



## Original Research Article

## The relationship between headache and convergence insufficiency

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## ARTICLE INFO

## Article history:

Received 16-10-2020

Accepted 24-10-2020

Available online 29-04-2021

## Keywords:

Asthenopia  
Convergence  
Astigmatism  
Headache

## ABSTRACT

Convergence insufficiency (CI) is a common dysfunction of binocular vision. The prevalence of Convergence Insufficiency varies widely ranging from 2% to 27%. The role of CI as a cause of headache is neglected often. In this study, the association between Convergence insufficiency and Headache was being evaluated.

**Aim:** To assess the prevalence of Convergence Insufficiency in headache patients.

**Materials and Methods:** A prospective descriptive study included 84 patients in the age group 5 - 36 years with complaints of headache. After taking detailed history about headache pattern and asthenopic symptoms, complete ocular evaluation of both anterior and posterior segment examination, Refraction and Binocular vision assessment was done. Data was analysed by Percentage and Chi square test.

**Results:** In this study, the prevalence of Convergence Insufficiency was 26.2% among headache patients CI was more common in female patients (63.6%) than in male patients (36.4%). 72.8% of CI was seen in young patients in the age group 10 – 29 years. Frontal headache (78.7%) and Astigmatism (45.5%) was frequently associated with CI. Increase in the Near Point of Convergence (NPC) value and decrease in the value of Base out Prism was associated with asthenopic symptoms in CI patients.

**Conclusion:** Convergence Insufficiency is frequently associated with headache especially in younger patients. In this electronic era, the demand for near work has increased. Apart from thorough refractive evaluation, binocular vision assessment is also important in younger patients presenting with headache.

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## 1. Introduction

Headache is defined as pain or discomfort arising from any pain-sensitive structures in the head.<sup>1</sup> Headache is one of the most common symptoms for patients seeking medical attention. In the Global Burden of Disease Study, updated in 2013, Headache disorders collectively were the highest cause worldwide of years lost due to disability (YLD).<sup>2</sup>

Even though the evidence in the literature for a strong association between ocular diseases and headache is weak, Ophthalmologists are usually the first physicians to evaluate patients with headaches. Refractive errors, presbyopia,

binocular vision anomalies, glaucoma, inflammatory diseases, computer vision syndrome are the common ocular causes for headache.<sup>3</sup>

Convergence insufficiency (CI) is a common dysfunction of binocular vision. Convergence insufficiency (CI) is the inability to accurately converge or to maintain convergence at near. The symptoms can vary from redness, pain in and around the eyes, blurred vision, frontal headache, and intermittent diplopia for near vision. In literature, the prevalence of Convergence Insufficiency varies widely ranging from 2 % to 27%.<sup>4,5</sup> Binocular vision anomalies have been a major cause of headache which goes undetected due to neglect towards this aspect as a cause of headache.

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In this study, the association between Convergence insufficiency and headache was evaluated.

## 2. Materials and Methods

It was a prospective cross-sectional study conducted in the department of Ophthalmology, at a tertiary eye care hospital. The approval from the Institutional ethics committee and an informed written consent from the patients was obtained.

The study included 84 patients with complaints of headache who either had come by their own or were referred from other departments to the department of Ophthalmology. Patients were also referred to other departments to rule out non-ocular cause of headache.

### 2.1. Inclusion criteria

Any patients with headache aged from 5 to 35 years

### 2.2. Exclusion criteria

Age > 36 years of age, unco-operative patients, any patients with strabismus, inflammatory ocular diseases, post ocular surgery/ trauma, pregnancy, recent history of hospitalization (within 3 months before the date of examination) for any systemic illness.

Detailed history was obtained from all the participants regarding the demographic profile, the headache pattern and asthenopic symptoms. Ocular evaluation consisted of detailed refractive check-up with retinoscopy, binocular vision assessment and anterior segment by slit lamp examination and posterior segment examination by +90 D with slit lamp biomicroscopy.

Refractive errors were classified as myopia, hyperopia and astigmatism. Myopia was defined as a spherical equivalent of  $\geq -0.50$  Diopters (D), hyperopia was defined as a spherical equivalent of  $\geq +0.50$  D, astigmatism was defined as the cylindrical component of the refractive error more than 0.50 D.

CI is defined as Near Point of Convergence (NPC) >10 cm, positive fusional vergence and exophoria greater for near than for distance. Near point of Convergence (NPC) and Near point of Accommodation (NPA) was measured with a Royal Air Force (RAF) ruler. Fusional reserves were measured with a vertical bar prism using an accommodative target. Near base-in and base-out fusional reserves were recorded at the break point. Heterophoria was measured first, followed by divergence amplitudes and then convergence amplitudes to prevent vergence adaptation.

Data was entered in Microsoft excel sheet. These individual data were analysed by Percentage and Chi square test. P value < 0.05 is considered statistically significant.

## 3. Results

A total of 84 patients with headache complaints participated in the study. Females constituted the majority of patients (66.6%) and males (33.3%).

**Table 1:** Age distribution in headache patients

Age	Percent
0-9 years	2.4
10 -19 years	50.0
20- 29 years	28.6
30 – 35 years	19.0
Total	100.0

50% was in the school going age group 10 – 19 years. Among the participants, 57.14 % were students (both school and college), 28.57% were home makers and 2.3% had computer related works.

Among the headache patients, astigmatism was seen in 59.6%; mainly myopic astigmatism seen in 31%. Emmetropia was seen in 33.3% , myopia 4.8 % and hypermetropia in 2.4%.

Abnormal Near point of convergence > 10 cm was seen in 26.2 % of headache patients. Base out prism value less than 18ΔD was seen in 23.8 %. In this study, the prevalence of Convergence Insufficiency was 26.2% among headache patients.

**Table 2:** Age and convergence insufficiency.

Age	Percentage of CI
5 -9 years	0
10 – 19 years	36.4%
20 – 29 years	36.4 %
30 – 35years	27.3 %

72.8% of CI was seen in young patients. CI was more common in female patients (63.6%) than in male patients (36.4%) in our study. House wives were commonly affected (45.5 %) when compared with the students (36.4%).

**Table 3:** Type of headache and Convergence insufficiency

Type Headache	Percent in CI
Frontal	78.7%
Occipital	9.09%
Diffuse	9.09%
Others	9.09%

Frontal headache was seen in 78.7% of patients with CI. The frequency of other symptoms were defective vision 36.4 %, eye strain 45.5 % and Eye pain 54.5 %. Intermittent diplopia was not seen in any patients.

In this study, astigmatism was seen in 45.5% of CI patients, followed by emmetropia (36.4%). 72.7% of CI patients had vision between 6/12 to 6/6.

**Table 4:** Association between Base out prism and NPC

		NPC		Total	
		$\geq 10$	$< 10$		
Base out prism	<18	Count	18	22	
		% within Base out prism	81.8%	18.2%	100.0%
		% within NPC	81.8%	6.5%	26.2%
	>18	% of Total	21.4%	4.8%	26.2%
		Count	4	58	62
		% within Base out prism	6.5%	93.5%	100.0%
Total	>18	% within NPC	18.2%	93.5%	73.8%
		% of Total	4.8%	69.0%	73.8%
		Count	11	31	42
	Total	% within Base out prism	26.2%	73.8%	100.0%
		% within NPC	100.0%	100.0%	100.0%
		% of Total	26.2%	73.8%	100.0%

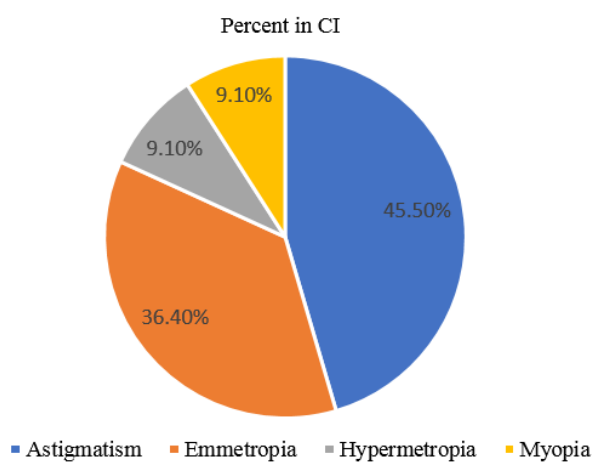
**Fig. 1:** Refractive error and CI

Table 4 show the between Base out prism and NPC is found to be statistically significant with Chi-Square value: 23.85 (p-value < 0.005)

The association between Base out prism and eye pain is found to be statistically significant with Chi-Square value: 6.74 (p-value < 0.005). The association between eye pain and NPC is found to be statistically significant with Chi-Square value: 19.21 (p-value < 0.005). Age group, gender, occupation, other symptoms were not statistically significant.

#### 4. Discussion

In this era of increased technological use of computers and cell phones, the importance of binocular vision anomalies have become more significant. CI is the most common and the easily treatable vergence anomaly.

In this study, the prevalence of Convergence Insufficiency was 26.2% among headache patients. This prevalence is less than Garg et al<sup>6</sup> (39.19%) but more than Sanjay et al<sup>7</sup> (16.25%) and Amy et al<sup>8</sup> (18.7%). The

prevalence is similar to Vaishali RS et al<sup>5</sup> (27.5%). These discrepancies might be due to different occupation of the patients in the study group.

72.8% of CI patients were in the age group 10 -29 years. Females outnumbered males in a ratio of 2:1 with 36.4% males and 63.6% females. These findings correlates with the literature.<sup>6,7</sup> Since young patients has more stress in their academics and profession, headache is more common in this group and they seek medical advice frequently.

The association between Base out prism break with abnormal NPC was statistically significant. Base out prisms abolishes the fusion and causes diplopia, causing strain on the convergence system to maintain binocular single vision. In case of CI, the amplitude of fusional vergence is less and so these patients cannot converge with Base out prisms. These patients will be more symptomatic. This correlates with our finding where the association between Base out prism and eye pain is found to be statistically significant.

Near point of convergence (NPC) is the point where the binocular single vision is maintained with maximum effort of the convergence when a near target is presented. In CI, NPC value increases.

Frontal headache (78.7%) was frequently associated with CI in our study similar to Garg et al<sup>6</sup> and Sanjay et al.<sup>7</sup> Asthenopic symptoms were seen in 82 % of CI patients, asymptomatic in 18%). The asthenopic symptoms are frequent when the NPC and Base out prism values are more deranged.

In our study, CI was commonly seen in astigmatism (45.5%). This correlates with Amy et al<sup>8</sup> and Sanjay et al.<sup>7</sup> Headache is frequently associated with astigmatism.<sup>9</sup> In this study, since headache patients were the study population, CI is frequently associated with astigmatism. Gupta et al<sup>10</sup> reported that CI was common in myopia. Vaishali RS et al<sup>5</sup> reported no correlation between CI and refractive error.

## 5. Conclusion

This study provides the evidence that vergence anomalies are frequently associated with headache. But exact percentage of these anomalies causing headache needs further study as these anomalies are associated with refractive error often. We conclude that thorough refractive evaluation and binocularity evaluation are important in patients presenting with headache especially in younger age group as their demand for near work is very high in this technology driven era. With early detection of convergence insufficiency, quality of vision and life can be maintained.

## 6. Source of Funding

No financial support was received for the work within this manuscript.

## 7. Conflict of Interest

The authors declare they have no conflict of interest.

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**Cite this article:** Priya SV, Priya TV, Amudha P, Lalithambigai C. The relationship between headache and convergence insufficiency. *Panacea J Med Sci* 2021;11(1):147-150.