Original Article

Profile of Myopic Patients with Convergence Insufficiency at an Eye Care Center in Northern India

Heena Gupta*[1], M.OPT

1. Tamojyoti Netralaya Eye Clinic, Gurugram, India.

***Corresponding Author:** Heena Gupta
E-mail: heenagupta979@gmail.com

Abstract

Purpose: This study aimed to evaluate the profile of myopic patients suffering from convergence insufficiency (CI) at an eye care center in northern India.
Patients and Methods: A total of 172 myopic patients aged 5 to 39 years who attended Tamojyoti Netralaya eye clinic, Gurugram, India, from December 2023 to December 2024 were included. All patients underwent comprehensive ophthalmic evaluations, including visual acuity, subjective refraction, and assessments of near point of convergence (NPC), accommodative functions, positive fusional vergence (PFV) and negative fusional vergence (NFV).
Results: CI was prevalent among myopic patients, and patients with compound myopic astigmatism showed a higher rate of CI. The degree of CI increased with age and the severity of myopia. Notably, even low degrees of myopia (0.5 D and above) were associated with CI.
Conclusion: Our study results indicate that CI is commonly associated with myopia. CI was more prevalent in patients with compound myopic astigmatism, especially among adults aged 20–24 years. Therefore, regular eye examinations are essential to reduce asthenopic symptoms in these patients.

Keywords: Myopia; Convergence Insufficiency; Vergence; Exophoria; Accommodation.

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Introduction

Convergence insufficiency is a common disorder of binocular vision associated with symptoms during tasks such as near work, reading, and prolonged computer use [1]. It is a frequent cause of muscle discomfort and is typically linked to a patient's inability to converge the eyes properly and smoothly when an object, such as a pen, moves from a distance toward the eyes [2]. The symptoms, which range from mild to moderate, can be exacerbated by factors like stress, illness, or lack of sleep, and patients may experience headache, asthenopia, difficulty with reading or other near tasks, and diplopia.

Headaches often occur during extended periods of reading, usually manifesting in the frontal or periocular regions. Some studies suggest that these headaches may be related to underlying conditions such as migraines [3]. Asthenopia is commonly described as a feeling of tired or strained eyes accompanied by pain during near work, or as a sensation of pulling or pressure around the eyes. This discomfort arises from the increased accommodative or convergence effort needed to meet visual demands. Additionally, patients sometimes report blurred words, the sensation of print moving on the page, and difficulties with concentration. Diplopia, the perception of seeing two distinct images, is another complaint; patients may even find temporary relief by closing one eye.

Refractive errors play a major role in reading-related tasks and, if uncorrected, can lead to binocular anomalies including convergence insufficiency. Conditions such as hypermetropia, myopia, and astigmatism are all associated with decreased visual acuity. Although these refractive errors are often genetic, they can change over time based on the patient's visual demands. Myopia, or nearsightedness, occurs when the eye does not bend or refract light properly, causing light to focus in front of the retina. Since myopic patients generally possess greater refractive power than normal, they require less accommodation for near tasks, which may contribute to the development of convergence insufficiency [4]. Despite these observed relationships, the extent of the association between refractive errors and convergence insufficiency has not been extensively studied. In children, the prevalence of convergence insufficiency is estimated at 4.2–6 %, while in adults the annual incidence is about 8.4 per 100,000 individuals. By the ninth decade of life, approximately 70 % of individuals may be affected, with incidence rates increasing alongside additional near work demands [5]. Although convergence insufficiency is reported to be rare in children younger than 10 years, the increased visual demands of schoolwork and prolonged periods of near work or reading can lead to the development of symptoms in older children [6].

The prognosis for convergence insufficiency is generally favorable in most patients, as conservative therapies tend to be effective. However, approximately one quarter of patients experience a significant increase in near deviation 20 years after diagnosis, and a small percentage may require surgery, monocular occlusion at near, or additional therapeutic interventions [7]. Typical signs include an increased near point of convergence, decreased fusional convergence amplitude, and greater exodeviation at near [8]. Positive fusional convergence amplitude is measured by placing an increasing power of a base-out prism in front of either eye while the patient focuses on a distant target; the maximum prism strength at which the patient loses binocular fixation or reports diplopia is recorded as the

positive fusional vergence amplitude, with healthy individuals generally exhibiting a convergence amplitude of more than 15 prism diopters.

Moreover, patients with mild to moderate myopia may not need to stimulate accommodation to see clearly at near distances in their uncorrected state, which can result in decreased accommodative convergence. In this study, we examined the profile of myopic patients with convergence insufficiency in order to diagnose their symptoms as early as possible and provide them with orthoptic exercises to alleviate symptoms that can hinder daily activities such as reading and other near tasks.

Patients and Methods

This study was conducted at an eye care center. Patients who attended Tamojyoti Netralaya eye clinic, Gurugram, India, from December 2023 to December 2024 were recruited for the study. The study protocol was approved by the institutional ethics committee, and written informed consent was obtained from the parents of all participants before enrollment.

The inclusion criteria for the study were myopic patients between 5 and 39 years with a best-corrected visual acuity of up to 6/9, who were otherwise in good general health, irrespective of gender. Exclusion criteria comprised emmetropic, hyperopic, or presbyopic patients; patients with strabismus or those with binocular anomalies due to trauma or surgery; and patients with systemic diseases associated with binocular anomalies, anisometropia, or amblyopia.

A detailed medical and ophthalmic history was obtained, including information on systemic diseases, ocular trauma or injury, and any previous ocular surgery. A history of intraocular procedures, such as cataract or strabismus surgery, as well as the use of contact lenses or other myopia control treatments like atropine or amblyopia therapy, constituted exclusion criteria. Patients from any job profile, regardless of whether they were exposed to poor ergonomics or prolonged visual demands, and who were in good general health with myopia and normal biomicroscopy or fundoscopy findings, were included.

Patients presenting with common binocular vision disorders—accompanied by symptoms such as slow reading, sleepiness, blurred vision, diplopia, headaches, or eyestrain—underwent a complete ophthalmic examination. This examination assessed visual acuity; performed dry and wet refraction; and measured the near point of convergence (NPC), near point of accommodation (NPA), fusional amplitudes, accommodative facility, and Royal Air Force (RAF) values, as well as negative and positive relative accommodation (NRA and PRA) for each patient.

Based on their diagnosis of convergence insufficiency (CI), patients were categorized and assigned to randomized clinical trial therapies for convergence insufficiency. These therapies included home-based and office-based interventions such as the pen push-up, computer-based convergence exercises, Brock string exercises, and prism bar therapy. Monthly visits were scheduled at the clinic for those assigned to home-based therapies, while patients receiving office-based therapies were scheduled for follow-up visits ten days after each session.

In the pen push-up procedure, a pencil with a 20/60 size letter and a fusion card (or cat card) in the background was used to provide a suppression check through physiological diplopia. The goal was to move the pencil to within 2–3 cm of the brow area, just above the nose, during each push-up while keeping the

target single and clear for 5 minutes.

For computer-based therapies, software such as Bynocs was employed. Using this program, patients performed fusional vergence exercises, including base-out exercises with a random dot stereopsis target, with the software automatically modifying the therapy sessions at each follow-up visit according to the patient's progress.

The Brock string exercise utilized a loop of white string with three beads: red, yellow, and green. For convergence, the beads were arranged for near fixation at approximately one meter, and the string was held under the nose. The patient fixated on the first bead; if it appeared double, this indicated a binocular problem, and the patient continued fixating until the bead became single. As the exercise progressed, the beads typically formed a pattern resembling the letters "V," "X," and "A," indicating physiological diplopia.

For prism bar therapy, the convergence prism bar was placed in front of one eye in a base-out position to prevent double vision. If double vision occurred, the patient adjusted until the image became single and clear, and then performed the necessary vergence movement. For near targets, the object was placed at 40 cm, while for distance targets it was placed at 3 meters.

Results

Myopic patients who attended Tamojyoti Netralaya eye clinic, Gurugram, India, from December 2023 to December 2024 were recruited for this study. A total of 172 patients were diagnosed with convergence insufficiency during this period.

The mean age of the patients was between 20 and 24 years, indicating that most were students. Consequently, they were more affected due to the extensive screen time required for their studies and online classes (Figure 1).

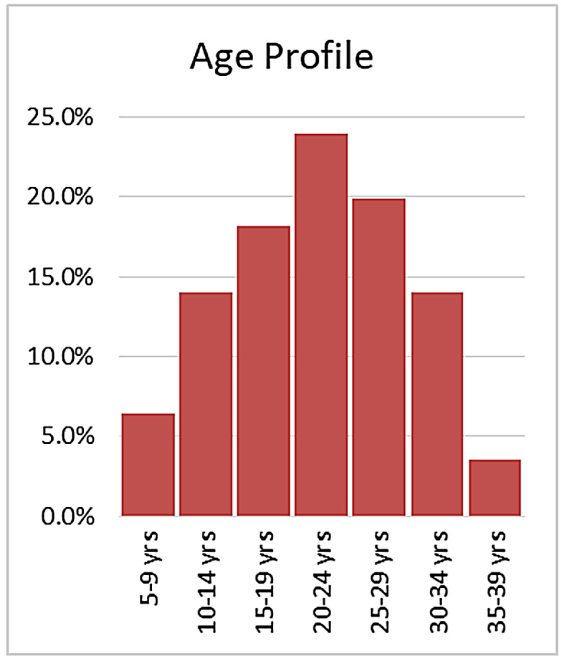

Figure 1: Mean age profile

Figure 2: Females were more affected, likely due to factors such as working from home, taking online classes, or, in the case of some housewives, spending most of their time on mobile devices watching videos or playing games.

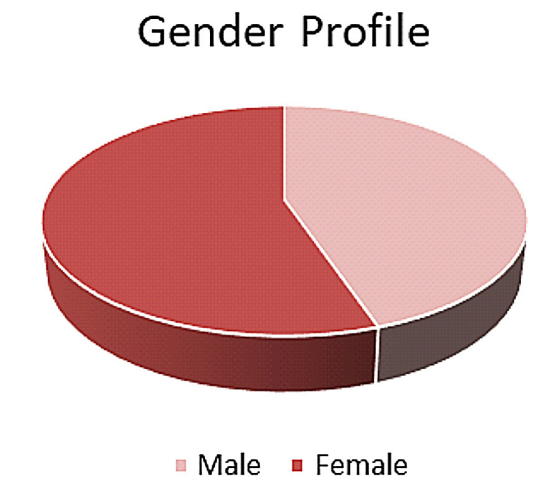

Figure 2: Male Female Ratio

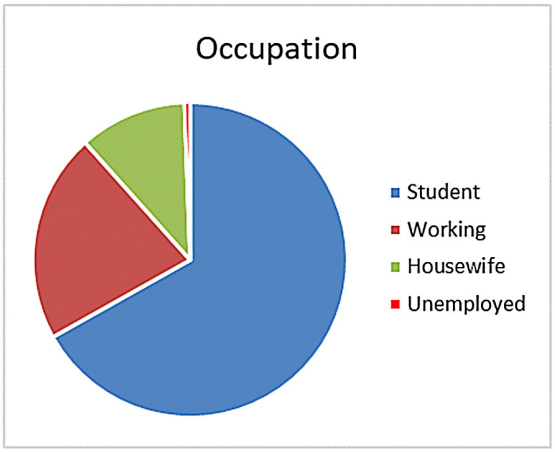

Figure 3: Occupation profile of patients entering the study

Out of 172 patients, 77 (44.8 %) were male and 95 (55.2 %) were female, as shown in figure 2. Females appeared to be more affected, possibly because some work from home or take online classes while others, such as housewives, spend a significant amount of time on mobile devices watching videos or playing games.

Out of 172 patients, 115 (66.9 %) were students, 37 (21.5 %) were employed, 19 (11.0 %) were housewives, and 1 (0.6 %) was unemployed (Figure 3).

As observed in figure 4, 73 eyes (42.4 %) exhibited compound myopic astigmatism, while 64 eyes (37.2 %) showed simple myopic astigmatism. Additionally, 29 eyes (16.9 %) had simple myopia, 5 eyes (2.9 %) had moderate myopia, and 1 eye (0.6 %) had high myopia.

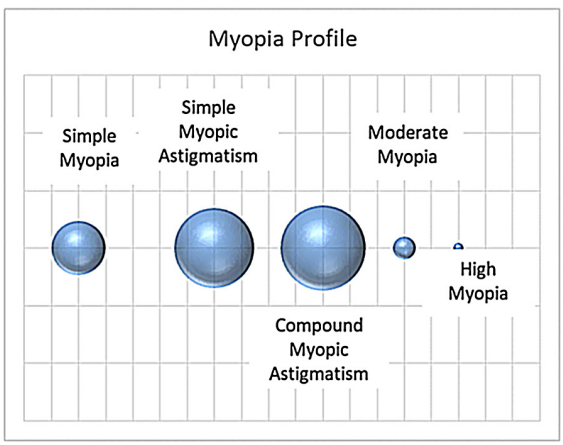

Figure 4: Refractive status of patients entering the study

Discussion

The aim of the study was to study the profile of myopic patients suffering from convergence insufficiency at an eye care center in northern India. A total of 172 myopic patients with CI, aged 5 to 39 years, were included; among them, 44.8 % were male and 55.2 % were female. Out of 172 patients, 115 (66.9 %) were students, 37 (21.5 %) were employed, 19 (11.0 %) were housewives, and 1 (0.6 %) was unemployed. Students were more affected; likely due to increased screen time from online classes and near work for their studies [9]. Meanwhile, housewives and unemployed patients were also affected, as they tend to spend most of their time on mobile devices rather than engaging in outdoor activities.

We observed that (42.4 %) of our patients exhibited compound myopic astigmatism, while 64 eyes (37.2 %) showed simple myopic astigmatism. Additionally, 29 eyes (16.9 %) had simple myopia, 5 eyes (2.9 %) had moderate myopia, and 1 eye (0.6 %) had high myopia.

Scheiman et al., [10] suggested that refractive errors are not the only cause of an abnormal near point of convergence. Other contributing factors include phorias, tropias, injuries, trauma, and psychological influences. To explore the relationship between refractive errors and CI, Davis et al., [11] conducted a comparative study. This study aimed to determine whether moderate or high astigmatism was associated with an increased rate of CI compared to children with no or

low astigmatism. Their sample included 485 students aged 9 to 16 years. The prevalence of convergence insufficiency was 6.2 % (30/484). Astigmatism <1.00 D was present in 43.8 % (212/484) of the subjects, astigmatism between >1 D and <3 D was present in 26.0 % (126/484), and astigmatism >3 D was present in 30.2 % (146/484). There was no significant relationship between the presence of CI and the magnitude of astigmatism.

In a study by Syeda et al., [12] one hundred and fifty Indian adolescents with myopia aged 10 to 17 years were divided into three refractive error groups (high, moderate, and low myopia). They reported that the most common dysfunction found in low myopia (75.3 %), and moderate myopia (54 %) was convergence insufficiency. High myopes (62.8 %) were found to have combined convergence and accommodative insufficiency followed by accommodative dysfunction (14 %) and basic exophoria (6 %). In a study by Akram et al., [13] the authors evaluated the relationship between convergence insufficiency and different refractive errors. They concluded that there is a weak relationship between refractive errors and convergence insufficiency and myopia is the only contribution to remote near point of convergence. The relationship between myopia and CI highlights the need of complete vision examinations and tailored therapies, such as vision therapy and corrective lenses, to reduce their combined effect on functional vision and everyday activities [14]. Similarly in our study myopia was found to be associated with convergence insufficiency. The differences between our study and others studies' findings may be attributed to factors such as age distribution, data collection techniques, gender distribution, occupation profile, and myopia profile (refractive status of each eye). The present study had some limitations including lack of a control group and being a single center study. Future multicenter controlled studies with higher sample sizes are recommended to further understand the relation between myopia and CI.

Conclusion

Our study results indicate that CI is commonly associated with myopia. CI was more prevalent in patients with compound myopic astigmatism, especially among adults aged 20–24 years. Therefore, regular eye examinations are essential to reduce asthenopic symptoms in these patients.

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Authors ORCIDs

Heena Gupta:
https://orcid.org/0009-0005-2115-3940

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Footnotes and Financial Disclosures

Conflict of interest:

The authors have no conflict of interest with the subject matter of the present manuscript.