Assessment of retinal nerve fiber layer thickness in myopic patients using optical coherence tomography

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ABSTRACT:
Background: Optical Coherence Tomography is the key tool for assessment of the retinal nerve fiber layer (RNFL) thickness which is occasionally altered in myopic patients.
Aim of study: To assess the effect of different degrees of myopia on the thickness of retinal nerve fiber layer by the use of spectral domain optical coherence tomography .
Patients and Method(s): Our study included examination of 40 myopic patients and 40 emmetropic persons.Retinal nerve fiber layer thickness was measured by the use of Optical Coherence Tomography.
Results: Evaluation of RNFL thickness at the different sectors revealed that the thickness at the superior sector is of 102.13 ± 24.91µm for the myopics and of 124.5 ± 15.58 µm for the emmetropes. At the inferior sector the thickness was of 114.08 ± 25.15µm for the myopesanf of 134.63 ± 19.08 µm for the emmetropes ,at the nasal sector the thickness was of 71.9 ± 20.62 µm for the myopes and of 81.48 ± 9.45 µm for the emmetropes, at the temporal sector the thickness was of 75.25 ± 23.4 µm for the myopes and of 74.78 ± 13.42 µm for the emmetropes .
Conclusion: Different grades of myopia affects the RNFL thickness by different degrees with the thinnest one goes to the high myopia. So, High myopia should be considered in the interpretation of OCT data because of thinning of RNFL thickness, and normative database corrected for refractive error and axial length should be incorporated.
Keywords: Myopia, Retinal nerve fiber layer thickness, Optical Coherence Tomography.

Introduction

Myopia is considered as a one of the most common refractive errors.
Myopia, especially high myopia, can lead to marked pathologic changes, in the form of posterior staphyloma, scleral thinning, large tilted opticdiscs **(Hopfet al.,2017)**.Participants with myopia were found to be at an increased risk of glaucoma compared with non myopic participants , and the relationship between the myopia and glaucoma was confirmed by several studies . It is therefore important to detect whether any correlation exists between retinal nerve fiber layer measurements and axial length / refractive error in myopia, with regard to the observation that with an increasing degree of myopia the, risk of development of glaucoma is increased.
The myopic eyeball is enlarged with the increase of axial length and stretching beyond normal dimensions, which may lead to the thinning of the retina**(Hobdayet al., 2016)**Parameters measured by optical coherence tomography(OCT) in the myopic eye have been previously studied. OCT is a new imaging technique based on coherence interferometry, and newer versions of OCT based on spectral domain (SD) technology have been developed, these techniques offer higher axial resolution and scanning speed than do conventional time-domain (TD) techniques**(Leung et al., 2009).** Compared with Stratus OCT, Cirrus high-definition (HD) OCT, which is one of the newest versions of OCT, offers reduced test variability and provides detailed information.(12)However, OCT characteristics have not yet been systematically analyzed and compared among different degrees of myopia.
The purpose of the present study was to evaluate the RNFL thickness of subjects

usingspectraldomain OCT (SD-OCT) and analyze therelationship between RNFL thickness and myopia.

Patients and methods:
This prospective study was performed in department of ophthalmology at South Valley university hospital between September 2018 and September 2019 Informed consent was obtained from every patient before the study. A south valley university institutional ethics committee approval was obtained.In this study 40 eyes with a known degree of myopia , fully examined and compared with 40 emmetropic eyes.

Evaluation of selected patients:
To each person in this study we have to take full history in the form of name, age, sex, duration of blurring of vision and medical history of previous operationsor previous treatment. Then, clinical examination of the eye in the form of measurement of visual acuity, refraction, intraocular pressure (IOP), fundus examination ,RNFL thickness measuring employing a SD-OCT (Spectralis; Heidelberg Engineering, Inc., Heidelberg, Germany) , and measurement of the axial length using A-scan ophthalmic ultrasound device (OTI; ophthalmic technologies INC, Canada) The exclusion criteria of our study includes IOP>20mmHg,having any history or evidence of retinal disease, glaucoma. Refractive or cataract or retinal/vitreous surgeries or suffering from diabetis mellitus. All participants were randomized into the following groups; Group A : including persons with a known degree of myopia . This category in turn is classified into three subgroups as the following: Subgroup 1:low myopia (from 0.5 to 3.00 degrees).Subgroup 2 : including moderate myopia (from 3.00 to 6.00 degrees).Subgroup 3 : including high myopia (more than 6.00 degrees). Group B:(control group) consist of 40 emmetropic eyes.

Results:

We evaluated the cases and the controls with different gender selection as shown in **Table 1** between males and females (counting to 56.5% males and 43.5 females as for myopic, 43.5% males and 56.5 females as foremmetropic persons).

Table 1: summery of the recorded cases and controls.

	Cases		Control	
	No.	**%**	**No.**	**%**
Gender				
Male	23	56.5	18	43.5
Female	17	43.5	22	56.5
OD/OS				
OD	19	47.5	22	55.0
OS	21	52.5	18	45.0
Refraction level				
- 0.5 to -3.0	12	30.0	0	0
-3.0 to -6.0	11	27.5	0	0
More than - 6.0	17	42.5	0	0

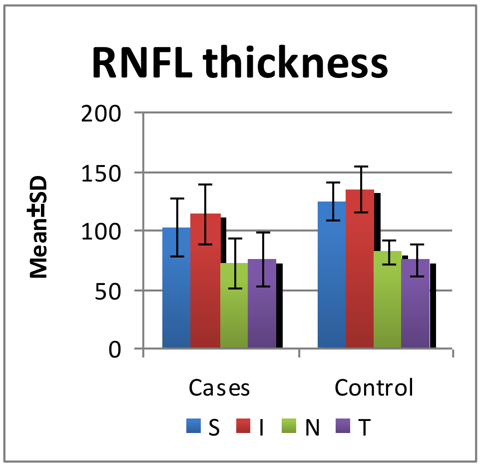
We evaluated different age groups ranging at 38.04 ± 11.01 years for myopics and 35.91 ± 11.54 years for the emmetropicones.
The degree of myopia is divided as shown in figure (2) into low myopia (from 0.5 to 3.00 degrees) which counts for 30 % of the cases and moderate myopia (from 3.00 to 6.00 degrees) which counts for 27.50% of the cases and high myopia (more than 6.00 degrees) which counts to for 42.5% of the cases.

Table 2: Association of factors with RNFL thickness in both myopic and emmetropic patients.

	Cases	Control	P. value
	Mean±SD	Mean±SD	
Age	38.04±11.01	35.91±11.54	0.525
UCVA	0.11±0.08	-	-
Refraction	-6.83±5.4	-	-
BCVA	0.29±0.18	-	-
IOP	12.23±2.04	11.05±1.71	0.007**
Axial length	24.44±1.91	23.06±0.81	<0.001 **
RNFL thickness			
S	102.13±24.91	124.5±15.58	<0.001 **
I	114.08±25.15	134.63±19.08	<0.001 **
N	71.9±20.62	81.48±9.45	0.009**
T	75.25±23.4	74.78±13.42	0.912

Independent samples T Test,
* Statistically significant difference (p<0.05),
** Highly statistically significant difference (p<0.01).

The axial lengh was measured for all having the range of 24.44 ± 1.91 for myopes and 23.06 ± 0.81 mm for emmetropes.
The evaluation of the RNFL thickness of our cases regardless the degree of myopia or the sectorial distribution revealed that the RNFL thickness of the myopic cases was of 90.84±11.57 µm and of103.84±9.84 µm for the emmetropic persons.



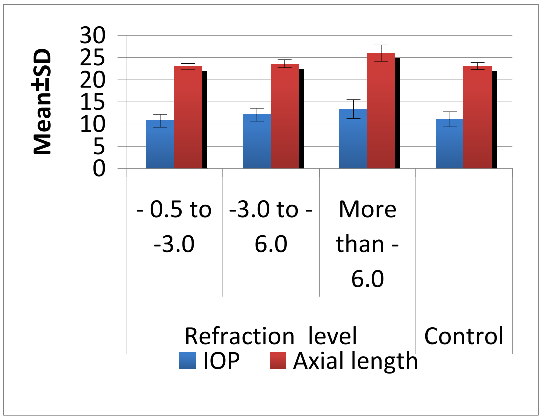
Figure(1): Mean+/-standard deviation of the measurementofthe retinal nerve fiber layer thickness at the superior(S) , inferior(I) , nasal(N) , temporal(T) quadrantsamongthecases and controls

Evaluation of RNFL thickness at the different sectors as shown in figure (2), revealed that the thickness at thesuperior sector is of 102.13 ± 24.91 µm for the myopics and of 124.5 ± 15.58 µm for the emmetropes.
At the inferior sector the thicknesswas of 114.08 ± 25.15 µm for themyopesanf of 134.63 ±19.08µmfor the emmetrope,at the nasal sector the thickness was of71.9 ± 20.62 µm for the myopesand of 81.48 ± 9.45 µm for theemmetropes and at the temporalsector the thickness was of 75.25 ± 23.4 µm for the myopesandof 74.78 ± 13.42 µm for the emmetropes.

The IOP was measured for all as shown in figure (3), having the range of 12.23 ± 2.04mmHg for myopes and of 11.05 ± 1.71mmHg for the emmetropes.

Table(3):The mean RNFL thickness among cases and controls

	Cases	Control	P. value
	Mean±SD	Mean±SD	
RNFL thickness	90.84±11.57	103.84±9.84	<0.001**



Figure(2): The variation of the intraocular pressure(IOP) and the axial length among the different degrees of myopia and the control.

Discussion:

This study evaluates the RNFL thickness in myopic and emmetropic eyes and observed that the overall global RNFL thickness of myopic eyes was significantly thinner than that of emmetropiceyes(**Budenzet al. ,2007**).

More specifically comparing the peripapillary RNFL thickness of high myopic eyes (SE≤-6.0 D) with those of low myopic eyes (SE from −0.25 to −3.0 D) and found that the mean overall thickness of the peripapillary RNFL within the high myopic subjects was considerably lower than that in the low myopic subjects(**Lee et al. , 2010**). In our study, subjects were divided into four groups, with one emmetropic group and three myopic groups. It was illustrated that myopic eyes had a thinner average global RNFL thickness compared with emmetropic eyes, while the high myopic eye had the thinnest average global RNFL thickness. From this results, it can jusify that the global RNFL thickness has a linear decrease with the increase of spherical equivalent(**Andersonet al. , 2007**) . This trend may explain why the average global RNFL thickness in the present study (100.08 µm) was thinner than 102 µm obtained in a study by Zhao et al (8) but close to 100.7 µm obtained in a study by Alasil et al . The difference may lie on the more myopic SE of the present research compared with others.

The myopic eyes showed thicker temporal RNFL and thinner superior and inferior RNFL. In addition, the RNFL thickness

Also , the thickness at the nasal sector of our study which was of 71.9 ± 20.62 µm for the myopes which is also similar to the result of the same study which found that the thickness at the nasal sector was 63.38±10.27 µm

In contrast, the results of Da Lin study revealed that the thickness at the temporal sector was of 85.05±13.47 µm and at the nasal sector is 59.91±14.415 µm and they are both away from our results.

Conclusion:

Different grades of myopia affects the RNFL thickness by different degrees with the thinnest one goes to the high myopia

So, High myopia should be considered in the interpretation of OCT data because of thinning of RNFL thickness, and normative database corrected for refractive error and axial length should be incorporated**.**

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