POST LASIK ECTASIA: understanding the mechanistic pathway beyond topography

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POST LASIK ECTASIA: Rare (0.04-0.06 %) but most dreaded complication

Post LASIK ectasia

Known factors
- Natural course of Keratoconus
- Ectasia Risk scoring factors
- Corneal Biomechanics

Unknown factors
- Missed FFKC
Current screening Modalities

Risk Assessment for Ectasia after Corneal Refractive Surgery

J. Bradley Randleman, MD.1,2 Maria Woodward, MD.1 Michael J. Lynn, MS.3 R. Doyle Stulting, MD, PhD1,2
Table 5. Ectasia Risk Factor Score System

Parameter | Points
--- | ---
Topography pattern | 2
RSB thickness (μm) | 1
Age (yrs) | 1
CT (μm) | 1
MRSE (D) | 1

ABT = asymmetric bowtie; CT = preoperative corneal thickness; D = diopters; FFKC = fo MRSE = modified regular keratoconus; RSB = regular subclinical

Association Between the Percent Tissue Altered and Post–Laser In Situ Keratomileusis Ectasia in Eyes With Normal Preoperative Topography

MARCONY R. SANTHIAGO, DAVID SMADJA, BEATRIZ F. GOMES, GLAUCO R. MELLO, MARIO L.R. MONTEIRO, STEVEN E. WILSON, AND J. BRADLEY RANDLEMAN
Post LASIK ectasia

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?
What is ectasia?

Research question: Study this molecular signature

Molecular signature causing collagen degradation
What causes ectasia beyond topography?
Study design

Post LASIK Ectasia cases (n=6) referred from other centres (over 8 months)

Post LASIK controls cases (n=7) From our centre (Age, gender, duration since sx matched)

Corneal topography

Tear collection and analysis

In vivo confocal microscopy
Results

Normal Pre operative topography

Increased

Dendritic cells

In our study

Increased inflammatory markers

IL-1α
IFNα
IL-2
IL-4
IL-8
MCP1
RANTES

Tear Inflammatory Mediators in controls and Ectasia cases

Increased inflammatory markers
When compared to Progressive keratoconus
<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>Ectasia</th>
<th></th>
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<tbody>
<tr>
<td></td>
<td>(n = 7; 14 eyes)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>Mean ±SEM: 5.3±1.3</td>
<td>Mean ±SEM: 82.6±2.8</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Median: 8.3</td>
<td>Median: 81.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Range: 0.0-12.5</td>
<td>Range: 66.7-95.8</td>
<td></td>
</tr>
<tr>
<td><strong>OSDI - Discomf</strong></td>
<td>Mean ±SEM: 9.2±0.8</td>
<td>Mean ±SEM: 74.3±2.1</td>
<td></td>
</tr>
<tr>
<td>ort scale</td>
<td>Median: 8.3</td>
<td>Median: 73.9</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Range: 6.3-14.6</td>
<td>Range: 64.6-85.4</td>
<td>&lt;0.000</td>
</tr>
<tr>
<td><strong>OSDI - Vision</strong></td>
<td>Mean ±SEM: 13.0±0.9</td>
<td>Mean ±SEM: 65.9±1.7</td>
<td></td>
</tr>
<tr>
<td>scale</td>
<td>Median: 12.5</td>
<td>Median: 64.6</td>
<td>&lt;0.000</td>
</tr>
<tr>
<td></td>
<td>Range: 8.3-20.8</td>
<td>Range: 58.3-75.0</td>
<td>&lt;0.000</td>
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</table>
What causes ectasia beyond topography?

Ectasia
(Biomarkers study)

Tears-
Inflammatory mediators

How does this change my practice?

Looking beyond topography
Elevated Expression of Matrix Metalloproteinase-9 and Inflammatory Cytokines in Keratoconus Patients Is Inhibited by Cyclosporine A


Weaker Biomechanics

Mechanistic trigger
PROPOSED ECTASIA MODEL

LASIK

Nerve damage → corneal sensitivity

↓ Tear secretion, ↓ Goblet cell density, ↓ Mucin secretion

Inflammation, Hyperosmolarity

Tear film instability

Genetic factors, Environmental factors

↓ Collagen matrix degradation

↓ Collagen matrix

↑ MMPs, ↓ TIMPs

Epithelial cells, Fibroblasts, etc.

Pre-Op → Nerve plexus → Post-Op
Novel biomarkers (MCP1) causing dendritic cell migration - targeted approach

Inflammation - Collagen degradation - Cornea ectasia

Novel finding

Novel biomarkers (MCP1) causing dendritic cell migration - targeted approach

Corneal topography

Corneal Biomechanics

Cellular mechanisms
What causes ectasia beyond topography?

Ectasia (Biomarkers study)

Tears - Inflammatory mediators

How does this change my practice?

Looking beyond topography
Change my practice?

- Tear MMP 9 Kit
- Tear osmolarity
- OSDI
- Inflammation

Treat inflammation

Refractive surgery
Thank you