OCT: Applications in Laser Vision Correction and Lens-Based Refractive Surgery

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I have received lecture honoraria from Avellino Labs.

I have no disclosures relating to this talk.
Residual Stromal Bed Measurement

Modern Anterior Segment OCT

- Axial resolution 5-10μm – able to resolve the five layers of the cornea
- Images each individual interface in cornea – not just anterior or posterior surface
  - Information about what is going on inside of cornea
  - Subtle perturbations in epithelium, stroma
- Good news – you probably already have it or can easily get it!

Anterior Segment OCT Options

<table>
<thead>
<tr>
<th>Device</th>
<th>Axial Resolution</th>
<th>Field of View</th>
<th>Imaging</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optovue RTVue/Avanti (CAM Package)</td>
<td>5μm</td>
<td>6mm (9mm in trials)</td>
<td>Pachymetry map, Epithelial map, Line Scans</td>
</tr>
<tr>
<td>Tomey Casia 2*</td>
<td>10μm</td>
<td>13mm</td>
<td>Pachymetry map, Topography, Line Scans</td>
</tr>
<tr>
<td>Zeiss Visante</td>
<td>18μm</td>
<td>10mm</td>
<td>Pachymetry map, Topography, Line Scans</td>
</tr>
<tr>
<td>Zeiss Cirrus (AS Adaptor)</td>
<td>5μm</td>
<td>10mm</td>
<td>Pachymetry map, Epithelial map*, Line Scans</td>
</tr>
<tr>
<td>Heidelberg Spectralis (AS Adaptor)</td>
<td>4-7μm</td>
<td>6mm</td>
<td>Line Scans</td>
</tr>
</tbody>
</table>

* Not FDA approved

Pachymetry Map

Cirrus

RTVue
Keratoconus Diagnosis with Optical Coherence Tomography Pachymetry Mapping

Keratoconic corneas thinner, more focally abnormal
Thinning displaced inferior
Greater difference between mean thickness and thinnest point

Why do I need OCT when I've got the Pentacam?

• Commercially available on RTVue with Pachymetry + Cpwr scan software package
• Ability to differentiate between stromal and epithelial processes
• 8 radial scans with automated boundary detection: tear film to Bowman’s

OCT Epithelial Mapping

Keratoconus Pachymetry Map
Epithelium Map

• Normal Thickness: Central >Inferior >Superior
• Epithelium is very sensitive to underlying corneal curvature-thickness
• Highly reflective of local contour changes

OCT & Screening for Ectasia

• Epithelium thins over steepest portion of cornea and thickens elsewhere
• Makes cone appear less steep
• May be earliest change in ectasia

Keratoconus

Epithelial Thinning over the Cone

Forme Fruste Keratoconus?
Posterior Float

Forme Fruste Keratoconus?

- 76 normal eyes/35 KCN eyes
- Pattern Standard Deviation (PSD) of the Epithelium
  - Indicator of difference from normal epi map
  - PSD ≥ 0.57 – 100% sensitivity and specificity for non-normal
  - Abnormal in CL warpage, severe dry eye and KCN

Corneal Epithelial Thickness Mapping by Fourier-Domain Optical Coherence Tomography in Normal and Keratoconic Eyes

Ophthalmology 2012;119:2425-2433

Forme Fruste Keratoconus?

Pattern Standard Deviation = 0.57
The epithelium is a very sensitive and specific indicator of early ectasia.

**Epithelial thickening in area of steepening**

**Contact Lens Warpage**

**Forme Fruste Keratoconus?**

**OCT**

- Evaluate the macula
- Evaluate the macula
- Evaluate the macula
- Post-Refractive IOL Calculations
OCT & IOLs

OCT with similar mean prediction error to ORA and Hagis-L formulas

Comparison of Newer Intraocular Lens Power Calculation Methods for Eyes after Corneal Refractive Surgery

- OCT-based formula had smallest variance in IOL power and smallest mean error in prediction (0.39D)

On the Horizon

Comparison of Intraoperative Aberrometry, OCT-Based IOL Formula, Haigis-L, and Masket Formulae for IOL Power Calculation after Laser Vision Correction
Epithelial Remodeling, Regression and Refractive Predictability

Anterior Segment OCT Angiography

Optovue Avanti with AngioVue
Zeiss AngioPlex

Summary

• OCT may provide improved IOL calculations for post-refractive patients (myopic, hyperopic and post-RK)

• It may also provide earlier and more sensitive detection of patients at risk for post-refractive ectasia

• OCT continues to evolve new and exciting applications in anterior segment diagnosis

Thank you!

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