

A Study of the Role of Pentacam in Identifying Ectasia Risks Among Keratorefractive Candidates

Thesis

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by

Khaldoon Omer Ali Al-Nosairy
M.B.B.S, Sana'a University

Under Supervision of:

Prof. Dr. Ismail Ibrahim Nour El Din Hamza

Professor of ophthalmology
Ain Shams University

Dr. Mouamen Mohamed Mostafa

Lecturer of Ophthalmology
Ain Shams University

**Ain Shams University
Faculty of Medicine
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Table of Contents

Acknowledgment	i
Table of Contents	ii
LIST of Abbreviations	v
LIST OF FIGURES	viii
LIST OF TABLES	xi
INTRODUCTION	1
Aim of the work	3
1. Keratorefractive Surgery	4
1.1. Cornea and Optics	5
1.2. The excimer laser	9
1.2.1. PRK and LASIK	11
1.3 The femtosecond laser	12
2. Ectatic Corneal Disorders	14
2.1. Keratoconus	14
2.1.1. Epidemiology	15
2.1.2. Aetiology and Clinical picture	16
2.1.3. Forme Fruste Keratoconus/ Keratoconus Suspect	19
2.1.4. Atypical Forms of Keratoconus	24
2.1.5. Pseudokeratoconus: Artifacts in the Characterization of Corneal	24
2.2. Pellucid Marginal Degeneration	26
2.3. Keratoglobus	27
3. Ectasia after Keratorefractive Surgery (Keratectasia)	28

3.1.	Epidemiology of Keratectasia	28
3.2.	Biomechanics of Keratectasia	30
3.3.	Histopathology of Keratectasia	31
3.4.	Diagnosis of Keratectasia	32
3.5.	Risk Factors for Keratectasia	33
3.5.1.	Abnormal Preoperative Topography	34
3.5.2.	Residual Stromal Bed Thickness (RSB)	36
3.5.3.	Corneal Thickness (CT)	37
3.5.4.	Degree of Myopia	38
3.5.5.	Age	39
3.6.	Ectasia Risk Scoring Systems	40
4.	<i>Corneal Imaging for Keratorefractive Candidates</i>	44
4.1.	Corneal Topography	46
4.1.1.	Keratometry	46
4.1.2.	Keratotomy	47
4.1.3.	Computerized Videokeratotomy: Modern Corneal Topography	47
4.1.4.	Topographic-Based Indices for Detecting Ectasia	51
4.1.5.	Limitation of Corneal Topography	54
4.2.	Corneal Biomechanics	56
4.3.	Elevation Based Topography (Tomography)	58
5.	<i>Pentacam as A Screening Tool for Ectasia Risks</i>	59
5.1.	Scheimpflug's Principle	61
5.2.	Pentacam Maps and Screening Guidelines	63
5.2.1.	Curvature Maps	64
5.2.2.	Corneal Asphericity	65
5.2.3.	Elevation Maps	66

5.2.4.	Posterior Corneal Surface	70
5.2.5.	Corneal Pachymetry	72
5.2.6.	Topometric indices	77
5.2.7.	The Belin–Ambrosio Enhance Ectasia Display III(BAD III)	78
II.	Materials and Methods	80
III.	RESULTS	87
	Discussion	102
	Conclusion	115
	Recommendations	117
	Summary	118
	References	120

LIST of Abbreviations

AA	Analyze Area
AB/IS	Asymmetrical Bowtie/ Inferior Steepening
AB/SKRAX	Asymmetrical Bowtie/Skewed Radial Axis
AC	Anterior Chamber
AFE	Apex Front Elevation
AK	Arcuate Keratotomy
ALK	Automated Lamellar Keratectomy
APE	Apex posterior elevation
APP	Apex point pachymetry
ART	Ambrosio Relational Thickness
ASCRS	American Society of Cataract and Refractive Surgery
BAD III	Belin/Ambrosio Enhanced Ectasia Display III
BSCVA	Best Spectacle Corrected Visual Acuity
BFTE	Best-fit toric ellipsoid
BSF	Best Fit Sphere
CCT	Central Corneal Thickness
CH	Corneal Hysteresis
CLEK	Collaborative Longitudinal Evaluation of Keratoconus
CLMI	Cone Location and Magnitude Index
CRF	Corneal Resistance Factor
CSI	Center/Surround Index
CT	Corneal Thickness
CTSP	Corneal Thickness Spatial Profile
D	Diopter
Da	Deviation of ambrosio relational thickness from normality
Df	Deviation of front surface elevations from normality
Db	Deviation of back elevations from normality
DP	Deviation of Pachymetric distribution from normality
DSI	Differential Sector Index

Dt	Deviation of thinnest point pachymetry and displacement from normality
EHBFS	Enhanced Best fit sphere
Epi-LASIK	Epipolis Laser in Situ Keratomileusis
ERSS	Ectasia Risk Scoring System
FDA	US food and Drug Administration
FEB	Front elevation point of Belin
Femto-LASIK or FS-LASIK	Femtosecond Laser in Situ Keratomileusis
FFKC	Forme Fruste Keratoconus
Flex	Femtosecond Lenticule Extraction
Hex K	Hexagonal Keratotomy
IHD	Index of Height Decentration
Inf.	Inferior
IOL	Intera-ocular Lens
IOP	Intera-ocular Pressure
I-S	Inferior- Superior
ISRS/AAO	International Society of Refractive Surgery of the American Academy of Ophthalmology
ISV	Index of Surface Variance
IVA	Index of Vertical asymmetry
K	Keratometry
K ₁	Flat meridian keratometry
K ₂	Steepest meridian keratometry
KC or KCN	Keratoconus
KCS	Keratoconus Suspect
KI	Keratoconus Index
KISA	K- value, I-S value, AST and SRAX
K _m	Mean Keratometry
K _{max}	Maximal Keratometry
KPI	Keratoconus Prediction Index
LASEK	Laser Assisted Subepithelial Keratomileusis
LASIK	Laser Assisted in Situ Keratomileusis
LRI	Limbal Relaxing Incision
Max.	Maximum
Max. AE	Maximal Anterior Elevation point
Max. PE	Maximal posterior elevation point
Min.	Minimum

MRSE	Manifest Refraction Spherical Equivalent
NCT	Non-contact Tonometry
ORA	Ocular Response Analyzer
OSI	Opposite Sector Index
PEB	Posterior Elevation point of Belin
PI. Avg.	Pachymetric progression index average
PI. Min	Pachymetric Progression index minimum
PI. Max	Pachymetric progression index maximum
PIT	Percentage Increase in Thickness
PLK	Pellucid-like Keratoconus
PMD	Pellucid Marginal Degeneration
PRK	Photorefractive Keratectomy
PPI	Pachymetric Progression Index
r	Radius
RelEx	Refractive Lenticule Extraction
RK	Radial keratotomy
Rmin.	Radii minimum
ROC	Receiver Operating Curve.
RP	Refractive Power
RSB	Residual Stromal Bed
SAI	Surface Asymmetry Index
SD	Standard Deviation
SIM K	Corneal Power Simulation Measurements
SMILE	Small Incision Lenticule Extraction
SRAX or SRA	Skewed Radial Axis
TFE	Thinnest front elevation point.
TKI	Topographic Keratoconus Classification Index
TPE	Thinnest posterior Elevation Point
TP	Thinnest Point
TPP	Thinnest point pachymetry
μ	Micron
VA	Visual Acuity
Yrs	Years

LIST OF FIGURES

<i>Figure 1-1 Topographic zones of the cornea</i>	6
<i>Figure 1-2 Corneal vertex and apex.</i>	7
<i>Figure 2-1 A. Keratoconic Eye B. Munson Sign C. Rizzuti Sign</i>	19
<i>Figure 2-2 Schematic representation of the distribution of quantitative variables in the normal (N), forme fruste keratoconus (forme fruste), keratoconus suspects (suspects) and keratoconus (K) eyes.</i>	21
<i>Figure 2-3 The hallmark of PMD on the corneal thickness map: the bell sign.</i>	27
<i>Figure 3-1 Representative light photomicrographs of human post-LASIK corneal buttons with ectasia. A case shows epithelial hypoplasia (black arrowhead) over an ectatic region and peripheral epithelial hyperplasia (grey arrowheads). In addition to epithelial hypoplasia, ectatic regions commonly displayed Bowman's layer breaks (black asterisk) and larger than normal artifactual interlamellar clefts (white arrowhead), particularly in the posterior-most region of the RSB.</i>	32
<i>Figure 3-2 Subtle topographic changes in early post-LASIK ectasia. Notice the inferior steepening on the sagittal front map and the corresponding abnormal elevations on both anterior and posterior surfaces.</i>	33
<i>Figure 3-3 Comparison of flap in LASIK and Femto-LASIK.</i>	37
<i>Figure 4-1 Videokeratoscopic mires are closer together in the axis of steep curvature (arrow), and farther apart in the flat axis (arrowhead).</i>	48
<i>Figure 4-2 Schematic representation of the difference between axial distance (axial curvature) and radius of curvature for 2 points on a curved surface. Points C1 & C2 are centers of curvatures of the surface points. Points A1 & A2 are endpoints of axial distances for the given axis Local, and steeper areas of curvature are underestimated, whereas flatter areas are overestimated.</i>	49
<i>Figure 4-3 Top A, round; B, oval; C, superior steepening; D, inferior steepening; E, irregular; F, symmetric bow tie; G, symmetric bow tie with skewed radial axes; H, asymmetric bow tie with inferior steepening (AB/IS); I, asymmetric bow tie with superior steepening; J, asymmetric bow tie with skewed radial axes (AB/SRAX) (i.e. Skewing of more than 30° is described as significantly abnormal).</i>	50

Figure 4-4 Topography of a patient with keratoconus. The top image shows axial curvature, the bottom, tangential curvature. Note that the steeper curve on the bottom is more closely aligned to the cone. 50

Figure 4-5 Rabinowitz calculation of SRAX for the topography map in figure below. The steepest radius above the horizontal meridian is at 30 degrees. The steepest radius below the horizontal is at 273 degrees. The SRAX is 180 minus the smaller of the 2 angles between these 2 radii. 52

Figure 4-6 Preoperative topographies of a case showing a vertical D pattern in both eyes. 53

Figure 4-7 Figure 4 5 A schematic depiction of CLMI. C1, 2-mm-diameter circle encompassing the steepest region on the map; P1, center of circle C1; r, radial distance of P1 from the center of the map; p2, point 180 degrees from P1; C2, 2-mm-diameter circle center at p2. 53

Figure 4-8 Placido imagery for calculating the corneal curvature. The assumption that the perpendicular 55

Figure 4-9 Representation of corneal axial curvature analysis. A change in the reference axis can create different axial curvature maps from the same shape. The map on the left appears as a "normal" symmetric astigmatism in which the line of sight and corneal apex the same. The map on the right appears "abnormal" with a highly asymmetric bowtie pattern. Both images, however, were generated from the same astigmatic test object in which the line of sight and cornea apex are different. Red line (steep axis; blue one (flat axis) 56

Figure 4-10 Signal diagram obtained with the ORA in a normal eye. The red line represents the applanation signal and the green line the pressure changes. As shown, the device delivers an air pulse to the eye, which causes the cornea to move inward achieving a specific applanation state or flattening (Pressure 1). Milliseconds after the first applanation, the pressure decreases and the cornea passes through a second applanated state (Pressure 2) while returning from concavity to the normal convex curvature. 58

Figure 5-1: A. normal camera has a limited depth of focus compared with a Scheimpflug camera B. Three planes must intersect to produce a sharp picture (Scheimpflug Camera). 62

Figure 5-2 The Pentacam images the anterior segment of the eye by a rotating Scheimpflug camera performing a series of slit photographs. This rotating process generates pictures in

three dimensions. Because of the rotational imaging, even the center of the cornea can be precisely measured. 63

Figure 5-3 Axial curvature map of a keratoconic cornea obtained by a rotating Scheimpflug camera device. 65

Figure 5-4 Raw elevation data from the PAR CTS(PAR Technology). The raw elevation data displays the elevation values without comparing them to a reference surface. 67

Figure 5-5 Schematic drawing showing how exclusion of the cone from the reference surface calculation will influence the best-fit sphere and highlight the corneal abnormality. Because the normal cornea is only minimally prolate (does not have a conical region) the resultant "Enhanced" BFS in normal eyes is only minimally different and there is almost no difference in the elevation maps using the standard vs the "Enhanced" BFS. 69

Figure 5-6 Belin Enhanced elevation Maps 70

Figure 5-7 Pachymetric map of a keratoconic eye obtained by means of the Scheimpflug photography-based system. 74

Figure 5-8 Module of pachymetric analysis from the Pentacam system. Pachymetry map with 22 concentric circles drawn centered on the thinnest point of the cornea. 74

Figure 5-9 Belin/Ambrosio enhanced ectasia display. 79

Figure III-1 Classification of patients asking for keratorefractive surgery. 87

Figure III-2 Categories of keratorefractive patients. 88

Figure III-3 Categories of patients asking for keratorefractive surgery. 88

Figure III-4 Gender distribution among groups of Patients (P value 0.065). 89

Figure III-5 Frequency of abnormalities among excluded patients detected by Pentacam (BADIII= Deviation of final D value of Belin and Ambrosio Display from normality). 89

Figure III-6 Distribution of topographic patterns among normal patients. (inf. Or Sup.= Inferior or superior steepening). 93

Figure III-7 Distribution of topographic patterns among excluded candidates (IS= Inferior steepening; SS= Superior Steepening; SKRAX= Skewed Radial Axis). 93

Figure III-8 Rate of abnormality of topography among normal and excluded candidates. 94

Figure III-9 Topographic keratoconus classification among normal and excluded candidates (TKI= Topographic keratoconus index classification incorporated in Pentacam software). 95

LIST OF TABLES

<i>Table 1-1 Overview of keratorefractive surgical procedures.</i>	4
<i>Table 1-2 Patient selection criteria for LASIK and PRK</i>	14
<i>Table 2-1 Amsler-Krumeich Classification of Keratoconus by Stage</i>	18
<i>Table 2-2 Summary of keratoconus definitions</i>	21
<i>Table 2-3 Abnormal parameters distribution among KC definitions.</i>	23
<i>Table 2-4 Comparison between Pellucid-like keratoconus (PLK) and Pellucid marginal degeneration (PMD).</i>	27
<i>Table 3-1 Reported incidence of post-LASIK ectasia</i>	29
<i>Table 3-2 Ectasia risk score system for identifying eyes at high risk for developing ectasia after LASIK</i>	41
<i>Table 3-3 Ectasia Risk Factor Score Categories</i>	41
<i>Table 3-4 Preoperative Grading System for the Detection of Patients Who Are at Risk of Corneal Ectasia after LASIK in the Correction of Myopia (Spherical Equivalent, -4.00 to -8.00 D)</i>	42
<i>Table 4-1 Commonly used topographic indices.</i>	54
<i>Table 5-1 Comparative table about Scheimpflug imaging systems.</i>	60
<i>Table 5-2 Values of asphericity for the conic surfaces.</i>	66
<i>Table 5-3 Abnormality ranges for the topographic parameters provided by the Pentacam system.</i>	77
<i>Table II-1 Criteria for patients inclusion in the study.</i>	80
<i>Table II-2 Definitions of patients' groups.</i>	81
<i>Table II-3 cut-off values of elevation points.</i>	84
<i>Table II-4 BAD III parameters.</i>	85
<i>Table II-5 cut-off values for BADIII enhanced best sphere elevation points.</i>	86
<i>Table II-6 BAD III values and color coding.</i>	86
<i>Table III-1 Age distribution among groups of patients with relation to gender.</i>	87
<i>Table III-2 Correlation between abnormality of keratometry and exclusion of patients.</i>	90

<i>Table III-3 Correlation between abnormality of corneal thickness and exclusion of patients.</i>	90
<i>Table III-4 Correlation between abnormality of topometry and exclusion of patients.</i>	90
<i>Table III-5 Correlation between abnormality of posterior elevation points and exclusion of patients.</i>	91
<i>Table III-6 Correlation between abnormality of final BAD III D value and exclusion of patients.</i>	91
<i>Table III-7 Severity classification of keratoconic eyes.</i>	91
<i>Table III-8 Comparison of thinnest point pachymetry and apex point pachymetry within groups.</i>	92
<i>Table III-9 The correlation between staging of topographic keratoconus classification and exclusion of patients.</i>	94
<i>Table III-10 Comparison of Pentacam parameters between patients having normal and topogrpahy.</i>	96
<i>Table III-11 Interocular differences among normal patients.</i>	97
<i>Table III-12 Interocular asymmetry among keratoconic patients.</i>	98
<i>Table III-13 Comparison of age and keratometric Indices between normal, suspicious and keratoconic groups.</i>	100

INTRODUCTION

Since approval of the use of the excimer laser by the US Food and Drug Administration (FDA) in 1995 to reshape the cornea, significant developments in the correction of refractive errors such as myopia, hyperopia, and astigmatism have been achieved. Photorefractive keratectomy (PRK) as well as laser in situ keratomileusis are both documented to be safe and effective. Despite these advances, certain limitations and complications exist.¹

Post-operative ectasia emerged as one of the most important complications of keratorefractive surgery (PRK and LASIK) since the first reports of such cases by Theo Seiler MD, PhD, in 1996.² The incidence of which is estimated to range from 0.041% to 0.6%.³ Therefore, refractive surgeons face routinely the challenge of identifying cases at a higher risk for progressive keratectasia, a rare but severe complication of keratorefractive surgery.⁴

There's an indisputable recognition for the need to improve both sensitivity and specificity of the diagnostic tools for screening ectasia risks. As a result, corneal characterization should go beyond front surface curvature and single point central thickness. Consequently, a tomographic approach is essential.⁵

Regarding the role of corneal tomography for screening refractive surgery candidates, it is critical to understand that susceptibility to ectasia usually occurs in eyes with relatively normal front-surface topography. In these cases, an abnormal back elevation and pachymetric distribution provide evidence that the tomographic characterization enhances the sensitivity of this approach for detecting a predisposition to ectasia.⁶

The only commercially available purely elevation based system is the Oculus Pentacam which enables front and back elevation and pachymetric reconstruction from limbus to limbus. This gives the clinician a global view of the structure of the cornea and allows the physician to effectively screen patients for ectatic diseases.⁷ Rotating Scheimpflug cross-sectional analysis meets the criterion for a successful screening tool in that it not only provides the necessary data, but does so in a manner that does not interrupt patient flow.

Screening for the risk of ectasia is a critical issue for contemporary ophthalmology practice. The main goal of the screening for ectasia risk among refractive candidates should be the identification of very mild abnormalities that would likely be present in the preoperative states of cases with unexplained ectasia after keratorefractive surgery.⁸