Comparison between Choroidal Thickness in Myopes and Hypermetropes

Thesis

Submitted for Partial Fulfillment of Master Degree in Ophthalmology

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Cairo, Egypt
2018

Acknowledgment

I am deeply thankful to ***Allah*** *All Mighty, for providing me with the potential, patience and foundation to fulfill this work.*

I am also very grateful to my dear supervisor ***Prof. Dr. Dina Ezzat*** *for her continuous advice, support and guidance throughout the work. I am really honored to get my Master degree under her supervision.*

I would like also to thank ***Dr. Maged Maher and Dr. Ahmed Taha*** *for the continuous encouragement and advice throughout this thesis. There suggestions and efforts in revising the work and its writing are really appreciated.*

Finally, I would like to present my humble respect and deepest thanks to ***my family,*** *this work wouldn't have been completed without the continuous care, support and supervision, encouragement of my father* ***Prof. Dr. Mounir Abou El Ela,*** *My mother* ***Dr. Mona Abdel Moneim*** *and my brother and sister* ***Ahmed and Mayar*** *and my fiancée* ***Dr. Dina Edarous.***

Mohamed Mounir

List of Contents

List of Tables

List of Tables (Cont...)

List of Figures

List of Figures (Cont...)

List of Abbreviations

Abb.	Full term
µm	*Micrometer*
BCVA	*Best Corrected Visual Acuity*
CNV	*Choroidal Neovascularisation*
CSI	*Chorioscleral interface*
CT	*Choroidal Thickness*
D	*Diopters*
EDI	*Enhanced depth imaging*
ICG	*Indocyanine green*
ICNs	*Intrinsic Choroidal Neurons*
IOL	*Intra Ocular Lens*
IOP	*Intraocular Pressure*
K	*keratometry*
LASIK	*Laser Assisted in Situ Keratomileusis*
mm	*Millimeters*
nm	*Nanometers*
OCT	*Ocular Coherence Tomography*
PCAs	*Posterior Ciliary Arteries*
PRK	*Photorefractive Keratectomy*
RPE	*Retinal Pigmented Epithelium*
SD	*Spectral Domain*
SE	*Spherical Equivalent*
SFCT	*Subfoveal Choroidal Thickness*
TD	*Time Domain*
UCVA	*Uncorrected Visual Acuity*

ABSTRACT

Background: the choroid is a vascular sheet that forms the most posterior part of the middle coat of the eye, extending from optic nerve to the ciliary body. Its function is to provide the blood supply of the retinal pigmented epithelium (RPE) and the outer half of the sensory retina. Moreover, it absorbs excess light energy that penetrates the retina through its pigmented cells preventing light reflection. The choroidal thickness (CT) is 250 µm at the posterior pole, thickest at the macula with 300 µm and thinner anteriorly 100 µm.

Aim of the Work: to evaluate and compare CT in hypermetropes (+1.00 D to +5.00 D) and in myopes (-1.00 D to -6.00D) using SD- OCT.

Patients and Methods: this is a cross sectional study. This study was conducted on 60 eyes of 55 Egyptian healthy subjects, 24 males and 31 female were selected by convenient sample with the mean age of 36 years old, they equally divided into two groups, myopia group and hypermetropia group. All procedures were done at Demerdash hospital. This study it was used the RS-3000 SD-OCT machine.

Results: in this study it was found that in hypermetropic group SFCT was 98.58±31.31µm and in myopic group, SFCT was 96.13±35.24 µm.

Conclusion: there was no statistically significant difference between the choroidal thickness in the myopic group and the hypermetropic group.

Keywords: *Choroidal Thickness – Myopes – Hypermetropes - Ocular Coherence Tomography*

INTRODUCTION

The choroid is a vascular sheet that forms the most posterior part of the middle coat of the eye, extending from optic nerve to the ciliary body. Its function is to provide the blood supply of the retinal pigmented epithelium (RPE) and the outer half of the sensory retina. Moreover, it absorbs excess light energy that penetrates the retina through its pigmented cells preventing light reflection. The choroidal thickness (CT) is 250 µm at the posterior pole, thickest at the macula with 300 µm and thinner anteriorly 100 µm. [(1)]

It is divided into four layers (classified in order outside inward); Haller's layer which is the outermost layer of the choroid consisting of larger diameter blood vessels, Sattler's layer is the layer of medium diameter blood vessels, the choriocapillaris is the layer of capillaries and Bruch's membrane (innermost). [(2)]

There are many factors that may affect the CT, such as myopia, intraocular surgery, diabetic retinopathy, age-related macular degeneration, central serous chorioretinopathy, glaucoma and laser therapy. [(3)]

Moreover, some medications may alter the CT like sildenafil citrate ingestion, intravenous acetazolamide, homatropine eye drops, and anti-glaucomatous drugs as timolol eye drops. Additionally; choroid thickness shows a significant diurnal variation as thicker around midnight and thinner around noon.[(3)]

Myopia has many classifications; one of them is by etiology into axial myopia and refractive myopia. Axial myopia is caused by the increase in the antro-posterior diameter of the eye and is subdivided into simple, degenerative and congenital. Refractive myopia is caused by the increase of the power of the eye either by increased curvature of the refractive media of the eye as cornea and lens or index myopia caused by increase in the index of the refractive media as in nuclear sclerosis of the lens. (4)

Another classification is by degree into: low from -0.25 to -3.00 Diopters (D), medium from -3.00 to -6.00 D and high more than -6.00 D. (4)

In high myopia, even near vision is affected as objects must be extremely close to the eyes to see clearly. A common change in high myopia is retinal atrophy. At the edge of the retina there may be retinal thinning known as lattice degeneration. As the eye stretches it can cause breaks that occur in Bruch's membrane, known as lacquer cracks. In some people new blood vessels can grow from the blood supply underneath the retina and cause choroidal neovascularization (CNV). The damage to the retina caused by new blood vessels causes scarring, which at the macula, is called Foster Fuchs spot. (5)

Likewise, hypermetropia is classified by anatomical features into: axial hypermetropia, curvature hypermetropia and index hypermetropia. Another classification is by degree into: low from +0.25 to +3.00 D, medium from +3.00 to+5.00D, and high more than +5.00D. (6)

Choroidal thickness can be measured by the optical coherence tomography (OCT) where a light in the near-infrared spectrum 810 nm from a super luminescent diode is used to create high-resolution cross-sectional images of the retina. A partially reflective mirror is used to split the coherent light beam into a measuring beam and a reference beam. The measuring beam is directed into the eye, where successive optical interfaces (e.g., retinal layers, RPE, choriocapillaris) reflect the beam to a variable extent. [7]

Early OCT models were based on time-domain (TD) OCT technology. More recent models take advantage of spectral domain (SD), or Fourier domain, technology which circumvents use of a reference beam, enabling faster acquisition of a larger amount of data, ultimately providing higher resolution images that can yield three-dimensional reconstructed views**.** [7]

Spectral domain OCT uses a wavelength of 840 nm and a technique where the light source is brought closer to the eye. It can produce an inverted image focusing on the choroid and inner sclera, to allow an accurate image of the choroid**.**(8)

This technique that enables high-resolution visualization of the choroid is termed enhanced depth imaging (EDI). It has also been performed with OCT prototypes using a 1 060 nm wavelength.[9]

The choroid thickness has been demonstrated to be 170-220 µm in normal eyes by histology and SD-OCT. Histological studies demonstrated that the variation in CT is due to significant change in thickness of the choriocapillaris and focal lack or engorgement of vessels.(10)

Time domain OCT light source wave length is 820 nm but in SD OCT it is 840 nm and with broader band width. The resolution in TD OCT is 10 µm axially and 20 µm in transverse direction. In contrast, in SD OCT they are 7 µm and 10 µm respectively which gives better visualization. The scanning speed in TD-OCT range from 400 to 500 A-scans per second in comparison with SD-OCT the speed reaches up to 52 000 A-scans per second.(11)

AIM OF THE WORK

Aim of the study is to evaluate and compare CT in hypermetropes (+1.00 D to +5.00 D) and in myopes (-1.00 D to -6.00D) using SD- OCT.

Chapter 1

CHOROID

The choroid is traditionally described as arranged in layers of vessels from the outer to inner part of the choroid the Haller layer, the Sattler layer, and the choriocapillaris. The Haller layer contains larger choroidal vessels, and the Sattler layer has medium-sized vessels. There is no distinct border between these layers or even an established definition of what is meant by large or medium. The blood from the short posterior ciliary arteries (PCAs) enters the eye and travels through successively smaller arterioles within the choroid to arrive at the choriocapillaris.[12]

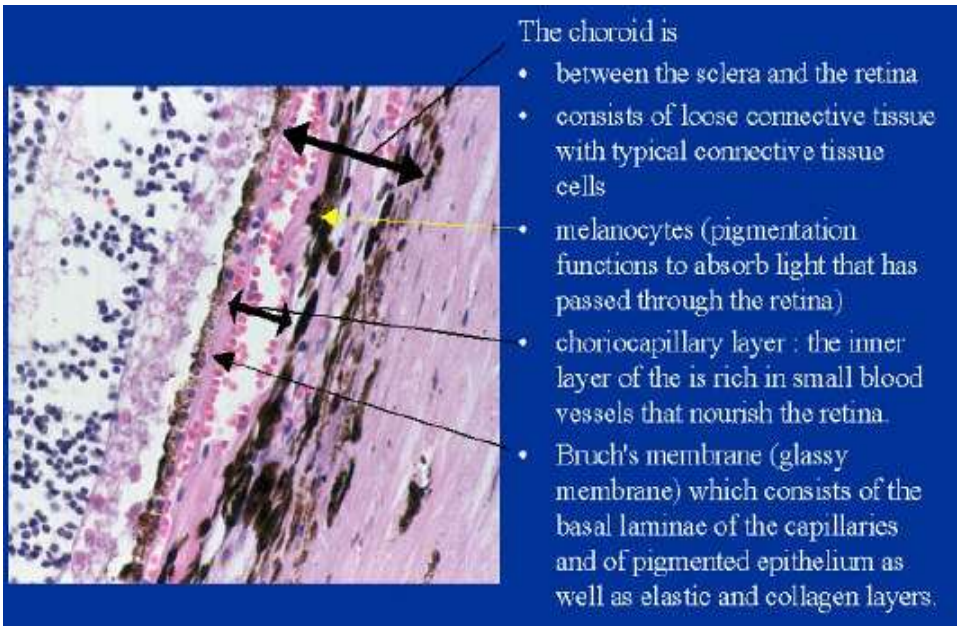

Figure (1): Microscopic anatomy of choroids.[12]