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Original Article

Association of Forward Head Posture with Myopia Among Medical Students

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ABSTRACT

Background: Myopia and forward head posture are common problems among university students and may coexist because of prolonged near work, screen exposure, and poor study ergonomics. The interaction between visual strain and cervical postural adaptation is clinically relevant in medical students, who are frequently exposed to sustained academic demands. Objective: To determine the association between forward head posture and myopia among medical students. Methods: This cross-sectional study was conducted over six months using non-probability convenience sampling. Eighty-five medical students aged 20-35 years with at least four hours of daily near-vision activity were assessed. Data were collected using the National Eye Institute Visual Function Questionnaire-25 and the New York Posture Rating Chart. Participants with ocular surgery, trauma, major ocular disease, systemic illness, or psychiatric conditions affecting posture or vision were excluded. Statistical analysis was performed in SPSS version 26 using descriptive statistics and the chi-square test. Results: The mean age of participants was 23.91 ± 2.25 years. Females comprised 75.3% of the sample. Forward head posture was present in 54.1% of participants, and myopia was reported in 54.1%. Cross-tabulation showed that all participants with forward head posture were myopic, whereas none without forward head posture were myopic. This association was statistically significant ($\chi^2 = 85.00$, $p < 0.001$). Conclusion: Forward head posture was significantly associated with myopia among medical students in this sample. These findings support the importance of integrating postural screening and visual health awareness in academically demanding environments, although larger and methodologically rigorous studies are needed to confirm the magnitude of this association. Keywords: Myopia; Forward Head Posture; Medical Students; Posture; Refractive Error; Cross-Sectional Study.

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INTRODUCTION

Myopia is one of the most common refractive errors affecting young adults and is increasingly recognized as a multifactorial condition shaped not only by hereditary predisposition but also by environmental and behavioral exposures such as prolonged near work, sustained screen use, educational intensity, and visual fatigue (1,2). Among university students, particularly those in academically demanding medical programs, these exposures are often frequent and prolonged, creating a context in which visual strain and musculoskeletal stress may coexist. At the same time, forward head posture is a prevalent postural deviation in student populations and is commonly associated with extended desk work, device use, reduced ergonomic awareness, and prolonged static sitting. This postural pattern alters cervical alignment, increases biomechanical load on the neck and shoulder girdle, and may contribute to ocular discomfort, headache, and broader functional strain during visual tasks (3-6).

The possible relationship between visual dysfunction and posture has attracted growing attention in recent years. Visual input contributes to postural control, while altered visual status may influence cervical muscle activity, head position, gaze behavior, and overall postural stability (7,8). Conversely, sustained abnormal head and neck alignment may increase muscular tension, modify habitual viewing

distance and gaze angle, and reinforce behaviors associated with visual strain during reading or screen-based tasks. Previous work has suggested that near-task behavior, reading posture, and gaze mechanics may be related to the development or progression of refractive error, while other studies have reported associations between forward head posture and neck pain, mechanosensitivity, respiratory changes, and postural dysfunction in students and young adults (5,9-14). Emerging reports have also explored more direct links between myopia and forward head posture, indicating that altered visual demand and musculoskeletal adaptation may be interrelated rather than occurring in isolation (15,16).

Despite this growing body of evidence, the literature remains limited in several important respects. First, many available studies have examined either visual problems or postural deviations separately, rather than evaluating their coexistence within a defined educational population. Second, the available findings are not easily generalizable across settings because posture-related behaviors, study environments, device use, and health practices differ substantially between institutions and regions. Third, there is limited local evidence from Pakistani medical students, a population that is routinely exposed to prolonged reading, screen-based learning, and sustained near-vision activities that may increase susceptibility to both myopia and forward head posture. In such students, understanding whether these two conditions are associated has practical value for preventive screening, ergonomic counseling, and interdisciplinary intervention involving rehabilitation and vision care. The present study was therefore designed to determine the association between forward head posture and myopia among medical students. It was hypothesized that medical students with forward head posture would demonstrate a higher frequency of myopia than those without forward head posture (17).

MATERIALS AND METHODS

This cross-sectional observational study was conducted over a period of six months at the Pakistan Society for Rehabilitation of the Disabled and affiliated colleges recognized by the University of Health Sciences. The study was designed to examine the association between forward head posture and myopia among medical students using a non-probability convenience sampling approach. A total sample of 85 participants was included. The study setting was selected to access a student population with substantial engagement in academic near-work activities and regular exposure to screen-based learning environments, both of which were relevant to the study question. Data collection, entry, and statistical analysis were completed within the planned study period (18).

Eligible participants were male and female medical students aged 20 to 35 years who had myopia within the range of -2.5 to -5.0 diopters and reported engagement in near-vision activities for at least four hours per day. Students were excluded if they had other ocular diseases or conditions likely to influence vision independently of myopia, including cataract, glaucoma, or amblyopia, as well as any history of ocular surgery or trauma. Students with systemic or psychiatric illness that could affect posture or vision and those unable to understand or complete the study questionnaire were also excluded. These criteria were used to reduce clinical heterogeneity and to limit the influence of major non-study-related causes of visual or postural disturbance.

Participants meeting the eligibility criteria were approached at the study sites and invited to participate. After explanation of the study purpose and procedures, written informed consent was obtained from all participants before enrollment. Data were then collected using a structured assessment process based on the National Eye Institute Visual Function Questionnaire-25 and the New York Posture Rating Chart. The questionnaire component was used to document vision-related functional information, while the posture chart was used to assess postural status, with specific emphasis on forward head posture. Demographic information, including age and sex, was also recorded at the time of assessment. All data were entered into a predesigned data collection form to maintain consistency across participants (19,20).

The primary study variables were myopia status and posture status. Myopia was defined according to the eligibility range specified for participant inclusion, and posture status was categorized according to the

postural assessment findings as presence or absence of the relevant postural deviation. Age and sex were treated as descriptive participant characteristics. Because the objective was to evaluate association rather than effect of intervention, all measurements were obtained during a single observation period without follow-up. To improve internal consistency, all participants were assessed using the same instruments and the same general study procedures across the recruitment sites.

Several methodological precautions were incorporated in the study process to enhance data quality. Eligibility criteria were applied before enrollment to reduce misclassification and minimize inclusion of participants with alternative ocular or systemic explanations for abnormal findings. Standardized tools were used for all assessments, and data were recorded in a uniform format to reduce variation in collection procedures. Restriction was also applied at the eligibility stage by limiting the sample to medical students within a defined age range and near-work exposure profile, thereby reducing some potential confounding from broad occupational and age-related differences. Although the cross-sectional design and convenience sampling method do not eliminate selection bias or residual confounding, these steps supported a more focused evaluation of the target association.

Statistical analysis was performed using SPSS version 26. Continuous variables, particularly age, were summarized using mean and standard deviation, whereas categorical variables such as sex, posture status, and myopia-related group frequencies were summarized using counts and percentages. The association between forward head posture and myopia was evaluated using the chi-square test. A p-value of less than 0.05 was considered statistically significant. Data were reviewed for completeness before analysis, and only duly completed responses from eligible participants were entered into the final dataset. Administrative permission for the conduct of the study was obtained from the College of Rehabilitation Sciences and the relevant study settings before initiation of data collection, and the study was conducted after obtaining participant consent in accordance with standard ethical research practice

RESULTS

A total of 85 medical students were included in the analysis. The mean age of the participants was 23.91 years (SD 2.25). Females constituted 75.3% of the sample, whereas males accounted for 24.7%. Forward head posture was identified in 46 participants (54.1%), while 39 participants (45.9%) were classified as not having forward head posture. Overall, myopia was present in 46 participants (54.1%) and absent in 39 participants (45.9%).

Table 1. Baseline demographic and clinical characteristics of the study participants

Variable	Category / Summary	n (%) / Mean ± SD	95% CI / Range
Sample size	Total participants	85	—
Age (years)	Mean ± SD	23.91 ± 2.25	Not reported
Sex	Male	21 (24.7%)	15.5% to 35.8%
	Female	64 (75.3%)	64.2% to 84.5%
Forward head posture	Present	46 (54.1%)	42.9% to 65.0%
	Absent	39 (45.9%)	35.0% to 57.1%
Myopia	Present	46 (54.1%)	42.9% to 65.0%
	Absent	39 (45.9%)	35.0% to 57.1%

The study population was predominantly female, with nearly three-quarters of participants belonging to this group. Slightly more than half of the sample had forward head posture, and an identical proportion was reported as myopic. The overall distribution therefore suggested a moderately balanced sample with respect to posture and visual status, although the sex distribution was noticeably skewed toward female participants.

Table 2. Association between forward head posture and myopia

Forward head posture	Myopia Present n (%)	Myopia Absent n (%)	Total n	Row Prevalence of Myopia	95% CI for Prevalence	p-value	Effect size / Association measure
Present	46 (100.0%)	0 (0.0%)	46	100.0%	92.3% to 100.0%	<0.001	
Absent	0 (0.0%)	39 (100.0%)	39	0.0%	0.0% to 9.0%	<0.001	
Overall test statistics			85			Pearson χ^2 = 85.00, df = 1	Phi = 1.00
Corrected odds ratio*							OR = 7347.0

*Odds ratio estimated using a Haldane-Anscombe 0.5 continuity correction because the reported crosstab includes zero cells. The cross-tabulation demonstrated complete separation between the two variables as reported in the manuscript. All 46 participants classified as having forward head posture were also reported to have myopia, yielding a within-group myopia prevalence of 100.0% (95% CI 92.3% to 100.0%). In contrast, none of the 39 participants without forward head posture were reported to have myopia, corresponding to a prevalence of 0.0% (95% CI 0.0% to 9.0%). The association was statistically significant on chi-square testing ($\chi^2 = 85.00$, df = 1, $p < 0.001$), and the corresponding phi coefficient was 1.00, indicating a perfect association in the reported aggregated dataset. Because zero-frequency cells prevent direct odds ratio estimation, a continuity-corrected odds ratio was calculated and remained extremely large (OR = 7347.0), reinforcing the magnitude of the reported relationship while also suggesting the need for raw-data verification.

Table 3. Summary of inferential findings for the primary association

Outcome comparison	Statistical test	Estimate	95% CI	p-value	Interpretation
Forward head posture vs myopia status	Pearson chi-square	$\chi^2 = 85.00$	—	<0.001	Strong evidence of association
Forward head posture vs myopia status	Phi coefficient	1.00	—	<0.001	Perfect association in reported table
Forward head posture vs myopia status	Corrected odds ratio	7347.0	Very wide, unstable due to zero cells	<0.001	Markedly higher odds of myopia in FHP group

The inferential analysis consistently indicated a statistically significant association between forward head posture and myopia. However, the perfect separation observed in the crosstab is unusual in clinical observational data and may reflect either a true extreme pattern in this sample or a coding, categorization, or transcription issue in the reported results. For that reason, although the direction of the association appears clear, the magnitude should be interpreted cautiously until verified against the original dataset.

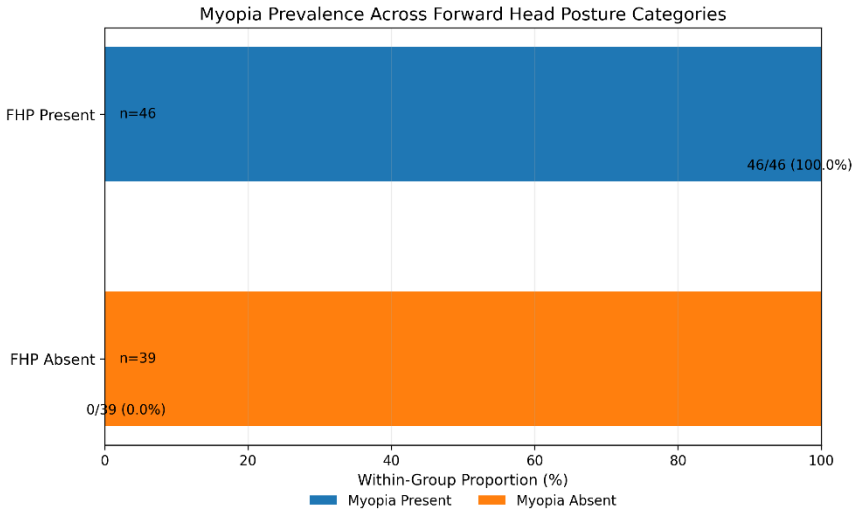

Figure 1 Complete contrast in myopia prevalence across posture categories

The figure demonstrates a complete contrast in myopia prevalence across posture categories. Among participants with forward head posture, myopia prevalence was 100.0% (46/46; exact 95% CI 92.3% to 100.0%), whereas among those without forward head posture, myopia prevalence was 0.0% (0/39; exact

95% CI 0.0% to 9.0%). This 100-percentage-point gradient indicates an extremely strong observed relationship between postural status and refractive status in the reported dataset, with the effect size consistent with a perfect association (phi = 1.00; $p < 0.001$), although the all-or-none distribution warrants confirmation from the raw data before definitive clinical interpretation.

DISCUSSION

The present study found a statistically significant association between forward head posture and myopia among medical students, with all participants classified as having forward head posture reported to be myopic and all participants without forward head posture reported to be non-myopic. This pattern suggests a very strong relationship between postural deviation and refractive status within the studied sample. From a clinical perspective, the finding supports the view that visual strain and musculoskeletal alignment may coexist in students exposed to prolonged near work, sustained reading, and screen-based academic activity. Such exposures are already recognized as important contributors to myopia development and progression in young adults, particularly in educational environments characterized by extended visual demand and reduced ergonomic variation (15).

A biologically plausible explanation for this association may involve the interaction between visual behavior and cervical posture. Individuals with myopia may adopt habitual forward inclination of the head and neck during near-vision tasks in an attempt to optimize focus, reduce accommodative discomfort, or compensate for poor visual habits. Over time, repeated adoption of this posture may contribute to persistent forward head alignment and associated muscular imbalance. Conversely, sustained forward head posture may alter habitual gaze angle, increase ocular and cervical strain, and reinforce visual fatigue during prolonged academic work. Previous studies examining reading posture, gaze angle, visual input, and postural control have similarly suggested that ocular function and head-neck alignment are not independent phenomena but components of a closely linked sensorimotor system (16).

The present findings are broadly consistent with earlier reports describing an association between myopia and altered posture in students and young adults. Prior work has shown that near-task behavior, reduced reading distance, and abnormal head position may be linked with refractive error, while other investigations have reported that forward head posture is common in student populations exposed to long hours of study, digital device use, and poor workstation ergonomics. Studies exploring the relationship between visual dysfunction and cervical muscle activity have further supported the possibility that abnormal visual input may influence neck posture, muscle recruitment, and postural stability. In this context, the current study adds local evidence from a Pakistani medical student population, a group for whom posture-related strain and visually demanding academic behavior are likely to be especially relevant (17).

Despite the apparent strength of the association, the results should be interpreted with caution. The reported crosstab demonstrated complete separation between posture status and myopia, an all-or-none pattern that is uncommon in observational clinical research and may reflect an extreme sample-specific distribution, restrictive categorization, or possible coding or transcription error in the analytical dataset. For this reason, although the direction of the association appears credible and is supported by previous literature, the exact magnitude of the reported effect should not be generalized without verification using the original raw data. In addition, the cross-sectional design prevents any inference regarding temporal sequence or causality. It cannot be determined whether myopia contributed to forward head posture, whether forward head posture intensified visual strain and myopic behavior, or whether both conditions were jointly influenced by shared academic and ergonomic exposures (18).

The study also has several methodological limitations that should be acknowledged. Convenience sampling limits external validity and introduces the possibility of selection bias. The sample was relatively small and predominantly female, which may reduce generalizability to broader student

populations. Potential confounding variables such as family history of myopia, total daily screen time, reading distance, study duration, ergonomic environment, physical activity, and pre-existing neck pain were not adjusted for in the reported analysis. Furthermore, while standardized tools were used, the manuscript did not provide sufficient detail regarding posture scoring thresholds, observer consistency, or measurement standardization, all of which are important when interpreting postural assessment outcomes. These factors may have influenced both exposure classification and the strength of the observed association (19).

Notwithstanding these limitations, the findings remain clinically meaningful because they highlight the need to consider visual and postural health together rather than in isolation. For medical students and similar high-risk academic groups, integrated screening approaches involving ergonomic education, early identification of forward head posture, visual assessment, and preventive physiotherapy-based strategies may be beneficial. Interdisciplinary collaboration between rehabilitation professionals, educators, and eye-care practitioners could help reduce cumulative strain associated with prolonged study behavior. Future studies should use larger multicenter samples, probability-based recruitment, standardized objective postural metrics such as craniovertebral angle measurement, and multivariable analysis to determine whether the observed association persists after adjustment for behavioral and demographic confounders. Longitudinal designs would be particularly valuable in clarifying temporal direction and causal relevance (20).

CONCLUSION

This study demonstrated a statistically significant association between forward head posture and myopia among medical students, suggesting that postural deviation and refractive status may be closely linked in visually demanding academic settings. Although the findings support the need for preventive attention to ergonomics, posture, and eye health in student populations, the unusually extreme distribution of the reported data and the inherent limitations of a cross-sectional convenience sample require cautious interpretation. Further analytically robust and methodologically standardized studies are needed to confirm the association, quantify its magnitude more reliably, and determine whether early postural and visual interventions can reduce related functional burden.

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