IJMA

International Journal of Medical Arts

1/2022 (volume 4, Issue 1)

http://ijma.journals.ekb.eg/

Print ISSN: 2636-4174

Online ISSN: 2682-3780

About IJMA

- International Journal of Medical Arts is the Official Scientific Journal of the Damietta Faculty of Medicine, Al-Azhar University, Egypt
- It is an International, Open Access, Double-blind, Peer-reviewed, monthly-published (starting January 2022) Journal
- The First Issue was published in July 2019
- Published under the following license: Creative Commons Attribution-ShareAlike 4.0 International Public License (CC BY-SA 4.0).
- The Egyptian Knowledge Bank hosts the web site and supports IJMA
- IJMA follows the regulations of the International Committee of Medical Journal Editors
- IJMA is a member of the International Society of Managing and
- Technical Editors
- IJMA is indexed in the "Directory of Open Access Journals" [Indexed on 15 January 2021], Index Copernicus and J-Gate [29-6-2021].
- IJMA Listed in "Publons", "Academic resource index [ResearchBib]", "Electronics journal library", "Eurasian Scientific Journal Index", World Catalogue of Scientific Journals, Information Matrix for the Analysis of Journals (MIAR) live 2021, WorldCat and "Citefactor"
- IJMA introduced to the search engine [BASE] through DOAJ

Available online at Journal Website
https://ijma.journals.ekb.eg/
Main Subject [Ophthalmology]

Original Article

Choroidal Thickness in Different Degrees of Myopia Measured by Enhanced Depth Imaging Mode Optical Coherence Tomography

Esraa Mahmoud Abd-Elkhalek *[1], Heba Mahmoud Abdelrahman [1], Mona Mohamad Aly [1], Ahmed Shafeek Abdullah [1]

[1] Department of Ophthalmology, Faculty of Medicine [For Girls], Al-Azhar University, Cairo, Egypt

Article information

Submitted: 08-12-2021

Accepted: 06-01-2022

DOI: 10.21608/IJMA.2022.109812.1409

*Corresponding author

Email: dresraam20@gmail.com

Citation: Abd-Elkhalek EM, Abdelrahman HM, Aly MM, Abdullah AS. Choroidal thickness in different degrees of myopia measured by enhanced depth imaging mode optical coherence tomography. IJMA 2022 Jan; 4 [1]: 2035-2040 [DOI: 10.21608/IJMA.2022.109812.1409].

ABSTRACT

Background: Choroidal thickness [CT] is associated with many ocular conditions. Different generations of optical coherence tomography [OCT] are important for clinical application.

Objective: This study aimed to evaluate the effect of myopia on CT by the use of enhanced depth imaging [EDI] OCT and correlate the measured data with both the axial length [AL] and the refraction.

Patients and Methods: A Cross-sectional study included 80 adult patients of both sexes. The patients were divided into 4 groups: [G1, control]: 20 emmetropic subjects. [G2]: 20 myopic patients with refraction up to -6 D. [G3]: 20 myopic patients with refraction >-6 D up to -10 D and [G4]: 20 myopic patients with refraction > -10 D. Spectralis OCT has been utilized in assessing CT in subfoveal region, 500, 1000 and 1500 um temporal and nasal to fovea.

Results: A highly statistically significant variation existed among groups considering AL and refraction with G4 having higher values and G2 and G1 having lower values. Regarding CT, the highest value was found in G1 and 2, followed by G3, but the lowest value was found in G4. There was significant positive correlation between refraction in all patients and their AL [p< 0.001], and significant negative correlation appeared between refraction and AL in all patients regarding their all measures of CT [nasal, temporal and subfoveal] [p < 0.001].

Conclusion: Myopia with different degrees caused a decrease in CT compared to its thickness of healthy eyes, with marked thinning in advanced myopia.

Keywords: Axial length; Choroid thickness; Myopia; Enhanced depth imaging.

INTRODUCTION

One of the commonest etiologies of visual impairment is high myopia. It affects about one percent of population [1]. Choroid is the structure that shows the earliest changes in high myopic eyes. New studies have highlighted choroid being involved in changes that occurs in high myopia [2].

One of the most important parameters that can detect the changes in myopic eyes is the choroidal thickness [CT] [3]. Many facilities have been developed in the field of choroidal imaging including optical coherence tomography [OCT] [4]. This technique has been improved by involving enhanced depth imaging [EDI], leading to improved images of choroid, making the measurement of CT more accurate, simple and safe [5].

THE AIM OF THE WORK

The current study was conducted to measure CT in myopic eyes using [EDI] OCT and correlate the measured data with both the axial length [AL] and refraction.

PATIENTS AND METHODS

Type of the study: A cross-sectional study comprised 80 cases of both sexes, for one year.

Patients were classified into 4 groups: Group 1 [G1, control]: included 20 emmetropic subjects, Group 2 [G2]: included 20 myopic patients with refraction up to -6 D, Group 3 [G3]: included 20 myopic patients with refraction >-6 D up to -10 D, and Group 4 [G4]: included 20 myopic patients with refraction > -10 D.

Inclusion criteria: Age above 18 years old, emmetropic subjects as control group, axial myopic patients having good fixation and phakic eyes with different degrees of myopia.

Exclusion criteria: Patients with diabetes and proliferative retinopathy, astigmatism more than -2 D, retinal hemorrhage, retinal detachment, epiretinal membrane, choroidal neovascularization, amblyopia, or macular hole, high intraocular pressure [IOP] [above 21 mmHg], media opacity as significant cataract and corneal pathologies, and patients with other ocular pathology causing vision loss other than high myopia.

Methods

After meeting all inclusion criteria, the patients were evaluated by full history taking, complete clinical evaluation, entire ophthalmic examination comprising: visual acuity, non-cycloplegic refraction, slit lamp biomicroscopic examination of both anterior and posterior segment with +90 D lens, IOP, and fundus examination with indirect ophthalmoscope.

Axial Length measurement: Measurement of AL was enabled by the usage of IOL Master 700 [Carl Zeiss Meditec AG, Jena, Germany]. In high myopia with posterior staphyloma, AL was evaluated by A-scan ultrasonography. Before this technique, we anaesthetized cornea by 1 drop of topical benoxinate HCl with 0.4 % concentration [6].

Optical coherence tomography: All cases have been examined by Choroidal mode EDI-OCT [Heidelberg Spectralis OCT; Heidelberg Engineering, Heidelberg, Germany] after mydriasis by Tropicamide 0.5% eye drops. The adequate time to prevent effect of diurnal variation on CT is from 9 AM to 12 PM [7]. Capturing OCT scan was achieved by the use of a single line scan which was taken horizontally through the macula at 180° and getting the camera close to the patient's eye till the image has been inversed and choroidal mode was obtained; subsequently the image has been taken after being clear enough and having signal with high intensity. Subfoveal CT [SFCT] and predefined locations [500um, 1000um, 1500um nasal and temporal to the fovea] were perpendicularly measured from hyperreflecting outer border of retinal pigment epithelium [RPE] to sclero-choroidal interface [SCI].

Data Collection and Analysis: We used Statistical Package for the Social Sciences [SPSS] version 20 [SPSS Inc., Chicago, Illinois, USA], to statistically analyze data. For quantitative variables, we used the mean ± standard deviation. To compare between groups, A one-way analysis of variance [ANOVA] test was used. But in order to compare between multiple variables, Post Hoc test: Tukey's test was used. If the expected count in any cell < 5, Fisher's exact and Chi-square tests were done. The relationship between two variables has been estimated by Pearson's correlation coefficient [r] test. [P-value] <0.05 donating significant, and >0.05 donating insignificant.

Ethical considerations: All procedure performed in the study were in accordance with the medical ethics committee of Al-Azhar University. All participants have signed a written informed consent after full explanation.

RESULTS

Demographic data of studied groups [age and sex]

No statistically significant variations were found between groups regarding both age and sex [P value was 0.200 and 0.246 respectively] as illustrated in Table [1].

Axial Length [mm] of the studied groups

The AL showed a statistically significant difference between groups as p-value was < 0.001. The highest value was found in group 4 [29.85±1.44], followed by group 3 [26.81± 1.09], while the lowest measurement was found in group 2 [25.13 ± 1.13], and group 1 [23.44 ± 0.42] [Figure 1].

Refraction of the studied groups

The refraction showed a significant variation between groups with p-value <0.001. The highest value was found in group 4 [-14.89±3.76], followed by group 3 [-7.98 ± 1.16], while the lowest one was found in group 2 [-3.30 ± 1.51] [Figure 2A].

Nasal CT in the studied groups

A statistically significant variation was recorded between groups according to the measures of nasal CT at 500, 1000 and 1500 with p-value < 0.001. The maximum value was present in group 1 and 2 while the minimum value was in group 3 and 4 [Figure 2B].

Subfoveal CT in the studied groups

The variation between groups as regard the subfoveal CT was statistically significant with p-value <0.001. The maximum value was in group 1 and 2 [315.95 ± 62.69 and 279.15 ± 83.46], followed by group 3 [198.93±74.63], while the minimum value was in group 4 [98.92 ± 50.10] [Figure 2C].

Temporal CT in the studied groups

There was a statistically significant change between groups according to the measures of temporal CT at 500, 1000 and 1500 [p<0.001]. The highest measurement was represented by group 1 and 2 while the lowest value was in group 3 and 4 [Figure 2D]. Our findings were illustrated in figure 3 showed that the SFCT was thickest in emmetropic eyes [figure 3a] and eyes with low myopia [figure 3b], whereas the nasal CT was the thinnest. In moderate [figure 3c] and advanced myopic eyes [figure 3d], the thickest CT was in the temporal location whereas the thinnest in nasal region.

Correlation between both AL and refraction with CT in all patients

There was a positive correlation between refraction in all patients and their AL [p< 0.001. There was a negative correlation between AL in all patients and their measures of CT "nasal, subfoveal and temporal", with p-value less than 0.001. Also, a negative correlation was found between refraction in all patients and their measures of CT "nasal, subfoveal and temporal", with p-value [p-value <0.001] as illustrated in Table [2].

Table [1]: Demographic data of the studied groups

Demographic data		Group 1 [n=20]	Group 2 [n=20]	Group 3 [n=20]	Group 4 [n=20]	Test	P
Age [years]	Mean ± SD	28.20±5.60	32.40 ±10.57	32.45±12.58	35.20±10.94	F= 1.585	0.200
Sex	Female	10 [50.0%]	11 [55.0%]	12 [60.0%]	6 [30.0%]	x^2= 4.153	0.246
	Male	10 [50.0%]	9 [45.0%]	8 [40.0%]	14 [70.0%]		

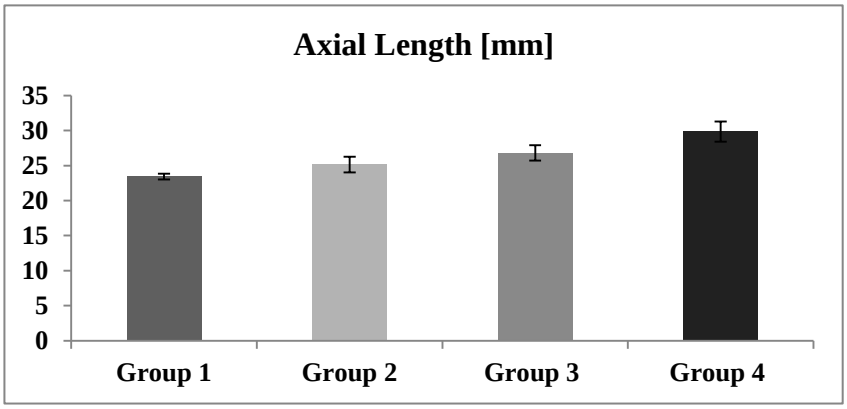

Figure [1]: Axial Length measurements in all studied group

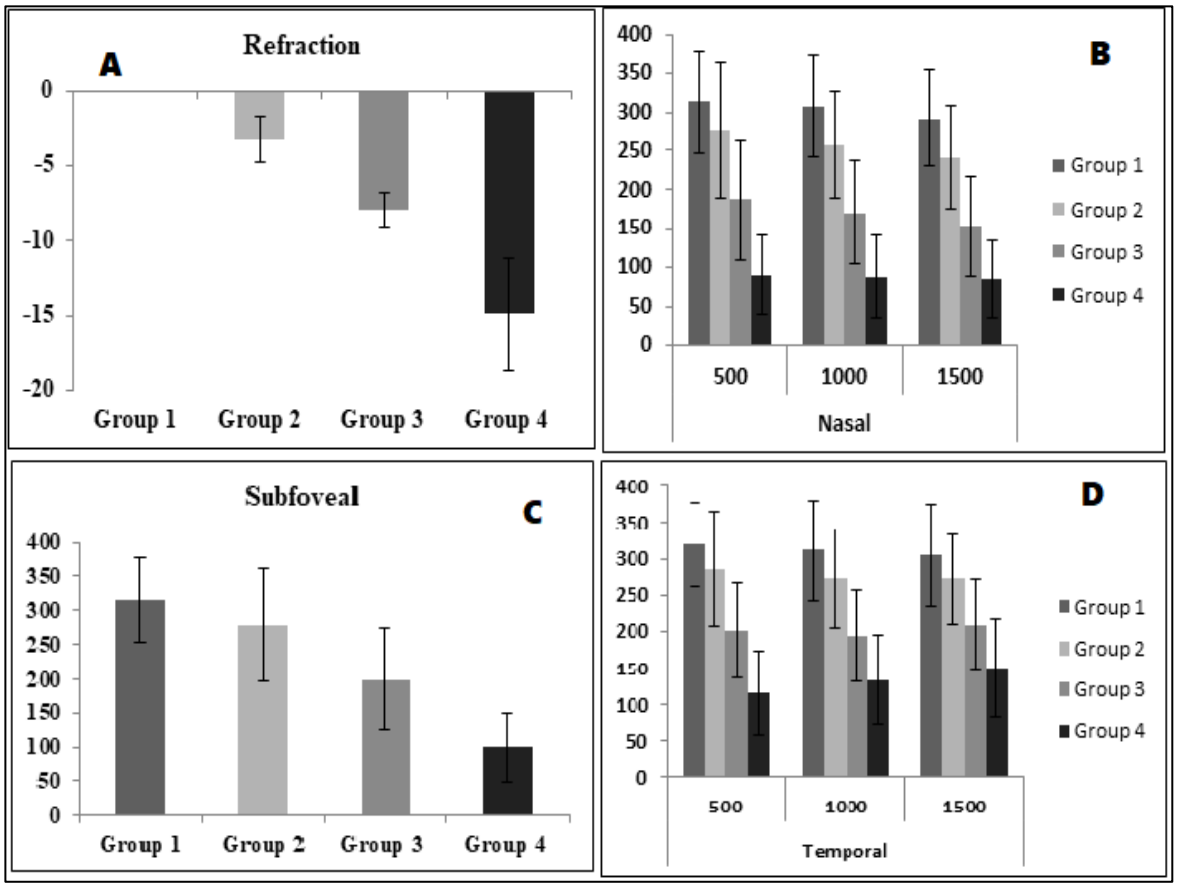

Figure [2]: Comparison between groups according to refraction, nasal CT, subfoveal, and temporal CT

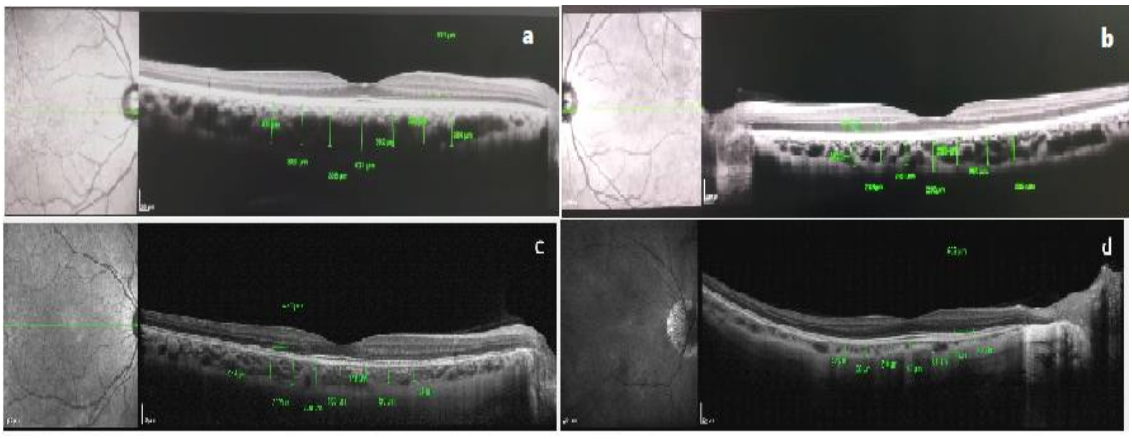

Figure [3]: EDI-OCT for CT

Table [2]: Correlation between both AL and refraction with CT for all patients

All patients	AL		Refraction	
	r	P-value	r	P-value
AL			0.926	<0.001**
Refraction	0.926	<0.001**		
500 Nasal	-0.723	<0.001**	-0.679	<0.001**
1000 Nasal	-0.746	<0.001**	-0.709	<0.001**
1500 Nasal	-0.740	<0.001**	-0.684	<0.001**
Subfoveal	-0.715	<0.001**	-0.664	<0.001**
500 Temporal	-0.706	<0.001**	-0.655	<0.001**
1000 Temporal	-0.662	<0.001**	-0.620	<0.001**
1500 Temporal	-0.647	<0.001**	-0.586	<0.001**

r-Pearson Correlation Coefficient; **p-value <0.05 significant;

DISCUSSION

Detection of the retinal diseases such as myopia has been facilitated by the measurement of CT using OCT. Previous researches recorded a high relationship existed between myopia and CT in children and adults. These studies have documented that thinner CT was found in high myopic eyes than in normal eyes [8]. But these studies did not correlate other factors such as AL [9].

This study aimed to measure CT in myopic eyes using EDI-OCT and correlate the measured data with both the AL and the refraction.

Regarding age and gender, our study showed insignificant variations among groups as P value was 0.200 and 0.246 respectively.

The present work illustrated that in eyes with low myopia, SFCT was the thickest, while nasal CT was the thinnest similar to normal eye. On the other hand, temporal CT in moderate and advanced myopia was thickest.

This goes in line with El-Shazly *et al.* [10] who divided their patients into 2 groups: G1 involved 240 myopic eyes whilst G2: included 60 normal eyes. EDI-OCT imaging of choroid, and AL measurement were done to all patients. They measured the CT at five locations; subfoveal and upper, lower, temporal, and nasal to the fovea. They found that CT showed significant decreasing in myopic group comparing with normal group and the lowest CT was found in the nasal regions with descending pattern with increasing the degree of myopia. On the other hand, the highest CT was changeable regarding the grade of myopia where in low myopia, it was found in the subfoveal region, in moderate myopia, it was found in temporal region, in high myopia it was in lower region, and in the upper region in advanced myopia. Regarding AL, it was found that a significant negative correlation existed between AL and CT in variable regions.

Our study was in accordance with Zang *et al.* [11] whose research provided a geographical map of CT around the macular region. It was conducted on 20 myopic subjects not suffering from any other ocular pathology. Myopia was divided into: Low myopia [20 eyes]: of ≤ 3 diopters [D], moderate myopia [10 eyes]: ranged from -3 and -6D, and high myopia [10 eyes]: of ≥ 6D. The 3D OCT images of the choroid were segmented into superior, inferior, nasal and temporal quadrants, from which the CT was measured. The CT showed rapid decline in the nasal direction. A little alteration occurred in CT towards the temporal direction.

Also, the study of Hoseini-Yazdi *et al.* [12] included 27 cases were classified into 2 groups: G1 was emmetropes [n = 14], while 13 cases were myopes. CT was measured in the macular and extra-macular regions using OCT. They compared both groups and found that the maximum value of CT was superior and the minimum in the nasal region. Myopia produced a thinner choroid than that of normal eyes in macular region, whilst, this variation declined towards the periphery.

The present work showed a positive correlation between refraction in all patients and their AL, with p-value less than 0.001. A negative correlation was found between AL in all patients and their measures of CT "nasal, subfoveal and temporal", with p-value <0.001. Also, a negative correlation was reported between refraction in all patients and their measures of CT "nasal, subfoveal and temporal", with p-value less than 0.001.

This was in accordance with Teberik and Kaya [13] whose prospective study included 65 individuals divided into: high myopic patients [30 patients] and 35 healthy subjects. OCT was used for choroidal imaging in the nasal, temporal and subfoveal region. They found that there was a significant lower value for subfoveal CT in high myopic group than control group [p < 0.001]. Choroid was thinnest at the nasal 1,500 μm location in both groups. CT was inversely proportional to AL and age in high myopic eyes.

Also, Flores-Moreno *et al.* [14] studied 120 eyes with high myopia and 96 normal eyes. They found that in high myopic patients, the thickest choroid was in the temporal region [134 μm], followed by the subfoveal region

[130 μm], while the thinnest was in nasal location [68 μm]. These results markedly differed from the healthy eyes. Also, they found that CT declined about 25.9 μm for each additional millimeter to AL in high myopic patients.

Conclusion: The thinnest CT was found in high myopic eyes even in different subgroups. There was a positive correlation between refraction and their AL while a negative correlation between AL and their measures of CT and between refraction and their measures of CT.

Funding: This research did not receive any specific grant from any funding agency in the public, commercial or not-for-profit sector.

Conflict of interest: The authors declare that they have no conflict of interest.

REFERENCES

1. Read SA, Fuss JA, Vincent SJ, Collins MJ, Alonso-Caneiro D. Choroidal changes in human myopia: insights from optical coherence tomography imaging. Clin Exp Optom. 2019 May;102[3]:270-285. DOI: 10.1111/cxo.12862.
2. Aumann S, Donner S, Fischer J, Müller F. Optical Coherence Tomography [OCT]: Principle and Technical Realization. 2019 Aug 14. In: Bille JF, editor. High Resolution Imaging in Microscopy and Ophthalmology: New Frontiers in Biomedical Optics [Internet]. Cham [CH]: Springer; 2019. Chapter 3. DOI: 10.1007/978-3-030-16638-0_3.
3. Gul A, Basural E, Ozturk HE. Comparison of choroidal thickness in patients with active and stable thyroid eye disease. Arq Bras Oftalmol. 2019;82[2]:124-128. DOI: 10.5935/0004-2749.20190019.
4. Lee K, Lee J, Lee CS, Park SY, Lee SC, Lee T. Topographical variation of macular choroidal thickness with myopia. Acta Ophthalmol. 2015 Sep;93[6]:e469-74. DOI: 10.1111/aos.12701.
5. Agrawal R, Seen S, Vaishnavi S, Vupparaboina KK, Goud A, Rasheed MA, Chhablani J. Choroidal Vascularity Index Using Swept-Source and Spectral-Domain Optical Coherence Tomography: A Comparative Study. Ophthalmic Surg Lasers Imaging Retina. 2019 Feb 1;50[2]:e26-e32. DOI: 10.3928/23258160-20190129-15.
6. Jonas JB, Ohno-Matsui K, Panda-Jonas S. Myopia: Anatomic Changes and Consequences for Its Etiology. Asia Pac J Ophthalmol [Phila]. 2019;8[5]:355-359. DOI: 10.1097/01.APO.0000578944.25956.8b.
7. Pablo LE, Cameo B, Bambo MP, Polo V, Larrosa JM, Fuertes MI, *et al.* Peripapillary Choroidal Thickness Analysis Using Swept-Source Optical Coherence Tomography in Glaucoma Patients: A Broader Approach. Ophthalmic Res. 2018;59[1]:7-13. DOI: 10.1159/000479877.
8. Minami S, Ito Y, Ueno S, Kataoka K, Takeuchi J, Ito H, *et al.* Analysis of macular curvature in normal eyes using swept-source optical coherence tomography. Jpn J Ophthalmol. 2020 Mar;64[2]:180-186. DOI: 10.1007/s10384-020-00721-8.
9. Read SA, Alonso-Caneiro D, Vincent SJ, Collins MJ. Peripapillary choroidal thickness in childhood. Exp Eye Res. 2015 Jun;135:164-73. DOI: 10.1016/j.exer.2015.03.002.
10. El-Shazly AA, Farweez YA, ElSebaay ME, El-Zawahry WMA. Correlation between choroidal thickness and degree of myopia assessed with enhanced depth imaging optical coherence tomography. Eur J Ophthalmol. 2017 Aug 30;27[5]:577-584. DOI: 10.5301/ejo.5000936.
11. Zhang Q, Neitz M, Neitz J, Wang RK. Geographic mapping of choroidal thickness in myopic eyes using 1050-nm spectral domain optical coherence tomography. J Innov Opt Health Sci. 2015 Jul 1;8[4]:1550012. DOI: 10.1142/S1793545815500121.
12. Hoseini-Yazdi H, Vincent SJ, Collins MJ, Read SA, Alonso-Caneiro D. Wide-field choroidal thickness in myopes and emmetropes. Sci Rep. 2019 Mar 5;9[1]:3474. DOI: 10.1038/s41598-019-39653-w.
13. Teberik K, Kaya M. Retinal and Choroidal Thickness in Patients with High Myopia without Maculopathy. Pak J Med Sci. 2017 Nov-Dec;33[6]:1438-1443. DOI: 10.12669/pjms.336.13726.
14. Flores-Moreno I, Lugo F, Duker JS, Ruiz-Moreno JM. The relationship between axial length and choroidal thickness in eyes with high myopia. Am J Ophthalmol. 2013;155[2]:314-319.e1. DOI: 10.1016/j.ajo.2012.07.015.

1/2022

International Journal of Medical Arts

https://ijma.journals.ekb.eg/
Print ISSN: 2636-4174
Online ISSN: 2682-3780