.162±2.181 |
| **Left lateral rotation (in degrees)** | 6.4041±1.748 |

Cervical proprioception was quantified by calculating the angular deviation between the initial and final head

positions, expressed in degrees using the equation: Angle = $\tan^{-1}$(error distance/90 cm)[10]. A cervical repositioning error angle of less than 4.5° is considered indicative of normal cervical proprioception.[11,12] Test for normality was done for the given data with Shapiro-wilk test, Data was not distributed normally, hence Non- parametric (Spearman's test) was used to find the correlation between the CV angle and joint position sense. Shown in Table 2.

**Table 2: Correlation of forward head posture and cervical proprioception.**

| Variable 1 | Variable 2 | Rho-value | P value | Result |
|---|---|---|---|---|
| **CV angle** | JPE in flexion | -0.486* | <0.001 | Significant at 0.01 |
| | JPE in extension | -0.621* | <0.001 | Significant at 0.01 |
| | JPE in right rotation | -0.664* | <0.001 | Significant at 0.01 |
| | JPE in left rotation | -0.465* | <0.001 | Significant at 0.01 |

The Spearman's rho coefficient between CV angle and JPE in flexion was -0.486 ($p<0.01$), indicating a significant inverse relationship smaller CV angle corresponded to greater joint position errors during flexion. Shown in scatter graph Figure 1.

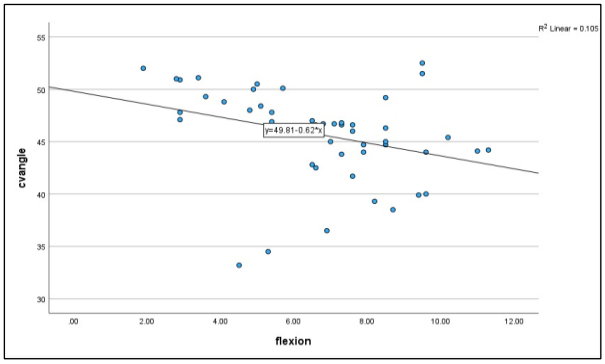


**Figure 1: Scatter graph for craniovertebral angle and JPE in flexion showing negative correlation i.e. increase in forward head posture is associated with decreased cervical proprioception during flexion.**

The Spearman's rho coefficient between CV angle and JPE in extension was -0.621 ($p<0.01$), indicating a significant inverse relationship smaller CV angle corresponded to greater joint position errors during extension. Shown in scatter graph Figure 2.

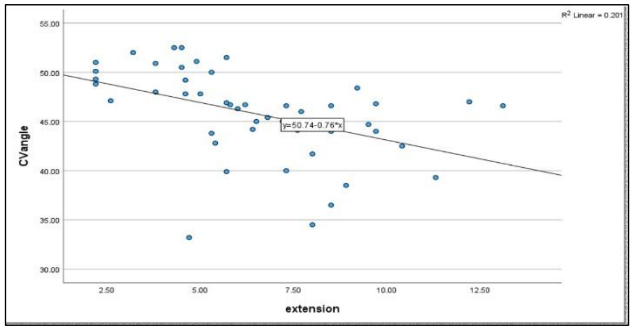


**Figure 2: Scatter graph for craniovertebral angle and JPE in extension showing negative correlation i.e. increase in forward head posture is associated with decreased cervical proprioception during extension.**

The Spearman's rho coefficient between CV angle and JPE in right lateral rotation was -0.664 ($p<0.01$), indicating a significant inverse relationship smaller CV angle corresponded to greater joint position errors during right lateral rotation. Shown in scatter graph Figure 3.

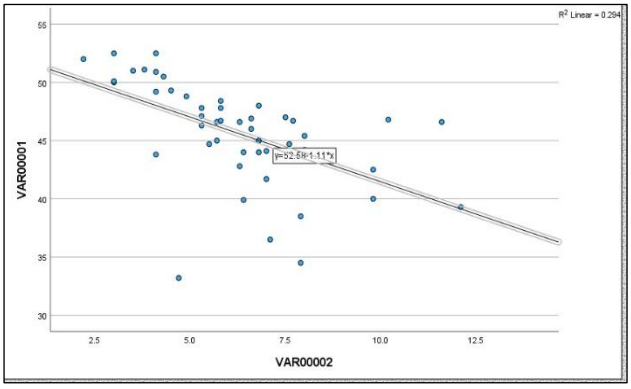


**Figure 3: Scatter graph for craniovertebral angle and JPE in right rotation negative correlation i.e. increase in forward head posture will decrease the joint position sense error during right rotation.**

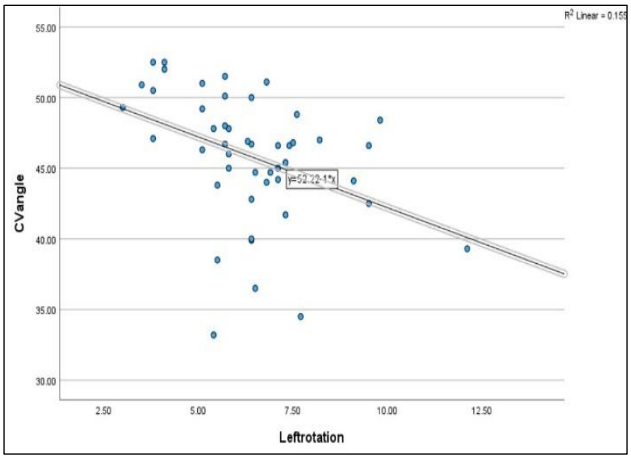


**Figure 4: Scatter graph for craniovertebral angle and JPE in left lateral rotation showing negative correlation i.e. increase in forward head posture is associated with decreased cervical proprioception during left lateral rotation.**

The Spearman's rho coefficient between CV angle and JPE in left lateral rotation was -0.465 ($p<0.01$), indicating a significant inverse relationship smaller CV angle corresponded to greater joint position sense error during left lateral rotation. Shown in scatter graph Figure 4.

## DISCUSSION

This study aimed to determine how forward head posture influences cervical joint position sense among physiotherapy students who wear eyeglasses. In this study 48 participants were taken including male and female population who wear eyeglasses. The mean age was 22.375±1.5928. The study showed that there is presence of forward head posture in physiotherapy students wearing eyeglasses. Out of 48 participants 35 (73%) participants had forward head posture and 13 (27%) were healthy individuals. Cervical proprioceptive accuracy was assessed across all movement directions. The findings revealed a moderate, statistically significant negative correlation between the craniovertebral angle and joint position error during flexion, extension, and both lateral rotations in physiotherapy students wearing eyeglasses. This indicates that decrease in craniovertebral angle i.e. increase in forward head will increase joint position sense error in flexion, extension and right, left lateral rotation. The mean JPE was greater in extension 6.464±2.653 followed by JPE of right lateral rotation 6.125±2. and last mean JPE of flexion 5.521± 2.303 rotation 6.4041±1.748 and last mean JPE od flexion 5.521±2.303.

According to this study, a significant portion of people who wear glasses have forward head posture, which may be influenced by their usage of visual display terminals (VDTs) like computers and cell phones. The widespread availability of visual display terminals (VDTs) in both domestic and professional environments has been strongly associated with musculoskeletal disorders.[13] Physiotherapy students are frequently exposed to VDTs during lectures and often spend extended periods sitting with poor posture, which can contribute to the development of forward head posture.[13] Increased strain on the eye and neck muscles may lead to compensatory postural changes, such as head tilting or squinting.[14]

Individuals with forward head posture (FHP) who use eyeglasses often demonstrate reduced cervical proprioception. Mean values of all four movements were greater than 4.5 degrees indicating increased JPE. Maintaining the head and neck in a prolonged forward-flexed position can lead to repetitive microtrauma, disturbing the normal length-tension equilibrium of cervical muscles and placing stress on posterior tissues.[15] This imbalance may weaken the deep cervical flexors while increasing activity in superficial muscles such as the sternocleidomastoid and upper trapezius.[16] Proprioception, which is essential for postural regulation, provides continuous feedback on body orientation through sensory input from muscle spindles.[3] Given the high density of muscle spindles in the neck, cervical muscles play a dominant role in this feedback system.[3] In FHP, altered muscle mechanics can interfere with afferent signals, resulting in diminished proprioceptive accuracy[13] and delayed sensorimotor responses[17]. Consequently, these disturbances may increase joint position error and reduce the craniovertebral angle, reflecting modified motor strategies during head repositioning.[13]

In this study, a moderate correlation with a statistically significant p-value was observed, indicating that forward head posture alters muscle condition and, consequently, affects cervical proprioception. These results are in line with earlier studies that looked at a variety of demographics, such as dentists and healthy people, which similarly found a direct correlation between cervical proprioception and forward head posture.[1-3] Rehabilitation strategies should prioritize correcting forward head posture and improving cervical proprioceptive function in physiotherapy students wearing eyeglasses to optimize postural alignment and reduce neck strain.

This study has few limitations. Study did not consider the total amount of hour spent and years spent wearing eyeglasses. Study was limited to physiotherapy students wearing eyeglasses, contact lens user were not included in the study and type of lens (bifocal, single vision) were not considered.

### *Clinical implications*

Early screening for forward head posture and inclusion of proprioceptive training exercises should be prioritized, especially for eyeglass wearers with substantial visual demands such as students. Therefore, eyeglass use should be considered a relevant factor during both the assessment and rehabilitation of individuals presenting with forward head posture.

## CONCLUSION

The findings of this study indicate a weak to moderate negative correlation between forward head posture and cervical proprioception in physiotherapy students wearing eyeglasses suggesting that participants with smaller craniovertebral angles demonstrated greater joint position errors.

### *Recommendations*

Conducting a long term follow up will help to understand the severity and progression of joint position error in association with forward head posture. Investigating the relationship between cervical proprioception, balance, and forward head posture may help clarify the broader impact of these factors on daily functioning and quality of life. Further Studies can study the comparison of relationship between forward head posture and cervical proprioception in students with and without eyeglasses.

*Funding: No funding sources*
*Conflict of interest: None declared*
*Ethical approval: The study was approved by the Institutional Ethics Committee of YMT College of Physiotherapy, Kharghar, Navi Mumbai*

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**Cite this article as:** Misal HR, Kashyap MM, Suryawanshi PS. Correlation between forward head posture and cervical proprioception in physiotherapy students wearing eyeglasses in Navi Mumbai: a correlational study. Int J Community Med Public Health 2026;13:1930-4.