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RESEARCH

Effect of correction of refractive error and threshold estimation in ocular headache patients in a tertiary eye care center

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Purpose: Headache is one of the most common symptoms in patients with refractive error. Our study aimed to find the effect of refractive error correction and estimate the threshold of refractive error in patients with ocular headaches in a tertiary eye care center.
Methods: We enrolled patients who came with complaints of headaches. It was a prospective, interventional study. All the patients underwent comprehensive ocular examination that included a detailed headache history, objective and subjective refraction, cycloplegic refraction, Humphrey visual fields test (30-2), cover test, and dilated fundus examination. We excluded uveitis, glaucoma, optic atrophy, papilledema, sinusitis, migraine, dental cavities, and neuropathy patients. We prescribed glasses after the post-mydriatic test. We surveyed via phone call regarding the compliance of spectacle wear and relief of headaches.
Results: Out of the 98 enrolled patients, 67 were female and 31 were male in the age group of 16 to 35. The patients had simple astigmatism (57.14%), simple myopia (15.30%), simple myopic astigmatism (23.46%), and hyperopia (9.18%). The threshold value of dioptric power was −1.25 D, −1.00 D, −0.75 DS/−0.75 DC, and +1.00 D for simple astigmatism, simple myopia, simple myopic astigmatism, and hyperopia, respectively. 86.73% recovered with glasses. Simple astigmatism had the highest recovery rate. Headaches frequently occurred in the frontal (44.89%), followed by temporal (32.65%), parietal (16.32%), occipital, and parietal (11.22%).
Conclusion: Lower degrees of refractive error caused the headache. We reported the threshold values of the refractive error that caused the ocular headache. Correcting the refractive error relieved the headache.

Keywords: headache, refractive errors, astigmatism, hypermetropia, myopia

1 Introduction

Headache is defined as a continuous or prolonged dull pain that is felt on both sides of the head or at the back of the neck and head. It is said that the severity of headache is higher in females than males. The lifetime prevalence of headaches is 99% (1). It is a predisposing factor for a medical emergency. Headache affects the quality of life by reducing productivity (2). Studies report that 60% of people with headaches used only over-the-counter medication. Migraine and tension-type headache is ranked first and second common type of headache by the Global burden of disease study (3). This type of headache is firstly due to the contraction of the ciliary muscle for prolonged periods to improve visual acuity. Secondly because of the prolonged contraction of brows, scalp, and neck to maintain clear visual acuity, especially during near work (4). The most common types of refractive error causing headaches are hypermetropia and astigmatism, where myopia is infrequent (4). There is a correlation between headache and uncorrected refractive error (5).

The International Headache Society (IHS) has defined HARE (Headache Associated with Refractive Error) as the condition with (1) Uncorrected or under-corrected refractive errors, (2) Headache in the frontal region, and (3) Headache getting aggravated during the day on prolonged near tasks (6).

Although there are evidences showing that correcting the refractive errors improves 90% of migraine headaches (5), no author estimates the threshold of refractive error that causes the headache. Our study aimed to find the effect of refractive error correction and estimate the threshold of refractive error when reported with ocular headache in a tertiary eye care center.

Our objective was to determine if the correction of refractive errors contributes to the resolution of headache and to know the type of refractive error that is commonly present with headache.

2 Methodology

This hospital-based prospective interventional study was conducted after obtaining approval from the institutional review board. The study was done in a tertiary eye care center in Chennai. We included both female and male patients with headache as the primary complaint with any frequency of onset under the age group of 16 to 35 years. Patients with a known history of ocular disease, sinusitis, dendrites, neuropathy, and other systemic conditions that cause headaches were excluded. Informed consent was obtained from all the patients based on inclusion criteria. This research followed the tenets of the declaration of Helsinki. All the patients included had uncorrected or mis corrected refractive errors.

We performed a comprehensive eye examination which included a detailed headache history. Our headache history had the following questions as described by Seymour Diamond (7), which included the frequency (the number of episodes per week), onset (age), location, duration of each episode, associations like photophobia, nausea, vomiting, stooping, quality (mild, moderate, severe), and relieving factors.

We examined unaided distance and near visual acuity using a Snellen chart at 6 meters, and reduced Snellen near acuity at their preferred reading distance. Retinoscopy, subjective refraction, duochrome, Jackson cross cylinder refining, and a cover test were done to diagnose any muscle imbalance, and Humphrey visual field (30-2) was done to rule out headache due to neurological disorders. Each patient underwent dilatation using tropicamide 0.8% with phenylephrine hydrochloride 5% and dilated fundus was examined. Spectacles were prescribed for patients with refractive error after the post-mydriatic test.

Constant use of spectacles was advised to all the patients.

The follow-up questions after 1 month via phone call were:

1. Did you wear your glasses continuously?	(a) Yes (b) No (c) Occasionally
2. How is your headache now?	(a) Completely got relieved (b) Severity has been reduced (c) Still the same

3 Results or finding

A total of 103 patients were included in the study, of whom 98 patients were enrolled in the study as per inclusion criteria, 67 females and 31 males (**Figure 1**) in the age group of 16 to 35.

3.1 Distribution of refractive errors

Among the 98 subjects, the patients had simple astigmatism (57.14%), simple myopia (15.30%), simple myopic astigmatism (23.46%), and hyperopia (9.18%). Range of astigmatism is as given below:

Mild astigmatism < 1.00 D
Moderate astigmatism 1.00 to 2.00 D
High astigmatism 2.00 to 4.00 D
Extreme astigmatism > 4.00 D (**Figure 2**)

3.2 Region distribution of headache

Out of the 98 patients, 44.89% patients had headache in frontal, 32.65% temporal, 16.32% parietal, 11.22% occipital and parietal (**Figure 3**).

3.3 Symptoms relief after correcting the refractive error

After correcting the refractive error by prescribing glasses, 85 patients got relieved after 1 month of follow-up. 84.90%

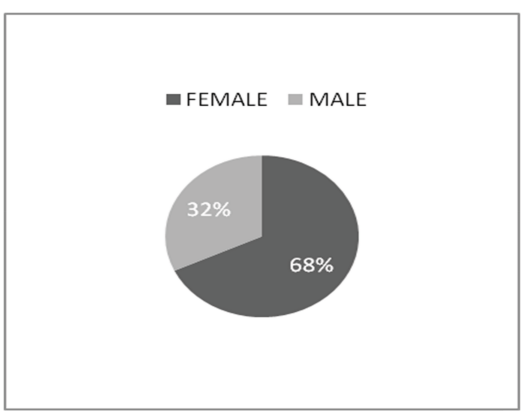

FIGURE 1 | Distribution of gender.

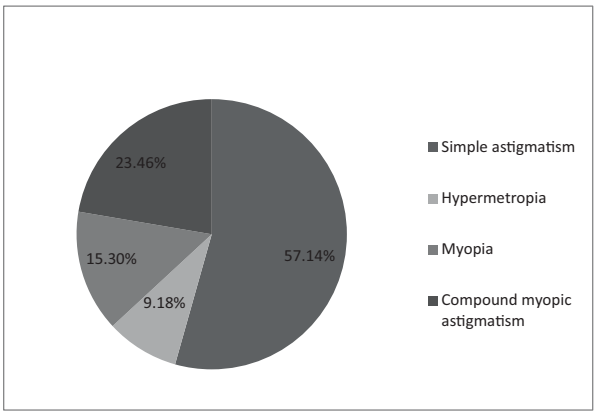

FIGURE 2 | Distribution of refractive errors.

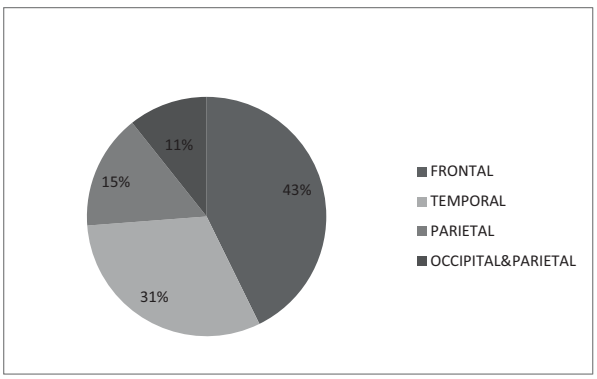

FIGURE 3 | Regional distribution of headache.

relief was seen in simple astigmatism, 100% relief was seen in hypermetropia, 93.33% relief in myopia, 77.27% relief in simple myopic astigmatism (**Table 1**).

Hypermetropia showed higher recovery followed by myopia, compound myopic astigmatism, simple astigmatism.

Symptom relief was seen highest in frontal headache followed by temporal, parietal, and occipital parietal.

Frontal headache showed the maximum recovery followed by parietal, temporal, occipital parietal.

TABLE 1 | Symptomatic relief after glass prescription.

Type of refractive error	Patients (n = 98)	Symptom relief (n = 85)
Simple astigmatism	53	45
Hypermetropia	9	9
Myopia	15	14
Compound myopic astigmatism	22	17

4 Discussion

Headache is a major complaint of patients attending ophthalmic OPD worldwide. The incidence of headache was slightly higher in refractive errors including presbyopia in 65% of cases, followed by a muscle imbalance in 18% and anterior segment abnormalities in 21% of cases (7). The patient presents with ocular discomfort on long hours of near and distance work. This is associated with headaches usually in the frontal region (5). The mechanism of headache in astigmatism, especially in lower degrees, is where the muscles contract irregularly, which causes more severe headaches (8). Frontal headache is more common than occipital headache (9). The International Headache Society states that there is a correlation between uncorrected or mis corrected refractive error and headache based on the classification of secondary headache (10). Similarly, our study also showed the correlation between uncorrected refractive error and headache. A few studies have shown similar results. A study demonstrated a higher incidence of headaches in children with astigmatism relieved by correcting the refractive error (11). Similarly, another study demonstrated a small but statistically significant correlation between refractive error and headache in schoolchildren (7). An article found a significant association between refractive error (34.2%) and headache. They found that hypermetropia is the most common cause of headaches, but they did not find any increase in headache frequency in myopia but a significant increase in hypermetropia (11).

One hypothesis is that a low degree of astigmatism makes some changes in the visual cortex of the brain in subjects with headache (12). Our study showed simple astigmatism, 54.36%, has the highest occurrence of headache followed by myopic astigmatism, 22.33%, myopia, 14.56%, and hypermetropia, 8.73%. Studies have reported that refractive errors alone cause nearly 44% of total cases complaining of headache, of which 63.6% have astigmatism (13).

A low magnitude of astigmatism is the most common refractive cause of ocular headaches in young individuals (14) In low-grade astigmatism, to obtain distinct vision, efforts of accommodation put a considerable strain on the eyeball and lead to symptoms of asthenopia, with headaches being the most prominent symptom (15). Symptomatic relief in asthenopic symptoms has been reported following the correction of refractive errors, (16–18) thus lending strength to the relationship between refractive errors and headache.

5 Conclusion

In the study, lower degrees of refractive error caused the headache. Correcting the refractive error relieved the headache. The highest prevalence of headache with refractive error was under the age group of 21 to 24, both male and female. The threshold dioptric power was found within −1.25 DC in simple myopic astigmatism, −0.75 DS ± 0.25 DS in myopia, +1.00 DS under fogging technique in hypermetropia, and −1.12 spherical equivalent

in compound myopic astigmatism. Simple astigmatism shows the highest prevalence of refractive error, which tends to cause headaches. The frontal is the frequent region causing headaches in patients with uncorrected or miscorrected refractive errors. Simple astigmatism showed the highest recovery rate among refractive errors. We conclude that proper correction of refractive errors clinically improves the complaint of headache and subsequently reduces the frequency of episodes.

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Author contributions

SB: Conceptualization, Methodology, Formal analysis, Writing – original draft, Visualization. PN: Data curation, Investigation, Validation, Writing – review & editing. MS: Software, Resources, Project administration, Writing – review & editing. S: Writing – review & editing.

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