

Optical Coherence Tomography Compared to Visual
Field Examination in Detection and
Follow Up of Glaucoma
As a Measure of Early Prevention of Blindness

Thesis Submitted for Partial Fulfillment
of the Medical Degree in Ophthalmology

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At first and foremost thanks to “Allah” who gave me the power to finish this work

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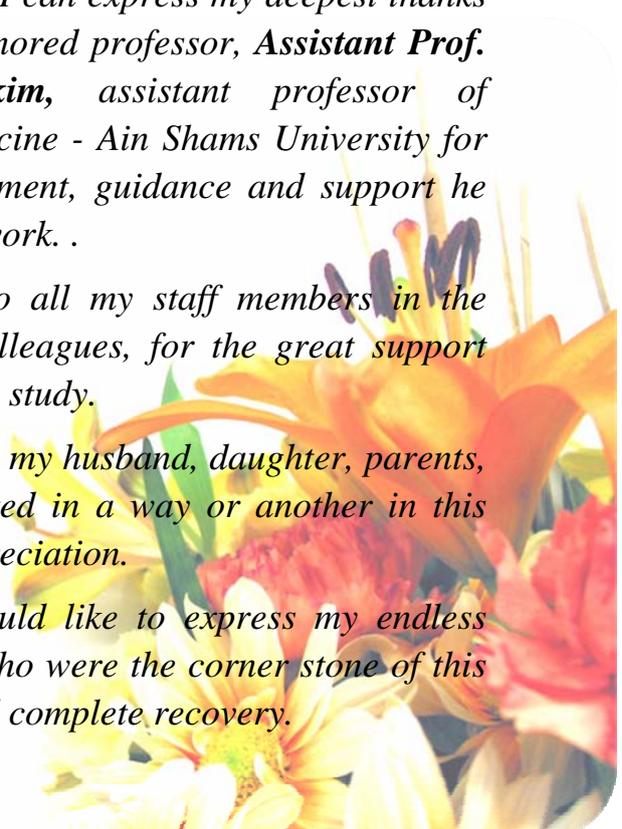


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List of Abbreviations

AGIS	:	Advanced Glaucoma Intervention Study
AOP	:	Acquired optic disc pit
BCVA	:	Best corrected visual acuity
CCT	:	central corneal thickness
CIGTS	:	Collaborative Initial Glaucoma Treatment Study
CPSD	:	Corrected Pattern Standard Deviation
CSLO	:	Confocal scanning laser ophthalmoscopy
D	:	Diopters
dB	:	decibel
EMGT	:	Early Manifest Glaucoma Trial
GAT	:	Goldmann Applanantion Tonometer
GHT	:	Glaucoma Hemifield Test
GS	:	Glaucoma suspect
HFAII	:	Humphrey Field Analyzer II
HRT	:	Heidelberg retina tomography
IOP	:	intraocular pressure
ISN'T	:	Inferior, superior, nasal and temporal
NTG	:	Normal Tension Glaucoma
OCT	:	Optical coherence tomography

OHTS	:	Ocular Hypertensive Treatment Study
ONH	:	optic nerve head
RNFL	:	retinal nerve fiber layer
RPE	:	retinal pigment epithelium
SAP	:	standard automated perimetry
SITA	:	Swedish Interactive Thresholding Algorithm
SLP	:	Scanning laser polarimetry
SWAP	:	Short-wavelength automated perimetry
VCC	:	variable corneal compensator
VF	:	Visual field

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Aim of the Work

The purpose of the study is to evaluate OCT's ability to detect glaucoma in its early stages and follow up progression of the disease compared to visual field examination aiming for better control of the disease decreasing the incidence of morbidity (blindness) resulting from this disease.

INTRODUCTION

Glaucoma is a chronic disease of the optic nerve characterized by the loss of retinal ganglion cells, and by specific patterns of progressively decreasing retinal sensitivity (*Spaeth, 1993*).

Over the years, the approach to following glaucoma progression has grown from administering serial visual field tests to detecting structural and functional changes with new modalities (*Hood et al, 2004*).

Visual field (VF) deficits are thought to be the functional expression of ganglion cell losses. The retinal sensitivity detected by standard automated perimetry (SAP) is measured using a logarithmic decibel (dB) scale (*Garway et al, 2000*). Compared with standard perimetry, short-wavelength automated perimetry (SWAP) may improve the detection of progressive glaucoma. Studies have demonstrated that SWAP use identified more patients than standard perimetry as having progressive glaucomatous changes of the optic disc (*Girkin et al, 2000*).

Optical coherence tomography (OCT), first described in 1991 by Huang and associates, is a high-resolution imaging technique that allows in vivo measurements of the retinal nerve fiber layer (RNFL) in cross section. It provides quantitative RNFL thickness data by measuring the difference in the temporal delay of back-scattered light from the RNFL and a reference mirror (*Huang et al, 1991*). The third-generation

instrument is able to quantify the thickness of the RNFL at a resolution of approximately eight to ten micrometers. (*Hougaard et al, ۲۰۰۶*).

Ideally, pairing of such two devices should show a good correlation between functional and structural examinations to permit a better interpretation of clinical findings and a more accurate staging of structural or visual impairment (*Bowd et al, ۲۰۰۶*).

ANATOMICAL CONSIDERATIONS

The OPTIC NERVE HEAD

The optic disc or optic nerve head is the location where ganglion cell axons exit the eye to form the optic nerve. The optic nerve head in a normal human eye carries from 1 to 1.2 million neurons from the eye towards the brain (*Anthony et al, 1991*).

The optic disc is placed 3 to 4 mm to the nasal side of the fovea. It is a vertical oval, with average dimensions of 1.76 mm horizontally by 1.92 mm vertically. Ophthalmoscopically, the disc corresponds in size to the internal opening of the scleral canal (*Allingham et al, 2009*).

The optic nerve represents the bundle of axons that extend from the cell bodies of ganglion cells in the retina to synapse on the lateral geniculate body in the brain. The optic nerve as a structure begins at the optic disc. A smaller, disc-shaped depression, called the cup, lies slightly temporal to the center of the optic disc. Nerve bundles penetrate the collagen of the sclera through a sieve perforations, termed the lamina cribrosa (*Allingham et al, 2009*).