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#### Real-time intraoperative Optical Coherence Tomography for lamellar keratoplasty and donor tissue preparation

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### Lamellar keratoplasties



ALK: Anterior lamellar keratoplasty
DALK: Deep anterior lamellar keratoplasty
PKP: Penetrating keratoplasty
DSAEK: Descemet's stripping automated endothelial keratoplasty
DMEK: Descemet's membrane endothelial keratoplasty

## Intraoperative OCT



#### **Bioptigen ENVISU C2300 (High resolution)**

- High-Resolution: 3µm (tissue)
- Working distance: 60mm
- Axial range= 2.15mm (air) or 1.56 (tissue)
- Scanning protocols:

Volumetric 10mm (H) x 10mm (V) x 1.56mm (D) Volumetric 8mm (H) x 8mm (V) x 1.56mm (D) - SDOCT probe mounted on a motorized stand custom built at Ophthalmic Biophysics Center, Bascom Palmer Eye Institute, Miami, FL, USA. (Aguilar et al. IOVS 201;52: E-abstract#4026)

### Posterior Lamellar Keratoplasty - DSAEK

 Descemet's Stripping Automated Endothelial Keratoplasty (DSAEK) is a surgical treatment performed for any pathology only affecting posterior layer of the cornea (endothelium)

- Indications:
  - Fuch's Dystrophy
  - Pseudophakic Bullous Keratopathy



#### DSAEK real-time OCT imaging





En face view



After graft attachement, the interface is imaged by SD high resolution OCT: no irregularities, no fluid, no folds in this scan.

#### Posterior Lamellar Keratoplasty - DMEK

- Descemet's Membrane Automated Endothelial Keratoplasty (DMEK) is a surgical treatment performed for any pathology only affecting posterior layer of the cornea (endothelium)
- In this procedure, only the endothelium is replaced. Graft thickness = 50 microns
- The graft is thinner than in DSAEK in which endothelium + a part of posterior stroma are removed.
- So Therefore donor tissue preparation for DMEK is a challenging procedure.

#### Donor tissue preparation for DMEK by reverse big-bubble technique: real-time OCT imaging



#### 2<sup>nd</sup> attempt: Needle introduced deeper into the cornea





Intrastromal emphysema

Big bubble: Descemet/stroma dissection

### Anterior lamellar keratoplasty - DALK

Deep Anterior Lamellar Keratopplasty (DALK) is a surgical treatment performed for any pathology only affecting anterior layers of cornea (epithelium and anterior stroma).

- ∞ Indications:
- Keratoconus in advanced stages with apical corneal scar
- Corneal scars post infectious keratitis or trauma
- Corneal dystrophies





### Succesful DALK by big bubble technique





The Descemet's membrane (26 microns) is perfectly separated from the posterior stroma.

En face view

## Corneal perforation: DALK converted to PK



Intrastromal emphysema after air injection



Corneal perforation: the Descemet's membrane rolled up and was floating in the anterior chamber



En face view





- Intraoperative high resolution OCT imaging is a useful tool to help surgeons during lamellar keratoplasty surgeries.
- Further improvements in this promising technology might help surgeons:
- -decrease the rate of postoperative complications in DSAEK by visualization of the quality of the donor/host interface intraoperatively

- guide intrastromal air injection in DALK when using big-bubble technique
- guide stroma/descemet's membrane separation in DMEK for donor tissue preparation when using reverse big-bubble technique