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قسم

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Studying the Influence of Axial Length on Retinal Nerve Fiber Layer Thickness and Optic Disc Size Measurements by Spectral-Domain OCT

A Thesis

Submitted for Partial Fulfillment of Master Degree
in Ophthalmology

By

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بسم الله الرحمن الرحيم

قالوا

سبحانك لا علم لنا إلا ما علمتنا إنك أنت العليم الحكيم

صدق الله العظيم

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✍ *Menna Anwar Ali*

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List of Abbreviations

Abbr.	Full-term
ACD	: Anterior chamber depth
AD	: Alzheimer's disease
AL	: Axial length
BCVA	: Best corrected visual acuity
CA	: Corneal astigmatism
CCD	: Charge-coupled device
CDRs	: Cup–disc ratios
CNV	: Choroidal new vessels
cpRNFL	: Circumpapillary retinal nerve fiber layer
CRA	: Chorio-retinal atrophy
CSLO	: Confocal scanning laser ophthalmoscopy
D	: Diopter
FD-OCT	: Fourier-domain OCT
HRT	: Heidelberg retina tomography
ILM	: Inner limiting membrane
IOL master	: Ocular biometer
IOP	: Intra ocular pressure
LC	: Lamina cribrosa
MCI	: Mild cognitive impairment
mCNV	: Myopic choroidal neovascularization
MH	: Macular hole

MRI : Magnetic resonance imaging
MTM : Myopic traction maculopathy
NTG : Normal tension glaucoma
OAG : Open angle glaucoma
OCT : Optical coherence topography
ONH : Optic nerve head
PPA : Peripapillary atrophy
PSC : Posterior sub capsular
RGC : Retinal ganglion cell
RNFL : Retinal nerve fiber layer
RNFLT : Retinal nerve fiber layer thickness
RPE : Retinal pigment epithelium
SD : Standard deviation
SD-OCT : Spectral domain optical coherencetomography
SE : Spherical equivalent
SLP : Scanning laser polarimetry
SPSS : Statistical package for social science
SS-OCT : Swept source OCT
TD-OCT : Time domain optical coherencetomography
UCVA : Uncorrected visual acuity
VEGF : Vascular endothelial growth factor
VFDs : Visual field defects
3D-OCT : Three dimensional optical coherence tomography

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Abstract

Purpose: The aim of this study is to evaluate the effect of axial myopia on the retinal nerve fiber layer thickness and optic disc size using spectral domain Optical Coherence Topography. **Patients and Methods:** This study was a cross-sectional study on 30 myopic eyes of patients aged between 30-40 years who were coming to the outpatient clinic. The patients were recruited from the outpatient clinic of the Health Insurance Hospital in Suez. **Results:** This study found that the average, superior and inferior retinal nerve fiber layer thickness (RNFLT) significantly decreased with increase of the axial length. This study also found a direct correlation between axial length (AL) and disc area. However, AL was not significantly correlated with RNFL thickness in the nasal or temporal quadrant, optic rim area, or cup disc ratio (CDR). **Conclusion:** The study revealed that AL had a correlation with RNFLT and that axially myopic eyes showed thinner RNFLT than emmetropic eyes.

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Key words: Axial length, retinal nerve fiber layer thickness, optic disc size spectral-domain OC

Introduction

Refractive errors result when there is a mismatch between the optical power and the axial length of an eye. Theoretically, myopia may result from an eye being either too long or its optical components too powerful, leading to images of distant objects being formed in front of the retina ***(Ostrin et al., 2015).***

Vision in myopia may be restored using optical devices such as spectacles and contact lenses, but high myopia is closely linked to potentially visually disabling eye diseases. An extensive literature has documented a myriad of complications including cataract, glaucoma, myopic macular degeneration, retinal holes, and choroidal neovascularization **(*Tano, 2002*).**

Notably, myopia has been widely reported to affect the size and shape of the optic disc and peripapillary retinal nerve fiber layer (RNFL). Diagnosis of glaucoma in myopic patients is thus very challenging **(*Samarawickrama et al., 2007*).**

Thorough and accurate understanding of the relationship between myopia and the anatomic structures of the optic nerve head (ONH) and RNFL is important, particularly in light of the two to three times greater risk of glaucoma in myopic individuals compared with nonmyopic individuals. However, the influence of myopia on the shape and size of the ONH and peripapillary RNFL is still uncertain **(*Melo et al., 2006*).**

The retinal nerve fiber is the axon of a retinal ganglion cell (RGC), consisting of axonal membranes, microtubules, neurofilaments, and mitochondria. It is one of the major building blocks of the human visual system, carrying the visual information and transferring the signals from cone and rod photoreceptors via an RGC to the brain through the ONH ***(Huang, 2006*).**

Signal loss caused by nerve fiber defects leads to a possible loss of vision at a certain location of the visual field. In that sense, investigation and thorough understanding of structure and function of retinal nerve fibers, fiber bundles, and fiber layers are very important as one of the fundamentals of the visual system **(*Sugita et al., 2015).***

The distribution of the nerve fiber bundles is basically radial at the circum-papillary regions (i.e., around the ONH), and the striations of fiber bundles from the temporal part of the ONH mostly flow into the foveal region where a group of striations converge at the foveal center and the others divert themselves from the center to reach further distant temporal positions **(*Kocaoglu et al., 2011).***

In the superior, nasal, and inferior directions, the fiber bundle striations are basically radial and bend toward the temporal direction where they flow away from the ONH **(*Sugita et al., 2015*).**

The retinal layer which contains the nerve fiber bundles is the RNFL, which is located at the surface of retina, posterior to the inner limiting membrane (ILM), and anterior to the retinal ganglion cell layer **(*Hood et al., 2013*).**

The thickness of the RNFL ranges from about 10 μm (around the fovea) to 400 μm (margin of the ONH) for a healthy human eye. In case of glaucoma, the RNFL thickness is reduced **(*Sugita et al., 2015).***

Optical coherence tomography (OCT) is a noninvasive technology that has been extensively used to evaluate many diseases of the optic nerve. In most cases, scientists have focused their attention on the peripapillary RNFL thickness ***(Barboni et al., 2010).***

However, OCT can also analyze and measure topographic parameters of the ONH, including the disc area, neuroretinal rim area and cup-to-disc ratio (***Kamppeter et al., 2006).***

Evaluation of these parameters is essential, since the ONH size affects the clinical course of several pathologies of