Prevalence of astigmatism in headache

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Abstract

Aim: To study the prevalence of uncorrected low grade astigmatism as the sole cause of headache.

Materials and Methods: It is a prospective cross sectional study, conducted in the Department of Ophthalmology for 18 months. A total of 400 patients presenting with headache as the single complaint were enrolled in the study. All the patients were evaluated for presence of astigmatism with the help of visual acuity, retinoscopy, keratometry and post mydriatic test and then the follow up was done at 4, 8 and 12 week to see the status of headache.

Results: The prevalence of uncorrected astigmatism among cases presenting with headache as the single complaint was 49.3%. Age of patients ranged from 14 to 35 years with a mean age of 22.85±6.43 years, however, proportion of patients with age ≤20 years was significantly higher among astigmatism cases (50.8%) as compared to that of patients without astigmatism (40.9%). Mean age of astigmatic patients was also lower (21.72±5.53 years) as compared to that of those not having astigmatism (23.94±7.03 years). Majority of patients were females (69.8%). Statistically no significant association between gender and astigmatism was seen.

Conclusion: The findings of the study thus suggested that among cases presenting with headache as the sole cause, prevalence of astigmatism is quite high and treatment of uncorrected astigmatism brought about a phenomenal improvement in symptoms of headache.

Keywords: Astigmatism, Headache.

Introduction

Astigmatism is a Greek word, which has two components, "a" means absence and "stigma" means a point. It is a refractive error (ametropia) that occurs when parallel rays of light entering the non-accommoding eye are not focused on the retina.[1]

Refractive errors are one of he leading causes of headache and among these Astigmatism is of significant importance.[2] Association between refractive errors and headache has been established in various studies in almost all age groups.[3,4] Studies have reported that refractive errors alone cause for nearly 44% of total cases complaining of headache, of which 63.6% have astigmatism.[5]

Although International Headache Society (IHS) in its classification system[6] places Headache Associated with Refractive Errors (HARE) as a separate category of diagnosis of headache with the following diagnostic criteria:

1. Uncorrected [or miscorrected] refractive errors (e.g. hypermetropia, astigmatism, presbyopia, wearing of incorrect glasses).
2. Mild headaches in the frontal region and in the eyes themselves.
3. Pain absent on awakening, and aggravated by prolonged visual tasks at the distance or angle where vision is impaired.

The evidence suggests a close relationship between headache and refractive errors in general and astigmatism in particular.[7-10]

A low magnitude of astigmatism is the most common refractive cause of ocular headaches in young individuals.[11-13] In low grade astigmatism, to obtain distinct vision, efforts of accommodation put a considerable strain on the eyeball and lead to symptom of asthenopia, with headache being the most prominent symptom.[14] A symptomatic relief in asthenopic symptoms has been reported following correction of refractive errors,[15] thus lending strength to the relationship between refractive errors and headache.

Although there is a strong popular belief of causative effect of refractive errors on headache yet there is no definite evidence that refractive errors alone can be a cause of chronic headaches.[16] With this background, the present study was planned to study the prevalence of uncorrected astigmatism as the sole cause of headache and to quantify the minimum extent of astigmatic error which can be responsible for the symptomatic presentation of headache and to evaluate the impact of refractive correction using spectacles on the symptomatic relief of headache.

Despite this relationship being widely assumed, there are limited studies evaluating the prevalence of astigmatism among patients presenting for refractive error assessment with a sole complaint of headache. Moreover, the literature is scarce regarding the systematic assessments studying the impact of corrective measures on the headache complaints.

Materials and Methods

The present study was a prospective cross sectional study, conducted in the Department of Ophthalmology at Era's Lucknow Medical College and Hospital, Lucknow after getting Institutional Ethical clearance.

Inclusion criteria comprised of patients presenting with headache as the sole complaint, aged between15-35 years and giving valid informed consent and excluding those cases having any known disease which may cause or contribute to headache.

Demographic details including age and sex were noted. Thorough ocular evaluation was done on all selected patients both clinically as well as with the help of diagnostic instruments. Visual acuity both with and without pin hole was done using Snellen's charts; both uncorrected and best corrected visual acuity was noted. Retinoscopy was performed to evaluate the astigmatism using Pristley smith retinoscope, Keratometry was performed using Keratometer.

Astigmatism was defined as cylindrical refractive error measured after cycloplegia of more than or equal to 1.5 Diopter in either eye expressed in positive correcting cylinder form.

The astigmatism was further classified as:

Simple myopic astigmatism: when there was myopia in one meridian and emmetropia in the other meridian, *e.g.* -0.50 x 180.

Compound myopic astigmatism: when there was myopia in all meridians, of differing amounts, *e.g.* -0.50 DS/ -0.50DC x 180.

Simple Hypermetropic Astigmatism: When there was hyperopia in one meridian and emmtropia in the other meridians. For example +2.5 DC x 180 (diopter sphere).

Compound Hypermetropic Astigmatism: When there was hypermetropia in all meridians, of differing amounts. An example of compound hyperopic astigmatism is +0.50DS/ +0.50DC x 180.

Mixed astigmatism: When there is myopia in one meridian and hyperopia in the other meridian. An example of this is -0.75DS/ +1.25DC x 180.

All the patients of astigmatism were prescribed glasses and were requested for follow up at 4. 8 and 12 week of using glasses. At each follow up the patients were advised to rate the change in pattern of headache as either complete resolution, improvement, no change or worsening of Headache. The data so collected was subjected to statistical analysis using Statistical Package for Social Sciences, version 15.0. For, categorical data Chi-square test was used whereas continuous data was analyzed using paired 't'-test and student "t"-test. The confidence level of the study was kept at 95% and hence a "p" value less than 0.05 indicated a statistically significant association.

Results

The present study was carried out with an aim to assess the role of uncorrected astigmatism as the sole cause of headache. For this purpose, a total of 400 patients presenting with headache as the single complaint visiting our facility for refractive error evaluation were enrolled in the study. All the patients were evaluated for the presence of astigmatism as per criteria defined in the Materials and Method section of this work. Cases were subsequently grouped as per presence of astigmatism. All the patients with astigmatism were invited to participate in an intervention for correction of astigmatism by suitable spectacles. A total of 140 (71.1%) consented to participate in the study.

All the patients undergoing astigmatism correction were followed up at 4, 8 and 12 weeks.

Table 1: Distribution of cases according to astigmatism status

S.N	Group	No. of cases	Percentage
1.	Group I - with Astigmatism	197	49.3
2.	Group II - No astigmatism	203	50.8

Out of 400 pateints, a total of 197 (49.3%) were found to have uncorrected astigmatism. These patients comprised the Group I of study while remaining 203 (50.8%) did not have astigmatism and comprised the Group II of study. (Table 2)

Table 2: Socio-demographic details

S.N	Age group	Group I (n=197)		Group II (n=203)		Total	
		No.	%	No.	%	No.	%
1.	≤20 Yrs	100	50.8	83	40.9	183	45.8
2.	21-30 Yrs	88	44.7	80	39.4	168	42.0
3.	>30 Yrs	9	4.6	40	19.7	49	12.3
Mean Age±SD		21.72±5.53 (15-35)		23.94±7.03 (14-35)		22.85±6.43 (14-35)	
χ^2=27.56 (df=2); p<0.001							
SN	**Gender**	**Group I (n=197)**		**Group II (n=203)**		**Total**	
		No.	**%**	**No.**	**%**	**No.**	**%**
1.	Male	60	30.5	61	30.0	121	30.3
2.	Female	137	69.5	142	70.0	279	69.8
χ^2=-0.008 (df=1); p=0.929							

SN	VA	Group I (n=197)		Group II (n=203)		Total	
		No.	%	No.	%	No.	%
1.	VA 6/6	137	69.5	163	80.3	300	75.0
2.	VA 6/9	60	30.5	40	19.7	100	25.0
χ^2=-6.6165 (df=1); p=0.013							

Age of all patients ranged from 14 to 35 years. Maximum number of cases (n=183; 45.8%) were aged ≤20 years followed by those aged 21-30 years (n-168, 42%) and >30 years (n=49, 12.3%) respectively.

On evaluating the data in to groups proportion of those aged ≤20 years and 21-30 years was found to be higher in Group I (n=100, 50.8% and n=88, 44.7%) as compared to that in Group II (n=83, 40.9% and n=80, 39.4%) whereas proportion of those aged >30 years was higher in Group II (n=40, 19.7%) as compared to that in Group I (n=9, 4.6%). Statistically, this difference was significant (p<0.001).

Majority of patients were females (n=279, 69.8%). The proportion of females was slightly higher in Group II (n=142, 70%) as compared to that in Group I (n=137, 69.5%) (p=0.929).

Most of patients had visual acuity 6/6 in both the eyes (n=300, 75%). There were (n=100, 25%) patients having visual acuity 6/9 in one or both the eyes. On comparing the visual acuity status between two groups, proportion of those having visual acuity 6/9 was significantly higher in Group I (n=60, 30.5%) as compared to that in Group II (n=40, 19.7%) (p=0.013).

Table 3: Distribution of cases according to type of Astigmatism (n=197)

S.N	Type	No. of cases	Percentage
1.	Simple myopic	170	86.3
2.	Simple hypermetropic	22	11.2
3.	Compound hypermetropic	5	2.5
4.	Compound myopic	0	0
5.	Mixed	0	0

Further, distribution of group I patients into various types of we found that to astigmatism, Simple myopic type was most common (n=170, 86.3%) followed by simple hypermetropic (n=22, 11.2%) and compound hypermetropic (n=5, 2.5%) types.

All the 197 patients with astigmatism were invited to participate in an intervention for correction of astigmatism by suitable spectacles. A total of 180 (n=129, 91.4%) consented for participation. All the patients undergoing astigmatism correction were followed up at 4, 8 and 12 weeks. Final follow up was done at 12 weeks.

However, finally, 40 out of 180 consenting to participate in the study did not complete follow up. Hence, in final assessment only 140 patients were left. The outcome of intervention is being shown for these 140 patients. At first follow up, a total of (n=37, 26.4%) patients were relieved, (n=55, 39.3%) showed improvement, (n=37, 26.4%) showed no change while (n=15, 7.9%) showed worsening in headache

At second follow up, a total of (n=55, 39.3%) patients were relieved, (n=54, 38.6%) showed improvement, (n=22, 15.7%) showed no change while (n=9, 6.4%) showed worsening in headache. At third and final follow up, a total of (n=78, 55.7%) patients were relieved, (n=49, 35%) showed improvement, (n=8, 5.7%) showed no change while (n=5, 3.6%) showed worsening in headache.

Table 4: Statistical evaluation of change between different follow-up intervals (Wilcoxon signed rank test)

S.N.	Comparison	Z	'p'
1.	FU 1 vs FU 2	7.54	0.054
2.	FU 1 vs FU 3	35.9	<0.001
3.	FU 2 vs FU 3	11.9	0.008

On evaluating between the follow-up change in status of patients, though proportion of those showing relief and improvement showed a continuous increase by each follow up, however, the difference was significant only between first vs third (p<0.001) and second vs third (p=0.008) follow up intervals. No significant association was observed between Astigmatism type and outcome.

Table 5: Comparison of Outcome among different astigmatism types

SN	Outcome	Astigmatism Type					
		Simple Myopic		Simple Hypermetropic		Compound Hypermetropic	
At first follow up		n=113		n=22		n=5	
		No.	%	No.	%	No.	%
First Follow Up							
1.	No change	31	27.4	4	18.2	2	40.0

2.	Relieved	45	39.8	9	40.9	1	20.0
3.	Improvement	30	26.5	7	31.8	0	0.0
4.	Worsening	7	6.2	2	9.1	2	40.0
χ^2=10.033; p=0.123							
Second Follow Up							
1.	No change	44	38.9	7	31.8	4	80.0
2.	Improvement	44	38.9	10	45.5	0	0.0
3.	Relieved	18	15.9	4	18.2	0	0.0
4.	Worsening	7	6.2	1	4.5	1	20.0
χ^2=7.066; p=0.315							
Third Follow Up							
1.	No change	66	58.4	9	40.9	3	60.0
2.	Improvement	36	31.9	12	54.5	1	20.0
3.	Relieved	7	6.2	1	4.5	0	0.0
4.	Worsening	4	3.5	0	0.0	1	20.0
χ^2=9.019; p=0.173							

Discussion

Refractive errors and headache are some of the common health problems.[17-19] In different populations the prevalence of refractive errors range from 13 to 80% while incidence of chronic primary headache and sporadic headache are reported to be 15% and 40% respectively.[17] The high prevalence of both problems in general population prompts towards a possible relationship between two. Headache is a recognized symptom associated with refractive errors especially astigmatism. Experimental studies among computer users have shown that induced astigmatism leads to production of symptoms including headache.[17] The present study was carried out with an aim to make a correlative evaluation of uncorrected astigmatism as the sole cause of headache and to assess whether correction of astigmatism has any impact on complaints of headache.

For this purpose, a total of 400 patients presenting with headache as the single complaint visiting our facility for refractive error evaluation were enrolled in the study. The prevalence of astigmatism among these patients was found to be 49.3%. Thus almost half the patients presenting with complaints of headache had astigmatism. Prevalence of astigmatism among headache cases has been reported to vary substantially in different studies using different sampling frames. In one study, Akinci et al.[7] who conducted a case-control study among patients with headache enrolled as cases and controls without headache found the rate of astigmatism to be 19.7%. However, Marasini et al.[11] in their study from Nepal reported this prevalence rate to be 28%. On the other hand, Abolbashari et al.[10] in their study from an Iranian facility reported majority of headache patients (54.1%) to be having astigmatism. In two recent studies from India, the prevalence rates of astigmatism among headache patients were reported to be 41% and 40.8% respectively. The prevalence rates 49.3% as assessed in present study is thus within these ranges and shows that astigmatism remains to be one of the most important underlying morbidities among patients presenting with headache.

Age of patients ranged from 14 to 35 years with a mean age of 22.85$\pm$6.43 years, however, proportion of patients with age $\leq$20 years was significantly higher among astigmatism cases (50.8%) as compared to that of patients without astigmatism (40.9%). Mean age of astigmatism patients was also lower (21.72$\pm$5.53 years) as compared to that of those not having astigmatism (23.94$\pm$7.03 years). A relationship between type of astigmatism and age has been reported in several previous studies.[17,18] Studies conducted among infants and young children have shown that the prevalence of against-the-rule astigmatism is quite high in infants and toddlers, however, it disappears by the time the children reach school age[17]. Although, the present study did not include too young children, however, the role of age-related disappearance of astigmatism to be the cause behind significantly higher age of patients without astigmatism can be explained to a certain extent on the basis of the phenomenon of disappearance of astigmatism among children with advanced age.

In present study, majority of patients were females (69.8%). Statistically no significant association between gender and astigmatism was seen. The complaints of headache have been reported to be more common in females as evidenced in various epidemiological studies,[17,18] however, the present study failed to find out any association of astigmatism with gender.

Impact of correction of refractive error and astigmatism on headache frequency was also evaluated retrospectively in a study by Akinci et al.[7] who also showed proportion of patients with miscorrected refractive error to be significantly higher in headache cases (16.5%) as compared to controls (2%), thus emphasizing the fact that miscorrected or uncorrected refractive error and astigmatism have a detrimental role on the frequency of headache.

Incidentally, there are limited or almost negligible studies on the relationship between headache and

astigmatism and evaluation of impact of correction of astigmatism on headache despite a plenty of evidence reporting astigmatism prevalence to be higher in headache patients, especially in young age. The present study is probably the first attempt to systematically study the problem and shows that this relationship exists and correction of astigmatism can be helpful in relief from headache. Hence, further studies to evaluate this relationship further in detail are recommended.

Conclusion

The findings of the study thus suggested that among cases presenting with headache as the sole cause, prevalence of astigmatism is quite high and treatment of uncorrected astigmatism brought about a phenomenal improvement in symptoms of headache. The findings of present study thus emphasize the need for evaluation of astigmatism among persons with headache as a sole complaint, especially those in young age. These findings are encouraging, however, given fewer number of studies on the issue require further evaluation. Moreover, considering the subjectivity associated with headache, long-term post-correction follow-up is recommended to confirm whether the treatment effects are lasting.

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