ORIGINAL ARTICLE

Clinical Characteristics of Patients Presenting with Headache at Binocular Vision Clinic: A Hospital Based Study

Saif Hassan Al-Rasheed[1]

[1]*Department of Optometry, Qasim University, Saudi Arabia and Department of Binocular vision, Al- Neelain University, Khartoum, Sudan*

ABSTRACT

Purpose: To assess the clinical characteristics of patients presenting with headache at binocular vision clinic.

Place and Duration of Study: Al-Neelain eye hospital, Khartoum, Sudan, from February to October 2018.

Study Design: Descriptive cross-sectional study.

Material and Methods: One hundred fifty patients with history of headache were included in study. Detailed ocular examination was performed. Dissociated heterophoria was measured using Maddox Wing and Maddox Rod. Associated heterophoria was assessed by the Mallett unit fixation disparity and fusional vergence was measured using a prism bar. Data was analyzed using SPSS, version 25. The relationship between measures was determined using the chi-squared analysis. For all statistical determinations, significance levels were set at $p < 0.05$.

Results: Mean age was 25 ± 3.5 years. 86.7% patients with headache had visual acuity of 6/6. Females constituted 78% and headache was significantly associated with females (P < 0.0001). Majority of patients (82%) presented with exophoria (mean = 4.74 ± 0.75 Δ Base-In) at near fixation, 10.7% were orthophoric and 7.34percentage were esophoric (mean = 3.24 ± 0.5 Δ Base-Out). The association between near heterophoria and headache was statically significant (χ^2 = 7.426; p = 0.001). Association between distance heterophoria and headache was not statistically significant (χ^2 = 22.172; p = 0.265). The association between headache and positive fusional vergence at near fixation was statically significant (p = 0.03). Leading cause of headache was convergence weakness exophoria (39.3%; p = 0.001), followed by convergence insufficiency (24%; p = 0.02).

Conclusion: Headache was more common in females and was associated with exophoria, convergence insufficiency and inadequate positive fusional vergence at near fixation.

Key Words: Headache, binocular vision, exophoria, convergence insufficiency.

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INTRODUCTION

Headache is one of the commonest health complaints and it affect approximately half of world population. It has significant effect on work productivity and quality of life[1].

The problem may arise from conditions that range from benign to catastrophic. Quick and accurate diagnosis is an important step for successful management of headache[2,3]. A review of studies conducted globally, estimated the prevalence of headache as 58.4% among school-going children and 46% in adult population[2,3,4]. It is commonly believed

Correspondence to: Saif Hassan Al-Rasheed
College of Applied Medical Sciences, Qasim University, Saudi Arabia, Email: saif.alrasheed@yahoo.com

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that refractive errors and binocular vision anomalies can lead to headache among young individual[4]. Eye care professional reported that headache is a common patient complaint[5,6,7]. International headache society reported that the diagnostic criteria of headache associated with refractive errors is as follows: a) Uncorrected refractive errors such as hypermetropia, astigmatism, presbyopia, or wearing incorrect glasses, b) Mild headaches in the frontal region and in the eyes, c) pain absent on awakening and worse by prolonged visual tasks at distance or near[8].

In a masked case control study, to assess the relation between headache and binocular vision anomalies it was concluded that people suffering from headache had higher prevalence of heterophoria, associated phoria and reduced stereopsis compared with controls. The study found that there was strong association between exophoria and complaint of headache[9]. Another study have indicated that the positive fusional reserve should be at least twice the magnitude of an exophoria to be compensated (without symptoms)[10].

Binocular visual dysfunctions such as convergence insufficiency (CI) affects young people and is characterised by the inability to accurately converge, or sustain accurate convergence when focusing at near targets. It is associated with symptoms such as headache, blurry vision, eyestrain, and double vision[10]. Headache may also be due to different ocular diseases such as acute glaucoma, optic neuritis, uveitis, and visual anomalies such as uncorrected refractive errors, accommodative and vergence dysfunctions. The most common eye condition leading to headache after refractive errors is binocular vision anomalies[11].

There is a general increase in the number of people suffering from headaches. In addition, headaches have a significant negative impact on the quality of life and productivity. Therefore, the current study was conducted to assess the clinical characteristics of patients suffering from headaches who attended the binocular vision clinic at Al-Neelain eye hospital Khartoum, Sudan.

MATERIAL AND METHODS

One hundred and fifty patients suffering from headache and referred by ophthalmologists to the binocular vision clinic were selected by convenient sampling technique, from February to October 2018. Patients with other ocular or systemic diseases were excluded from the study. All selected patients underwent detailed ocular examinations by trained ophthalmologists. The patients were then referred to the orthoptic clinic for binocular vision assessment. Optometry graduate research assistants with experience in clinical optometry assisted with data collection. The data collectors underwent training in the study protocol procedures. Ethical approval for study was obtained from Al-Neelain University. To facilitate a better understanding of the procedures and conditions of involvement in the study, an information document detailing the nature of the study was provided to all the patients. Participation in the study was voluntary and patients were informed that they could withdraw from the study at any time without giving any reason. All forms and data sheets were shredded as soon as it is entered into database system for analysis.

The demographic information was collected from all the participants followed by measurement of visual acuity at distance using Snellen tumbling E-chart. Amplitude of accommodation and near point of convergence were measured using RAF Rule. Cover test was conducted at 33 cm for near and 6-meter for distance with the patients fixating on one line above the best visual acuity of the poor eye. The subjects underwent motility tests to assess the integrity of the eye muscles. Objective refraction was assessed using retinoscopy (NeitzRX, Japan) while dissociated heterophoria was measured using Maddox Wing and Maddox Rod at near and distance fixation, respectively. Associated heterophoria was assessed by the Mallett unit fixation disparity while the positive and negative fusional vergence were measured using a prism bar at 33 cm and 6 meter for near and distance respectively.

The data was entered in Microsoft Excel spreadsheet and analyzed using SPSS software, version 25 (SPSS, Inc., Chicago, IL). The data were analysed descriptively using standard deviations and percentages. The relationship between measures was determined using the chi-square analysis. Significance levels were set at $p < 0.05$.

RESULTS

A total of 150 patients who attended Al-Neelain eye hospital complaining of headaches were included in this study. The age of the participants ranged between 10 and 35 years with a mean age of 25.0 ± 3.5 years.

Seventy-one percent were between 15-20 years, followed by age groups (21–25) representing 57 (38%). One hundred and seventeen (78%) patients who complained of headache were females. Association of headache with females was statistically significant ($\chi^2 = 149.18$, $p < 0.0001$).

Association of decreased vision with headache was not statistically significant ($\chi^2 = 4.082$, $p = 0.850$), as shown in table 1.

The association between headache and types of refractive errors was not statistically significant ($\chi2 = 2.05$; $p = 0.562$) as illustrated in table 2.

Majority of the patients (82%) presented with exophoria (mean = 4.74 ± 0.75Δ Base-In) at near. The association between near heterophoria and headache was statistically significant ($\chi^2 = 7.426$; $p = 0.001$) as shown in table 3.

The association between distance heterophoria and headache was not statistically significant ($\chi^2 = 22.172$; $p = 0.265$) as shown in table 3.

Association between near point of convergence and headache was not statistically significant ($\chi2 = 3.04$; $p = 0.836$). Table 3. 72.7% patients presented without an associated phoria. Association between headache and associated phoria was statistically significant. ($\chi^2 = 13.837$; $p = 0.001$) as shown in table 4.

59.3% patients presented with weak positive fusional vergence at near fixation (2 – 14Δ Base-Out).

The association between headache and weak positive fusional vergence at near fixation was statistically significant $\chi^2 = 10.726$; $p = 0.03$) as illustrated in table 5.

Table 1: *Visual acuity (VA) among patients complaining of headache ($\chi^2 = 4.082$ $p = 0.850$).*

Age of Participants Mean SD (25.0 ±3.5 Years)	VA of Participants 6/6 n %	6/9 n %	≤ 6/12 n %	Total n (%)
10 – 14	11 (7.3)	0 (0.0)	0 (0.0)	11 (7.3)
15 – 20	61 (40.7)	5 (3.3)	5 (3.3)	71 (47.3)
21 – 25	48 (32.0)	3 (2.0)	6 (4.0)	57 (38.0)
26 – 30	8 (5.3)	1 (4.6)	0 (0.0)	9 (6.0)
31 – 35	2 (1.3)	0 (0.0)	0 (0.0)	2 (1.3)
Total	**130 (86.7)**	**9 (6.0)**	**11 (7.3)**	**150 (100)**

Table 2: *Distribution of refractive error among participants.*

Age of Participants Mean SD (25.0 ±3.5 Years)	Refractive error of participants Emmetropia n (%)	Hypermetropia n (%)	Myopia n (%)	Astigmatism n (%)	Total n (%)
10 – 14	8 (5.3)	0 (0.0)	1 (0.6)	2(1.3)	11 (7.3)
15 – 20	62 (41.3)	1 (0.6)	6 (4.0)	2(1.3)	71 (47.3)
21 – 25	52 (34.7)	0 (0.0)	1 (0.6)	4(2.7)	57 (38.0)
26 – 30	6 (4.0)	1 (0.6)	1 (0.6)	1(0.6)	9 (6.0)
31 – 35	1 (0.6)	1 (0.0)	0 (0.0)	0(0.0)	2 (1.3)
Total	**129 (86.0)**	**3 (2.0)**	**9 (6.0)**	**9(6.0)**	**150 (100)**

($\chi^2 = 2.05$; $p = 0.562$)

Table 3: *Near and distance dissociated heterophoria among the participants.*

Heterophoria		Gender of Participants Male n (%)	Female n (%)	Total n (%)	P-value
Near Dissociated phoria	Orthophoria	5 (3.3)	11 (7.3)	16 (10.7)	
	Exophoria	25 (16.7)	98 (65.3)	123 (82)	0.001
	Esophoria	3 (2.0)	8 (5.3)	11 (7.3)	
Distance Dissociated Phoria	Orthophoria	21 (14.0)	89 (59.3)	110 (73.3)	
	Exophoria	9 (6.0)	25 (16.7)	34 (22.7)	0.265
	Esophoria	3 (2.0)	3 (2.0)	6 (4.0)	
	Total	**33 (22.0)**	**117 (78.0)**	**150 (100)**	

Table 4: *Distribution of associated phoria among the participants.*

Associated Phoria		Gender of Participants Male n (%)	Female n (%)	Total n (%)	P-value
Near Associated Phoria	Orthophoria	19 (12.7)	90 (60.0)	109 (72.7)	
	Base-in	14 (9.3)	17 (11.3)	31 (20.7)	0.001
	Base-out	0 (0.0)	10 (5.3)	11 (6.6)	
	Total	**33 (22.0)**	**117 (78.0)**	**150 (100)**	

($\chi^2 = 13.837$; $p = 0.001$)

Table 5: *Fusional vergence among participants suffering from headache.*

Fusional Vergence		Gender of Participants Male n (%)	Female n (%)	Total n (%)	P-value
Positive Fusional Vergence	Weak (2 – 14 Base-out Δ)	19 (12.7)	70 (46.6)	89 (59.3)	
	Strong (16 – 35 Base-out Δ)	14 (9.4)	47 (31.3)	61 (40.7)	0.03
Negative Fusional Vergence	Weak (2 – 4 Base-in Δ)	8 (5.3)	16 (10.7)	24 (16.0)	
	Strong (6 – 15 Base-in Δ)	25 (16.7)	101 (67.3)	126 (84.0)	0.534
	Total	**33 (22.0)**	**117 (78.0)**	**150 (100)**	

With respects to negative fusional vergence, most of the patients (84%) had strong negative fusional vergence at near fixation (6 – 15Δ Base-in). The association between headache and weak negative fusional vergence at near fixation was not statistically significant ($\chi^2 = 2.139$; p = 0.534) as shown in table 5.

Table 6: *Binocular vision anomalies among patients complaining from headache.*

Binocular Vision Anomalies	Gender of Participants Male n (%)	Female n (%)	Total n (%)	P-value
Convergence Weakness Exophoria	10 (6.7)	49 (32.6)	59 (39.3)	0.001
Convergence Insufficiency	8 (5.3)	28 (18.7)	36 (24)	0.02
Weak Fusional Vergence	4 (2.7)	15 (10.0)	19 (12.7)	0.124
Divergence Excess Exophoria	5 (3.3)	13 (8.7)	18 (12.0)	0.131
Convergence Excess Esophoria	4 (2.7)	7 (4.6)	11 (7.3)	0.423
Divergence weakness esophoria	2 (1.3)	5 (3.4)	7 (4.7)	0.658
Total	**33 (22.0)**	**117 (78.0)**	**150 (100)**	

Binocular vision anomalies among patients complaining of headache is shown in table 6. The association between headache and convergence weakness exophoria was statistically significant p = 0.001. The association between headache and convergence insufficiency was also statistically significant P=0.02.

DISCUSSION

Headache is a common health complaint and is considered a public health problem. It has significant effect on public health as well as personal health. However, diagnosis of headache and its management is not always easy because the list of differential diagnosis of headache is one of longest in all of the diseases. Majority of the patients complaining of headache are referred to eye care professionals, ophthalmologist or optometrist for further diagnosis and management. When headache is a sign of a central nervous system disease, an ophthalmologist can offer valuable information about the nature and localization of the lesion to the neurologists[12]. In the current study, percentage of females presenting with headache was more than males. This was in accordance with a study in which it was reported that headache was three times more prevalent in females than males particularly during the reproductive age[5]. Similar results were published in other studies[13,14,15]. The commonest age group suffering from headaches was 15 – 20 years, representing 47.3%. The reason behind this could be more near tasks like reading and writing, in this age group. Jain et al[12] also reported that headache was more prevalent among young age group and the authors concluded that it could be due to psychological stress caused by educational pressures, emotional factors, and family conflicts.

The current study revealed that the association between headache and near exophoria was statistically significant ($\chi^2 = 12.726$; p = 0.001). This is in agreement with Harle et al[9], who reported that there was a strong association between exophoria and headache. Evans[16] reported that symptoms of exophoria were likely to include headache, which was associated with prolonged use of eyes in near task. This may be due to inadequate positive fusional vergence to compensate the degree of exophoria at near fixation. Another study suggested that the positive relative convergence (positive fusional reserve) should be at least twice the magnitude of an exophoria to be compensated[17]. This is supported by the result of the present study where the majority of patients suffering from headaches presented with weak positive fusional vergence at near fixation. The association between headache and weak positive fusional vergence at near fixation was statistically significant ($\chi^2 = 4.584$; p = 0.03). Gargetal[11] reported that the insufficient positive fusional vergence was more common among patients suffering from headaches. However, in this study there were only 7.3% esophoric patients who complained of headaches. Rabbetts reported that the symptoms of esophoric patients were frontal headaches, which might occur after prolonged use of eyes[18]. The association between near heterophoria and headache was also statistically significant *($\chi^2 = 7.426$; p = 0.001)*. However, the association between distance heterophoria and headache was not statistically significant ($\chi^2 = 22.172$; p = 0.265). This could be due to the fact that, at distance fixation, visual axis need less convergence effort, resulting in less ocular deviation compared to near fixation tasks such as reading and chatting on the smart phone.

Almost 27.4% of patients suffering from headache presented with associated heterophoria (aligning

prism). Several authors[19-23] reported that patients with a fixation disparity (associated heterophoria) on the near Mallett Unit were likely to have symptoms such as headache and eye strain.

With regards to final diagnosis the leading cause of headache among the patients referred to the binocular vision clinic was convergence weakness exophoria which was statistically significant *(χ^2 = 13.426; p = 0.001)*. It was followed by convergence insufficiency *(χ^2 = 6.483; p = 0.02)*. Rouse et al[24] defined convergence insufficiency as a syndrome based on near exophoria, low positive fusional reserves (e.g. failing Sheard's criterion) and near point of convergence more remote than 7.5 cm. In a study to assess the association between binocular vision anomalies and headache, it was revealed that the common binocular vision anomaly found in patients with headache was convergence insufficiency 39.19%.[11] This was supported by the fact that majority of patients in this study had near exophoria and weak positive fusional vergence.

The current study has some limitations. The sample size was small and stereopsis was not assessed in the patients suffering from headache. This was a cross sectional study and the effects of management on headache were also not studied.

CONCLUSION

Headache is more common in females than males, with convergence weakness exophoria and convergence insufficiency being the most common binocular vision anomalies in patients with headache. Weak positive fusional vergence at near fixation and associated phoria was common among patients suffering from headache.

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Ethical Approval

The study was approved by the Institutional review board/Ethical review board.

Conflict of Interest

Authors declared no conflict of interest.

Author's Designation and Contribution

Saif Hassan Alrasheed; Optometrist: *Study design, data collection, and manuscript writing.*

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