ORIGINAL PAPER

doi: 10.5455/medarch.2019.73.391-393

MED ARCH. 2019 DEC; 73(6): 391-393

RECEIVED: OCT 05, 2019 | ACCEPTED: NOV 27, 2019

Tilted Optic Disc Frequency in Myopia of Different Degree

Edita Dervisevic¹, Nejira Ibrisevic¹¹Eye Clinic, Clinical Center University of Sarajevo, Bosnia and Herzegovina

Corresponding author: Edita Dervisevic, MD PhD. Eye Clinic, Clinical Center of University of Sarajevo, Bosnia and Herzegovina. Address: Malta 9, 71000 Sarajevo, Bosnia and Herzegovina. Phone: +38761925750. E-mail: emaedita@gmail.com, ORCID ID: <https://orcid.org/0000-0001-7651-0312>

ABSTRACT

Introduction: Change in the fundus in myopic patients are often characterized by partially atrophic and tilted optic disc insertions. Due to the altered nerve fiber arrangement, it is more difficult to detect the initial pathological changes of the optic disc. This subject is important because myopia represents well known risk factor for glaucoma. **Aim:** This study explored frequency of tilted optic disc in different degree of myopia which has major effect on glaucoma assesment due to unreliable OCTs parameters of the neuroretinal rim in patients with tilted disc. **Methods:** Between September 2013 and December 2014, total number of 150 patiens from ophtalmic polyclinic „Dr Sefic“ underwent complete ophtalmic examniation. Total of 300 eyes were tested. Patients were separated in 3 groups by diagnosis. Each group was divided by the size of the optic disc diameter into three categories. ANOVA test was used in analysis. **Results:** Subjects with tilted disc shape have the highest degree of myopia, and there is a statistically significant difference with other forms of optic disc regardless of the size of the disc itself ($p < 0.05$). The patients with a large disc (4.05 ± 0.65) had the highest degree of myopia in subclass of tilted discs, and these values decreased linearly in relation to the size of the tilted disc. **Conclusion:** Myopia height values decreased linearly with respect to the size of the tilted disc.

Keywords: myopia, glaucoma, tilted optic disc.

1. INTRODUCTION

Myopia is a refractive anomaly in which parallel light rays coming from infinity, after breaking through the optical system of the eye, focus in front of the retina (1).

Experimental models of myopia and epidemiological data have shown that myopia is most often the result of disproportional elongation of the posterior segment of the eye, which is physically restricted by fibrotic sclera. Axial length is the most important element of eye refraction that determines the most a refractive error (2).

As the sclera is more and more stretched and at the same time thinning, the choroid cannot follow the sclera in this stretch, much less the retina, and the Weiss's circumferential reflex is first observed ophtalmologically next to the nasal edge of the optic disc. Further pathological elongation of the eye develops a white-yellow peripapillary cone in the shape of a crescent (conus myopicus), usually first temporally and then around the entire optic disc (3).

This cone is caused by atrophy of the choroid and the retinal pigment layer. The inside of this cone is made up of a whitish-yellow sclera seen

next to the optical disc itself. A little further away from the disc is a flat, gray choroid that has failed to fully track the sclera. The outer edge of the cone limits the retina by its edge. Sometimes in direct contact with the edge of the disc, the retina, after pathological elongation of the eye, is farthest from the disc. Due to its structure it can stretch the least. As the disease progresses, the cone surrounds the entire disc, taking the form of a whitish-yellowish ring (4).

This change in the fundus is often characterized by partially atrophic and tilted optic disc insertions which are relative to the scleral canal. If glaucoma occurs, classical glaucoma excavation does not develop (5).

Due to the altered nerve fiber arrangement, it is more difficult to detect the initial pathological changes of the disc. The outer, peripheral edge of the cone is formed by the edge of the retina, separated by these changes from the edge of the disc with which it was in contact (6).

The relation between glaucoma and myopia is often a subject of controversy, mainly due to the fact that it is difficult to sort out the structural and functional abnormalities we meet in myopia from the real glauco-

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	N	X	SD	SEM	95% CI		Minimum	Maximum
					Lower	Upper		
Glaucoma	100							
Glaucoma and myopia	100	-3.77	1.55	.156	-4.08	-3.46	-8	-1
Myopia	100	-2.49	1.25	.126	-2.74	-2.24	-6	-1
F=40,940; p<0.05								

Table 1. Myopia degree in relation to the study group

ma changes. Myopia is known risk factor for glaucoma (7).

There is strong epidemiological evidence linking myopia to glaucoma. Myopic optic discs can be a major challenge in making the correct diagnosis of glaucoma (8).

2. AIM

This study explored frequency of tilted optic disc in different degree of myopia which has major effect on glaucoma assesment due to unreliable OCTs parameters of the neuroretinal rim in patients with tilted disc.

3. METHODS

This is a prospective-retrospective, comparative, randomized, clinical trial conducted between September 2013 and December 2014.

Patients from the ophthalmic polyclinic "Dr Sefic" Sarajevo participated in the study. Of the 150 respondents, 97 were female and 53 were male. The age of the respondents ranged from 18 to 80 years.

In order to perform a scientifically valid statistical comparison, a total of 300 eyes were tested, ie 100 eyes per 3 groups of subjects of both sexes:

- Group I - patients with glaucoma,
- Group II - patients with myopia and diagnosed with glaucoma,
- Group III - patients with myopia only.

Each group is divided by the size of the optic disc diameter into three categories:

- a) Small optic disc (<1.30mm),
- b) Medium optic disc (between 1.31 mm-2.09 mm),
- c) Large optic disc (> 2.10 mm).

The morphology of the optic disc in all the study groups is descriptively presented.

4. RESULTS

The study included 300 eyes of respondents who were classified into three equal groups according to the criteria for inclusion in the study. The first group consisted of patients who were diagnosed with glaucoma and analyzed 100 eyes with glaucoma, the second group included patients who were diagnosed with glaucoma with myopia (n = 100), and the third group were patients who were diagnosed with only myopia (n = 100).

Analyzing the average value of diopter height in patients with myopia and patients who had myopia in addition to glaucoma revealed a statistically significant difference. The average level of diopter in patients with glaucoma and myopia was -3.77 ± 1.55 , while in patients with myopia alone it was -2.49 ± 1.25 , $F = 40,940$; $p < 0.05$.

DISC		N	X	SD	SE M	95% CI		Minimum	Maksimum
						Lower	Upper		
Small	Tilted	7	3.29	.48	0.184	2.83	3.74	3	4
	Round	11	2.09	1.04	0.315	1.39	2.79	1	4
	Shallow dish-shaped	2	1.00	.00	0.000	1.00	1.00	1	1
								F=7.208; p=0.005	
Medium	Tilted	38	3.26	1.20	0.195	2.87	3.66	1	5
	Round	65	1.65	0.99	0.123	1.40	1.89	1	4
	Elipsed	5	3.00	0.00	0.000	4.00	4.00	3	3
	Shallow dish-shaped	11	1.18	0.60	0.182	.78	1.59	1	3
								F=28.927; p=0.001	
Large	Tilted	22	4.05	0.65	0.139	3.76	4.33	3	5
	Round	36	2.25	1.25	0.208	1.83	2.67	1	4
	Elipsed	1	2.00	0.00	0.000	1.00	1.00	2	2
	Shallow dish-shaped	2	1.00	0.00	0.000	1.00	1.00	1	1
								F=15.499; p=0.001	

Table 2. Average value of myopia in relation to the size and shape of the optic disc

Figure 1. Presentation of average myopia values in relation to the size and morphology of the optic disc

Using the ANOVA test, a statistically significant difference in the height of myopia was found with respect to the shape of the disc. Even with small, medium and large discs, subjects with tilted disc shape have the highest degree of myopia, and there is a statistically significant difference with other forms of optic disc regardless of the size of the disc itself ($p < 0.05$).

The patients with a large disc (4.05 ± 0.65) had the highest degree of myopia in subclass of tilted discs, and these values decreased linearly in relation to the size of the tilted disc.

5. DISCUSSION

Evaluating morphometric parameters of the optic nerve head and peripapillary areas in patients with different myopia degree we are one step closer to identifying changes in the optic disc as the earliest signs related to

Shape of the disc		N	X	SD	SEM	95% CI		Minimum	Maximum
						Lower	Upper		
Tilted	Small	7	3.26	0.48	0.184	2.83	3.74	3	4
	Medium	38	3.29	1.20	0.195	2.87	3.66	1	5
	Large	22	4.05	0.65	0.139	3.76	4.33	3	5
	F=4.500; p=0.015								

Table 3. The degree of myopia of tilted discs in relation to the optic disc size

glaucoma. At Lomonosov University in Moscow in 2010, after years of research, a group of Russian scientists Akopjan et al. examining the effect of myopia on glaucoma, came to the conclusion that atypical discs are characterized by a specific distribution of the neuroretinal rim and by a characteristic glaucoma changes. Prominence and tilted optic discs can mask the signs of glaucoma; large, oval, shallow discs and optic discs with large excavations can also mask the real picture of glaucoma changes.

In eyes with tilted optic discs, OCTs have been found to be unreliable by the parameters of the neuroretinal rim (due to an OCT analysis error because of the low position of the basal surfaces of the tilted discs), and therefore a formula for calculating the error in these cases is proposed to determine the correct value of neuroretinal rim ($<0.345 \text{ mm}^3$) in differential diagnosis of glaucoma.

Knowing the real values of the neuroretinal rim in myopes is invaluable in establishing the correct diagnosis of glaucoma. Not only in atypical forms of the optic disc (oblique insertions), but also in other forms of the optic nerve head, which will try to overcome the current disadvantages of coherent tomography no matter what highly sophisticated testing technique is used.

6. CONCLUSION

The largest percentage of subjects in the small optic disc and glaucoma group had a circular disc shape (52.6%) as in the subjects with myopia (78.6%), while the subjects with glaucoma and myopia had the most tilted disc shape (66.7%). In the middle disc group, the subjects most often had a circular disc shape, and the tilted shape was equally represented in subjects with myopia and myopia with glaucoma (30%). In the large disc group, the largest percentage of tilted discs were found in subjects diagnosed with myopia and glaucoma (40.5%).

The highest degree of myopia, regardless of the size of the optic disc, was observed in subjects with tilted disc

shape in all three study groups. The subjects with a large disc (4.05 ± 0.65) had the highest degree of myopia in tilted discs. Myopia height values decreased linearly with respect to the size of the tilted disc.

- **Declaration of patient consent:** The authors certify that they have obtained all appropriate patient consent forms.
- **Author's contribution:** Each author gave substantial contribution in acquisition, analysis and data interpretation. Each author had a part in preparing article for drafting and revising it critically for important intellectual content. Each author gave final approval of the version to be published and agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.
- **Conflicts of interest:** There are no conflicts of interest.
- **Financial support and sponsorship:** Nil.

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