

Macular Thickness and Parity

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Abstract

The eye is one of the organs of the body that is affected by the physiological changes of pregnancy. Macular thickness varies with age and gender. Changes in macular thickness with increasing parity have been proposed by some researchers. This study sought to determine the effect of repeated pregnancies on macular thickness in Ahmadu Bello University Teaching Hospital, Zaria and to correlate macular thickness values based on parity. It was a cross-sectional descriptive study on healthy Nigerian adult female eyes in Ahmadu Bello University Teaching Hospital, Zaria. A total of 77 consenting female adult Nigerians with normal eyes were recruited and examined using Carl Zeiss Stratus Optical Coherence Tomography (OCT) machine Model 3000 software version 4.0. Data was analyzed using the independent sample t-test, one-way ANOVA and Sheffe post-hoc. Pearson method was used for correlation analysis. Mean age of subjects was 32.2 ± 8.2 years. Mean Total Macular Thickness (MTMT) was found to be $234.84 \pm 15.70\mu\text{m}$. MTMT was also found to be $283.84 \pm 16.12\mu\text{m}$, $283.85 \pm 16.37\mu\text{m}$ and $283.64 \pm 17.59\mu\text{m}$ in Hausa ($n = 106$), Igbo ($n = 03$) and Yoruba ($n = 20$) women respectively with no statistical significant difference between the three major tribes in Nigeria. Mean Central Foveal Thickness (MCFT) was $173.18 \pm 18.46\mu\text{m}$. The central fovea showed a statistically significant difference in the mean values for the nulliparaous, primiparous and multiparous groups $176.39 \pm 16.07\mu\text{m}$, $181.88 \pm 24.14\mu\text{m}$ and $169.58 \pm 18.0\mu\text{m}$ respectively ($P = 0.000$). Macular thickness has been shown to have a relationship with parity. Oestrogen has been proposed to play a role in this relationship. It is important to consider parity in the interpretation of macular thickness in parous females.

Keywords: Eye, Macular thickness, Parity, Oestrogen

INTRODUCTION

The macular is a round area at the posterior pole of the eye on the retina measuring between 5 and 6 mm in diameter. It subserves the central 15-20° of the visual field and is also responsible for colour vision and perception of fine details such as reading, writing, sewing, driving and others. Loss of peripheral vision may go unnoticed for some time, but damage to the macular will result in loss of central vision which may be noticed much earlier. (Kanski JJ and Bowling B, 2011).

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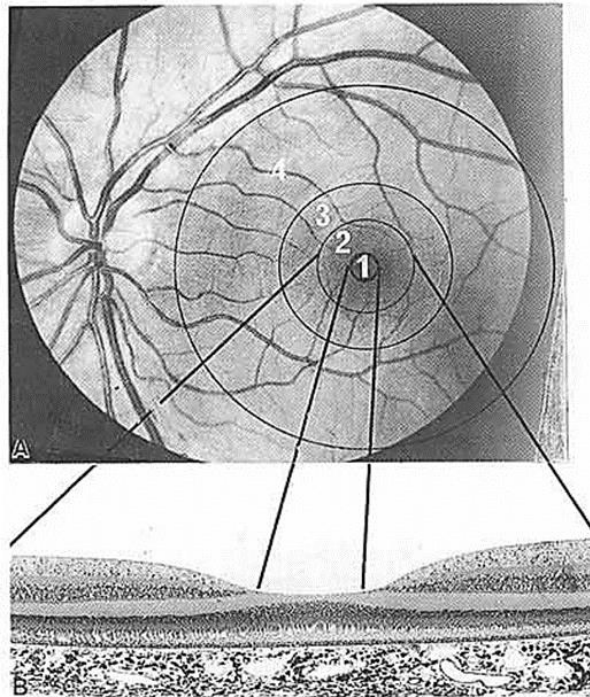


Figure 1: Fundus photograph of left human eye showing the macular area. From outwards inwards; 4 - Perifovea, 3-Parafovea, 2- fovea centralis, 1-foveola which has the central pit. Transverse section of the fovea retina matched to the fundus photograph shown above. Photomicrograph, original magnification $\times 70$. Tripathi RC et. al, 1984).

Optical Coherence Tomography (OCT) has been used in the study of retinal disorders including the macula since the late 1990s. This machine has contributed extensively in describing the possible pathogenesis of retinal diseases. Its peculiar ability to detect with high accuracy the inner and outer retinal boundaries from the acquired scans and to measure their distance (i.e., retinal thickness) has made OCT increasingly popular in the quantitative assessment of macular changes.

Macular thickness measurements were found to have high level of reproducibility and reliability. The level of reproducibility and reliability depends on the type of OCT with values ranging from 84.8% to 94.9% for Stratus OCT and from 93.1% to 97.9% for Spectral Domain (SD) OCT (Polito A et. al., 2005).

Mean foveal thickness was positively associated with age of females and parity as macular thickness were significantly higher in parous than nulliparous women (Wexler A et. al., 2003). Oestrogen receptors have been shown to confer some level of protection to the retina against age-inflicted injury partly by inhibiting lipid peroxidation. Parity has demonstrated the ability to lower oestrogen levels in parous premenopausal compared with nulliparous women, partly by altering the sensitivity to sex hormones. Low levels of oestrogen may be responsible for the increase thickness in the macula of parous women (Wexler A et. al., 2003).

Pregnancy is a physiological state that leads to important changes in all systems of the body including the eyes (Kubica-Trzaska A et. al., 2008). Some of the documented changes that occur in the eyes during pregnancy include increase in ocular blood flow, decrease intraocular pressure, loss of visual field, increase corneal thickness and altered curvature (Qureshi IA, 1997; Weinreb RN et. al., 1988; Sunness JS, 1988; Park SB et. al., 1992).

Pregnancy also poses a risk for pathological changes in the eyes. Notably, pregnancy is a risk factor for central serous chorioretinopathy which has been associated with the hyper permeability of the choroid vessels that occurs during pregnancy (Said-Ahmed K et. al., 2012; Haimovici R et. al., 2004; Liew G et. al. 2013). The effect of pregnancy on macular thickness has not been well explored in the literature (Ulusoy DM et. al., 2013). Few studies have reported increase in macular thickness in superficial, inferior and temporal quadrants during pregnancy, while others have reported no difference in macular thickness during pregnancy and three months after delivery (Demir M et. al., 2011; Cankaya C et. al., 2013). The effect of repeated pregnancies on macular thickness may affect the interpretation of macular thickness in parous women. This study sought to determine the effect of repeated pregnancies on macular thickness in women attending Ahmadu Bello University Teaching Hospital, Zaria and to correlate macular thickness values based on parity.

METHODOLOGY

Study Area

Zaria is one of the major towns of Kaduna State in North-Western geopolitical zone of Nigeria. It is located at latitude 11.193791° N and longitude 7.7117155°E. Zaria experiences both rainy and dry seasons with rainy season spanning from April to September with an average temperature of 30°C during this period. The dry season spans from October to March, during which the dusty harmattan period is experienced lasting from November to February when temperature drops to as low as 10°C at night (weatherpark.com, 2021).

Zaria is a cosmopolitan city consisting predominantly of Hausa and Fulani groups with farming as the major occupation of the locals.

Ahmadu Bello University Teaching Hospital (ABUTH) Zaria is a major health institution which serves as a tertiary and referral facility. It has an Ophthalmology Department that is being manned by an ophthalmologist, optometrists and ophthalmic nurses. The department has 5 units that provide emergency and elective ophthalmic services. Facilities for measurement of macular thickness using Stratus OCT are available.

Study Design

It was a cross-sectional descriptive study on healthy female Nigerian adult eyes in ABUTH - Zaria, Nigeria. Subjects above 18years of age with best corrected visual acuity of 6/6 or better were recruited for the study while subjects under 18 years of age, subjects with best corrected visual acuity of less than 6/6, subjects with history of diabetes, history of hypertension, history of ocular pathology or abnormal IOP, history of ocular trauma, Subjects with moderate and high refractive errors and abnormal axial length (>24mm) were excluded from the study.

Sampling Technique

Snowball sampling technique was used to recruit subjects. Simple balloting sampling technique was used to select the eye to be examined in order to eliminate bias by folding an identical paper with "R" or "L" written indicating right or left eye respectively.

Approval of the Health Research Ethics Committee (HREC) of ABUTH, Zaria was obtained prior to the commencement of the study. Informed consent was also obtained from all subjects. Subjects were reassured that they were free to withdraw from the study whenever they wished and were also reassured that no name of the participant will be published, and confidentiality will be maintained at every point.

Data Analysis

Statistical analysis was performed using the Statistical Package for Social Science (version 23.0; SPSS Inc., Chicago, IL, USA). Descriptive statistics (e.g., count, mean, and standard deviation) were generated for all the OCT outcomes and subject characteristics. The one-sample Kolmogorov-Smirnov test was used to test for normal distribution. Analysis of variance (ANOVA) with the Sheffe post hoc test was used to compare mean thickness across the regions and quadrants based on age, sex, axial length, parity and refractive errors and IOP of the subjects. The associations between subject characteristics and macular thickness were evaluated using the Pearson partial analysis. Significance was set at the 95% confidence interval ($P \leq 0.05$). Tables and results of printouts were used to illustrate results.

RESULTS

Table 1 represents the sociodemographics of subjects who consented for the study. A total of 77 female subjects were examined aged between 18 and 58 years. Using descriptive analysis of the IBM SPSS (version 23), more than half of the subjects were of the Hausa ethnic group (55.8%), while Yoruba and Igbo ethnic groups accounted for 15.6% and 2.6% respectively

Table 1: Socio demographic characteristics of Subjects. (N=77)

Age (years)	Frequency	Percent (%)
18-30	33	42.9
31-40	26	33.8
41-50	9	11.7
51+	9	11.7
Total	77	100.0
Ethnicity		
Hausa	43	55.8
Yoruba	12	15.6
Igbo	2	2.6
Others	20	26.0
Total	77	100.0

Table 2: Parity related to Macular thickness.

Thickness N= 23	Nulliparous N=8	Primipara N=45	Multipara	P-value	(μm)
Central fovea	176.39 $\pm$ 16.07	181.88 $\pm$ 24.14	169.58 $\pm$ 18.06	0.000	
Inner Region					
Superior	269.74 $\pm$ 16.33	270.25 $\pm$ 24.39	256.87 $\pm$ 16.94	0.132	
Nasal	255.39 $\pm$ 16.15	252.63 $\pm$ 26.67	250.13 $\pm$ 20.42	0.082	
Inferior	257.70 $\pm$ 18.20	256.50 $\pm$ 27.49	248.51 $\pm$ 21.94	0.023	
Temporal	254.22 $\pm$ 17.71	257.38 $\pm$ 25.30	242.09 $\pm$ 16.95	0.002	
Outer Region					
Superior	239.22 $\pm$ 14.77	232.50 $\pm$ 19.89	226.96 $\pm$ 14.92	0.046	
Nasal	245.83 $\pm$ 16.33	226.63 $\pm$ 84.51	243.89 $\pm$ 20.49	0.051	
Inferior	236.83 $\pm$ 15.83	232.13 $\pm$ 16.21	228.91 $\pm$ 17.02	0.379	
Temporal	231.44 $\pm$ 26.35	220.13 $\pm$ 25.67	216.64 $\pm$ 21.65	0.097	

The central fovea showed a statistically significant difference in the mean values for the nulliparaous, primipara and multipara groups (Table 2); 176.39 $\pm$ 16.07 μm , 181.88 $\pm$ 24.14 μm , 169.58 $\pm$ 18.0 μm respectively ($P = 0.000$).

DISCUSSION

Optical Coherence Tomography (OCT) remains one of the most objective tests in quantitative assessment of macular and retinal nerve fibre layer. Differences exist in the results obtained from the different types of OCT machines. Its use in diagnosis and follow up of a variety of retinal diseases is important for optimal provision of eye care.

Results in this study is similar to that obtained in Norway (Wexler A et. al., 2003) where macular thickness was significantly higher in parous than nulliparous women. Oestrogen receptors have been shown to confer some level of protection to the retina against age-inflicted injury and low levels of oestrogen have been proposed to be responsible for the increase thickness in the macular of parous women. (Wexler A et. al., 2003). Visual symptom concern up to 25% of patients with severe preeclampsia and 50% of patients with eclampsia (Samra KA, 2013) and the presence of macular oedema, or papilloedema or retinal detachment are warning signs for termination of pregnancy to save the vision of the mother (Reddy SC & Raghavamma TV, 1981; Reddy SC et. al. 2012). The most objective method of measuring the patients macular is by using the OCT machine. Values are then to be compared with the reference range for patient's parity status for a reliable result and hence a more guided decision. The parity of the patients could then play a vital role in the interpretation of the women's macular thickness values both at time of diagnosis, treatment and follow up.

Conclusion: Macular thickness has been shown to have a relationship with parity. Oestrogen has been proposed to play a role in this relationship. It is important to consider parity in the interpretation of macular thickness in females. This clinical relevance needs to be studied further.

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