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

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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

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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]