

**COMPARISON BETWEEN CORNEAL ABLATION
DEPTH MEASURED BY ULTRASOUND,
SCHEIMPFLUG AND OPTICAL COHERENCE
PACHYMETRY AND ITS CORRELATION WITH
REFRACTIVE OUTCOME IN MYOPIC LASER IN
SITU KERATOMILEUSIS**

Thesis

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Abbreviations

ABT	Asymmetrical bow-tie
AMO.....	Advanced Medical Optics
ATP	Adenosine triphosphate
ATPase	Adenosine triphosphatase
BCVA.....	Best corrected visual acuity
BSS	Balanced salt solution
CCT	Central corneal thickness
D	Dioptre
FDA	Food and Drug Administration
FFKC	Forme fruste keratoconus
g.....	Gram
GAG	Glycosaminoglycans
HMP	Hexose monophosphate
Hz	Hertz
IGF-1	Insulin-like growth factor 1
IOL	Intraocular lens
IOP.....	Intraocular pressure
IP	Imbibition pressure
IS	Inferior steepening
J	Joule
KHz.....	Kilo hertz

LASER..... Light amplification by stimulated emission of
 radiation
 LASIK Laser in situ keratomileusis
 LoA..... Limits of agreement
 MHz..... Mega hertz
 mJ Milli joule
 MK..... Microkeratome
 mm..... Millimeter
 mmHg Millimeter Mercury
 MRSE Manifest refraction spherical equivalent
 n..... Nano
 NADPH Nicotinamide adenosine dinucleotide phosphate
 hydrogen
 nJ Nanojoule
 nm..... Nanometer
 ns Nanosecond
 OCP Optical coherence pachymetry
 OCT Optical coherence tomography
 OLCR Optical low coherence reflectometry
 PCI..... Partial coherence interferometry
 PRK Photorefractive keratectomy
 RI..... Refractive index
 rpm..... Rotation per minute

RSB Residual stromal bed
S..... Second
SBT..... Symmetrical bow-tie
SD..... Standard deviation
SE Spherical equivalent
SP..... Scheimpflug pachymetry
SPSS Statistical Package for Social Sciences
SRA Skewed radial axis
UDVA Unaided distance visual acuity
US..... Ultrasound
USP..... Ultrasound pachymetry
UV Ultraviolet
W Watt

Corneal thickness is a key factor at all stages of a refractive correction (**Wang et al, 1999**). The volume of tissue removal determines the refractive change, and corneal thickness provides structural support (**Roberts, 2000**). Ablations deeper than planned may lead to overcorrections and inadequate residual corneal thickness, which may increase the risk of postoperative keratectasia (**Binder, 2007**).

In respect to the stability criteria of the cornea, corneal pachymetry often decides whether laser in situ keratomileusis (LASIK), epithelial LASIK, laser-assisted epithelial keratectomy, or PRK can be safely performed or whether a retreatment can be offered (**Lackerbauer et al, 2009**).

Several instruments are available to measure the corneal thickness with varying degrees of accuracy. Ultrasound (US) pachymetry is commonly used to measure central corneal thickness (CCT) because it is easy to use and relatively inexpensive and has been considered the gold standard for CCT measurement. Disadvantages of US pachymetry include the need to anesthetize the cornea, cornea–probe contact, corneal indentation and the possible compression effect during measurement, and corneal surface disturbance. There is also the risk for corneal epithelial damage and transmission of infections (**Ho et al, 2007**). In addition, measurements can vary as a result of probe misalignment or decentering and the probe may not be

perpendicularly aligned or may be inaccurately positioned because of a lack of fixation and gaze control (***de Sanctis et al, 2007***).

Until recently, there was no possibility to measure corneal thickness during refractive corneal surgery. This has changed with the integration of low-coherence interferometry into excimer laser systems. With this new device, very fine structures in the eye can be detected through an interferometric principle. The significant advantages of online pachymetry are the high resolution in micrometer range, no requirement of contact with the cornea and the continuous measurement of corneal thickness during the surgical procedure (***Wirbelauer et al, 2003***). In addition to ease of use, ability to evaluate the flap morphology in a wide area, direct visualization of the flap-stroma interface and precise measurement of the flap thickness (***Sun et al, 2012***).

Individual intraoperative measurements of corneal thickness appear to be desirable for the safe assessment of corneal thickness during LASIK and maintenance of a minimum residual stromal bed (RSB). (***Giledi et al, 2004***).

Furthermore, online monitoring of the central laser ablation has the potential to provide online pachymetry. The opportunity for an online adjustment based on the online

pachymetric data may be a great step toward optimizing refractive outcomes in the future (*Lackebauer et al, 2009*).

Corneal laser refractive patients often have high expectations in terms of the accuracy of postoperative refractive outcomes. More accurate ablation of stromal tissue is assumed to lead to improved refractive outcomes (*Lackebauer et al, 2009*).

Routine use of OCP could improve the safety of LASIK procedures.