

# Intra-operative OCT for Corneal Surgery

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# Financial Disclosure

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United States Patent Application

Application No.: 61809518

(University of Miami)

Not for Release

# Anterior Segment OCT

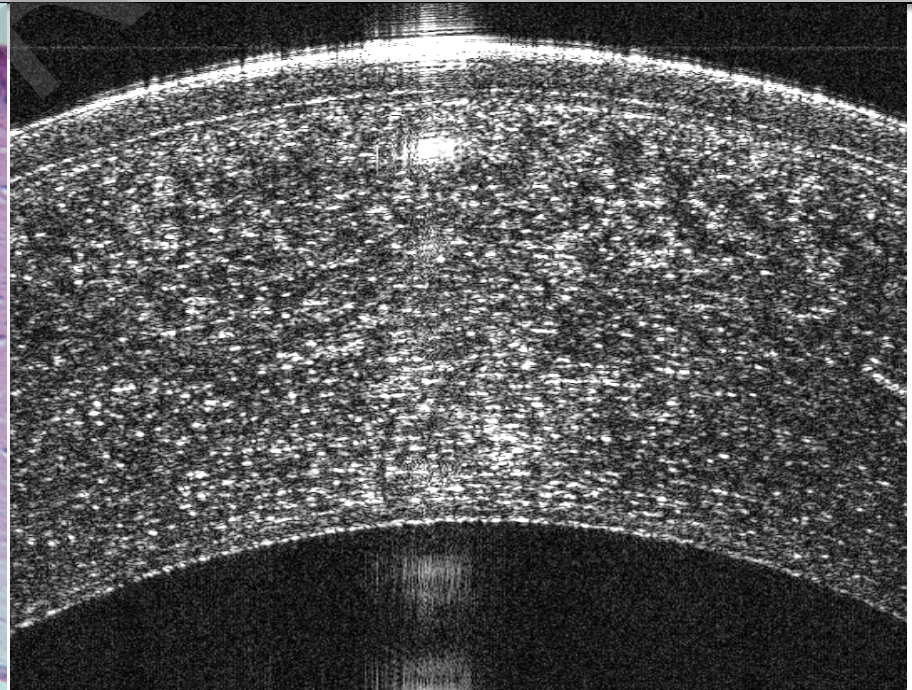
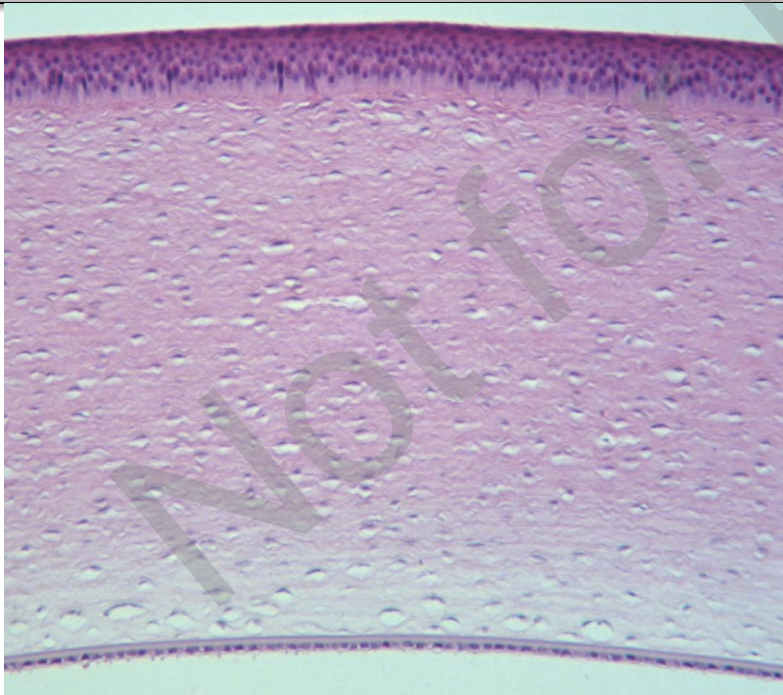
has become an ESSENTIAL diagnostic tool  
for the anterior segment specialist



# Anterior Segment OCT

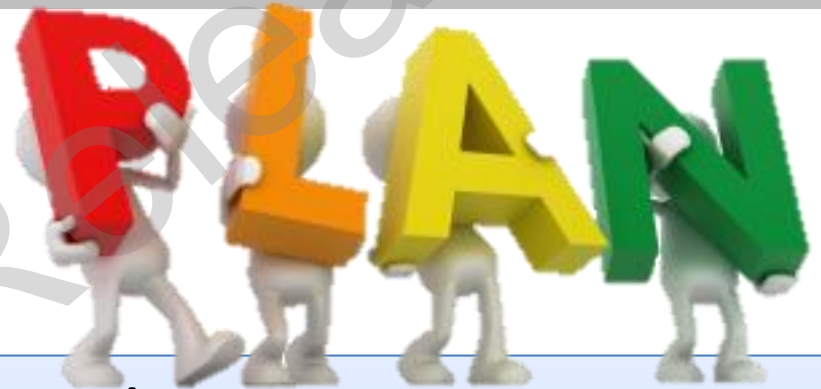
## *In vivo* Optical Biopsy

to guide the diagnosis and management  
of anterior segment pathologies





# ASOCT for corneal surgery planning

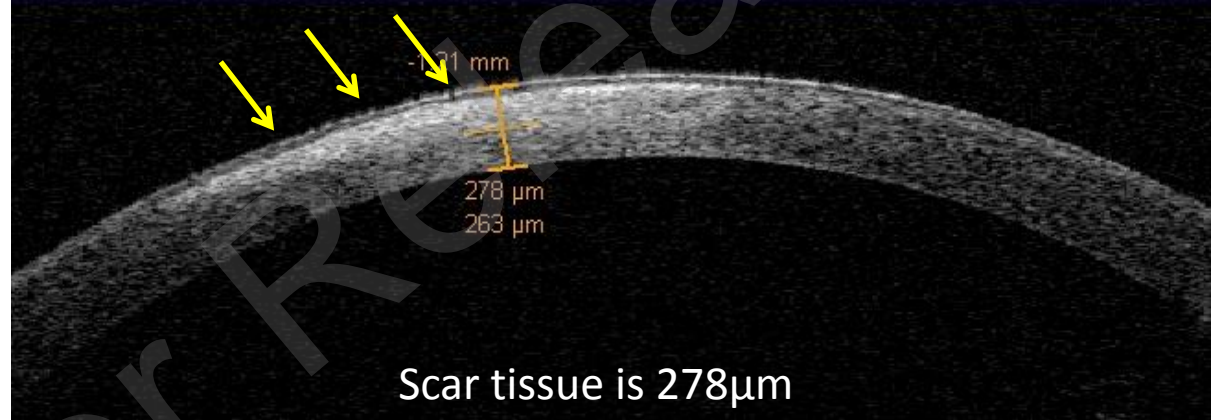
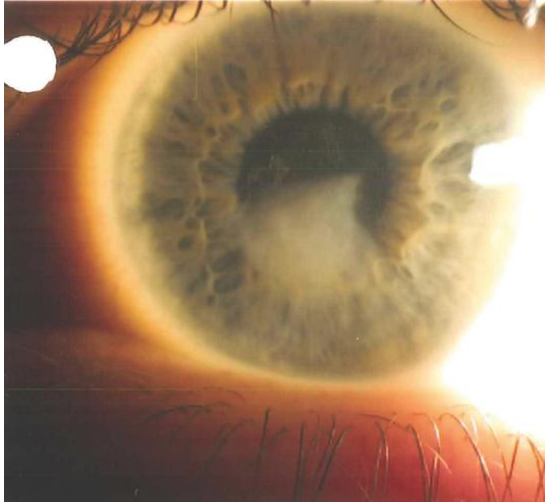


- Anterior Lamellar Keratoplasty
- Deep Anterior Lamellar Keratoplasty
- Endothelial Keratoplasty

# Anterior Lamellar Keratoplasty

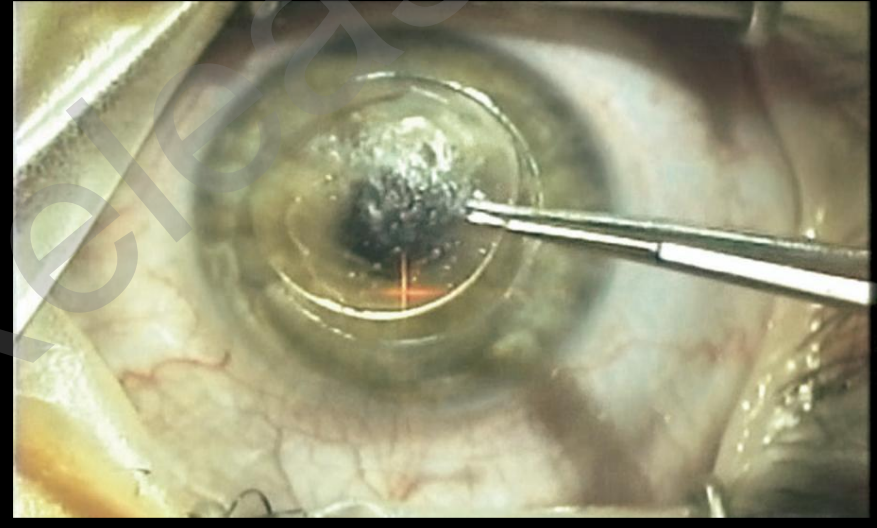
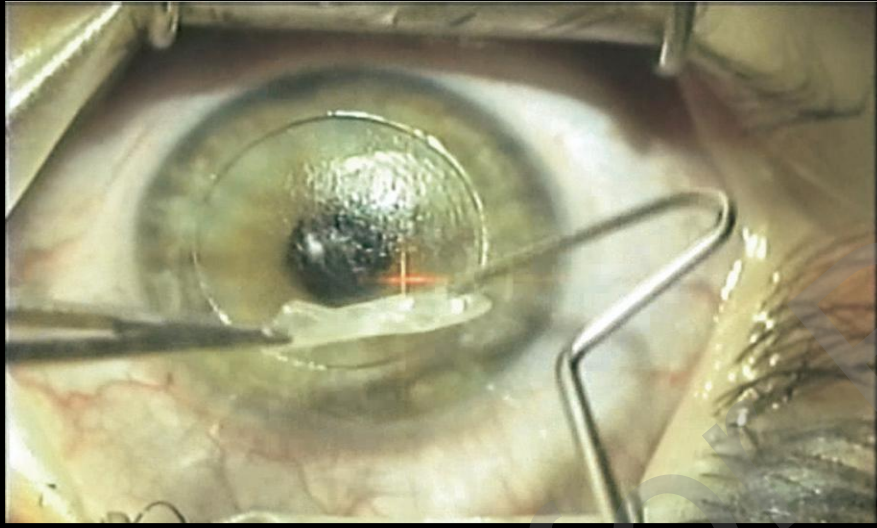
# Case 1: Surgical planning of femtosecond laser assisted lamellar keratoplasty

- 29 year old male patient with post keratitis corneal scar: **Preoperative BSCVA 20/400**



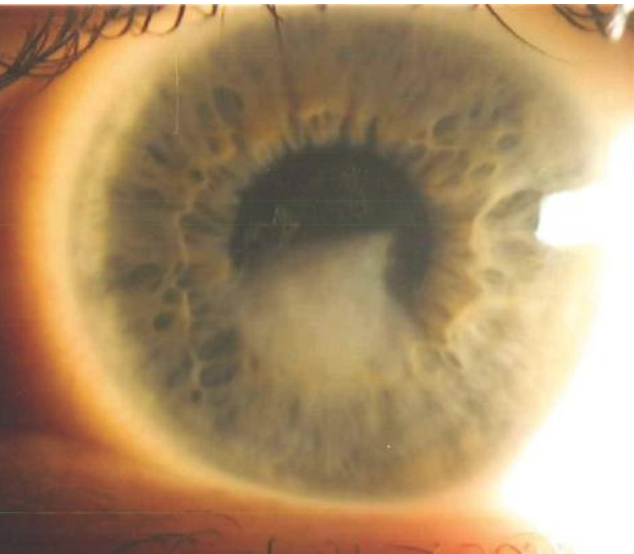
- Measure thickness of the corneal pathology using AS OCT.
- Program FS laser machine to cut at the measured depth.
- Cut both the donor and recipient using the same settings.

# Femtosecond Laser-Assisted Sutureless Anterior Lamellar Keratoplasty

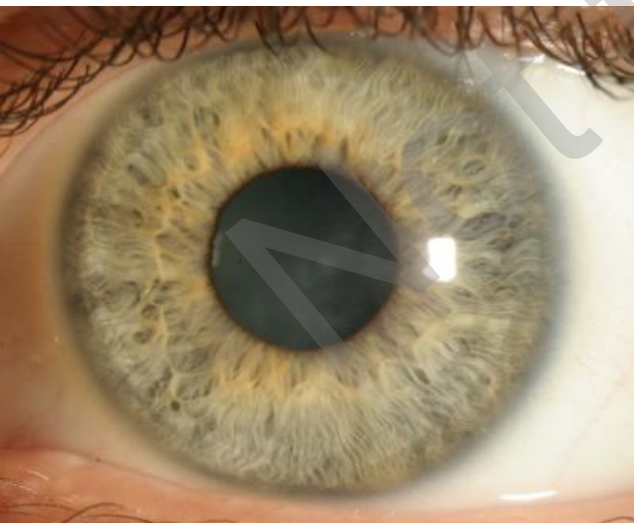
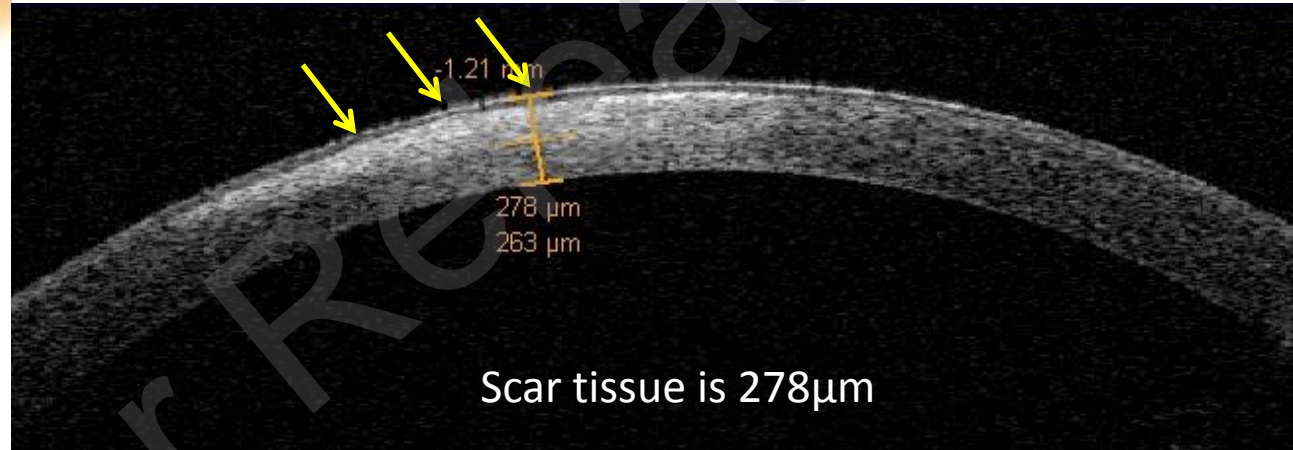


- Remove the recipient's pathological corneal tissue
- Replace it with the corneal donor lenticule
- Fit a bandage contact lens over the cornea

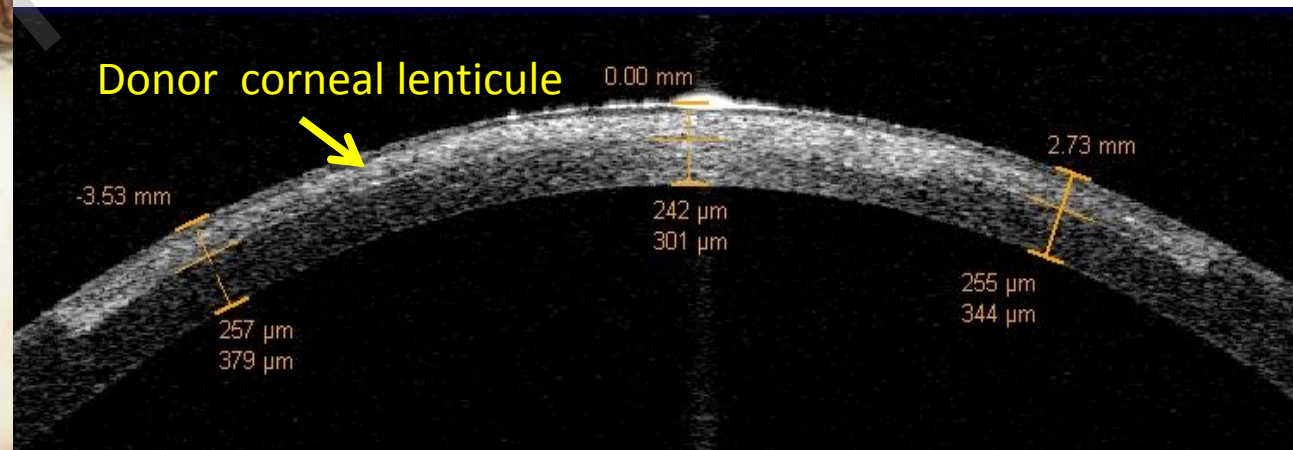
# Surgical planning of femtosecond laser assisted lamellar keratoplasty



- **Preoperative BSCVA 20/400**



- **3 weeks Postoperatively BSCVA 20/40**





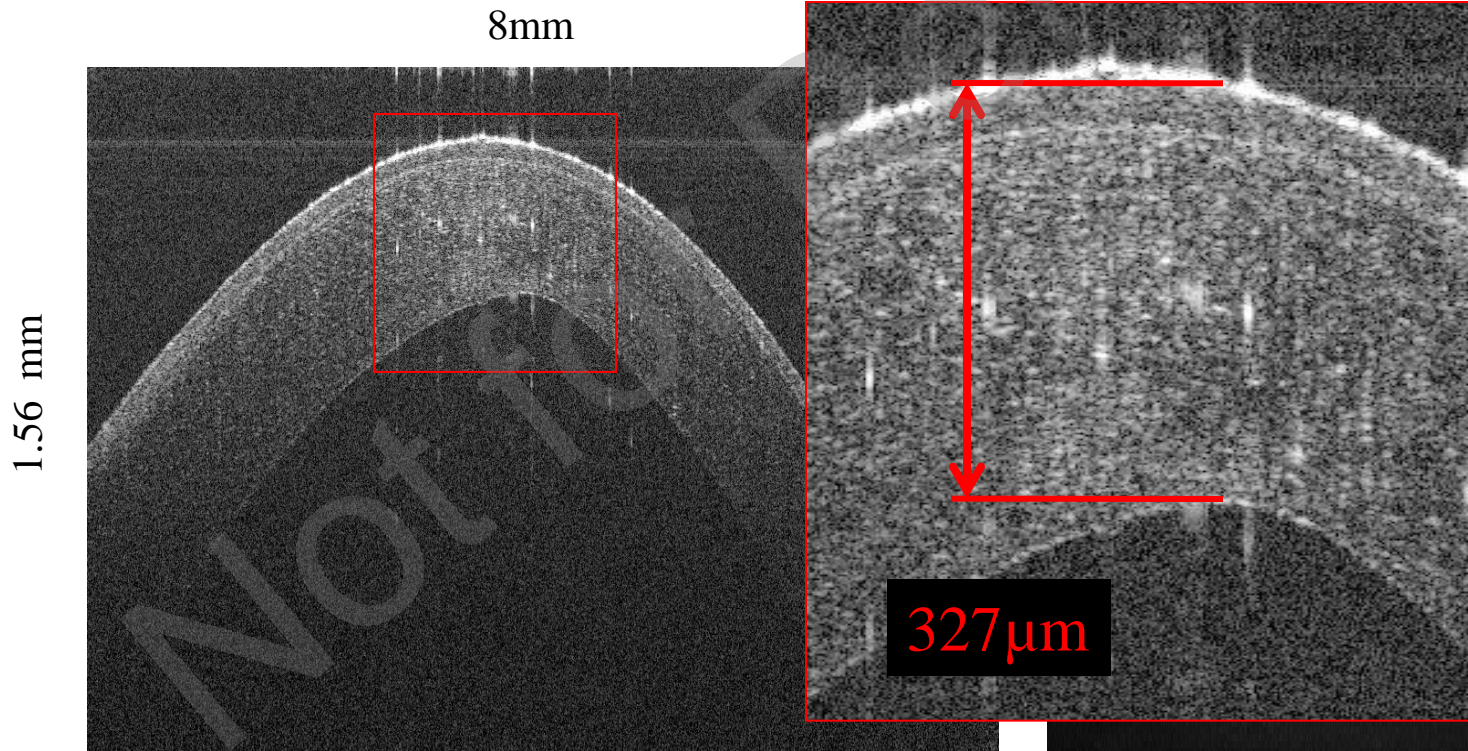
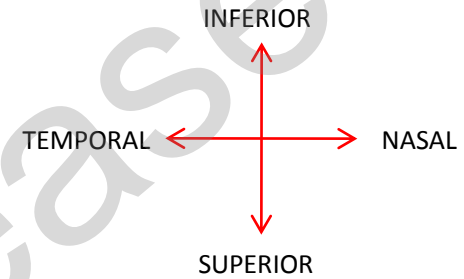
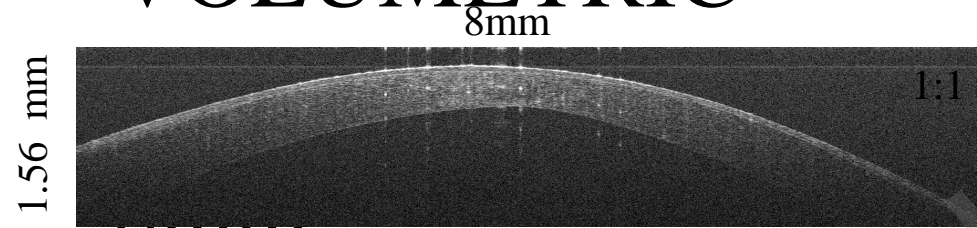
# Intraoperative OCT to assist corneal surgery

A novel technique that is evolving!



# DALK- cornea before surgery

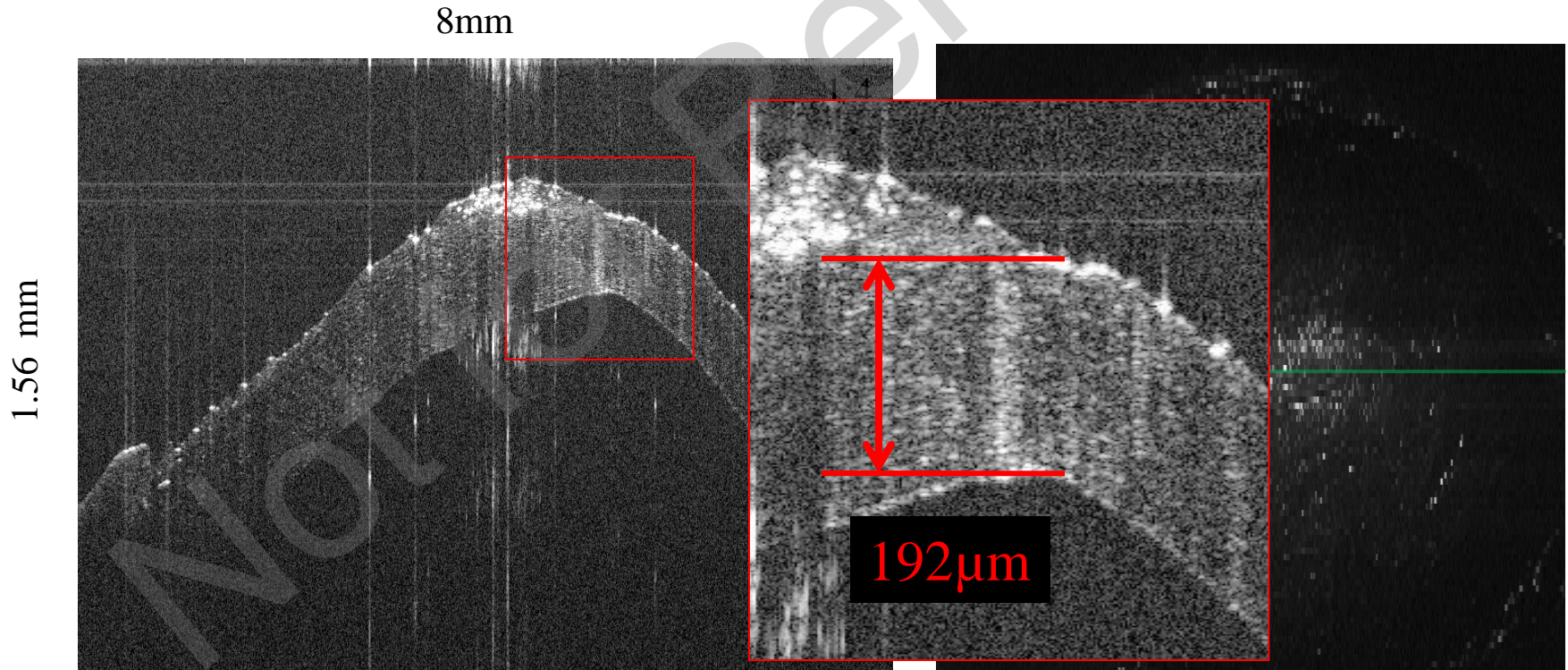
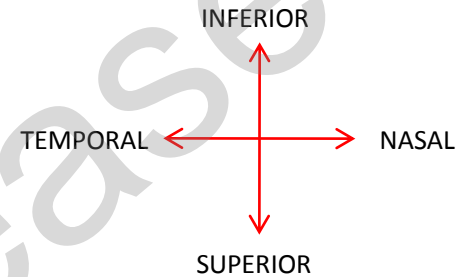
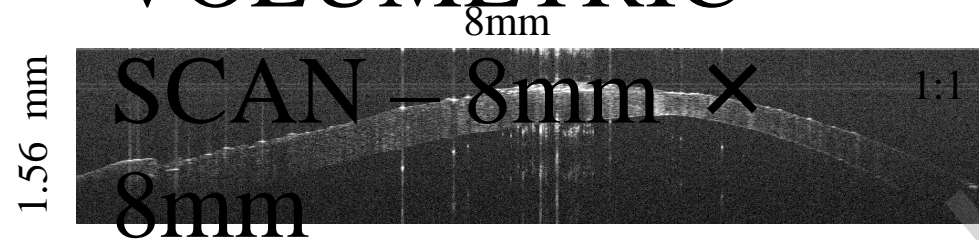
## VOLUMETRIC





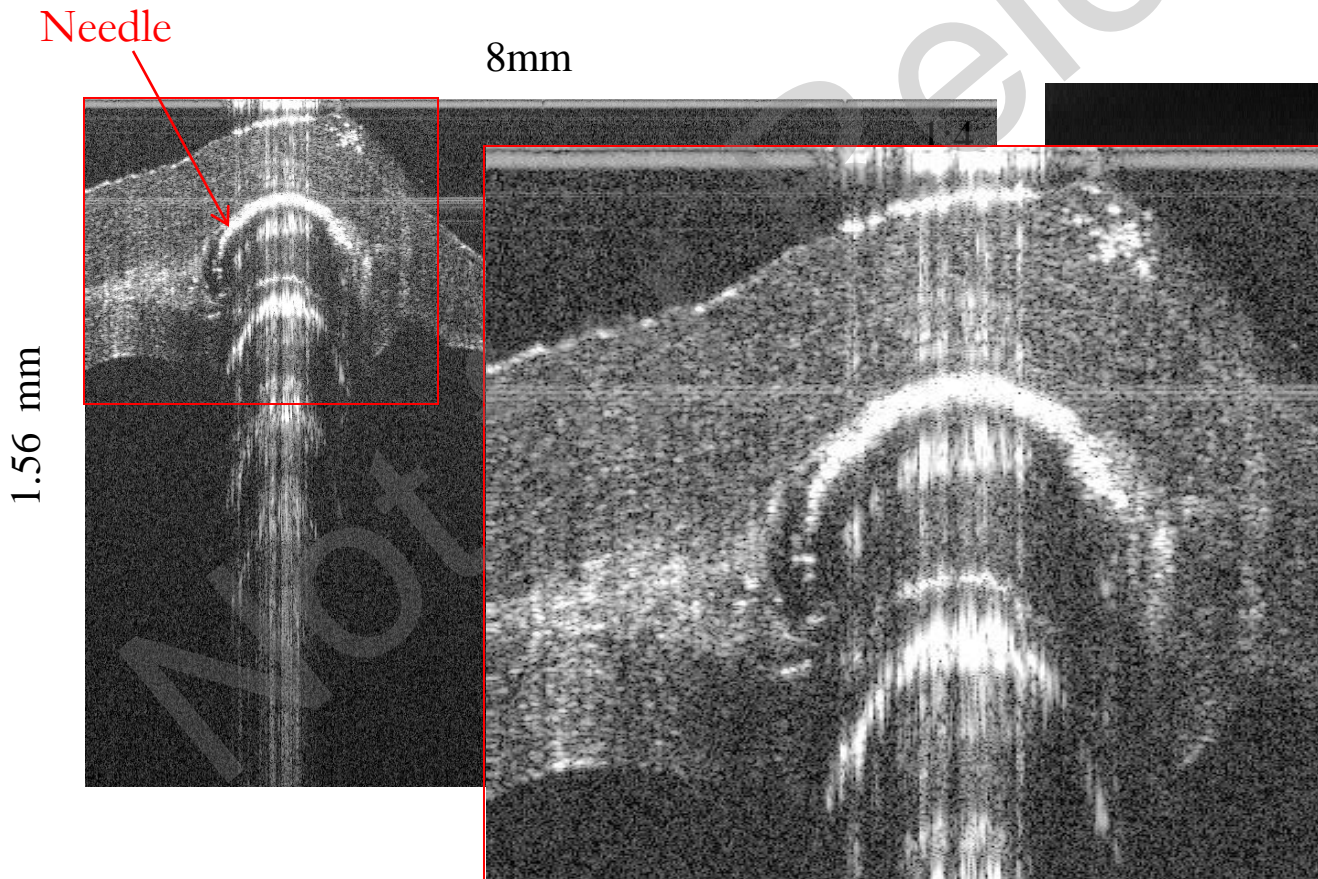
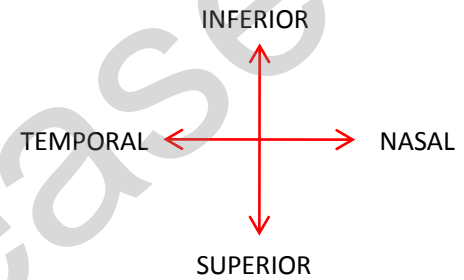
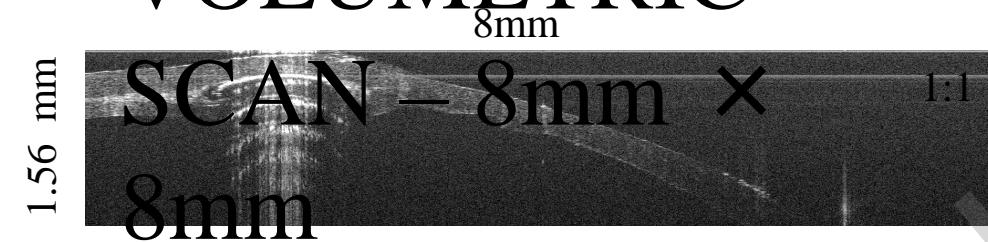
## 2) Thickness of the stroma after trephination and dissection

### VOLUMETRIC



### 3) Needle insertion

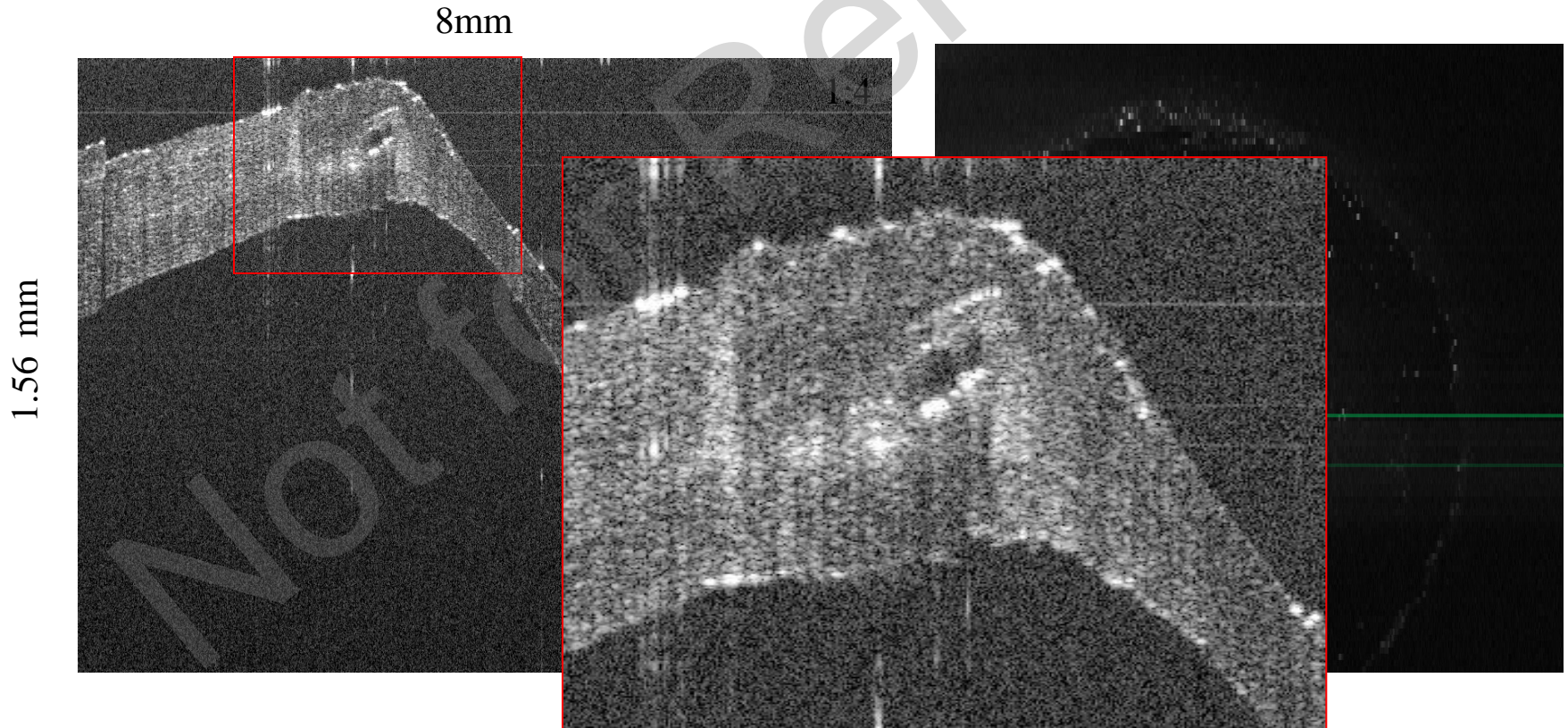
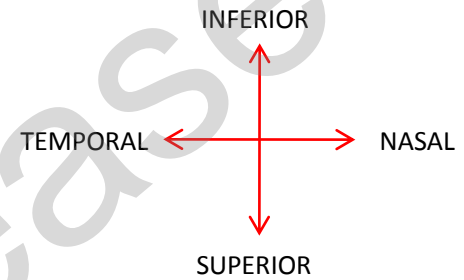
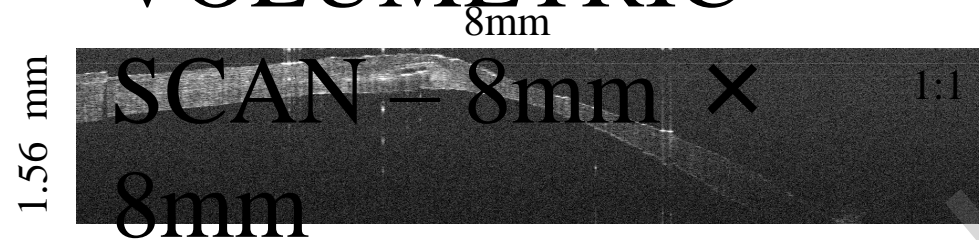
## VOLUMETRIC





### 3) Needle insertion

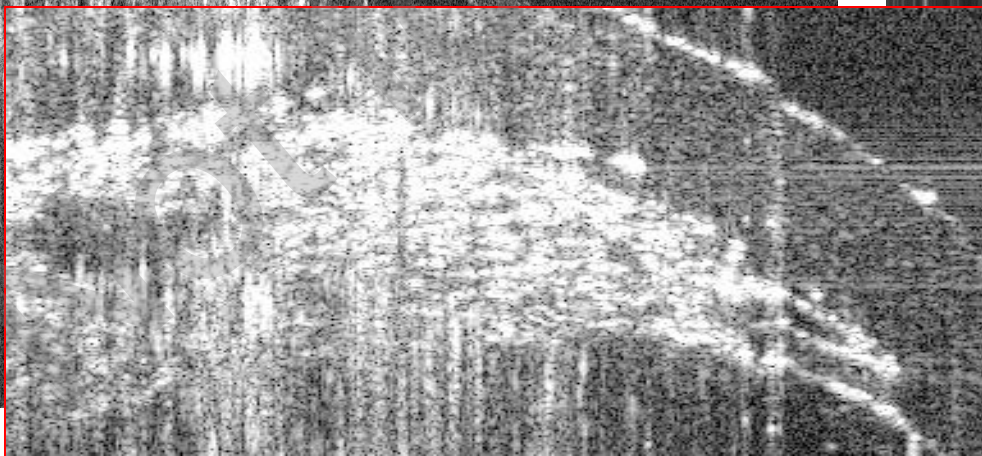
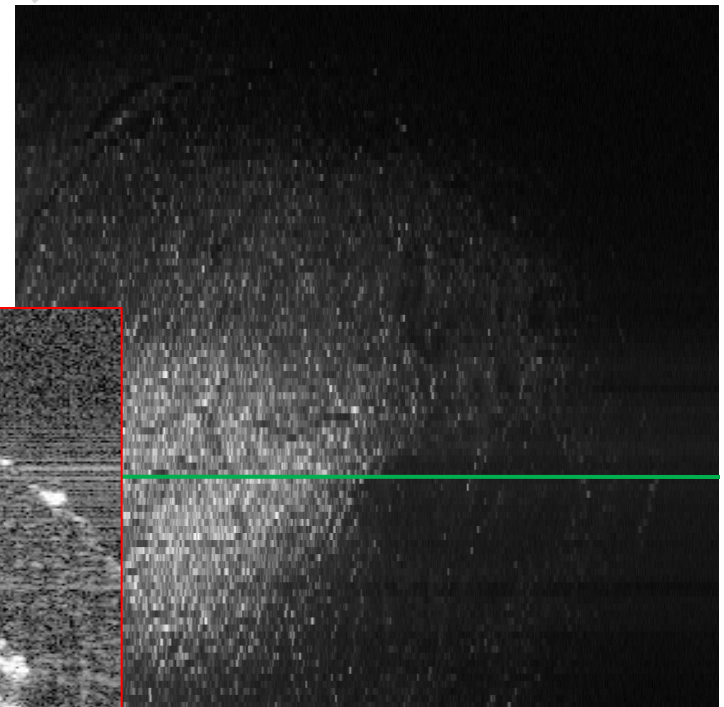
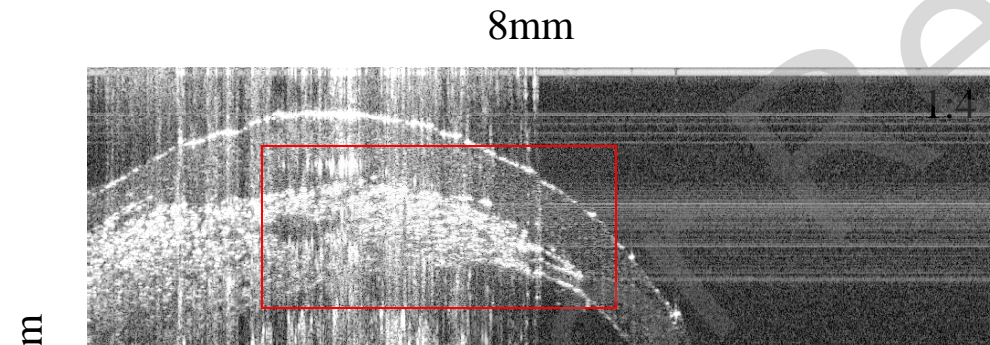
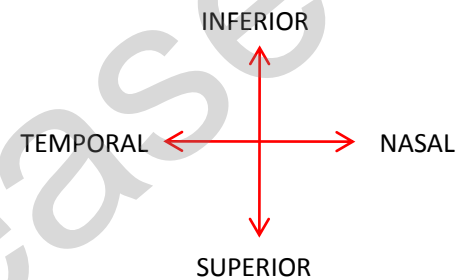
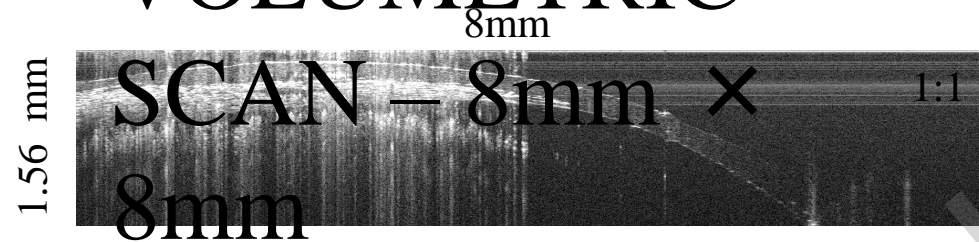
## VOLUMETRIC





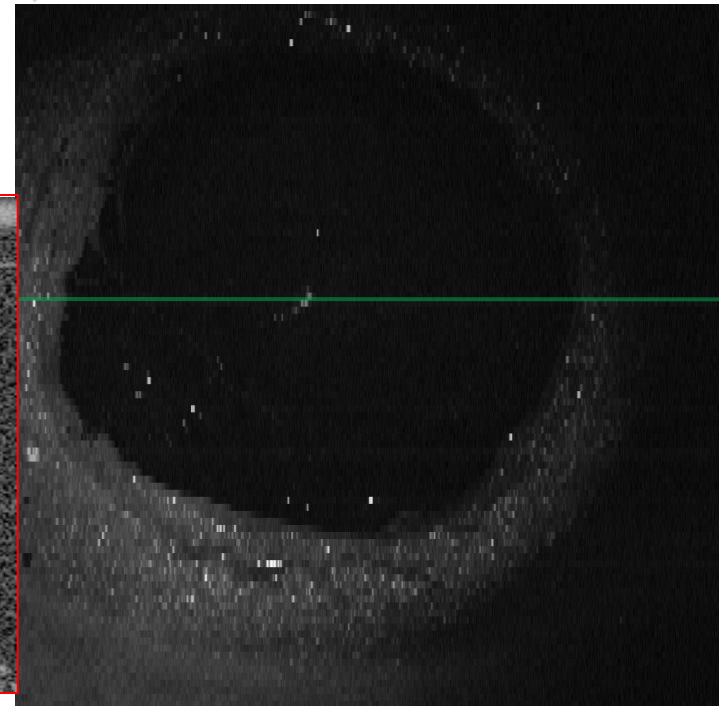
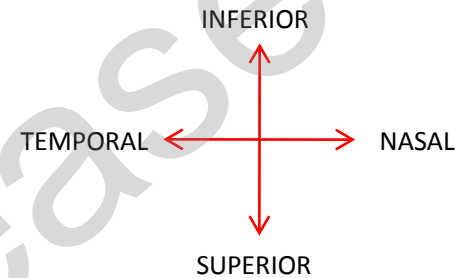
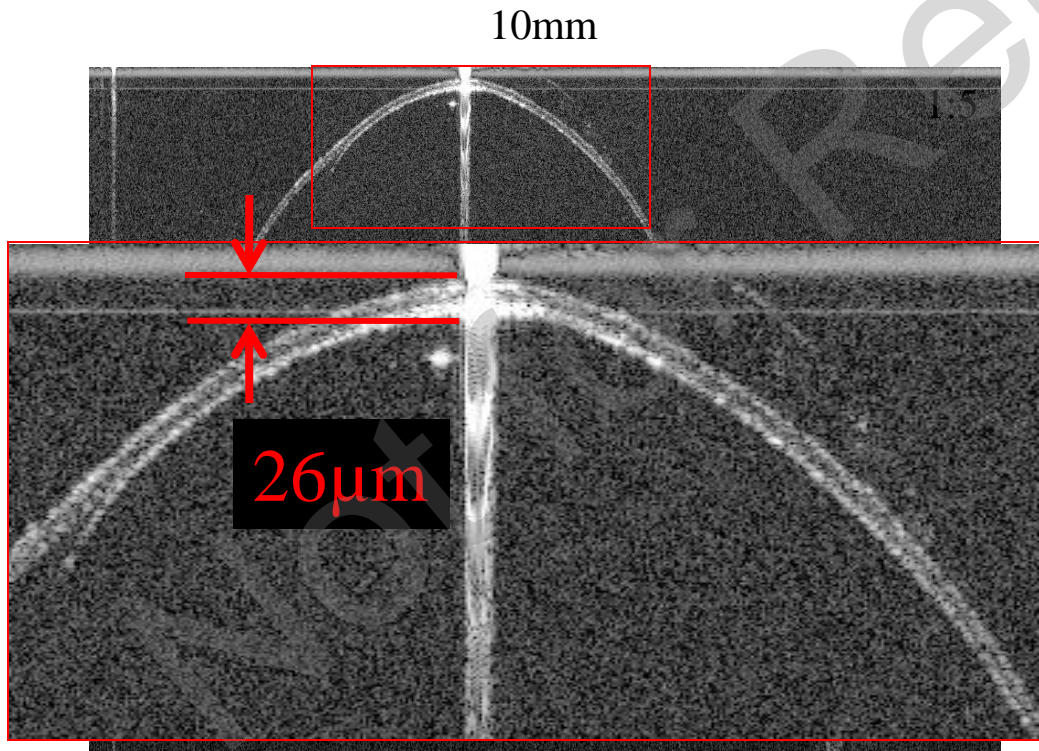
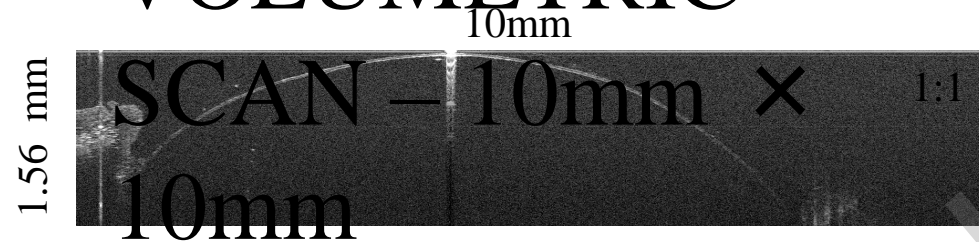
## 4) Air injection

### VOLUMETRIC



## 5) Descemet's membrane after stroma dissection

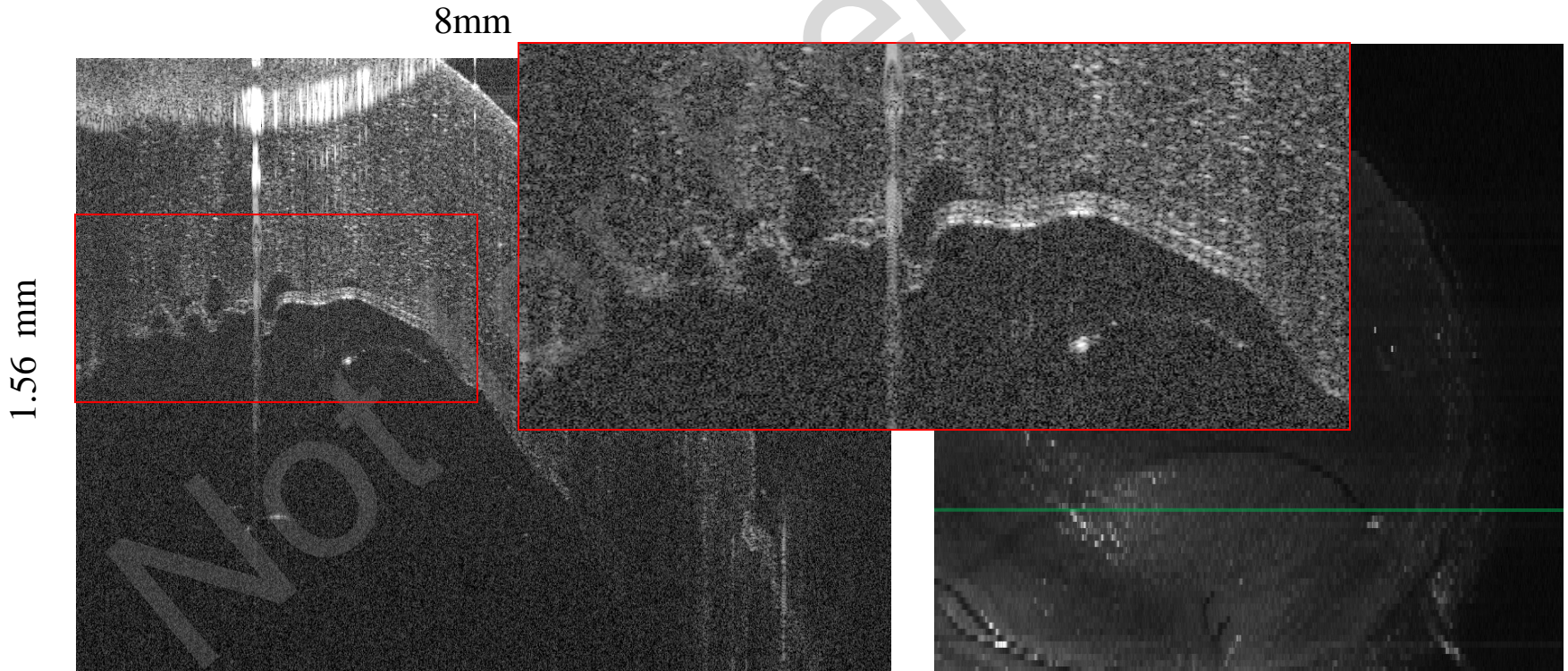
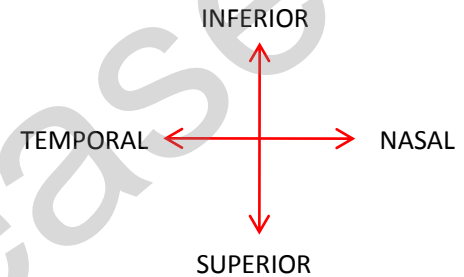
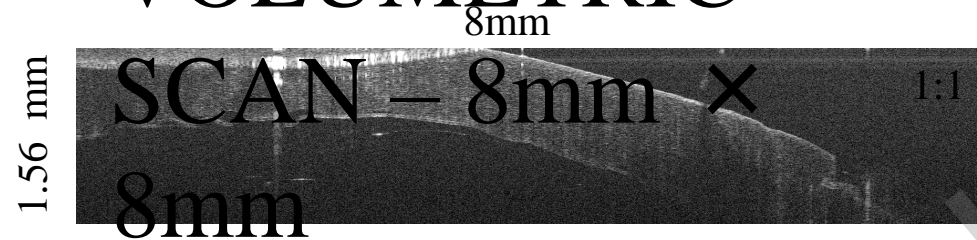
### VOLUMETRIC



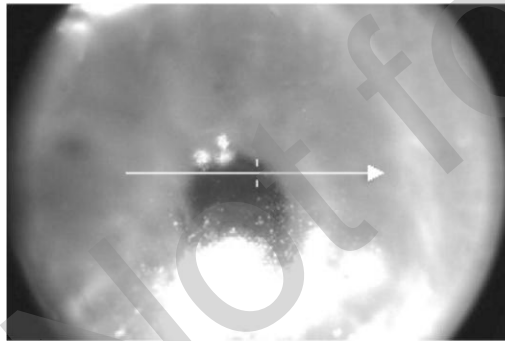
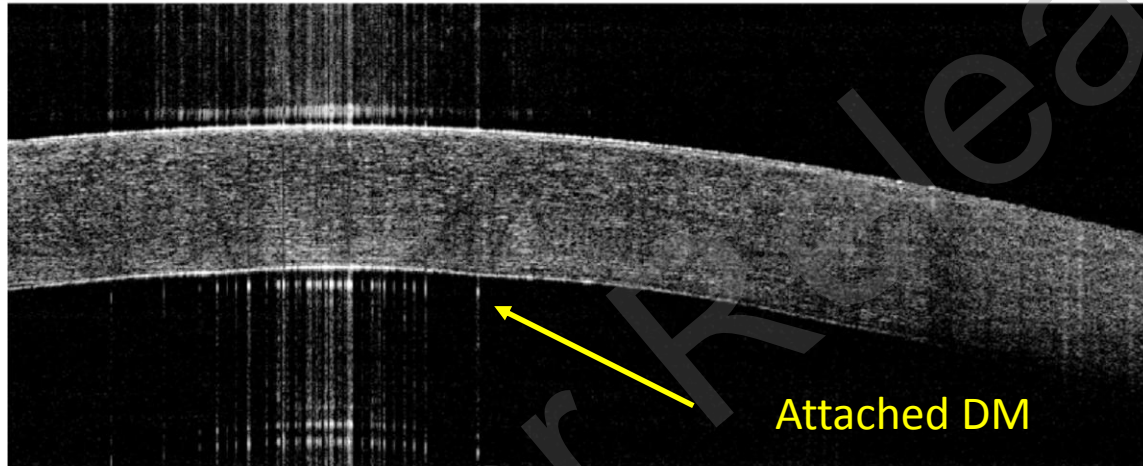


## 6) Descemet's membrane after transplant

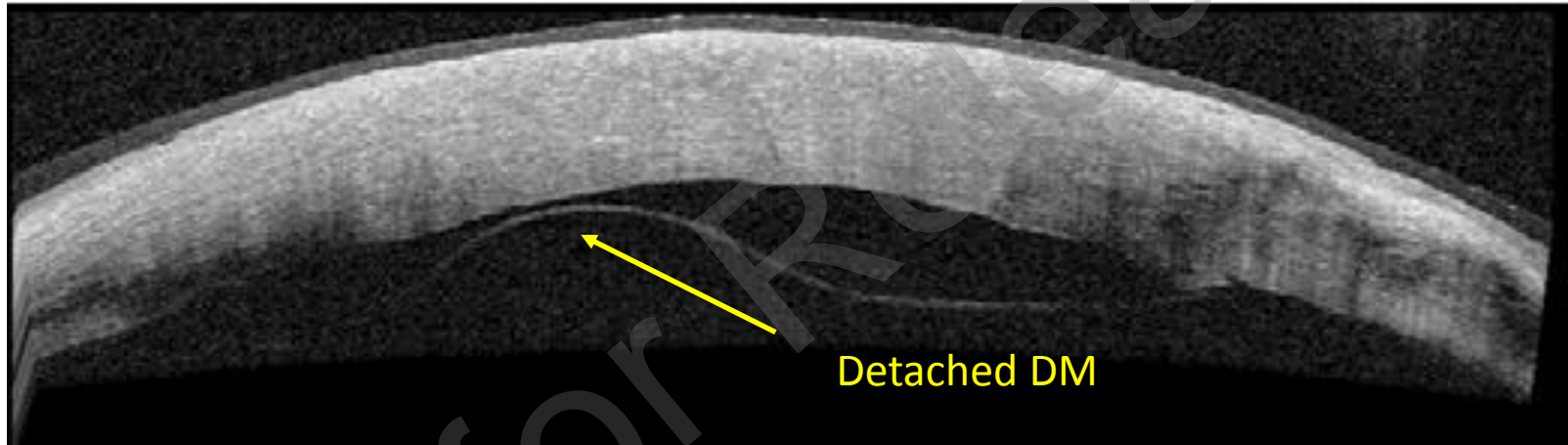
### VOLUMETRIC



# Case: Intraoperative OCT in DMEK surgery

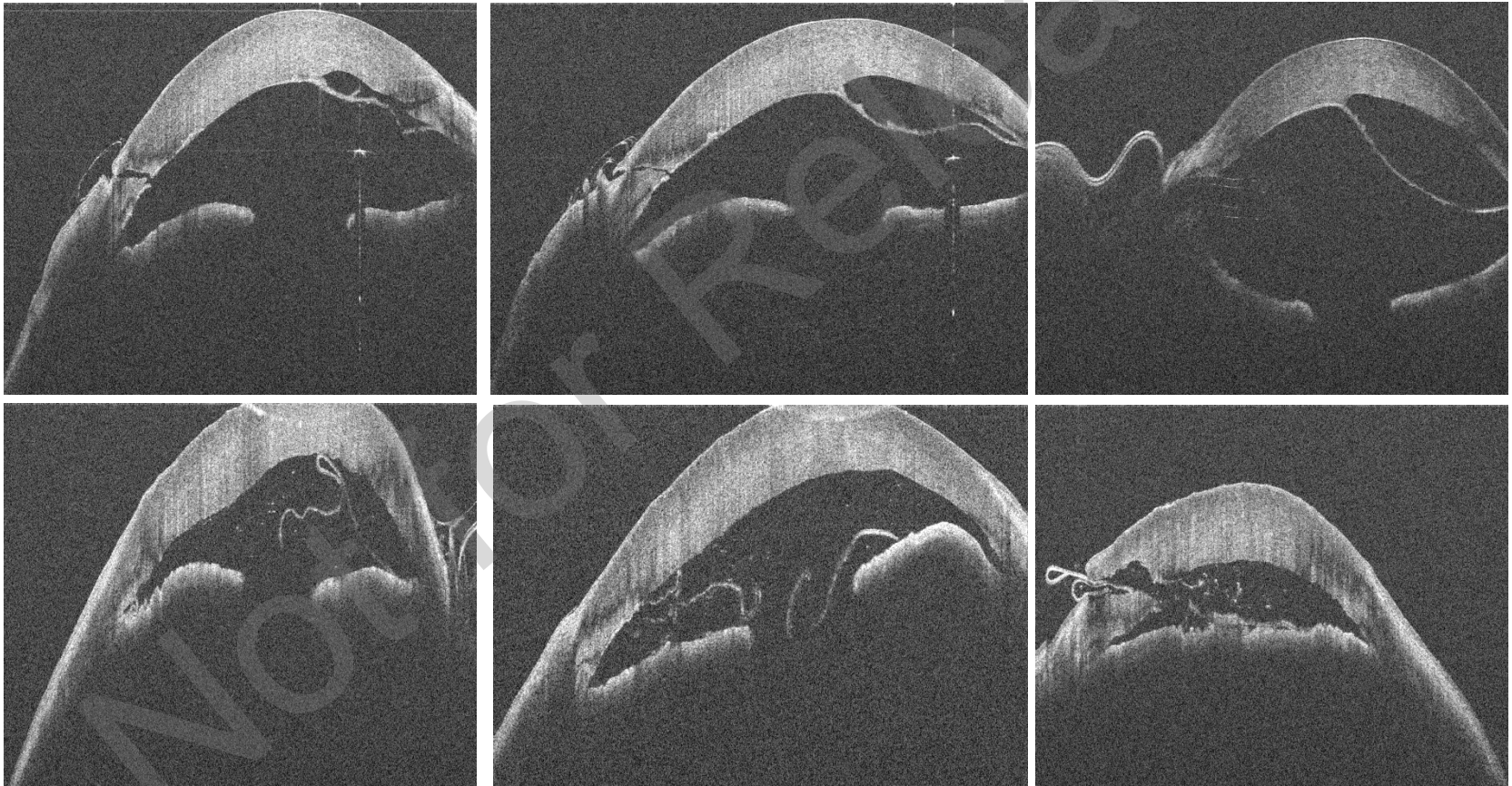


# Case: DMEK surgery

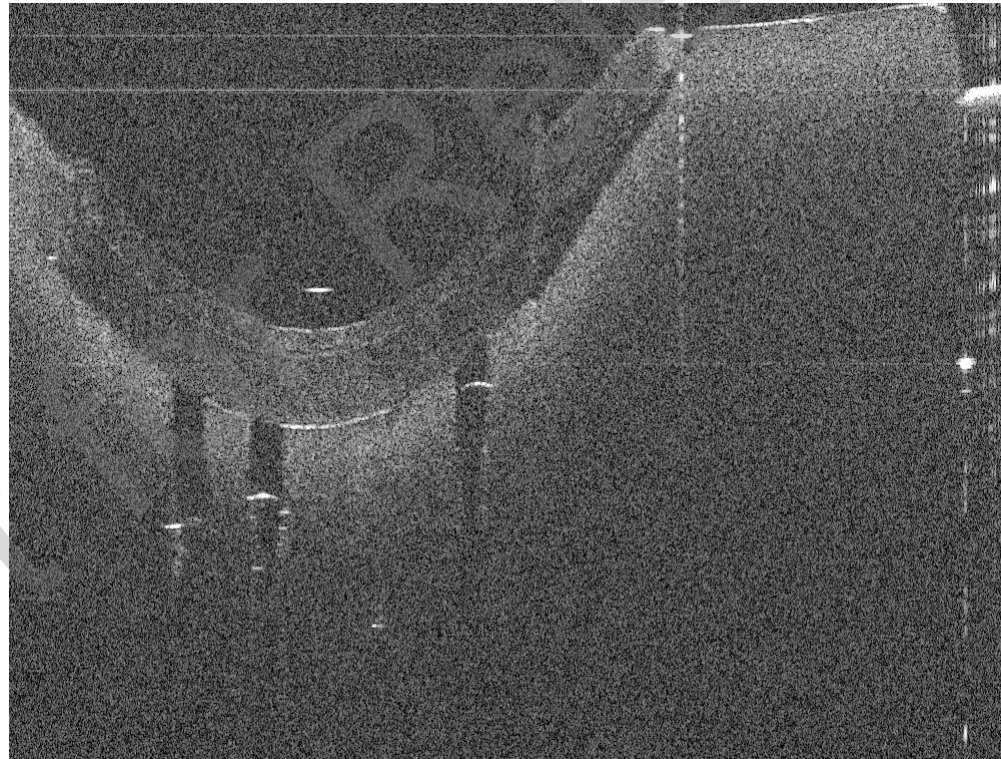




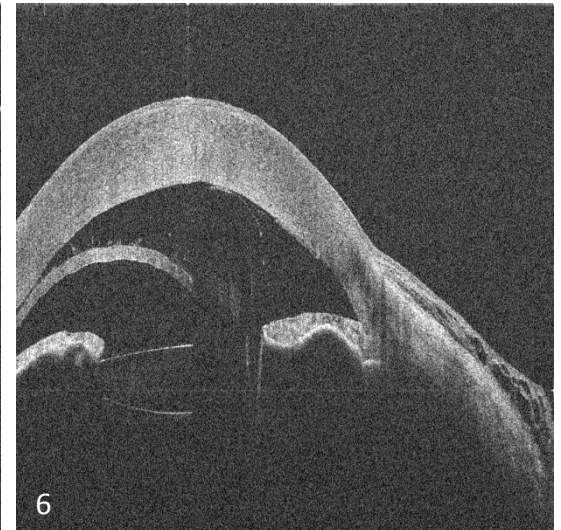
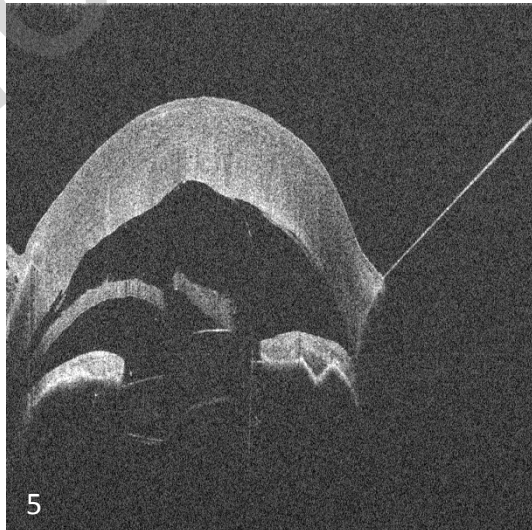
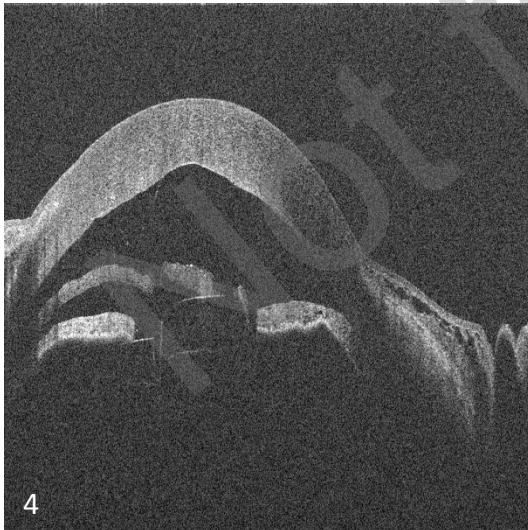
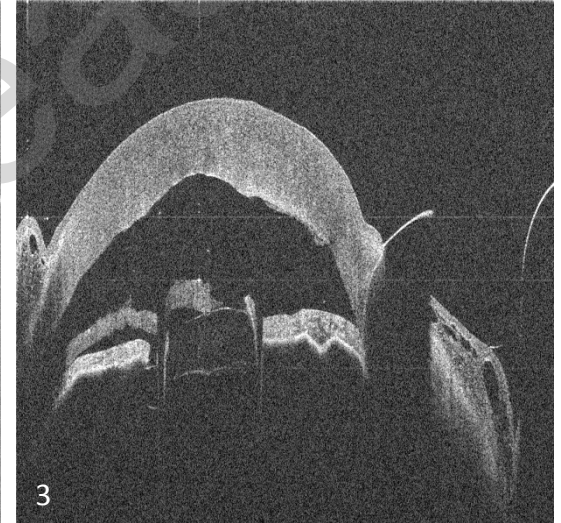
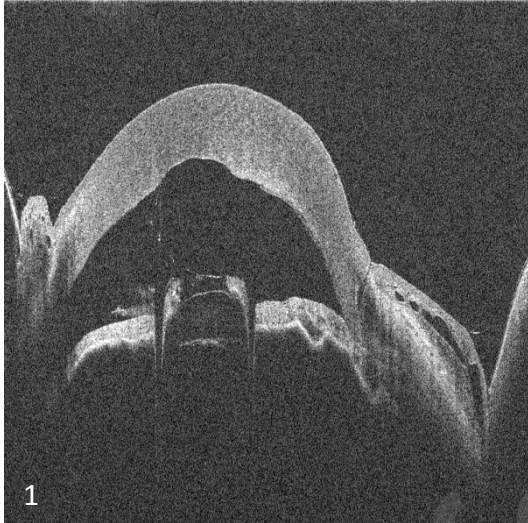
# DSAEK- DM peeling



# Graft preparation

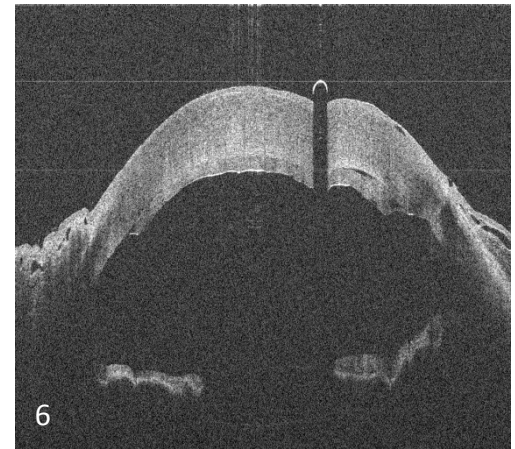
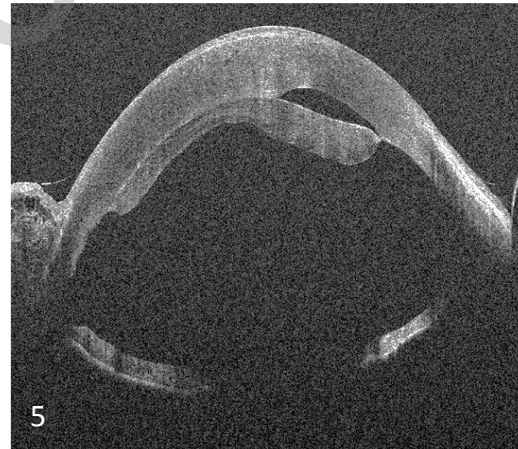
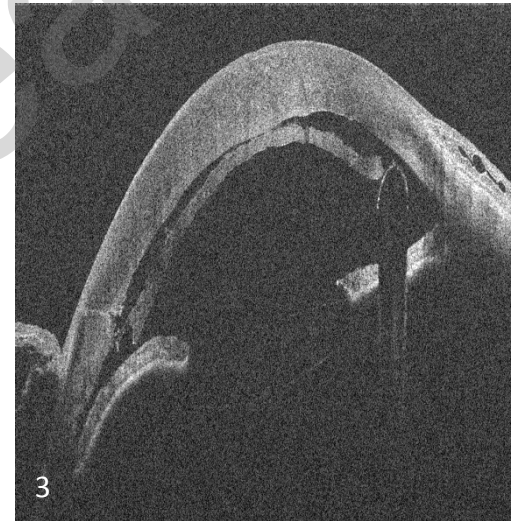
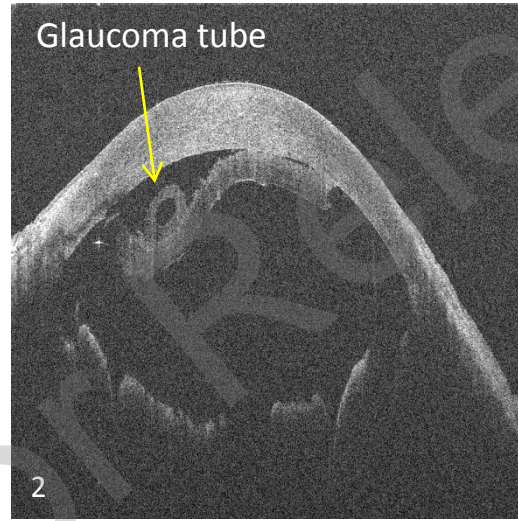
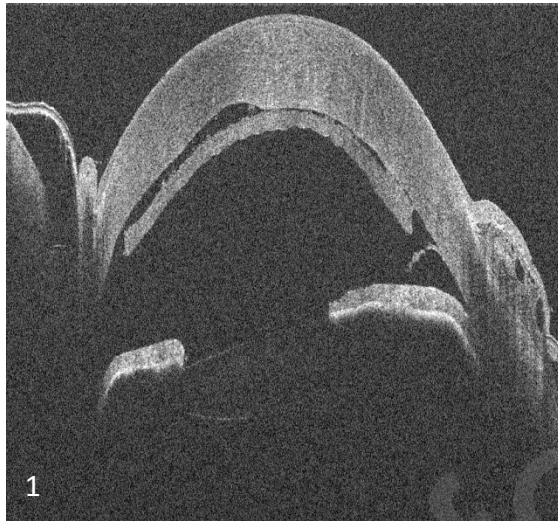


# DSAEK: donor graft injection

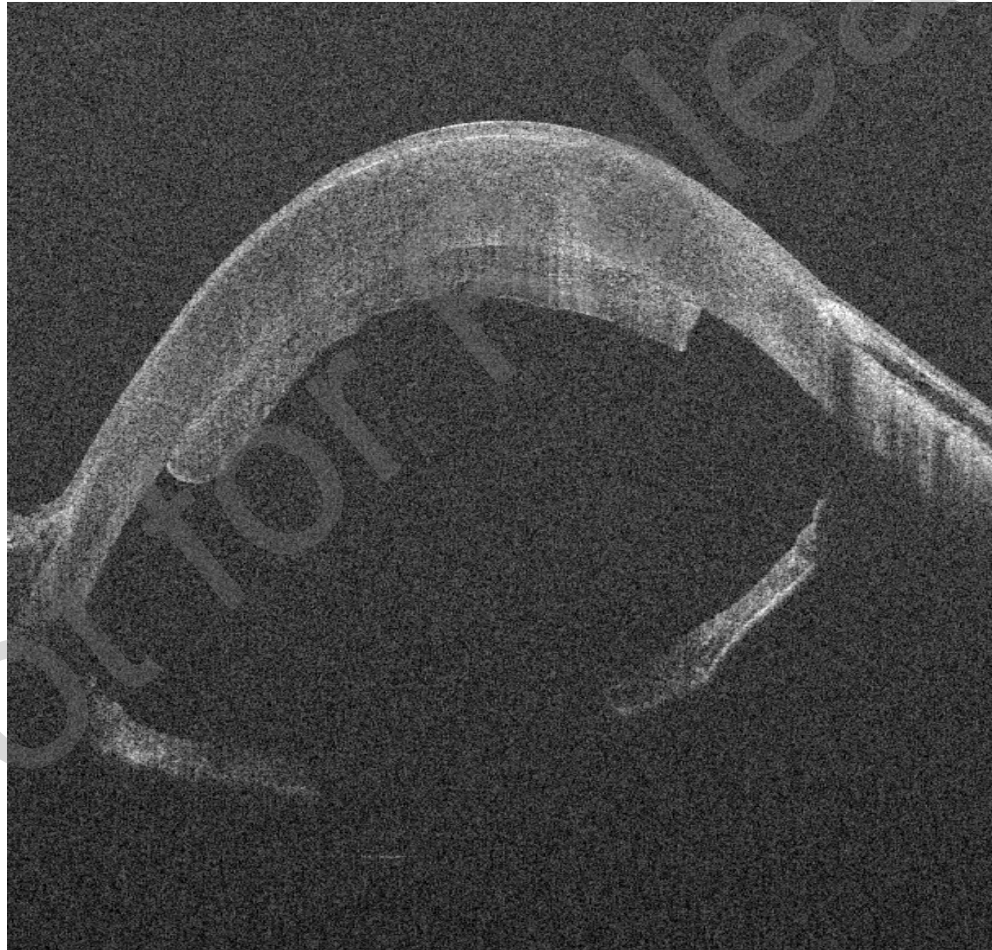




# DSAEK: interface



# DSAEK: final





# Future of ASOCT

- Corneal micro-layer tomography
- OCT angiography of the anterior segment



# ***Corneal Micro-Layer Tomography*** ***“C-MLT”***

***a Novel Diagnostic Imaging Technology***

Financial Disclosure

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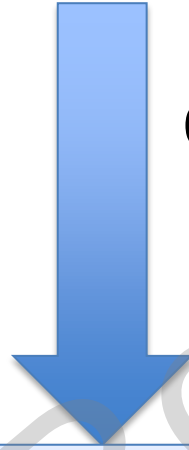
United States Patent No.: 61809518

# Corneal Micro-Layer Tomography “C-MLT”

- It is a ***technique*** for the ***diagnosis and management*** of:
  - Corneal graft rejection
  - Fuchs’ Endothelial dystrophy
  - Keratoconus
  - Dry Eye Syndrome
  - Ocular surface lesions



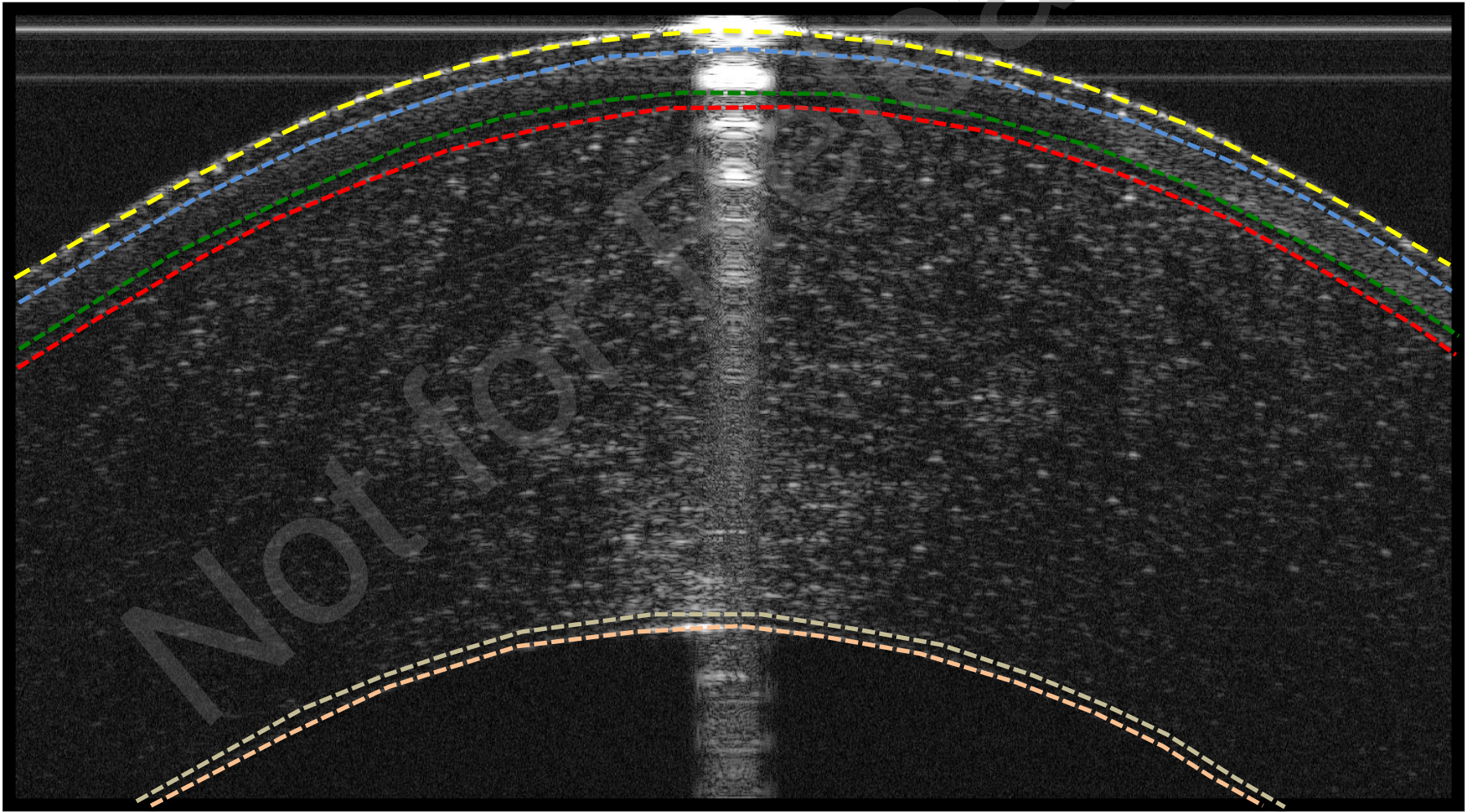
OCT Image raw data  
Uploaded to



**C-MLT Diagnostic Suite**

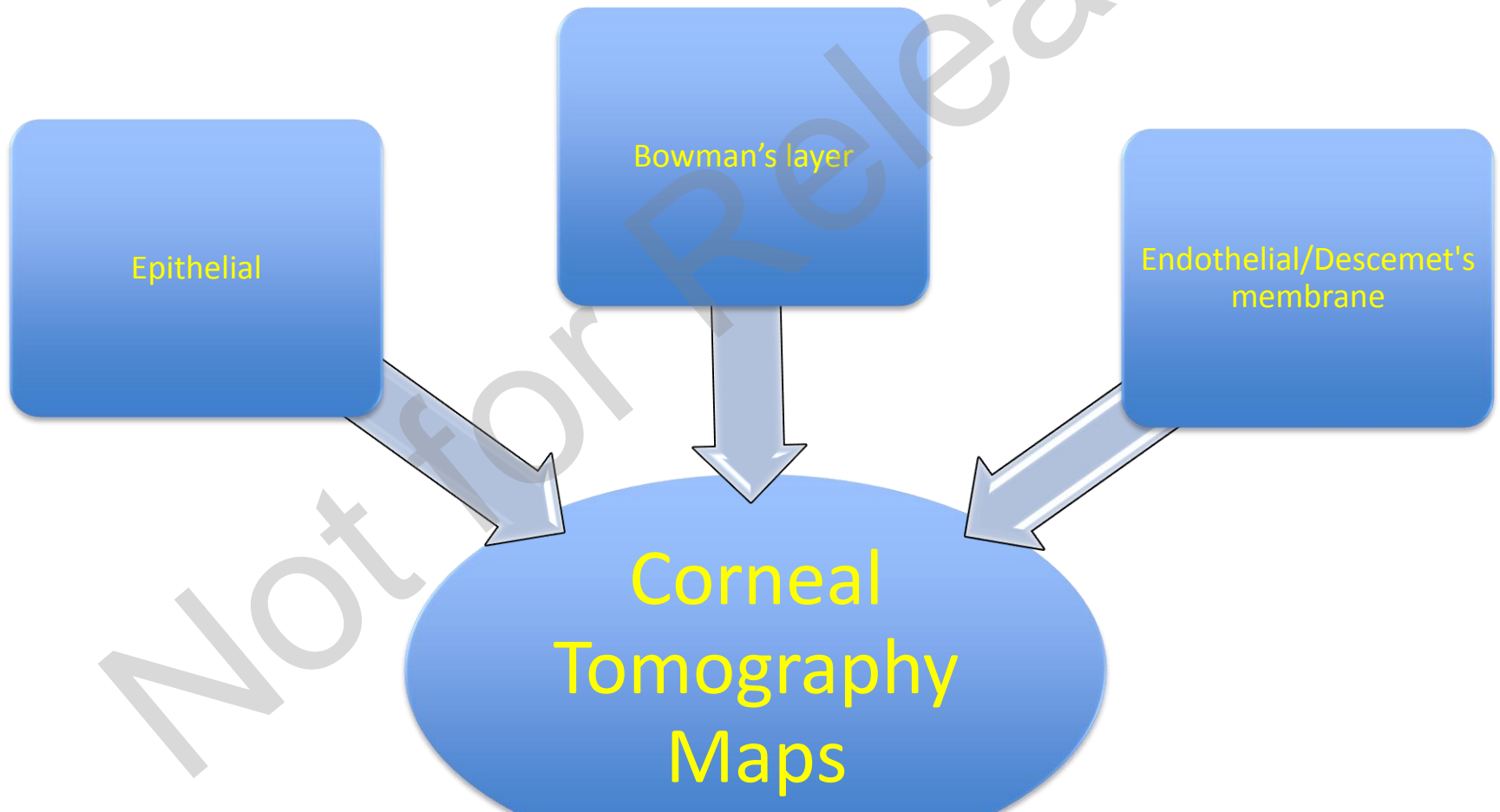
# C-MLT Diagnostic Suite

## Segmentation of Corneal layer



# MLT Diagnostic Suite

Creating tomographic maps of the histological layers of the cornea

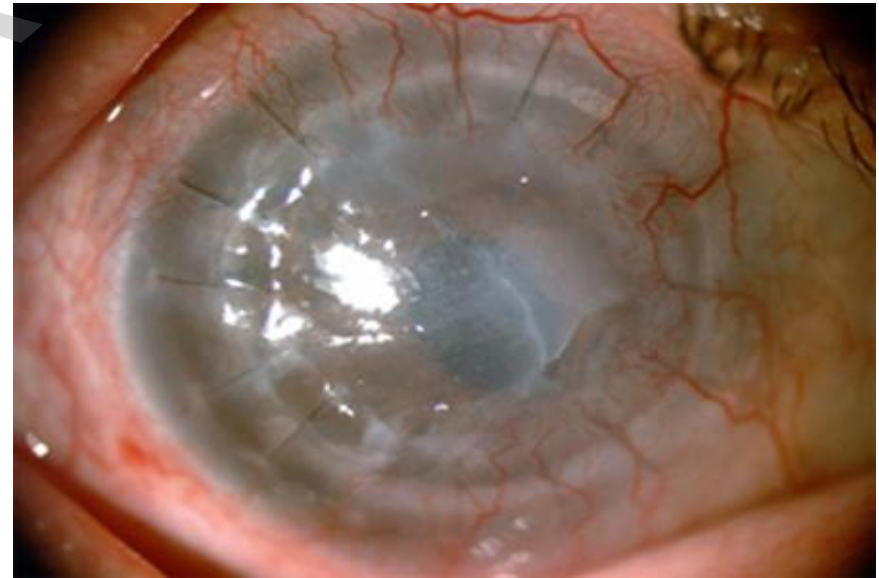


Each of those tomographic maps has its clinical indications

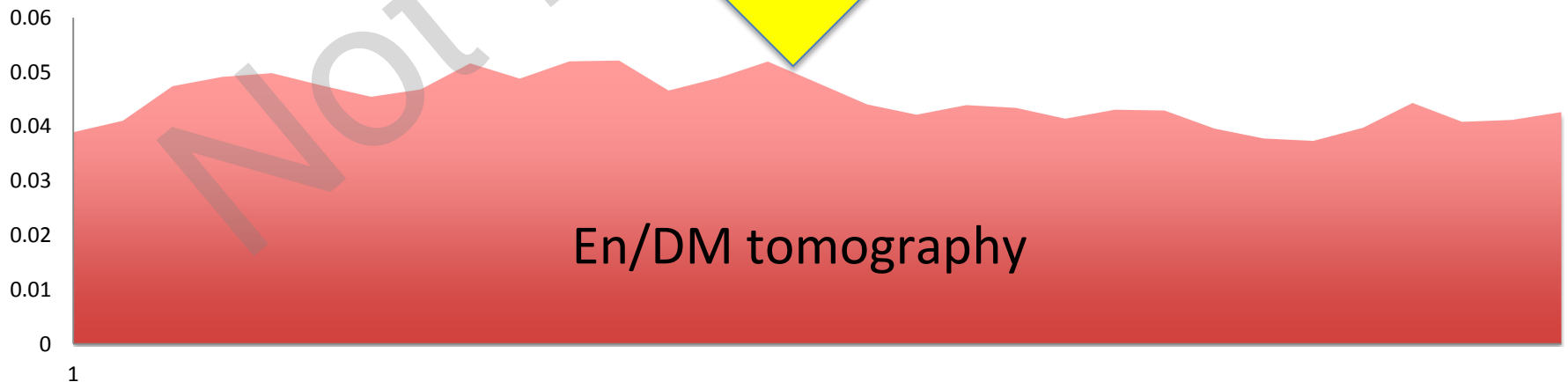
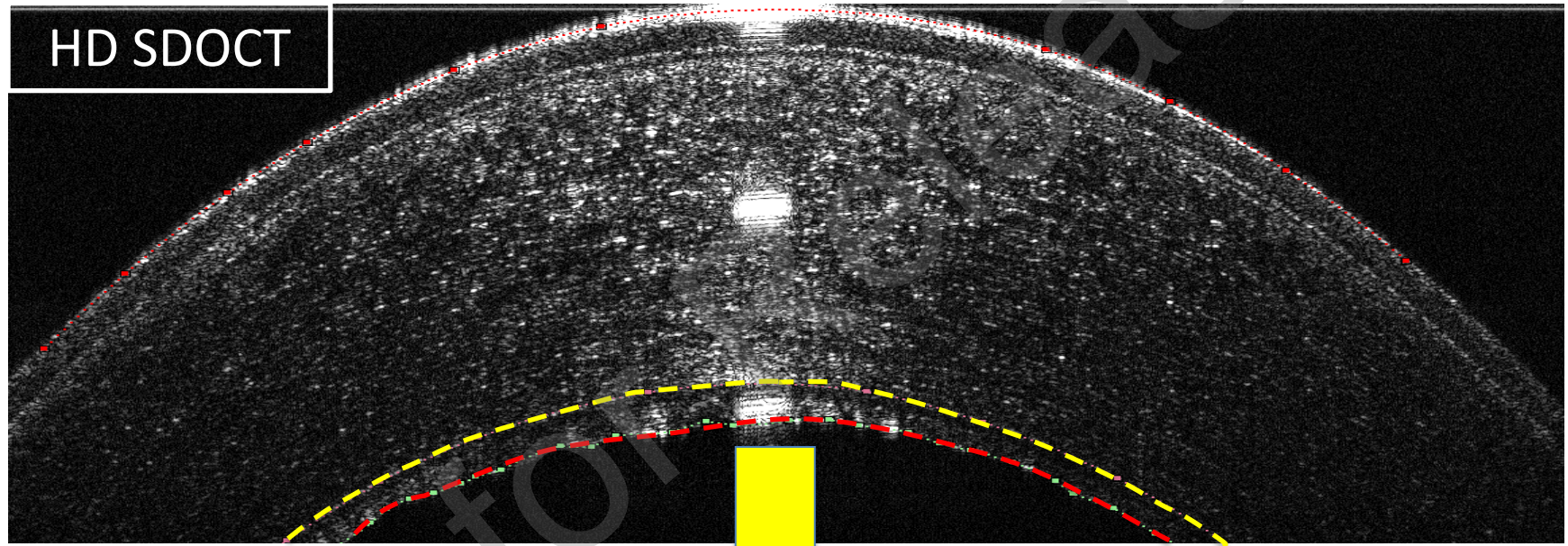


# Endothelial/Descemet's membrane Tomography Maps

for the diagnosis of  
**Corneal graft rejection**  
and  
**Fuchs' endothelial  
dystrophy**

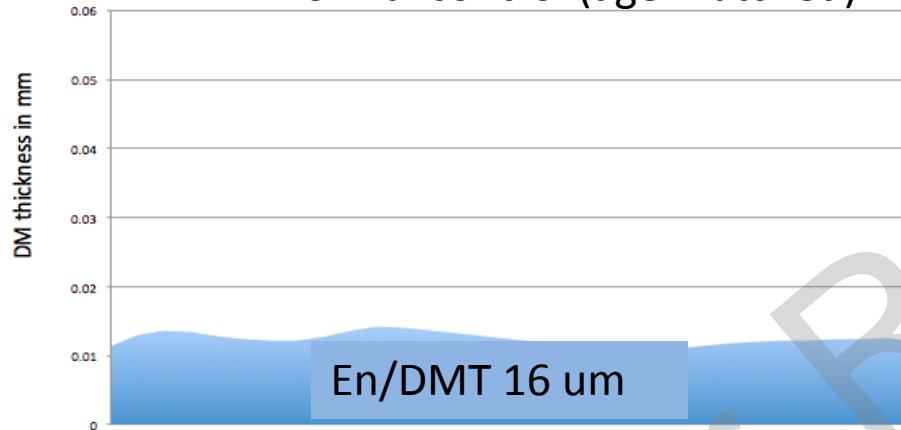


# Endothelial/Descemet's Membrane Complex (En/DM) Optical Tomography

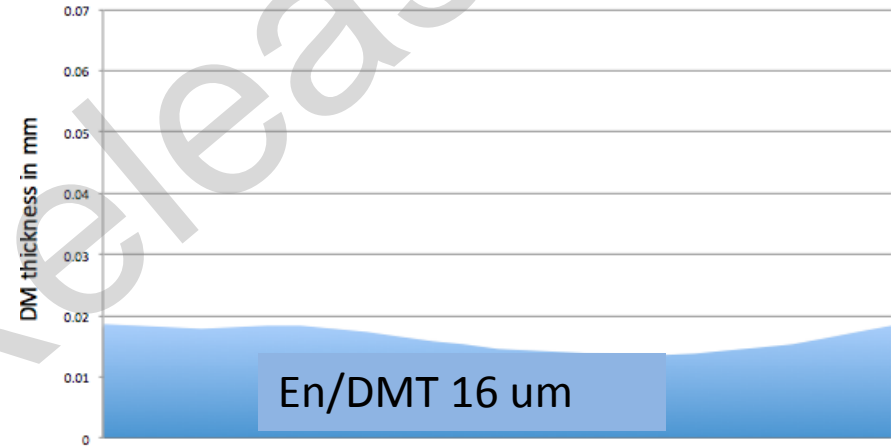


# En/DM Optical Tomography

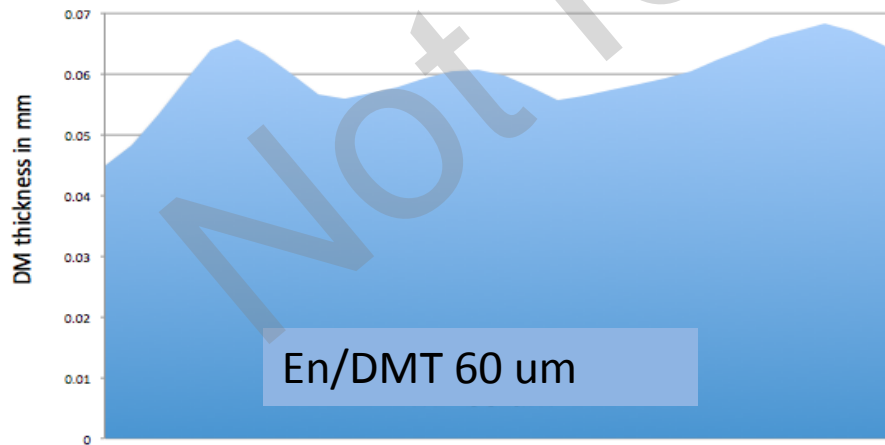
Normal control (age matched)



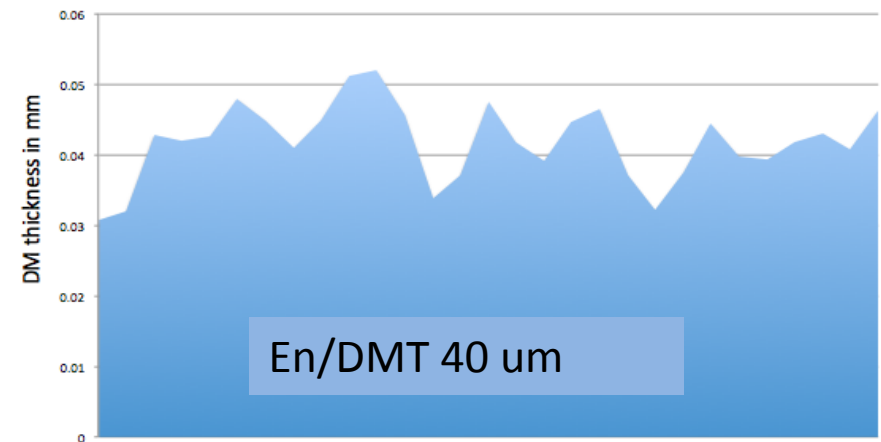
Clear PK graft



Rejected PK graft



Decompensated Fuchs' dystrophy





# Sensitivity and Specificity of En/DMT in the diagnosis of Endothelial Dysfunction

## Corneal Grafts

AUC of 1;  $P < .0001$

Optimal cutoff value of 24  $\mu\text{m}$

100%  
Sensitive

100%  
Specific

## Fuchs' Dystrophy

AUC of 0.994;  $P < .0001$

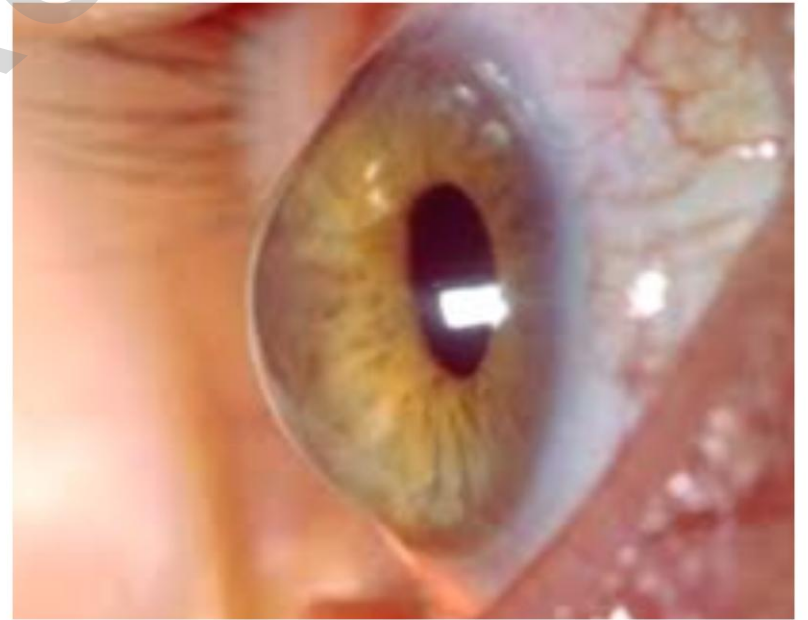
Optimal cutoff value of 21  $\mu\text{m}$

100%  
Sensitive

96%  
Specific

# Bowman's Layer Tomography Maps

for the diagnosis of  
**Keratoconus**

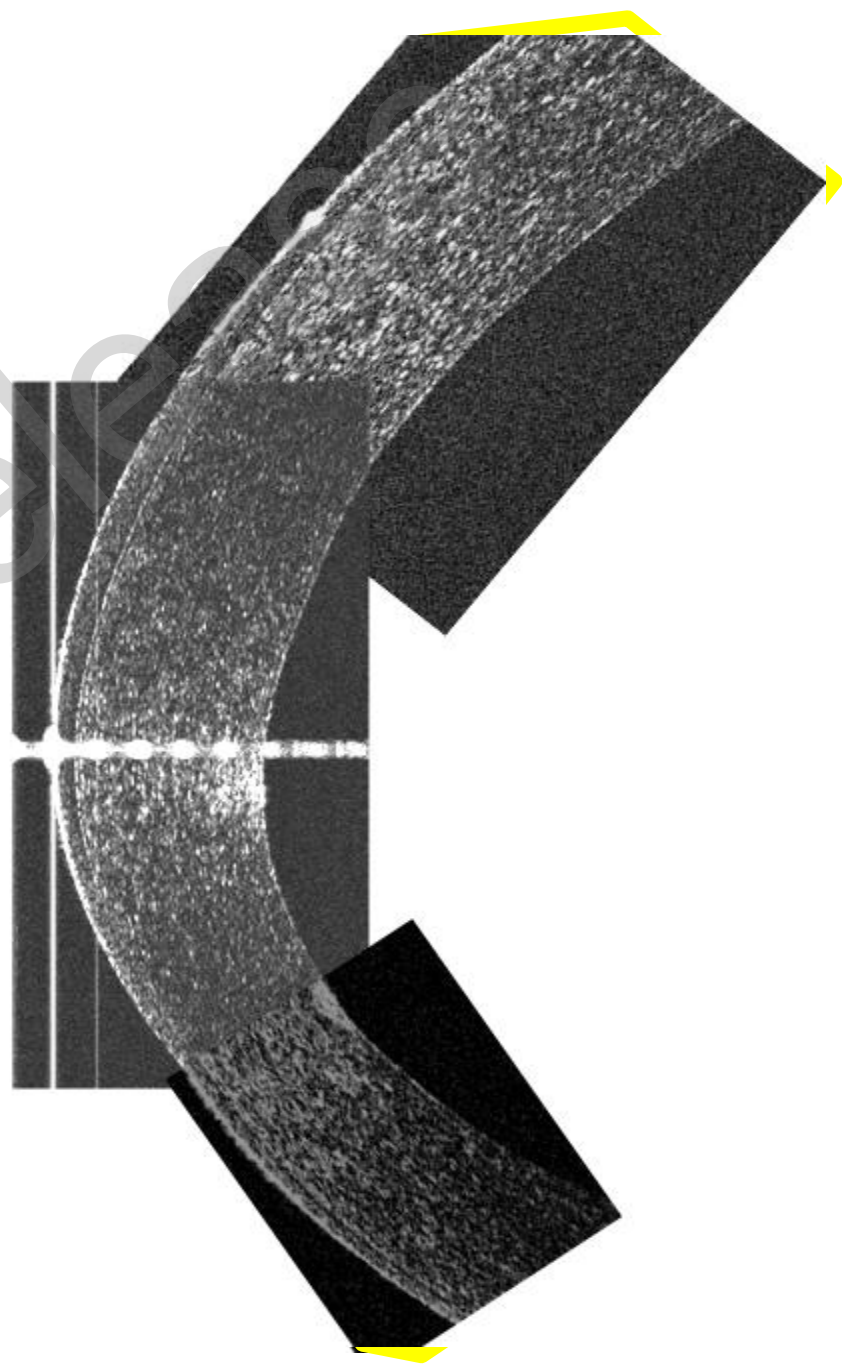
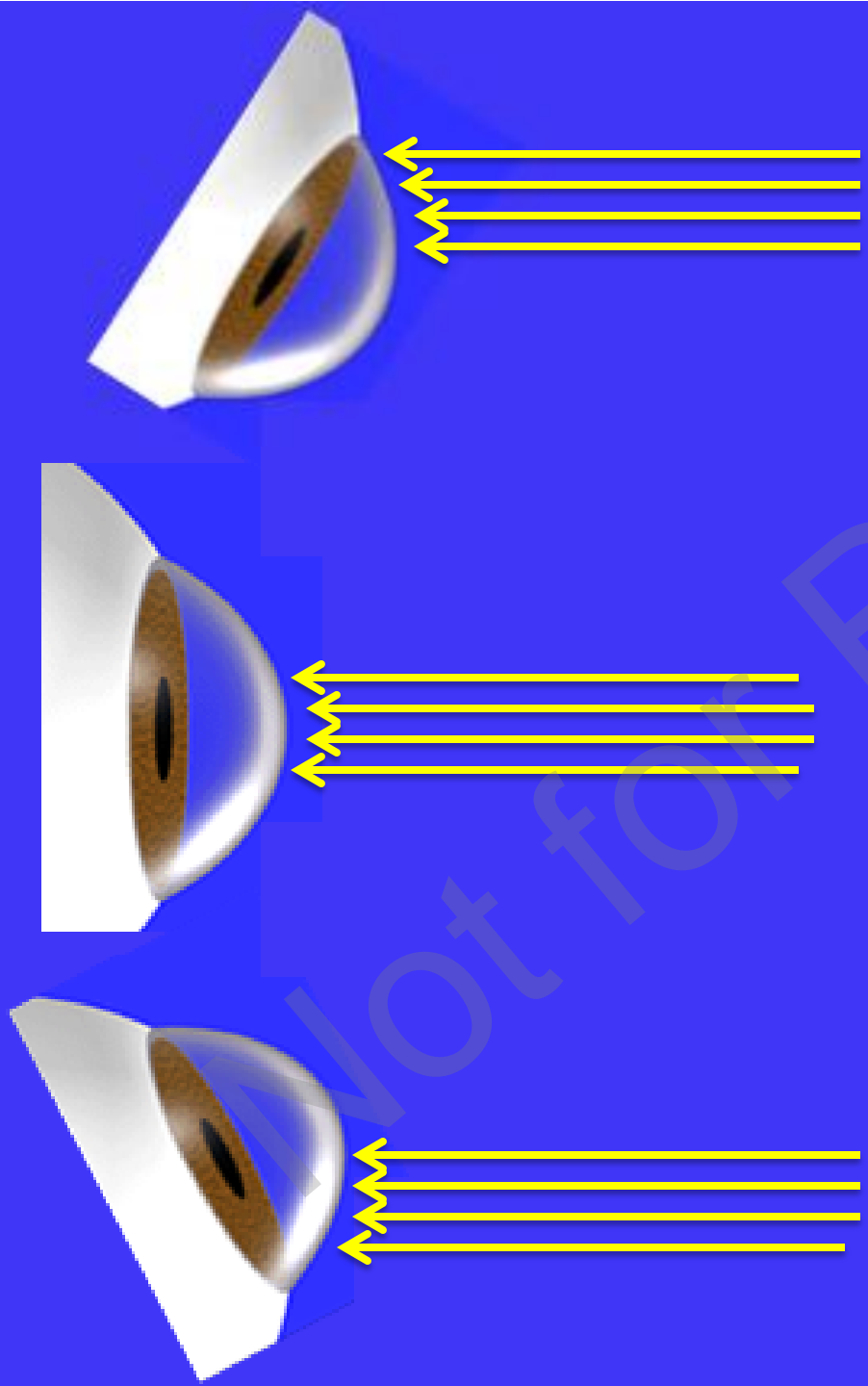


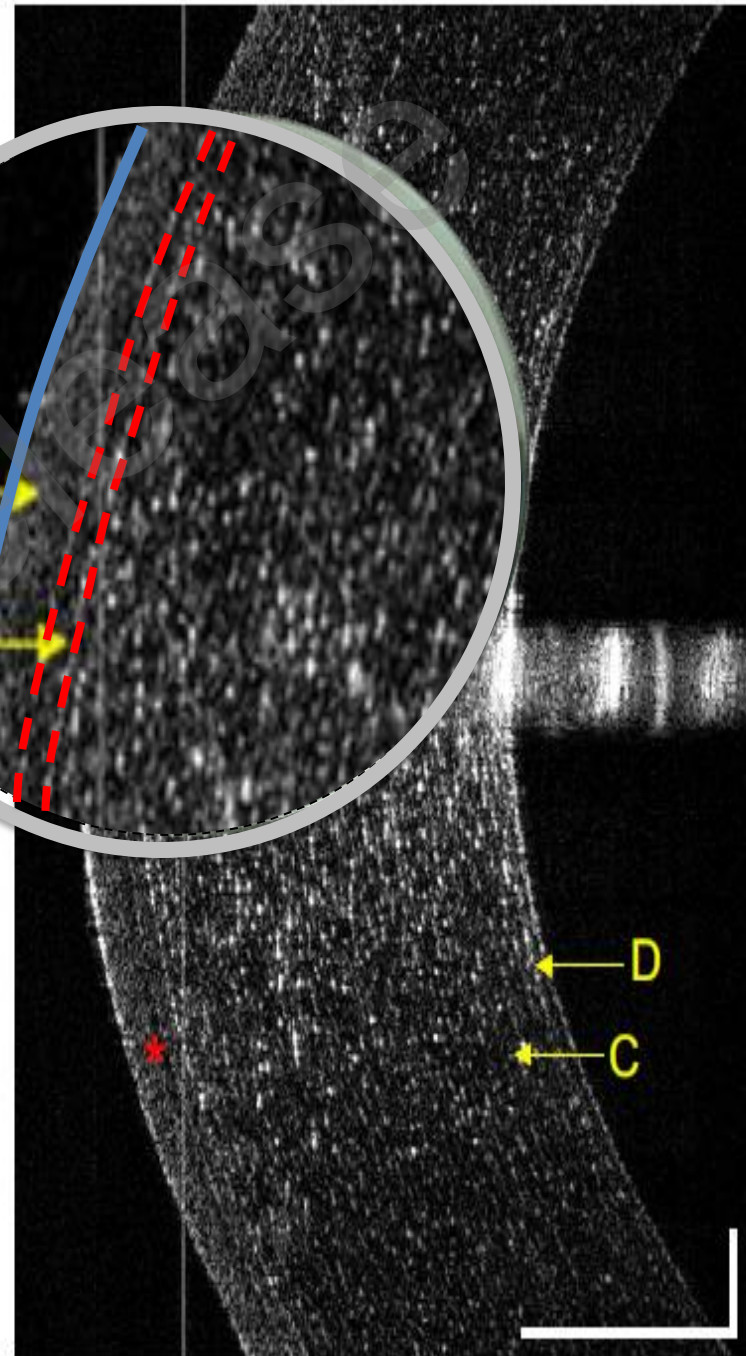
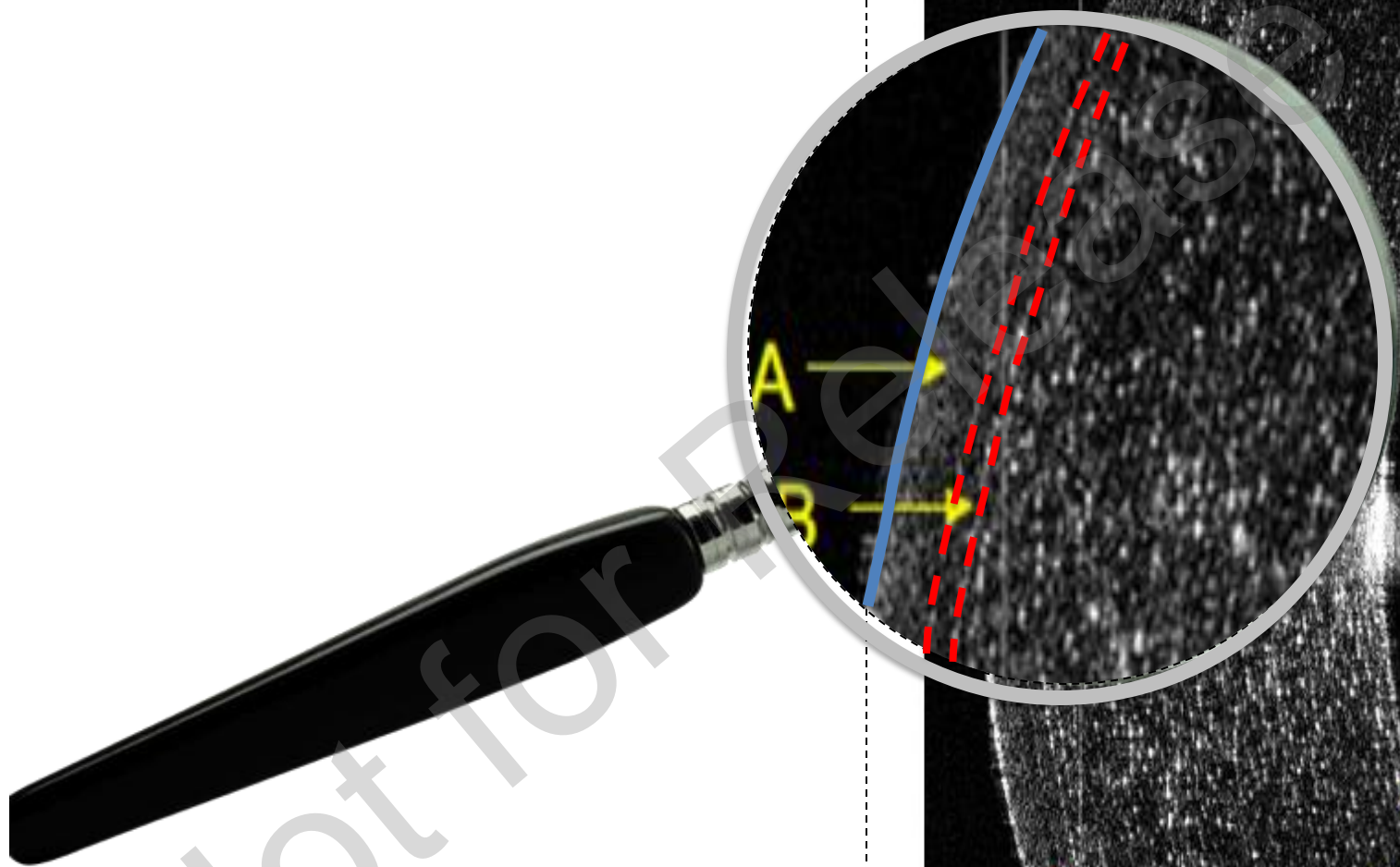
C-MLT for the diagnosis of Keratoconus

A limbus-to-limbus vertical  
topographic thickness map

Overcome the limitations  
of the current OCT technology

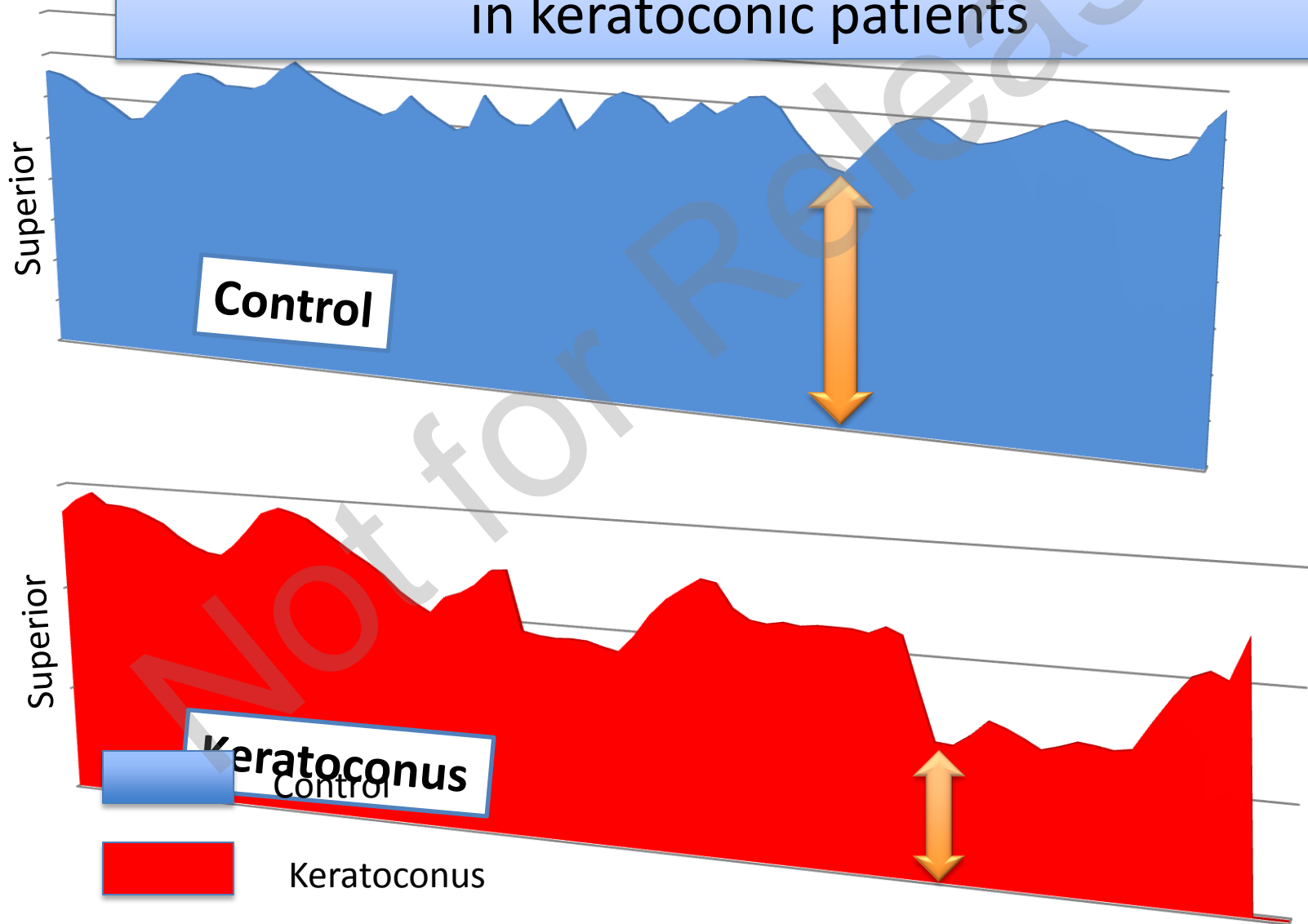






# Bowman's layer vertical topographic thickness map

Localized inferior thinning of Bowman's layer  
in keratoconic patients





# Sensitivity and Specificity of Bowman's Ectasia Index

AUC of 1

Excellent Predictive Accuracy For  
Diagnosis of Keratoconus

BEI optimal cutoff value of 80

100% Sensitivity

100% Specificity

# Summary

**Anterior segment OCT is a valuable technology that is helping to enhance our understanding of normal structure and function**

**It also helps us to correlate anatomical changes that occur with disease processes**

**Aids us in surgical planning and management**

# Thanks to BPEI team

Mohamed Abou Shousha, MD

Victor L. Perez, MD

Carol Karp, MD

Jay Wang, MD, PhD

Fabrice Manns, PhD

Marco Ruggeri, PhD

Ahmed Eidakkak, MD



**Bascom  
Palmer**  
EYE INSTITUTE  
UNIVERSITY OF MIAMI HEALTH SYSTEM

