DOI: https://doi.org/10.53350/pjmhs22161106

ORIGINAL ARTICLE

Choroidal Thickness in Normal Pakistani Eyes using Swept Source Optical Coherence Tomography

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ABSTRACT

Background: Information on choroidal thickness may be helpful in a variety of clinical settings for diagnosis, treatment, and disease progression assessment.
Aim: To assess the choroidal thickness in normal Pakistani eyes using swept source optical coherence tomography.
Study design: Cross-sectional study
Place and duration of study: Department of Ophthalmology, Shalimar Medical & Dental College from 1st March 2021 to 31st August 2021.
Methodology: Three hundred eyes were included from 150 healthy individuals. A thorough eye examination was performed for all the included participants. Choroidal thickness was measured by using swept source optical coherence tomography.
Results: The mean subfoveal choroidal thickness was 296.80±145.13 µ. The nasal outer macula was observed minimum mean choroidal thickness of 240.3±120.12 µ while in superior inner macula it was maximum mean choroidal thickness of 307.91±122.76µ. A non-significant (p=0.0731) and negative correlation (r = −0.0887) of age was observed with subfoveal choroidal thickness. The correlation of refractive error with subfoveal choroidal thickness was positive (r = 0.2271) and significant statistically (P = 0.001). Negative correlation (r = −0.3273) of the axial length was observed with subfoveal choroidal thickness (p=0.021).
Conclusion: The increase of axial length and age, decreases in the choroidal thickness occur.
Key words: Choroidal thickness; Normal eyes; Swept source optical chohence tomography (OCT)

INTRODUCTION

The choroid, which is the most posterior portion of the uveal tissue in eyes, has the highest vascular supply per unit mass. It is composed of five structural layers, the majority of which are blood vessels. The choroid performs critical tasks such as supplying nutrition and oxygen to the outer retina, particularly the photoreceptor cell layer, and regulating retinal temperature. Because of the existence of melanocytes, it also absorbs excessive light and inhibits internal reflection of light, as well as regulating intraocular pressure by modifying ocular flow of blood.[1] Increased choroidal thickness causes a rise in hydrostatic pressure and vascular permeability, which may be caused by choroidal vessel dilation. In the pathophysiology of chorio-retinal disorders, abnormalities of the choroid have been a significant issue[2,3].

However, when the choroidal thinning occurs, there is inadequate nutrition for the retina, which results in the degeneration of the retinal pigment epithelium (RPE) and the loss of photoreceptor cells[4]. As a result, knowledge on choroidal thickness may be helpful in a variety of clinical settings for diagnosis, treatment, and disease progression assessment. As a result, it is critical to obtain choroidal thickness normative data. The first method for assessing the choroid was indocyanine green angiography. This technique is invasive, and no information regarding the choroid's thickness or cross-sectional evaluation is obtained. Ultrasonography and magnetic resonance imaging (MRI) have been used to assess the thickness of the choroid, but their resolution inside the choroid is inadequate.[5,6]

Optical coherence tomography, which operates on the concept of low coherence interferometry, is an innovative, non-invasive, and fast technique for structural examination of the choroid.[7] Enhanced depth imaging (EDI) was first introduced by Spaide et al[8] employing spectral domain-OCT. The method involves collecting inverted pictures in which the choroid is positioned near zero delay, allowing for clear visualization of the choroidal structure. When using EDI OCT, however, better visibility of the choroid is obtained at the cost of compromised resolution of the retinal layers. It is possible to image the retina and choroid simultaneously using swept source OCT without using an EDI. Because swept source OCT has a better repeatability and penetration than spectral domain-OCT, it may give a more precise assessment of choroidal thickness. A few researches on choroidal thickness in healthy people have been published[9-11].

Using swept source OCT, this study provides normative values for choroidal thickness in healthy Pakistani people.

Received on 17-09-2021
Accepted on 05-01-2022

MATERIALS AND METHODS

This was cross-sectional study piloted at the Ophthalmology department, Shalimar Medical and Dental College from 1st March 2021 to 31st August 2021. Approval to this study was given by the institutional committee for research and ethics. The inclusion criteria for our study consist of healthy individuals, patients or relatives of the patients having no eye disorder, individuals of both the sexes having age 18-60 years. The exclusion criteria for our study was patients having history of retinal or choroidal pathology, inflammation, surgery, hyperopia greater than 4 D, myopia greater than 6 D, retinal pathology on OCT. All the patients having systematic disease history like vascular diseases, diabetes mellitus, thyroid disorders, hypertension or patients with kidney problems were also excluded. A thorough eye examination was performed, which included slit lamp testing, best-corrected visual acuity testing, measurement of intraocular pressure by means of noncontact tonometry and examination of dilated fundus. Ocular biometry was used to measure axial length. Automated refractometer was used for measurement of refractive error. The standard ETDRS was used to measure choroidal thickness using swept source OCT. Subfoveal choroidal thickness was defined as choroidal thickness in the middle 1 mm zone. In each eye, twelve equidistant radial scans of 12 mm length were acquired, each centered on the fovea. Choroidal thickness was measured automatically by the machine. All the layers detected in automatic mode were carefully verified manually and, if necessary, adjusted to prevent mistakes in choroido-scleral junction delineation. The SSOCT machine's inbuilt grading system guaranteed scan quality. Every scan is given a score out of ten by the machine. For analysis, scans having a score of 6 were approved. Each eye received a single high-quality scan from a single observer who was unaware of the samples or the current research. Within a central 6 mm region that corresponds to the normal ETDRS grid, retinal thickness measurements were similarly measured. To eliminate diurnal fluctuation in choroidal thickness, all scans in our research were performed between 10 a.m. and 2 p.m. Before the scan, the patients were required to sit properly for at least 20 minutes. Data was entered and analyzed by using SPSS-23.

RESULTS

There were 80 (53.33%) males while 70 (46.67%) were females (Fig. 1). The mean age was 27.30±9.72. The mean axial length, refractive error was 22.98±2.01mm, −0.95 (2.99) D respectively. (Table 1) The mean subfoveal choroidal thickness was 296.80±145.13 µ. The nasal outer macula was observed with minimum mean choroidal thickness of 240.3±120.12 µ while in superior inner macula it was maximum with mean choroidal thickness of 307.91±122.76 µ. Inner zones were observed with greater choroidal thickness as compared to outer zone. The mean foveal thickness (retinal) was 240.12±45.90 µ. Thickest retina with mean thickness of 306.86±29.66 µ in was observed in nasal inner zone while thinnest retina with mean thickness of 252.21±25.91 µ in temporal outer zone (Table 2). Age of the participants, refractive error and axial length were correlated with mean subfoveal choroidal thickness. A non-significant (p=0.0731) and negative correlation (r = −0.0887) of age was observed with subfoveal choroidal thickness. The correlation of refractive error with subfoveal choroidal thickness was positive (r = 0.2271) and significant statistically (P = 0.001). Negative correlation (r = −0.3273) of the axial length was observed with subfoveal choroidal thickness. This correlation was statistically significant [p=0.021] (Table 3).

Fig. 1: Frequency of genders

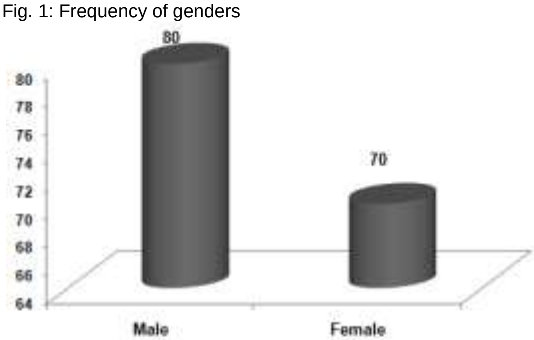

Table 1: Demographic and ocular parameters of the participants

Parameter	Mean±SD
Age (years)	27.30±9.72
Axial length (mm)	22.98±2.01
Refractive error (D)	−0.95±2.99

Table 2: Mean choroidal and retinal thickness of participant in all ETDRS zones

ETDRS zones	Choroidal thickness (µ)	Retinal thickness (µ)
Central subfoveal	296.80±145.13	240.12±45.90
Nasal inner macula	278.32±113.39	306.86±29.66
Nasal outer macula	240.3±120.12	284.34±25.11
Temporal inner macula	291.12±110.76	289.78±35.11
Temporal outer macula	278.11±106.19	252.21±25.91
Superior inner macula	307.91±122.76	305.92±38.12
Superior outer macula	302.33±112.42	265.19±28.32
Inferior inner macula,	295.20±123.22	299.98±34.30
Inferior outer macula	283.32±130.45	261.61±32.98

Table 3: Correlation of age, refractive error and axial length mean subfoveal choroidal thickness

Variable	Subfoveal choroidal thickness	
	r	P value
Age	−0.0887	0.0731
Refractive error	0.2271	0.001*
Axial length	−0.3273	0.021*

P<0.05 (Significant)

DISCUSSION

Earlier study reported the normative data of macular thickness in Pakistani population by using spectral-domain optical coherence tomography[12]. It is becoming more common in clinical practise to use swept source OCT due to the benefits it provides. A study done by Matsuo et al[13], use spectral domain and swept source OCT to measure and compared subfoveal choroidal thickness. They reported greater choroidal thickness with swept source OCT. It was ascribed to improved choroidos-cleral junction delineation, particularly in thicker choroid eyes. Other studies also reported superiority of swept source OCT as compared to spectral-domain OCT.[14,15] As a result, normative data for choroidal thickness using swept source OCT is recommended. This is the first research in Pakistan to use swept source OCT to provide normative data on choroidal and retinal thickness.

In the present study, mean age was 27.30±9.72 years, mean subfoveal choroidal thickness was 296.80±145.13 µ. The mean subfoveal-choroidal thickness was greater than previous study who reported mean foveal thickness 229±620.46 µ by using spectral domain OCT. In accordance to our finding, other studies also reported increased choroidal thickness by using swept source OCT.[13-15] In clinical practice, the little variation may be non-significant.[13] There is a lot of current research on choroidal imaging that relies on swept source OCT since it helps distinguish between the sclera and the choroidal junction better. In future research, we believe that the subfoveal choroidal thickness measured using swept source OCT will be more suitable for comparison. A non-significant (p=0.0731) and negative correlation (r = −0.0887) of age was observed with subfoveal choroidal thickness. A previous study done by Ikuno et al[16] stated that choroidal thickness decreases every decade 14 µ. Another study done by Chhablani et al[10] .also reported similar results to our study. In comparison to other studies, the decrease in choroidal thickness with age was non-significant statistically in our study. This might be due to age range (18-47 years) of the participants in our study because in most of the cases choroidal thinning is seen after 60 years.[17]

In line with earlier research, the subfoveal choroid of longer eyes was thinner, while the choroid of shorter eyes was thicker.[1,17] The correlation of refractive error with subfoveal choroidal thickness was positive (r = 0.2271) and significant statistically (P = 0.001). Negative correlation (r = −0.3273) of the axial length was observed with subfoveal choroidal thickness. This correlation was statistically significant (p=0.021). This may be helpful for determining the thickness of subfoveal choroidal in eyes that are longer or shorter.

The thickness of the choroidal layer varies topographically.[18-20] The fovea, or just the superior/temporal part of the fovea, is typically the point where thickness is high. For the highly active foveal region, thick choroid acts as a metabolic sink. Its centrifugal force progressively decreases. When seen from the nasal side, it rapidly narrows and suddenly terminates at the optical disc's border. As a result, it is the thinnest part of the nasal portion. With myopia (particularly high myopia in which the posterior pole elongates), temporal stretching occurs, causing the choroid to shift in relation to the fovea.[21] In such situations, increased thickness is seen temporally rather than in the center area. A topographic pattern is also seen in the thickness of the retina.[22,23] When compared to the nasal quadrant, where the most nerve fiber layers converge to join the optic disc, the temporal quadrant is thinner. The thickest quadrant is the superonasal quadrant, which may be attributed to large arcuate nerve fiber bundles in that region.

CONCLUSION

The increase of axial length and age, decreases in the choroidal thickness occur.

Conflict of interest: Nil

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