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Original Research Article

Effect of postural variation on near visual function in myopic subjects

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ABSTRACT

Background: Near visual tasks demand sustained accommodation and convergence, which may vary with body posture. This study examined the effect of sitting, standing and supine positions on amplitude of accommodation (AA) and near point of convergence (NPC) in myopic individuals.
Methods: A cross-sectional study was conducted on 60 optometry undergraduates aged 19–30 years with mild to moderate myopia. Comprehensive eye examinations were performed and AA and NPC were assessed in three postures. AA was measured monocularly using the push-up method with a Royal Air Force ruler and NPC was measured binocularly with a pen torch and 0.30 logMAR (6/12) letters. Each test was repeated thrice per posture and mean values were analyzed using one-way ANOVA.
Results: Mean AA in the right eye was 8.48±2.94 D (sitting), 7.89±2.74 D (standing) and 7.38±2.17 D (supine), with no significant difference (p=0.077). NPC averaged 5.38±1.15 cm (sitting), 5.38±1.15 cm (standing) and 5.15±1.45 cm (supine), also not significant (p=0.53).
Conclusions: While posture did not significantly influence AA or NPC, a trend toward better accommodative response was seen in the sitting position. These findings indicate that sitting may provide greater visual comfort for myopes during near tasks, highlighting posture's potential role in visual performance.

Keywords: Amplitude of accommodation, Myopia, Near point of convergence, Posture

INTRODUCTION

Ocular accommodation is the mechanism by which the eye adjusts its focusing ability to maintain clarity when viewing objects at different distances.[1-3] This dynamic process is crucial for achieving sharp vision as the gaze shifts between near and far targets. The concept of AA refers to the range, measured in diopters, through which the eye can modify its optical power to focus on near objects.[4] Gaining a comprehensive understanding of how accommodation works, along with the techniques used to assess its amplitude, offers valuable perspectives on visual performance and the impact of ageing on the subjective methods such as push-up, pull-away and minus lens techniques and objective approaches like dynamic retinoscopy and Pascal heterodynamic retinoscopy.[1,5,6] Extended periods of near work, such as prolonged reading, often result in a range of visual discomforts including reduced reading efficiency, headaches, eye strain (asthenopia), photophobia, blurred vision and double vision (diplopia).[7] To alleviate discomfort, individuals naturally adopt various reading postures that may inadvertently contribute to these visual issues.[1,4] The positioning of reading material plays a crucial role in determining head orientation, neck muscle strain, ocular fatigue and overall visual function, especially in people who engage in extensive near tasks. In the absence of specific visual cues, the eyes' accommodative and vergence responses can shift. When materials are positioned too close to the eyes, the increased demands on accommodation and convergence may, over time, diminish both flexibility and functional capacity of these systems. Additionally, optimal reading distance can be influenced by factors such as character size and text

clarity, which become particularly relevant in the ageing population. During typical daily activities, the text size of reading material remains unchanged, regardless of the viewing distance. As the working distance increases, the visual angle decreases, which can contribute to eye strain and altered head posture. If the reading material is positioned too far from the preferred viewing range, it may exacerbate visual discomfort and lead to inefficient postural adaptations.[8]

The objective of this study was to evaluate and compare the amplitude of accommodation and convergence across three distinct reading postures (sitting, standing and supine) in individuals with myopia.

METHODS

Recruitment and enrolment

Participants for this study were recruited from the outpatient department of Optometry at Sapthagiri Institute of Medical Sciences and Research Centre, Bangalore. Ethical clearance was obtained from the Institutional Ethical and Scientific Committee and the research adhered to the principles outlined in the Declaration of Helsinki. Prior to participation, all individuals were briefed about the study's objectives, procedures and potential implications and written informed consent was secured.

The study population consisted of undergraduate optometry students aged between 19 and 30 years. Inclusion criteria encompassed individuals with spherical myopia ranging from -0.50 D to -4.00 D and all with astigmatism not exceeding 0.75 D. All participants were required to be current users of single-vision spectacles with prescriptions that had remained unchanged for at least 2 to 3 months. Visual acuity standards included a best-corrected visual acuity of 0.00 logMAR (equivalent to 6/6) for distance at 4 meters and N6 for near vision at 30 centimetres in both eyes. Exclusion criteria included a history of systemic or ocular diseases, use of medications that could affect accommodative function, any form of ocular surgery including procedures involving the extraocular muscles, presence of oculomotor anomalies, neurological conditions, strabismus or amblyopia.

Baseline examination

A total of 60 individuals participated in this cross-sectional study from January 2025 to April 2025, each attending a single outpatient department visit at the institution while wearing their regular spectacle correction. A comprehensive case history was obtained from each participant, followed by a series of clinical assessments. These included measurements of visual acuity, both objective and subjective refraction, evaluation of pupillary responses, NPA, NPC, negative and positive relative accommodation (NRA and PRA) and both distance and near fusional vergence (positive and negative). Additional tests included accommodative and vergence facility, monocular estimation method (MEM), cover test, assessment of ocular motility through versions and ductions, slit-lamp biomicroscopy and fundus examination. Only participants who successfully met all inclusion criteria through these preliminary evaluations were enrolled in the study. An adjustable chair was utilized to facilitate posture changes (sitting and supine) during amplitude of accommodation and near point of convergence measurements.

The AA was assessed monocularly using the push-up method with a royal air force (RAF) Ruler (Unitech Vision, India), while participants viewed a 0.20 logMAR (6/9.5) target. The procedure was performed with the participants wearing their full spectacle correction to ensure accurate accommodative demand. They were instructed to maintain clarity of the letters as the target was slowly advanced toward the eye and to indicate the point at which the letters became persistently blurred. The corresponding distance was converted and recorded in diopters.[9] To enhance reliability, the measurement was repeated three times for each eye and the mean of these three readings was considered the final amplitude of accommodation. This assessment was conducted in three different postural positions sitting, standing and supine to evaluate any positional variations in accommodative response. The NPC was assessed binocularly using a pen torch affixed with a vertical column of 0.30 logMAR (6/12) letters. The test was conducted with participants wearing their full spectacle correction to ensure accurate visual demand. Individuals were asked to maintain a single, clear image of the letter row as the target was slowly moved toward their eyes. The point at which the participant experienced double vision, a noticeable outward deviation of one eye or an inability to continue converging was recorded. This distance, measured in centimetres from the centre of the brow to the point of disruption, was noted as the NPC value.[9]

To ensure consistency and reliability, the measurement was repeated three times for each posture and the average of the three readings was used for analysis. The assessment was carried out in three body positions seated, standing and lying supine to observe any positional effects on convergence ability.

Statistical analysis

Data entry was performed using Microsoft Excel and statistical analysis was carried out with SPSS software version 20.0 (IBM, Somers, NY, USA), with a significance level set at $p<0.05$. Descriptive statistics, including mean, standard deviation and range, were calculated to summarize the data. The Shapiro-Wilk test was employed to assess the normality of the distribution. To evaluate differences in amplitude of accommodation and near point of convergence across various postural positions, a one-way analysis of variance (ANOVA) was applied. Additionally, a paired samples t-test was conducted to compare amplitude of accommodation

measurements between the right and left eyes. Since no statistically significant differences were observed between the two eyes, only the data from the right eye were included in the final analysis for AA.

RESULTS

Demographic data

A total of sixty undergraduate students from the field of Optometry participated in the study. Among them, 25 (41.67%) were male and 35 (58.33%) were female. The participants had a mean age of 21.67±4.35 years and their ages ranged between 20 and 27 years. The average spherical equivalent of subjective refraction across the group was -2.25±1.50 D, with individual values spanning from -0.75 D to -3.25 D (Table 1).

Table 1: Demographics of the study population (n=60).

Factors	Results
Age (in years), mean±SD (range)	21.67±4.35 (20 to 27)
Sex (%)	
Male	41.67
Female	58.33
Subjective spherical refraction (D), mean±SD, range	-2.25±1.50 (-0.75 to -3.25)

Amplitude of accommodation in relation to different reading postures

The mean AA values in the sitting, standing and supine positions were 8.48±2.94 D, 7.89±2.74 D and 7.38±2.17 D respectively. Although a trend toward reduced AA with positional change was observed, the difference was not statistically significant (p=0.077). Thus, no significant variation in AA was found across the three postures. (Figure 1).

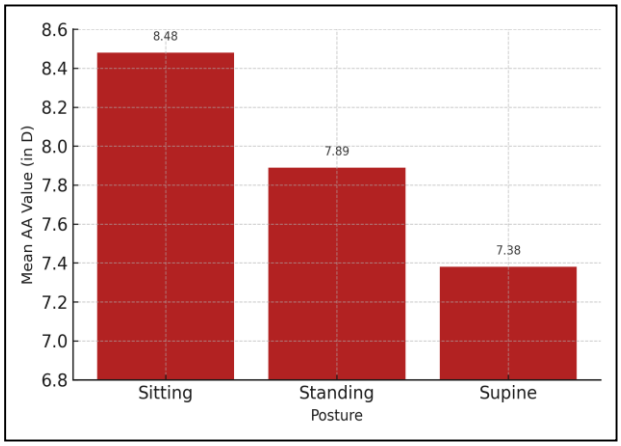

Figure 1: The mean AA across sitting, standing and supine postures.

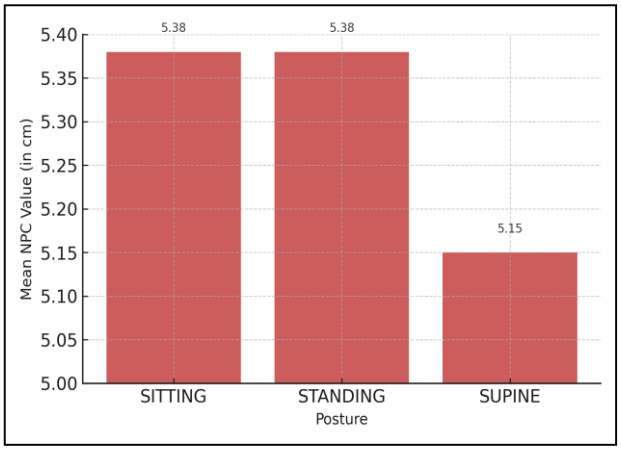

Figure 2: The mean NPC across sitting, standing and supine postures.

Near point of convergence in relation to different reading postures

The mean NPC for both eyes in the sitting, standing and supine positions were 5.38±1.15 cm, 5.38±1.15 cm and 5.15±1.45 cm, respectively. Statistical analysis revealed no significant differences in NPC across the three postures (p=0.53), indicating that body position had no notable impact on convergence ability (Figure 2).

DISCUSSION

Among the 60 participants recruited for this study, 25 (41.67%) were male and 35 (58.33%) were female. The mean age of the participants was 21.67±4.35 years, with the age range spanning from 20 to 27 years. This demographic distribution closely mirrors that reported in previous studies by Majumder et al and Rampel et al providing a relevant comparison framework and supporting the representativeness of our sample within the young adult myopic population.[8]

The primary objective of our investigation was to assess how variations in reading posture specifically sitting, standing and supine affect two critical near visual functions: the NPC and the AA. For consistency and accuracy, three separate measurements were taken in each posture for each parameter and the mean value was used for analysis. This approach aimed to minimize variability and enhance the reliability of the results.

In a comparative context, Majumder et al, conducted a study that reported a statistically significant variation in AA when comparing different reading postures, with a p-value of less than 0.0001.[10] Their results suggested that posture plays a significant role in accommodative function. However, in our study, although a trend of increasing AA was observed when transitioning from supine to standing and finally to sitting posture, this difference did not reach statistical significance (p=0.094). One plausible explanation for this discrepancy lies in the

differences in the sample populations. While Majumder et al, focused exclusively on emmetropic individuals and included participants from varied ethnic backgrounds, our study targeted a specific group individuals with mild to moderate myopia. These refractive differences can influence accommodative responses, potentially accounting for the lack of statistical significance in our findings. Despite this, the pattern of enhanced accommodative response in the sitting posture, as observed in both studies, supports the hypothesis that body posture may influence near visual function to some extent, particularly in tasks requiring sustained accommodation.[11]

Additionally, our findings related to NPC offer a useful comparison with the study conducted by Hashemi et al, who reported a mean NPC of 7.59 cm among individuals aged 20 to 29 years.[12] In contrast, our study, which involved participants aged 19 to 30 years, demonstrated a considerably shorter mean NPC distance of 5.30 cm. This discrepancy may be attributed to differences in measurement methodology. Hashemi et al defined NPC as the distance from the break point to the spectacle plane, while in our study, the measurement was taken from the break point to the lateral canthus, which is closer to the eye and may yield a shorter measurement. Furthermore, Hashemi et al used the reciprocal of NPA (near point of accommodation) to estimate AA, whereas we employed the push up method, which could also contribute to variation in results between the two studies.[12]

This study had certain limitations. The sample was restricted to undergraduate optometry students within a narrow age range, which may limit generalizability to broader age groups or non-student populations. Only individuals with mild to moderate myopia were included, so the findings may not apply to emmetropes, high myopes or hyperopes. The push-up method, though commonly used, is a subjective measure of accommodative amplitude and may be influenced by individual response variability. Additionally, posture changes were evaluated only in a controlled clinical setting, which may not fully replicate real-world conditions of prolonged near tasks. Future studies with larger, more diverse populations, objective assessment methods and extended task durations are recommended.

CONCLUSION

This study observed a trend of increasing accommodative and convergence values in myopic individuals as reading posture changed from supine to standing and then to sitting. Although these differences were not statistically significant, the findings suggest that the sitting posture is more favourable and comfortable for near tasks compared to standing or supine positions. Furthermore, the importance of wearing full distance correction during near work is emphasized to ensure accurate accommodative demand. Based on our findings, we conclude that the sitting posture provides greater visual comfort for myopic individuals when engaged in prolonged near activities.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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