

# **Optical Coherence Tomography Guided Corneal Surgeries**

Essay submitted for the partial fulfillment of M.Sc. degree in  
Ophthalmology

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## Abstract

It helps screen out patients with forme fruste keratoconus and is helpful in calculating the expected residual stromal bed thickness. It is also beneficial for detecting post LASIK complications early and accurately as: post LASIK ectasia, diffuse lamellar keratitis, epithelial ingrowth, interface fluid syndrome and macrostriae.

Key word: Tomography , Coherence , Ophthalmology

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# List of Abbreviations

<b>µm</b>	Micrometer
<b>ACI 7000</b>	Acu Focus Corneal Inlay 7000
<b>A-mode</b>	Amplitude mode
<b>AS - OCT</b>	Anterior segment optical coherence tomography
<b>BCVA</b>	Best corrected visual acuity
<b>BESSt</b>	Borasio, Edmondo, smith and Stevens
<b>B-mode</b>	Brightness mode
<b>C/P ratio</b>	Corneal central thickness over peripheral thickness
<b>CA USA</b>	California united states of America
<b>CAM</b>	Corneal adaptor module
<b>CCT</b>	Central corneal thickness
<b>CET</b>	Central epithelial thickness
<b>D</b>	Diopters
<b>DESEK</b>	Descmet's stripping endothelial keratoplasty
<b>DLEK</b>	Deep lamellar endothelial keratoplasty
<b>DLK</b>	Deep lamellar keratoplasty
<b>DSAEK</b>	Descemet's stripping automated endothelial keratoplasty
<b>EK</b>	Endothelial keratoplasty
<b>FD-OCT</b>	Fourier domain optical coherence tomography
<b>FFK</b>	Formefruste keratoconus

<b>I</b>	Inferior
<b>ICO</b>	International council of ophthalmology
<b>ICR</b>	Intracorneal rings
<b>ICRS</b>	Intracorneal ring segment
<b>IFS</b>	Interface fluid syndrome
<b>IOL</b>	Intraocular lens
<b>IT-SN</b>	Inferotemporal-superonasal
<b>K value</b>	Keratometric value
<b>KCI</b>	Keratoconus index
<b>KHz</b>	Kilo Hertz (One thousand cycle per second)
<b>KPI</b>	Keratoconus prediction index
<b>LASIK</b>	Laser insitu keratomeleusis
<b>mm</b>	Millimeters
<b>MR</b>	Manifest refraction
<b>nm</b>	Nanometers
<b>OCP</b>	Online corneal pachymetry
<b>OCT</b>	Optical coherence tomography
<b>UBM</b>	Ultrasound biomicroscopy
<b>PKP</b>	Penetrating keratoplasty
<b>PRK</b>	Photorefractive keratectomy
<b>PTK</b>	Phototherapeutic keratectomy
<b>RK</b>	Radial keratotomy

<b>S</b>	Superior
<b>SD OCT</b>	Spectral domain optical coherence tomography
<b>S-I</b>	Superior-inferior
<b>Sim-K</b>	Simulated Keratometric readings
<b>SL OCT</b>	Slit lamp optical coherence tomography
<b>SN-IT</b>	Superonasal-inferotemporal
<b>SRAX</b>	Skewed radial axis
<b>TD-OCT</b>	Time domain optical coherence tomography
<b>UBM</b>	Ultrasound biomicroscopy
<b>UCVA</b>	Uncorrected visual acuity
<b>UP</b>	Ultrasound pachymetry
<b>US</b>	Ultrasound
<b>USP</b>	Ultrasound pachymetry
<b>Vs</b>	Versus

### INTRODUCTION

Anterior segment optical coherence tomography (AS-OCT) can be used to assess corneal thickness and anterior chamber biometry. It is also used to image phakic intraocular lenses and intra-corneal ring segments<sup>(1)</sup>. Because it is a noncontact technique, it can be used intra-operatively, which could be useful after flap corneal surgeries to detect abnormalities in the cornea and in the interface<sup>(2)</sup>.

Current OCT technology is divided into Time domain OCT and Fourier Domain OCT. Fourier-domain OCT devices, which have faster image acquisition and higher resolution, are currently more preferred for preoperative and postoperative assessment of corneal surgeries<sup>(3)</sup>.

When assessing corneal thickness, advantages of OCT over ultrasound biomicroscopy include noncontact methodology, with consequent reduction of patient discomfort and risk of corneal injury, higher resolution and the ability to image the eye in the sitting position<sup>(1)</sup>. AS-OCT is simpler to use, requires much less operator skill, and provides noncontact scanning of the anterior segment<sup>(1)</sup>.

Slit scanning imaging as the Orbscan is an alternative noncontact optical system that has primarily been used to view the cornea, although it may also have applications in angle estimation<sup>(3)</sup>.

In comparison with orbscan, anterior segment OCT allows corneal mapping in 8 meridians (8x1019A-scans) in 0.31 seconds<sup>(2)</sup>.

Rapid acquisition during the pachymetry scan ensure an accurate and repeatable pachymetry map result for application in determining the safety of a refractive surgery. OCT measurements show a high degree of repeatability and reproducibility. Thus, OCT is emerging as a reliable tool for evaluation of central corneal thickness (CCT) in the clinical setting. With the pachymetric mapping protocol of AS-OCT, the results suggest that central and peripheral corneal thickness measurements in healthy subjects and in eyes with keratoconus are repeatable and reproducible<sup>(2)</sup>. Optical coherence tomography measurements of central corneal thickness agreed well with ultrasound (US) pachymetry measurements while Orbscan significantly underestimated corneal thickness<sup>(2)</sup>.

The Visante OCT is the first non-contact device to image, measure and document both corneal flap thickness and residual stromal thickness immediately following LASIK surgery<sup>(3)</sup>. It allows measurements of flap and residual stromal thickness at