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Brazilian Study Group of Artificial Intelligence and Corneal Analysis

Enhanced Ectasia Susceptibility Screening Based on Clinical Data and Scheimpflug Corneal Tomographer

Isaac Ramos, MD

Bernardo T. Lopes, MD; Marcella Salomão, MD; Lívia F. Jordão, MD; Allan Luz, MD; Rosane Correa, MD; Renato Ambrósio Jr, MD, PhD

Dr. Ambrósio is consultant for Oculus Optikgeräte GmbH (Wetzlar, Germany)

Hospital de Olhos Santa Luzia

Instituto de Olhos Renato Ambrósio

EYE LASER CENTRO DE CIRURGIA REFRATIVA

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Purpose

To test a new combined parameter previously described based on logistic regression analysis of clinical and corneal tomography data (Pentacam - Oculus, Wetzlar, Germany) to identify pre-operative risk for ectasia (SUSCEPTIBILITY).

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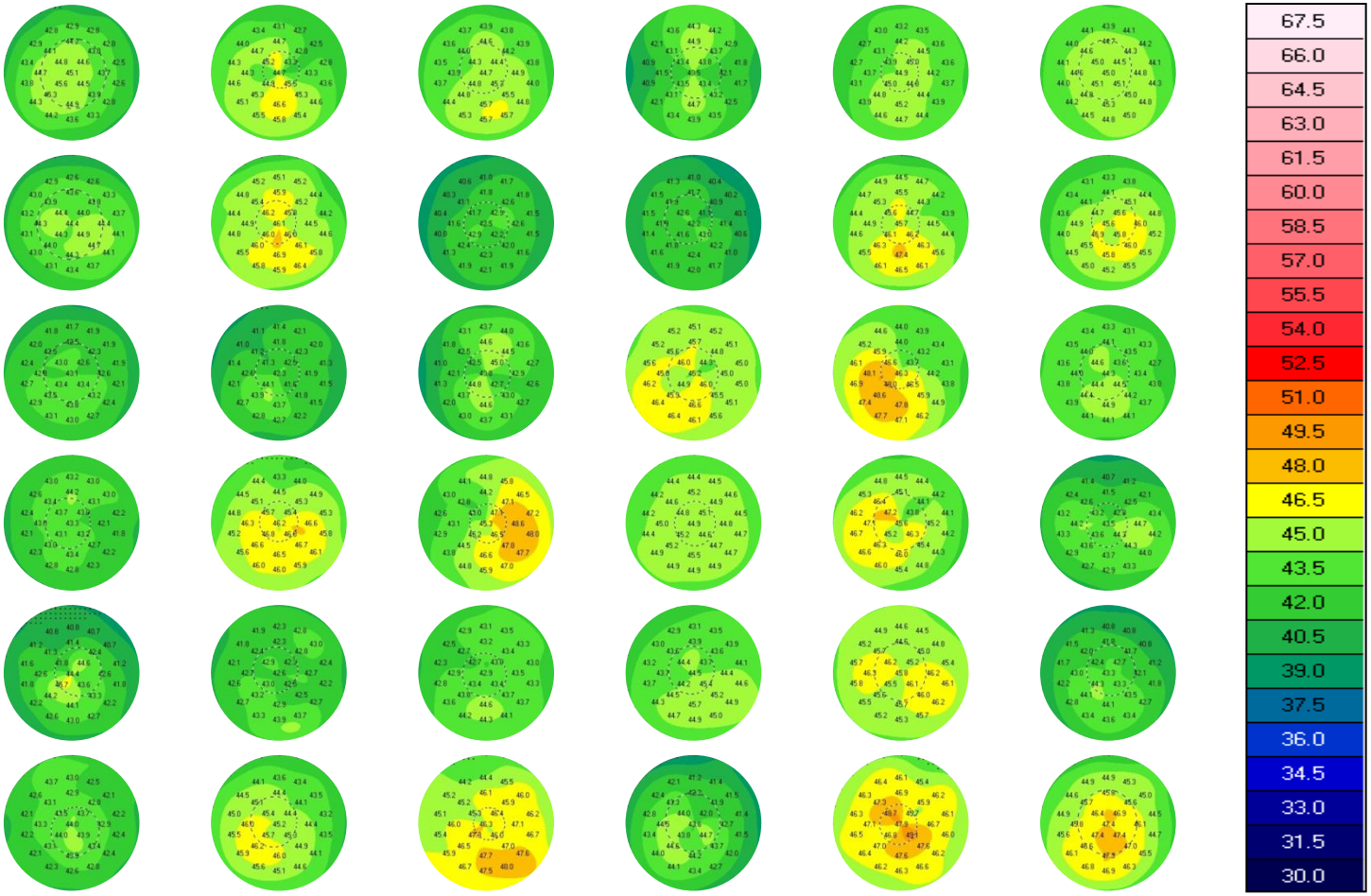
Methods

✓ The pre-operative clinical and tomographic data from 36 eyes from 27 patients that developed ectasia after femto-LASIK (Group 1), and 266 control eyes from 141 patients with stable femto-LASIK (Group 2) were analyzed.

- Group 1:



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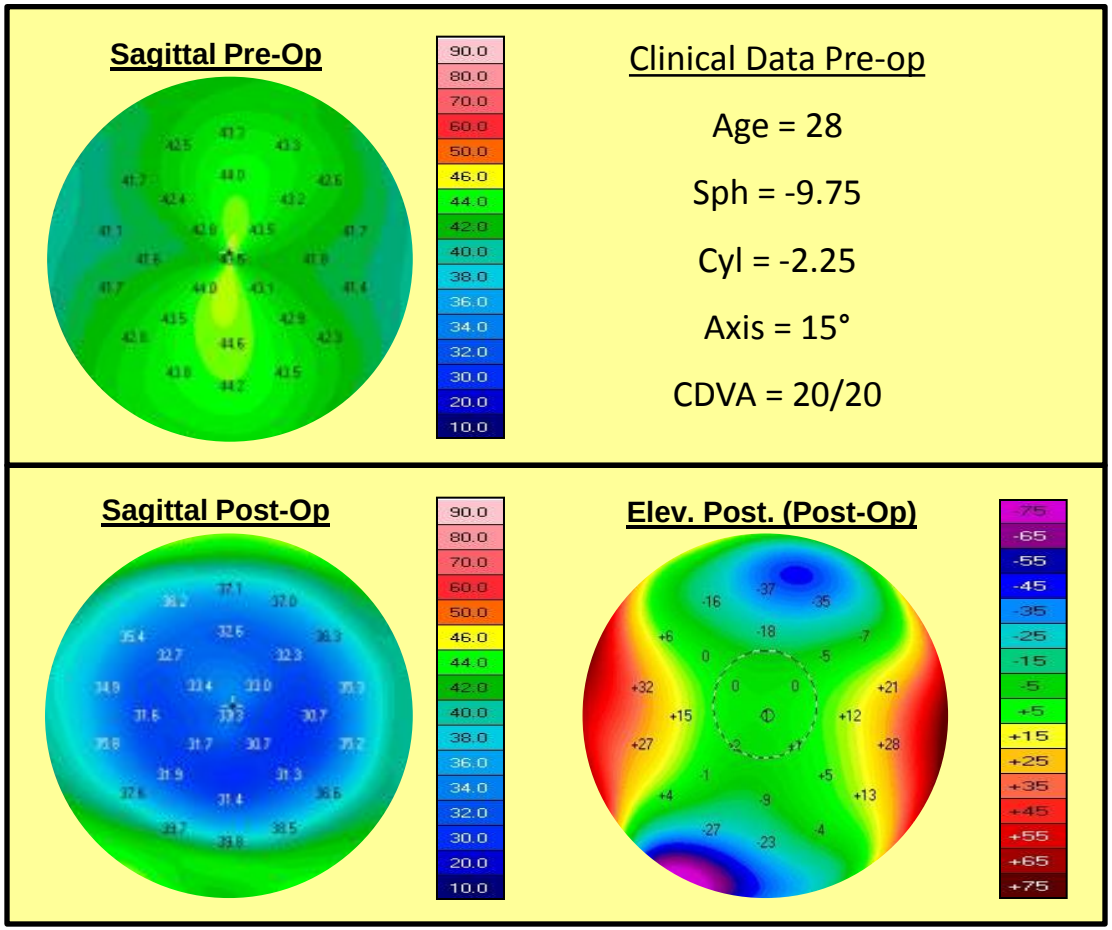
- Group 2:

Case Example



All patients in this group has over 1 year of follow-up.

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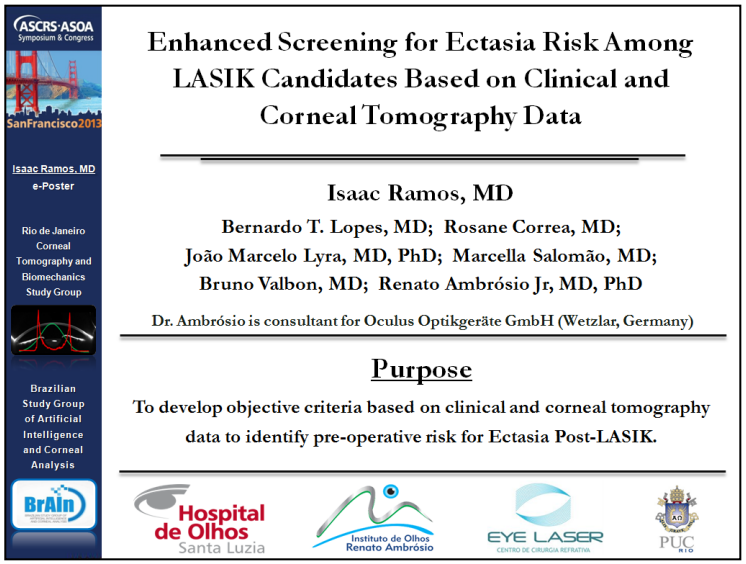
Methods

✓ The "Enhanced Ectasia Susceptibility Screening" (EESS), a combined parameter based on logistic regression analysis of pre-operative clinical and corneal tomography data, was previously described to identify pre-operative risk for ectasia.


ASCRS·ASOA Symposium & Congress
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Enhanced Screening for Ectasia Risk Among LASIK Candidates Based on Clinical and Corneal Tomography Data

Isaac Ramos, MD
Bernardo T. Lopes, MD; Rosane Correa, MD; João Marcelo Lyra, MD, PhD; Marcella Salomão, MD; Bruno Valbon, MD; Renato Ambrósio Jr, MD, PhD

Dr. Ambrósio is consultant for Oculus Optikgeräte GmbH (Wetzlar, Germany)

Purpose

To develop objective criteria based on clinical and corneal tomography data to identify pre-operative risk for Ectasia Post-LASIK.

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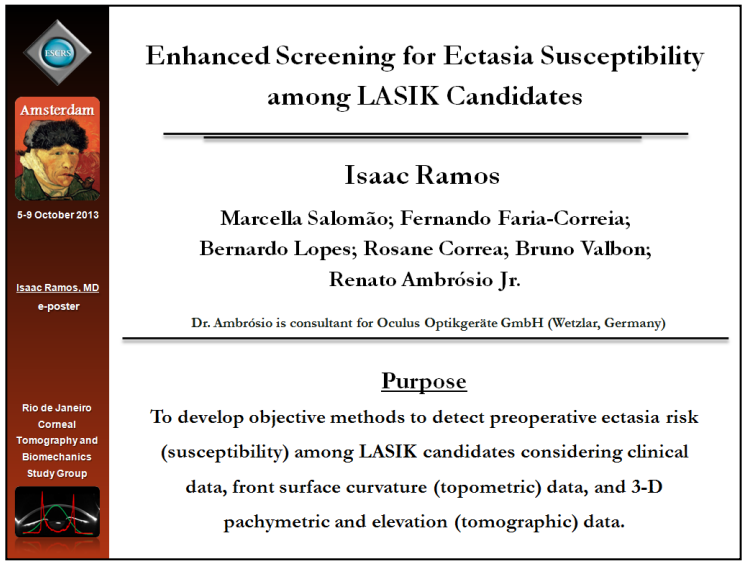
Poster of Interest
ASCRS Congress
2013


ESCRS
Amsterdam
5-9 October 2013
Isaac Ramos, MD
e-poster
Rio de Janeiro Corneal Tomography and Biomechanics Study Group

Enhanced Screening for Ectasia Susceptibility among LASIK Candidates

Isaac Ramos
Marcella Salomão; Fernando Faria-Correia; Bernardo Lopes; Rosane Correa; Bruno Valbon; Renato Ambrósio Jr.

Dr. Ambrósio is consultant for Oculus Optikgeräte GmbH (Wetzlar, Germany)

Purpose

To develop objective methods to detect preoperative ectasia risk (susceptibility) among LASIK candidates considering clinical data, front surface curvature (topometric) data, and 3-D pachymetric and elevation (tomographic) data.

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1st Prize
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Methods

✓ The EESS was calculated for all cases and used to distinguish the groups.

✓ Statistical Tests:

- The Mann-Whitney U test was used to verify the differences between the groups (after Kolmogorov Smirnov analysis).

- The ROC curve was used to determine the sensitivity and specificity of the EESS, and establish the best cut-off point to separate the two groups.

- The area under the ROC curve (AUC) was used to test the performance of this criteria in this series.

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Results

✓ Statistically significant difference was found for Enhanced Ectasia Susceptibility Screening among the groups.

	ECTASIAS	STABLE LASIK
CASES (n)	36	266
U =	159	
Z (U) =	9.4138	
p-valor (unilateral) =	< 0.0001	
p-valor (bilateral) =	< 0.0001	

Mann-Whitney U Test

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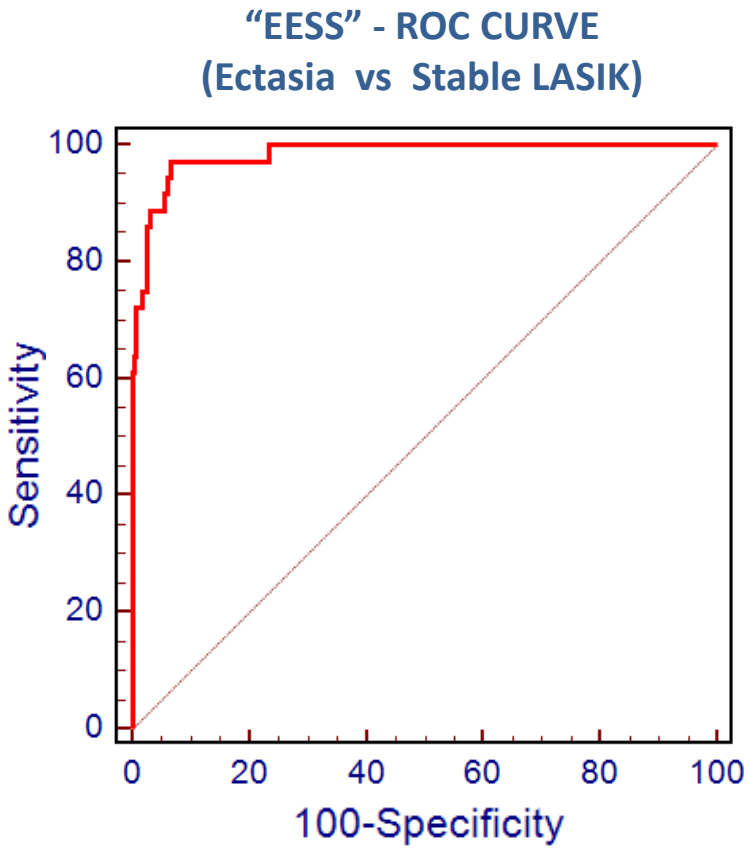
Results

✓ EESS obtained 97.22% of sensitivity, 93.23% of specificity, and AUC = 0.983 to distinguish ectasia susceptibility after LASIK from stable LASIK cases.



Sensitivity	97.22 %
Specificity	93.23 %
Cut-off	>2.0984
Area under the ROC curve (AUC)	0.983
Standard Error [a]	0.0076
95% Confidence interval [b]	0.962 to 0.995
z statistic	63.587
Significance level P (Area=0.5)	<0.0001

[a] DeLong et al., 1988

[b] Binomial exact

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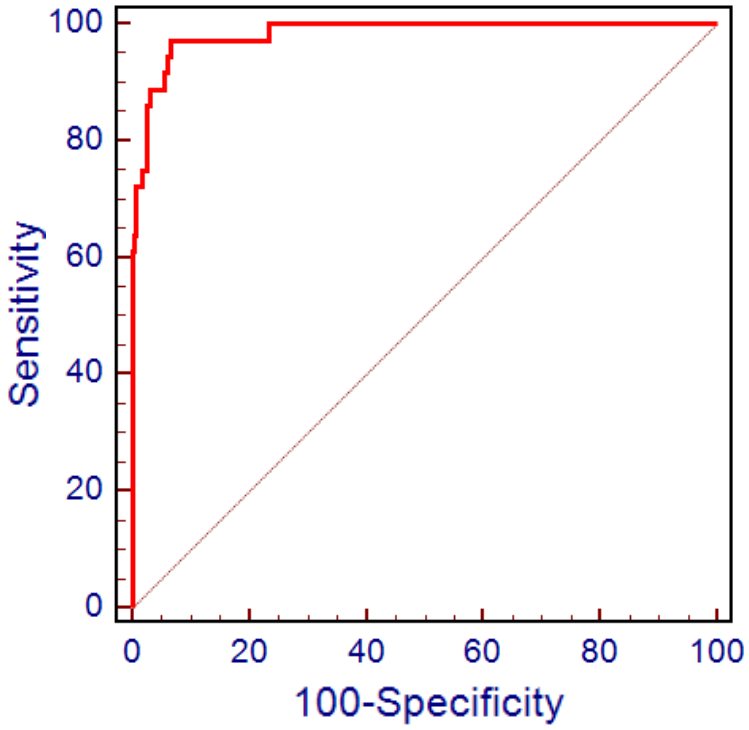
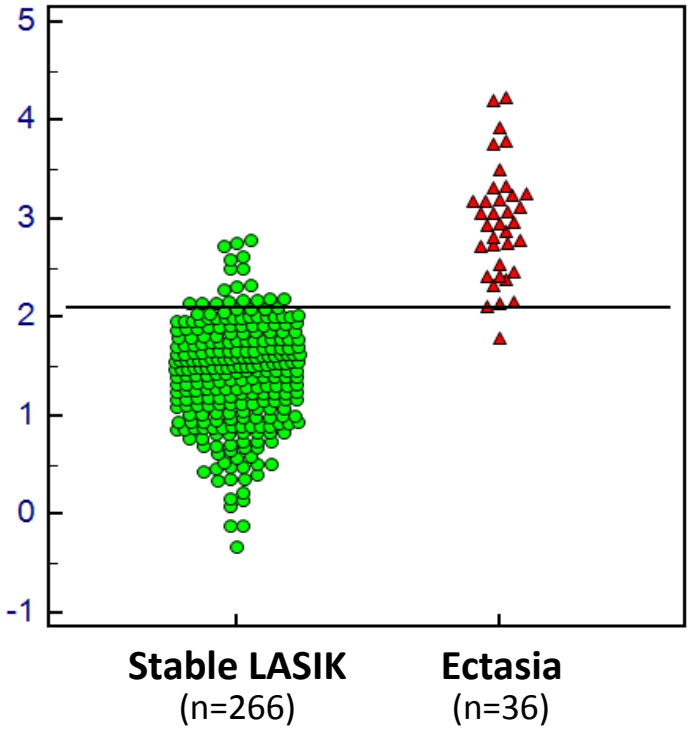
"EESS" - ROC CURVE
(Ectasia vs Stable LASIK)



"EESS" – Interative Dot Plot Diagram
(Ectasia vs Stable LASIK)



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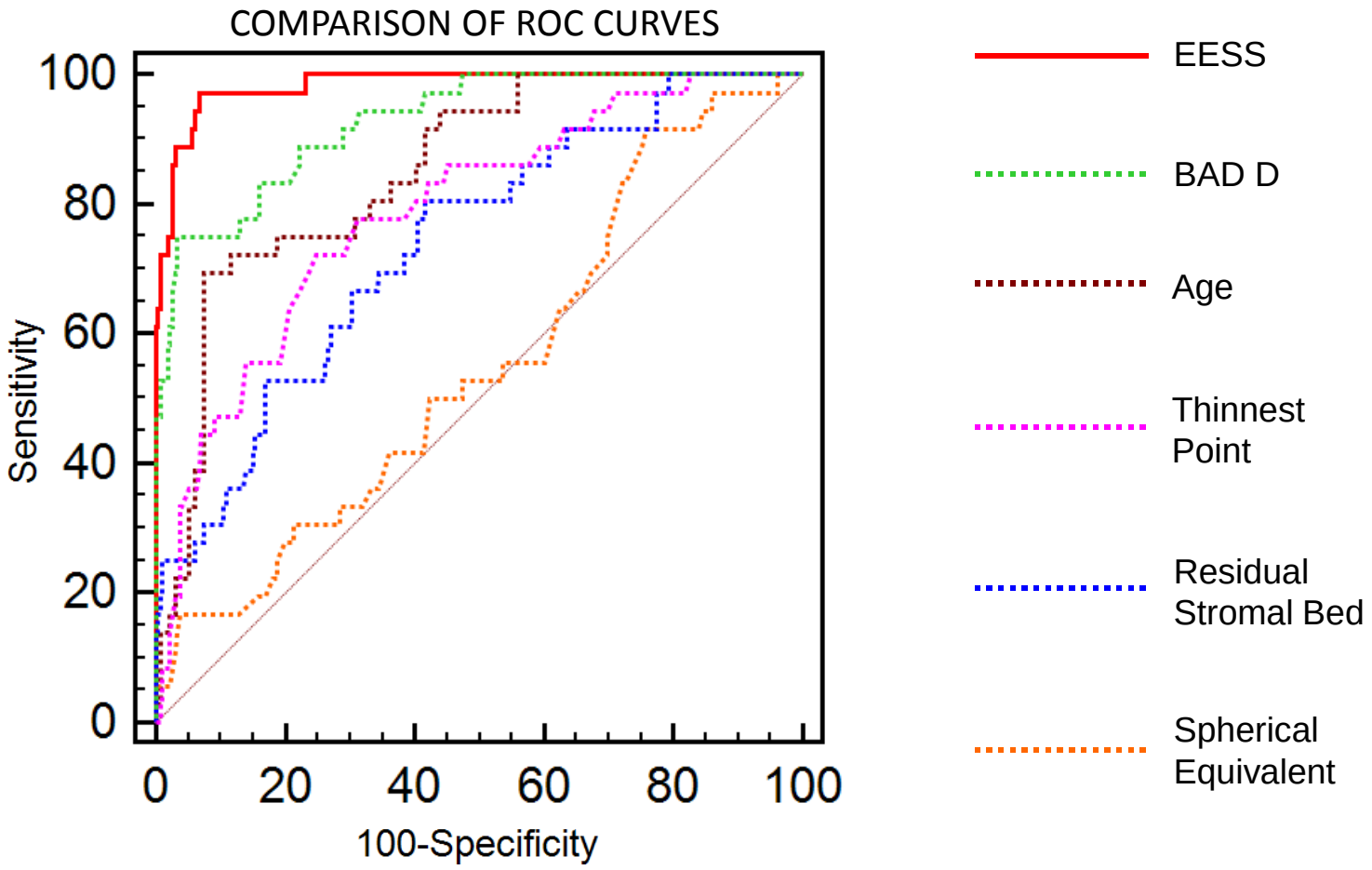
Results

✓ The performance of the EESS (combined parameter) to distinguish the groups was statistically better ($p<0.005$) than all other parameters when evaluated individually. See some examples below:



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Results

✓ The performance of the EESS (combined parameter) to distinguish the groups was statistically better ($p<0.005$) than all other parameters when evaluated individually. See some examples below:

EESS vs Age	
Difference between areas	0.133
Significance level	P < 0.0001

EESS vs Spherical Equivalent	
Difference between areas	0.433
Significance level	P < 0.0001

EESS vs Residual Stromal Bed	
Difference between areas	0.245
Significance level	P < 0.0001

EESS vs Thinnest Point	
Difference between areas	0.195
Significance level	P < 0.0001

EESS vs BAD D	
Difference between areas	0.0557
Significance level	P = 0.0031

DeLong´s method
(DeLong et al., 1988)

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Conclusions

✓ The EESS is a valid and effective method for detecting eyes at risk for ectasia after LASIK.

✓ Although it represents a significant improvement over previously utilized screening strategies, other artificial intelligence strategies may be applied to optimize accuracy.

✓ Also, novel diagnostic criteria, such as corneal biomechanics should be considered.