

## Original Research Article

# Assessment of retinal nerve fiber layer thickness in migraine patients measured with optical coherence tomography

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### ABSTRACT

**Background:** Headache is one of the most disturbing diseases with common neurological signs. Variations in optic nerve perfusion quality or retinal microcirculation may end up the peripapillary retinal nerve fiber layer (RNFL) thickness in patients with migraine. The aim of this study was to investigate the retinal nerve fiber layer (RNFL) thickness in patients with migraine.

**Methods:** This cross-sectional study was conducted by including thirty patients diagnosed with migraine and thirty normal individuals. Patients were evaluated in groups including migraine with and without aura and controls. Retinal nerve fiber layer (RNFL) thickness was measured using stratus optical coherence tomography (OCT) and then was compared in case and control groups. All data were analyzed using SPSS software version 16.

**Results:** RNFL was significantly thinner in migraine patients compared to the control group. Symmetry of RNFL showed significantly reduction in patients with migraine compared to standard value (95% vs 68%). Comparison of NRR area between patients and standard value showed significantly reduced values ( $P=0.0001$ ). Mean value of optic disc area showed significantly reducing value compared with standard value about  $2.35 \text{ m}^2$  ( $P=0.0001$ ).

**Conclusions:** This study suggests that migraine leads to a reduction in the peripapillary RNFL thickness and to thinning in choroidal structures. These findings can be explained by a chronic ischemic insult related to migraine pathogenic mechanisms.

**Keywords:** Optical coherence tomography, Optic nerve head, Migraine, Nerve fiber layer

### INTRODUCTION

Headache is one of the problems of each community. Although many of patients with headache never seek treatment but half of the people with headaches report daily dysfunction. An annual disability rate sometimes is higher than those of hypertension, breast cancer and rheumatoid arthritis. The International Headache Society (IHS) has divided headache into 4 different classes based on history, physical and neurological examination; and laboratory studies. Migraine is a type of headaches that occurs in 1% to 2% of the general population.<sup>1</sup> In a study conducted in 50 countries, the prevalence of this

disease is reported to be about 4-6% in men and 13-17% in women. More than half of the patients are female and the ratio of male to female is 1/3 to 2/3. Migraines usually occur in the third decade of life, and in 45%-80% of cases, there is a positive family history of migraine and the disease is more common in whites than black people.<sup>2,3</sup> Migraine attacks include unilateral and pulsatile headaches which can be associated with gastrointestinal symptoms such as nausea or vomiting, excessive stimulation including photophobia and phonophobia, which lasts from 4 to 72 hours. IHS classifies migraine into two groups auxiliary Aura and without aura. In 15% of cases aura occur before the migraine headache.<sup>1-3</sup>

Aura is a type of reversible neurological disorder which may result in skin paresthesia, or changes in auditory, visual, smell, or verbal sensations, which begin within 5 to 20 minutes and usually end in less than one hour.<sup>4</sup> Headache can be associated with irritable nervous symptoms, nausea, vomiting, photophobia, visual impairment as Scotoma and in severe cases with seizure and confusion.<sup>5,6</sup> Sleep disorders, stress, trauma, smoking, and hot foods and family history are effective at the onset or exacerbating migraine.<sup>7</sup>

Measuring the Retinal Nerve Fiber Layer (RNFL) thickness can be used as an indicator for assessing ganglion cell damage and retina nerve fibers.<sup>8</sup>

By knowing the optical coherence tomography (OCT), it is possible to calculate the thickness of the RNFL with a scale of 8-10 mm. The advantages of this device are noninvasive. OCT is a reliable and renewable technique for measuring and evaluating RNFL thickness. There are several hypotheses about the etiology of visual acuity damage in migraine patients, which included vascular disorders such as vasospasm or localized ischemia that may occur as transient or chronic.<sup>8</sup>

In recent two decades, lesions have been seen in the brain parenchyma in migraine patients with the advancement of imaging method, but its exact radiological properties are still unclear and there is a difference between the parts involved in the brain. So far CT-SCAN and MRI have been suggested as a diagnostic method, but MRI shows with higher confidence white matter anomalies and lesions in people with migraine.<sup>3</sup>

The aim of this study was to assessment of Retinal Nerve Fiber Layer (RNFL) thickness in migraine patients measured with optical coherence tomography (OCT) and compare it with standard indexes.

**METHODS**

In this descriptive cross-sectional study 30 patients with definite diagnosis of migraine who based on inclusion criteria were selected and entered to the study. Patients with previous history of ocular surgery, glaucoma in the own and family, eye diseases such as diabetic retinopathy, retinal diseases, optical and visual acuity disorders, excluded from the study. A consent form was obtained from the study people. All of the samples were tested for complete ophthalmology and their demographic and clinical data were recorded. In two study groups, for measuring the thickness of RNFL using OCT, picture taken from the periphaly region and to evaluate the visual acuity features using OCT, the imaging was carried out. Data were analyzed by descriptive and analytical statistical methods in SPSS version 21.

**RESULTS**

Twenty patients (64.5%) of patients were female and 11 (35.5%) were male with a ratio of 2 to 1. The mean age of patients was  $43.6 \pm 16.05$  years in range 16 to 77 years. The average thickness of the RNFL in the studied patients was  $94.94 \pm 7.87$  microns which was significantly lower than the standard value of  $107.7\mu\text{m}$  in patients with migraine. Also, the other items were significantly lower than standard value in migraine patients (Table 1).

**Table 1: Comparison of the mean of measured variables with standard index.**

Variables	n	Min	Max	Mean	SD	Standard value	P-value
Thickness of RNFL (micron)	31	81	125.5	94.95	7.87	107.2	0.0001
Symmetry of Thickness of RNFL (%)	31	70	95	86.8	6.81	95	0.0001
Neurorticular rim area (mm <sup>2</sup> )	31	1.01	2.2	1.36	0.24	1.61	0.0001
Optic disc area (mm <sup>2</sup> )	31	1.39	3.63	2.08	0.44	2.35	0.002
Cup volume (mm <sup>2</sup> )	31	0.02	0.84	0.24	0.17	0.28	0.3
Mean of Cup to Disc in head of optical nerve (mm <sup>2</sup> )	31	0.18	0.83	0.56	0.12	0.61	0.03
Ratio of Cup to Vertical Disc (mm <sup>2</sup> )	31	0.17	0.73	0.54	0.11	0.59	0.02

**DISCUSSION**

The results of this study showed that the mean thickness of RNFL in migraine patients was significantly less and thinner than the standard value which in line with Martinez et al and Gipponi studies that showed a lower RNFL thickness in migraine patients compared with the

control group.<sup>9,10</sup> It is noteworthy that RNFL is used as a simple test to evaluate headache progression over time.

In this study, the symmetry of the thickness of the layer of neuronal fibers in the two eyes in migraine patients in compare with the standard value was significantly lower than the standard value (95% vs 68%). In this study, the mean area of the neurorticular rim area in patients with

migraine was significantly lower than the standard value which was in line with the studies of Martinez et al, Tan et al and Drance et al.<sup>10-12</sup> Also, the mean optical disk area in patients with migraine was compared with the standard value, which was significantly less than the standard value of 2.35 mm<sup>2</sup> (P = 0.002). This finding was consistent with the results of the study of Gandhi et al, but not consistent with the results of the study of Kara.<sup>13,14</sup> This difference can be related to differences in the techniques used for RNFL thickness measured. It should be noted that the area of the optic disc after the age of 10 is not related to the person's age. Also, significant relationship between gender, best corrected visual acuity (BCVA) and depth of the anterior chamber has not been reported yet. Compare the mean volume of Cup in patients with migraine did not have a significant difference with the standard value of 0.28 mm<sup>2</sup>. Compare the mean Cup to disk at the head of the optic nerve in patients with migraine was significantly lower than the standard value of 0.61 m<sup>2</sup> (P=0.03).

The size of the Cup was determined by the size of the optic disc, so the big disk will have a large Cup and usually a small disk free of Cup. Comparison of Cup to disk ratio in migraine patients also showed that this value in migraine patients was significantly lower than standard 0.59 mm<sup>2</sup> (P = 0.03) which was similar to the findings reported by Gandhi et al, Sorkhabi et al, and Demircan et al.<sup>13,8,15</sup>

## CONCLUSION

Due to the significant difference in RNFL between patients with migraine and standard value, a proper treatment that can reduce the frequency, number of migraine attacks and the duration of each attack can prevent thinning of the RNFL thickness. Considering the limited sample size in this study as well as the different methods of RNFL evaluation design as study with a higher sample size with a control group of the same population in order to minimize ethnic and racial differences and also to compare the differences seen between different methods of measuring and evaluating the parameters of migraine in the eye is recommended in the future.

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## REFERENCES

1. Farnam AR, Noohi S, shafiee kandjani AR, Imani S, Karimzadeh A. Relationship between Depression

- and Degree of Pain Feeling in Patients with Migraine Headache. J Behavioral Sci. 2008;2:143-8.
2. Ramroodi N, Rigi R. Prevalence of migraine in high school children in Zahedan. Zahedan J Res Med Sci. (ZJRMS). 2012;13(1):64.
3. Abdolrasoul A, Maryam B, Ashraf Z, Seyed Mahmoud A. Evaluation of Cerebral MRI Findings in Migrainous Patients Compared with Non-Migrainous Individual. J Mazand Univ Med Sci. 2013;23(98):59-65.
4. Ekinci M, Ceylan E, Cagatay HH, Keles S, Huseyinoglu N, Tanyildiz B, et al. Retinal nerve fibre layer, ganglion cell layer and choroid thinning in migraine with aura. BMC Ophthalmol. 2014;14: 75.
5. Smitherman TA, Burch R, Sheikh H, Loder E. The prevalence, impact, and treatment of migraine and severe headaches in the United States: a review of statistics from national surveillance studies. Headache. 2013;53(3):427-36.
6. Wang SJ. Epidemiology of migraine and other types of headache in Asia. Curr Neurol Neurosci Rep. 2003;3(2):104-8.
7. Agostoni E, Aliprandi A. The complications of migraine with aura. Neurol Sci. 2006;2:91-5.
8. Sorkhabi R, Mostafaei S, Ahoor M, Talebi M. Evaluation of retinal nerve fiber layer thickness in migraine. Iran J Neurol. 2013;12(2):51-5.
9. Martinez A, Proupim N, Sanchez M. Retinal nerve fibre layer thickness measurements using optical coherence tomography in migraine patients. Br J Ophthalmol. 2008;92(8):1069-75.
10. Gipponi S, Scaroni N, Venturelli E, Forbice E, Rao R, Liberini P, et al. Reduction in retinal nerve fiber layer thickness in migraine patients. Neurol Sci 2013;34(6):841-5.
11. Tan FU, Akarsu C, Gullu R. Retinal nerve fiber layer thickness is unaffected in migraine patients. Acta Neurol Scand. 2005;112(1):19-23.
12. Drance S, Anderson DR, Schulzer M. Risk factors for progression of visual field abnormalities in normal-tension glaucoma. Am J Ophthalmol. 2001; 131(6):699-708.
13. Gandhi M, Dubey S. Evaluation of the Optic Nerve Head in Glaucoma. Journal of Current Glaucoma Practice. 2013;7(3):106-14.
14. Kara SA, Erdemoglu AK, Karadeniz MY, Altinok D. Color Doppler sonography of orbital and vertebral arteries in migraineurs without aura. J Clin Ultrasound. 2003;31(6):308-14.
15. Demircan S, Atas M, Yuksel S, Ulusoy MD, Yuvaci I, Arifoglu HB, et al. The impact of migraine on posterior ocular structures. J Ophthalmol. 2015;868.

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