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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By

Caroline Atef Guergues Tawfik

M.B., B.Ch, M.Sc. Ain Shams University

Under Supervision of

Prof. Dr. Osama Abdel Monem Raslan

Professor of Ophthalmology

Faculty of Medicine, Ain Shams University

Prof. Dr. Bahaa Eldin Abdallah Aly

Professor of Ophthalmology

Faculty of Medicine, Ain Shams University

Faculty of Medicine

Ain Shams University

Cairo- Egypt

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Contents

List of Figures

List of Tables

List of Graphs

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 ***(Lackerbauer 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 ***(Lackerbauer et al, 2009).***

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