



Original Research Article

Association of Gender and Educational Attainment with Convergence Insufficiency among Eye Care Patients in Rawalpindi.

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Abstract: Convergence is the manner in which both eyes turn and direct themselves towards objects that are in the vicinity. Convergence insufficiency is a condition that affects the functional ability of both eyes to work in harmony, particularly when focusing on nearby objects. Difficulty in focusing or the problem of ‘diplopia’ can be experienced when a person strains their eyes to look at an object that is near, such as the display screen of a mobile phone or book. In this cross-sectional study, 1,100 individuals were analyzed at Amanat Eye Hospital Rawalpindi. The subjects were screened at Amanat Eye Hospital Rawalpindi. Firstly, the medical history of each subject was obtained. Visual acuity was assessed carefully at a distance of 6 m using Snellen’s visual acuity chart. If the unaided visual acuity was found to be less than 6/6, clinical refraction was performed wherever required. Near point of convergence was assessed through the pencil push-up method, measured using a ruler, and near exophoria was assessed using the cover-uncover test. After the diagnosis of CI, the complaints of the subjects were recorded on a questionnaire. Ninety-nine individuals were diagnosed with Convergence Insufficiency among 1,100 individuals. Participants were categorized according to age, gender, educational level, impact on daily activities, and symptoms. The study provides valuable insights into the prevalence of Convergence Insufficiency among the study population in Rawalpindi. Regarding education levels, the frequency of convergence insufficiency was higher among participants with education below matriculation than among postgraduate participants. The most common symptoms were headache, eye fatigue, and double vision. Regarding gender distribution, the greater frequency of CI was found among females than males. The widespread undetected presence of CI was possibly associated with limited awareness of the condition among the Rawalpindi population. In the future, cooperative efforts between educators and healthcare providers could improve interventions and preventive measures, guaranteeing a comprehensive strategy to address visual problems in educational settings. Incorporating regular vision screening programs into educational institutions and implementing customized awareness initiatives will additionally facilitate early identification and appropriate management of convergence insufficiency.

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INTRODUCTION

Convergence is the manner in which both eyes turn and direct themselves towards objects that are in the vicinity. Convergence insufficiency is a condition that

affects the functional ability of both eyes to work in harmony, particularly when focusing on objects that are situated closer. Difficulty in focusing or the problem of ‘diplopia’ can be experienced when one strains their eyes

to look at an object that is near, such as the display screen of a mobile phone or a book [1]. Computers and reading have become essential activities in contemporary society. It is therefore possible for the quality of life to significantly decrease if a person develops near vision problems that negatively affect daily functioning. These near-vision problems can affect people of all age groups, including young children who are developing reading skills, computer users, and elderly patients who require clear near vision. Therefore, while diagnosing patients with near vision problems, practitioners should recognize and understand these abnormalities.

Convergence insufficiency is a relatively common condition that significantly affects near vision. Some of the symptoms include headache, double vision, and eye strain [2]. It may also lead to nausea, motion sickness, and/or dizziness [3]. In its pure form, it may occur as an isolated phenomenon, or it could be related to numerous other neurological diseases and could affect people at any age [4]. This is because of the subtle nature of this condition, and more often, parents and teachers end up perceiving these symptoms as learning disorders rather than recognizing them as signs of an ocular disorder [5].

CI is described by exophoric eye alignment, which is more pronounced at near, an increased near point of convergence (NPC), and decreased positive fusional vergence (PFV) while carrying out near work [6]. These symptoms are known to be especially worsened by reading and other related near-vision activities. The signs of convergence insufficiency include headache, double vision, eye fatigue, blurred vision, and sleepiness, especially when reading [7]. According to a prior study conducted in the United States, the frequency of convergence insufficiency in adults and children ranged from 2.25% to 8.30% [8].

Convergence insufficiency can manifest at any age; however, it is more common in young individuals. The prevalence of the condition is believed to range from 0.1% to 0.2%, affecting 11% to 19% of children with exodeviation [9]. Convergence insufficiency was found in 60.4% of the Romanian youth population who reported having trouble seeing during close vision tasks [10]. Furthermore, it was observed that the prevalence of convergence insufficiency was 5.46% in the Iranian population [11], yet significantly greater rates of 16.5% and 17.6%, respectively, were seen among Indian urban and rural populations [12].

Conventional therapies that are helpful in treating convergence insufficiency typically have a good prognosis for patients. To restore proper convergence, a small proportion of patients may nevertheless require surgery [13]. More recently, researchers examined several accommodative and binocular tests and found that the best test for detecting children with convergence insufficiency was the evaluation of the NPC break using an accommodating target [16]. Another recent study

found that a clinical cutoff value of more than 10 cm for the NPC break was the best predictor of convergence insufficiency for community-based screening, and that the minimum test battery needed to screen for non-strabismic binocular vision anomalies should include NPC with a penlight and a red filter [17].

Further testing can be carried out to confirm the diagnosis of potential convergence insufficiency, or a referral to another specialist can be made for further diagnosis and initiation of therapy. According to one study, many medical professionals diagnose individuals with convergence insufficiency using only the NPC [18]. A receding NPC, increased exodeviation at near compared with distance on cover tests, and decreased convergence amplitudes at near have historically been used to characterize convergence insufficiency [3]. The performance of these clinical tests varies greatly in practice. Convergence insufficiency can be diagnosed by some physicians using just one of the aforementioned criteria, whereas other physicians reserve the diagnosis for situations in which multiple criteria are satisfied [18, 19].

The primary aim of this study is to determine the prevalence of convergence insufficiency in Pakistan, specifically in the Rawalpindi district. Our study aimed to evaluate the prevalence of CI among individuals belonging to different educational groups, as CI may have a significant impact on educational activities, particularly when associated with excessive near work. In this study, we also focused on evaluating the frequency of CI among different genders, as females appeared to report symptoms and problems related to CI more frequently than males. A number of vergence exercises as a treatment modality will also be explained. The study also aims to increase awareness regarding the problems and effects of convergence insufficiency within the community, which may help local healthcare professionals and educators improve its clinical recognition and management in District Rawalpindi. After completing the questionnaire, patients were provided with information about CI and its management.

MATERIALS AND METHODS

Study Design and Setting

It was a cross-sectional study. Data were collected from Amanat Eye Hospital, Rawalpindi.

Study Duration

The study was conducted from October 2023 to December 2023.

Study Population

In this cross-sectional study, 1,100 individuals were included and assessed at Amanat Eye Hospital, Rawalpindi.

Inclusion and Exclusion Criteria

Individuals of all ages and genders who were residents of District Rawalpindi were included in the study.

Individuals with neurological disorders and individuals who were non-residents of District Rawalpindi were excluded from the study

Sample Size and Technique

A total of 1,100 subjects were included in the study. In this study, a non-probability convenience sampling technique was used.

Data Collection Procedure

The subjects were screened by following a standard protocol at Amanat Eye Hospital, Rawalpindi. First, the medical history of each subject was obtained. Visual acuity was assessed carefully at a distance of 6 m using Snellen's visual acuity chart. If the unaided visual acuity

was found to be less than 6/6, clinical refraction was performed wherever required. The near point of convergence was assessed using the pencil push-up method and measured with a ruler. Near exophoria was assessed using the cover-uncover test. After the diagnosis of CI, the complaints of the subjects were recorded using a questionnaire.

Data Analysis

The Statistical Package for the Social Sciences (SPSS), version 27.0, was used for data analysis. Descriptive statistics were performed for the study variables. Categorical variables were presented as frequencies and percentages.

RESULTS

A total of 1,100 individuals were analyzed, of whom 99 (9.0%) were diagnosed with convergence insufficiency (CI). Table 1 shows the demographic characteristics of the 99 participants diagnosed with convergence insufficiency. The most common age group was 11–15 years, comprising 25 (25.3%) participants, followed by 21–25 years with 23 (23.2%) and 16–20 years with 22 (22.2%). Females were more frequent than males, with 67 (67.7%) females and 32 (32.3%) males. Regarding educational level, most participants were under matriculation, 44 (44.4%), followed by intermediate, 21 (21.2%), graduate, 19 (19.2%), matriculation, 14 (14.1%), and postgraduate, 1 (1.0%).

Table 1. Demographic characteristics of participants diagnosed with convergence insufficiency

Characteristic	Category	Frequency (n)	Percentage (%)
Age group (years)	5–10	17	17.2
	11–15	25	25.3
	16–20	22	22.2
	21–25	23	23.2
	26–30	10	10.1
	31–35	2	2.0
Gender	Male	32	32.3
	Female	67	67.7
Educational level	Under matriculation	44	44.4
	Matriculation	14	14.1
	Intermediate	21	21.2
	Graduate	19	19.2
	Postgraduate	1	1.0
Total participants		99	100.0

Figure 1 shows the reported symptoms among participants with convergence insufficiency. Headache, double vision, and eye fatigue were the most commonly reported symptoms, occurring in 72 (72.0%) participants, followed by sleepiness when reading in 24 (24.0%). Needing to re-read things multiple times was reported by 2 (2.0%) participants, while difficulty concentrating on reading was reported by 1 (1.0%) participant.

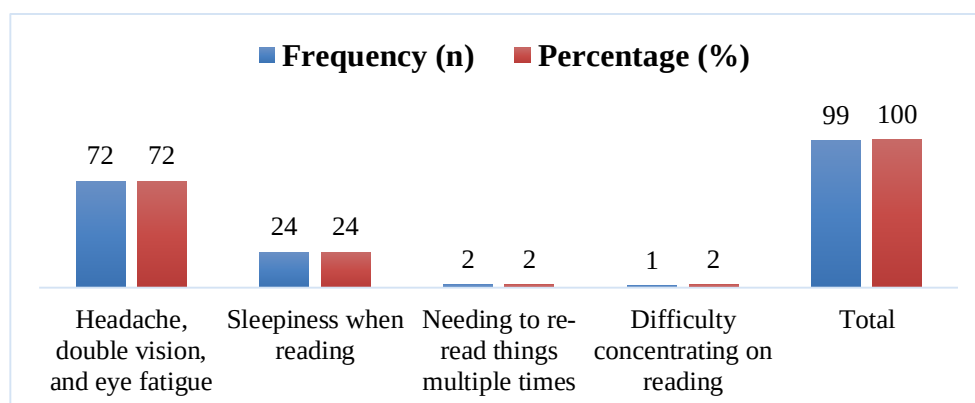


Figure 1. Distribution of reported symptoms among participants with convergence insufficiency

Figure 2 presents the duration of symptoms among participants with convergence insufficiency. Symptoms were reported as constantly present by 61 (61.6%) participants, followed by frequently by 21 (21.2%), occasionally by 14 (14.1%), and rarely by 3 (3.0%) participants.

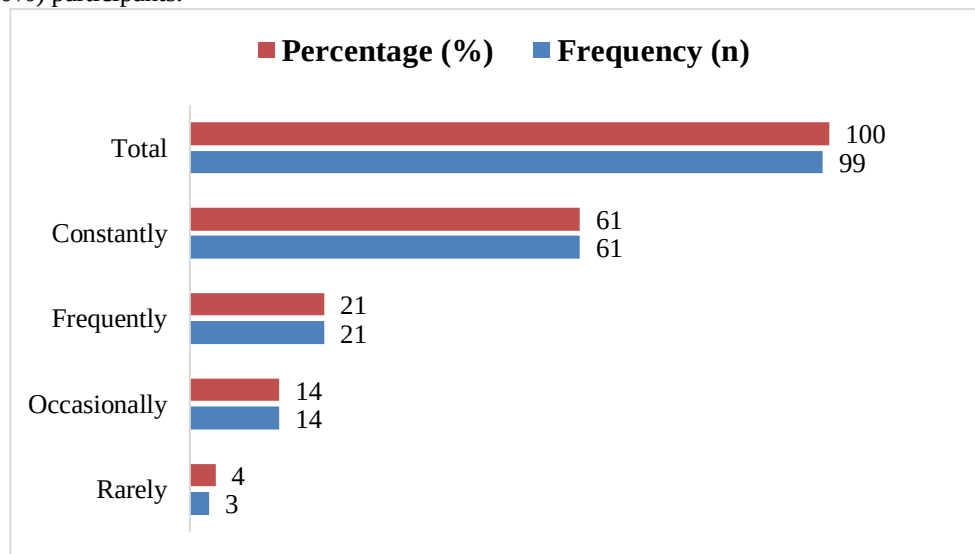


Figure 2. Duration of symptoms among participants with convergence insufficiency

Figure 3 illustrates the occurrence pattern of symptoms. Symptoms occurred moderately in 35 (35.4%) participants, persistently in 27 (27.3%), briefly in 23 (23.2%), and varied in 14 (14.1%) participants.

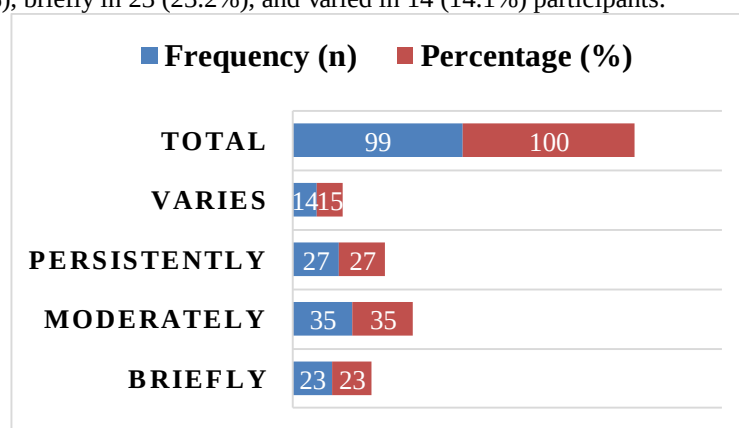


Figure 3. Occurrence pattern of symptoms among participants with convergence insufficiency

Figure 4 shows the impact of convergence insufficiency on daily life activities. A total of 48 (48.0%) participants reported that CI affected their daily activities, whereas 51 (52.0%) participants reported no impact.

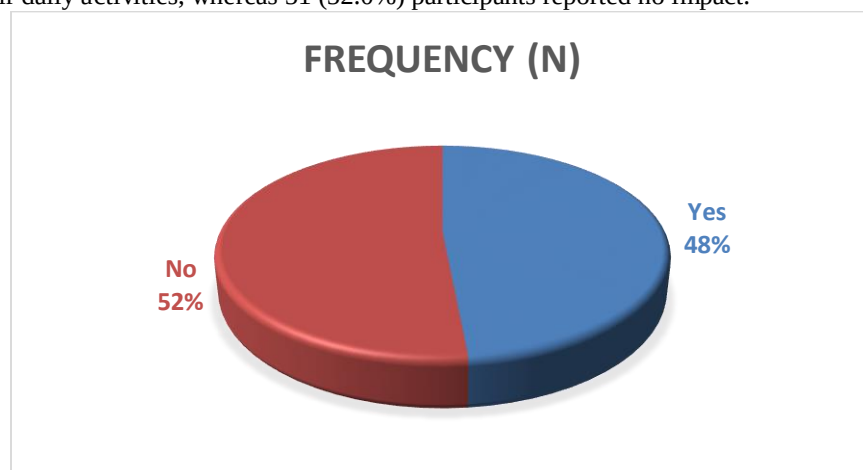


Figure 4. Impact of convergence insufficiency on daily life activities

Table 2 presents the frequency of convergence insufficiency according to gender and educational level. Females represented the larger proportion of participants with CI, accounting for 67 (67.7%), compared with 32 (32.3%) males. Regarding educational attainment, the highest frequency was observed among participants under matriculation, 44 (44.4%), while the lowest was among postgraduate participants, 1 (1.0%).

Table 2. Frequency of convergence insufficiency according to gender and educational level

Characteristic	Category	Participants with CI (n)	Percentage (%)
Gender	Male	32	32.3
	Female	67	67.7
Educational level	Under matriculation	44	44.4
	Matriculation	14	14.1
	Intermediate	21	21.2
	Graduate	19	19.2
	Postgraduate	1	1.0
Total		99	100.0

DISCUSSION

Convergence insufficiency is an eye condition that affects how both eyes work together when looking at close objects. Individuals who have CI may have difficulty controlling their eye movements, especially when they are looking from a distant object to a near object [29]. The current study focused on differences in educational level and gender to evaluate the frequency of convergence insufficiency (CI) among eye-care patients in Rawalpindi. A total of 1,100 individuals were analyzed, of whom 99 (9.0%) were diagnosed with CI. The results showed notable differences in the frequency of CI according to gender and educational attainment, which were compared with findings from previous studies.

In our study, females accounted for a higher proportion of participants with CI, comprising 68% of the total CI group, compared with males. Similarly, one study found that women had a greater frequency of CI. Further research is necessary to determine the causes of this gender difference, with possible factors including hormonal influences and variations in visual demands between males and females [30].

In our study, the education-level-based distribution showed a higher frequency of CI among participants with education below matriculation compared with other educational groups. Similar findings have been reported in previous studies. In one study, 4,211 students were screened, of whom 329 (7.8%) were diagnosed with CI [30]. In another study, 735 schoolchildren aged between 7 and 14 years were screened, of whom 70 (9.5%) had CI [31]. Another study showed that CI was more common among teenagers, while its frequency decreased with increasing age [9]. These findings raise the possibility that prolonged screen time, watching cartoons on mobile phones, and predominantly indoor activities may be associated with near-vision symptoms [32]. However, these factors were not directly assessed in the present study and therefore cannot be considered causal factors.

It is important to recognize the differences in

methodology between studies when comparing the results. Although our research used a cross-sectional design, other studies have used different approaches, such as the randomized clinical trial conducted by the Convergence Insufficiency Treatment Trial Investigator Group [33]. Therefore, differences in study design, population characteristics, diagnostic criteria, and sampling methods may contribute to variations in the reported frequency of CI [34,35].

In our study, several symptoms, including headache, double vision, eye fatigue, sleepiness when reading, needing to re-read things multiple times, and difficulty concentrating on reading, were observed among patients with CI. Headache, double vision, and eye fatigue were the most frequently reported symptoms, occurring in 72 (72.0%) participants. Similarly, a previous study reported symptoms such as headache, double vision, eye fatigue, blurred vision, sleepiness when reading, needing to re-read things a few times, and difficulty concentrating on reading, particularly during prolonged near work [9]. These findings highlight the importance of recognizing common near-vision symptoms when evaluating patients for convergence insufficiency.

CONCLUSION

The study provides valuable insights into the frequency of convergence insufficiency among eye-care patients in Rawalpindi. Regarding educational level, the frequency of convergence insufficiency was higher among participants with education below matriculation than among postgraduate participants. The most common symptoms were headache, eye fatigue, and double vision. Regarding gender distribution, a greater frequency of CI was found among females than males. The findings suggest that convergence insufficiency may remain under-recognized, highlighting the need for greater awareness among patients, educators, and healthcare providers in Rawalpindi.

Limitations

The study was cross-sectional and was conducted within a limited study period, which restricted the ability to establish temporal or causal relationships. The

distribution of participants according to gender was also unequal, with a higher proportion of females than males in the CI group.

Recommendations

Furthermore, cooperative efforts between educators and healthcare providers could improve interventions and preventive measures, ensuring a comprehensive strategy to address visual problems in educational settings. Incorporating regular vision screening programs into educational institutions and implementing customized awareness initiatives may facilitate early identification and appropriate management of convergence insufficiency.

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Authors' Contributions

Clinical data collection: Muhammad Numan, Shaheryar Tahir, Dr Abdulaziz and Dr Hamad Tariq.

Data analysis: Muhammad Numan and Shaheryar Tahir.

Manuscript writing and revision: Muhammad Numan, Dr Abdulaziz, and Dr Israr.

Study supervision and coordination: Dr Abdulaziz, Dr Israr, and Dr Hamad Tariq.

Final approval: All authors have read and approved the final version of the manuscript and agree to be accountable for all aspects of the work.

Availability of data and materials

All the data used to support the findings of this study are included within the article and are available on request from corresponding author.

Declarations

Ethics approval and consent to participate

Approval was obtained from the Ethical Committee of Bashir Institute of Health Sciences Islamabad (BIHS), and the study was carried out in accordance with the Declaration of Helsinki.

Written informed consent was obtained for participation in the study from families' members and parents of the children's.

Consent for publication

Written informed consent for the publication of these details have been obtained from the patients.

Competing interests

The author(s) declare that they have no competing interests.

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