



PREPARATION OF EK GRAFTS



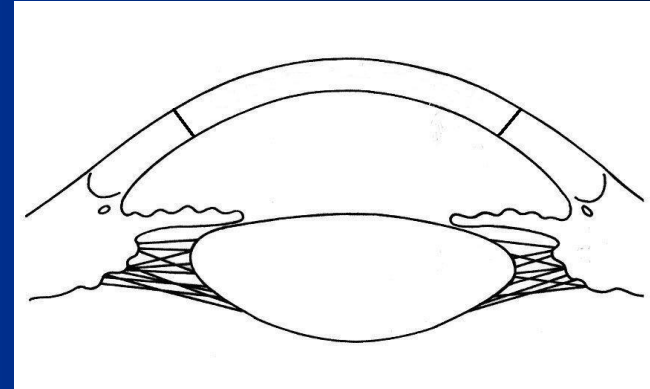
Massimo Busin

FORLI' (ITALY)



CONVENTIONAL PK

- “Perfect Disc in a Perfectly Round Hole”
- Healing > 1 Year
- Suture Removal after 1 Year
- VA Limited by Distortion (Sutures in Place)
- Final Astigmatism after Suture Removal ≥ 4 D in $\pm 20\%$ of Cases



NEW INFORMATION & KPL

- ✓ **Stromal Dissection May Be Compatible with 20/20 VA**
- ✓ **Corneal Layers Can Stick to Each Other without Sutures**

NEW INFORMATION & KPL

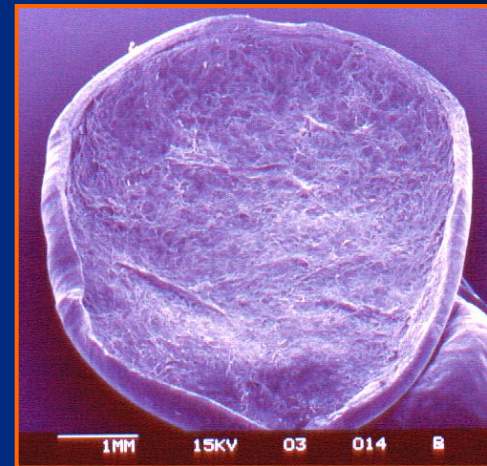
DISSECTION:

- ✓ **Manual**
- ✓ **(Excimer Laser)**
- ✓ **Microkeratome**
- ✓ **Femtosecond Laser**

CORNEAL DISSECTION

MANUAL:

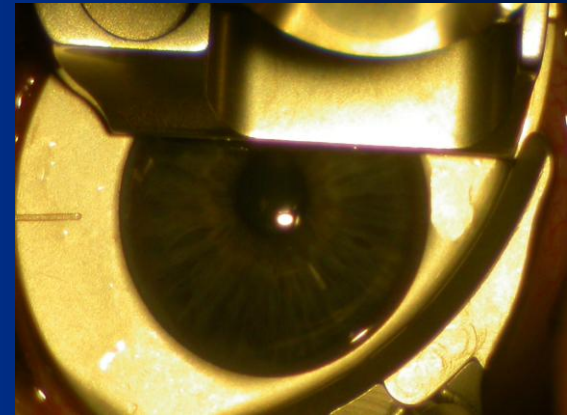
- Difficult
- Non Reproducible
- Interface of Poor Optical Quality (20/20 Vision is the **EXCEPTION !!!**)



CORNEAL DISSECTION

MICROKERATOME:

- Easy Use and Relatively Reproducible
- Relatively Imprecise
- Interface of Excellent Optical Quality (20/20 Vision is the **RULE !!!**)

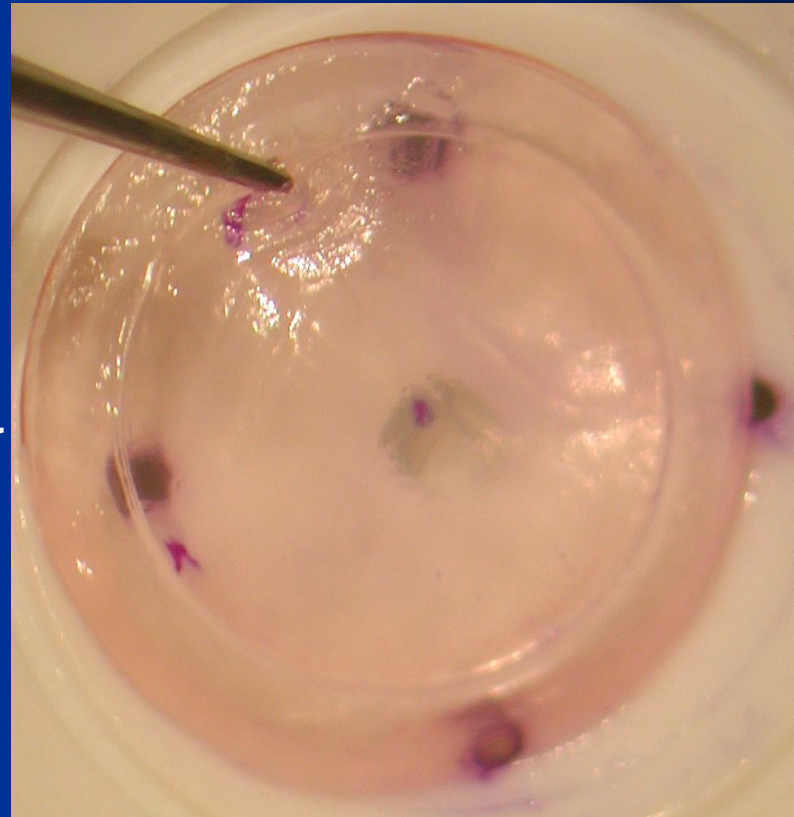


CORNEAL DISSECTION

FEMTOSECOND LASER:

- Expensive but Precise
- Optical Quality of Interface

???

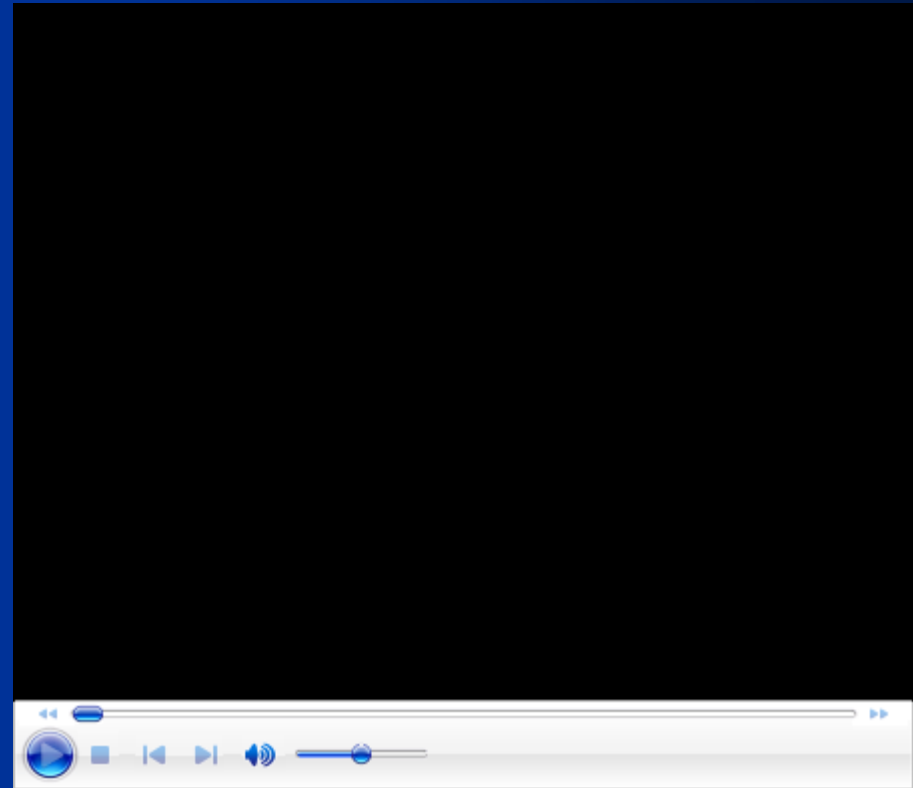


CORNEAL DISSECTION

FEMTOSECOND LASER:

Does NOT
Cut through
Opacities

!!!

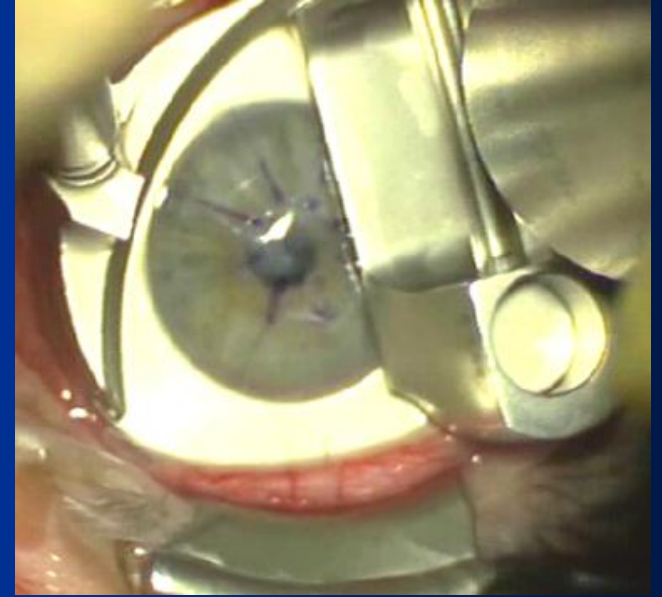


MICROKERATOMER-ASSISTED KERATOPLASTY

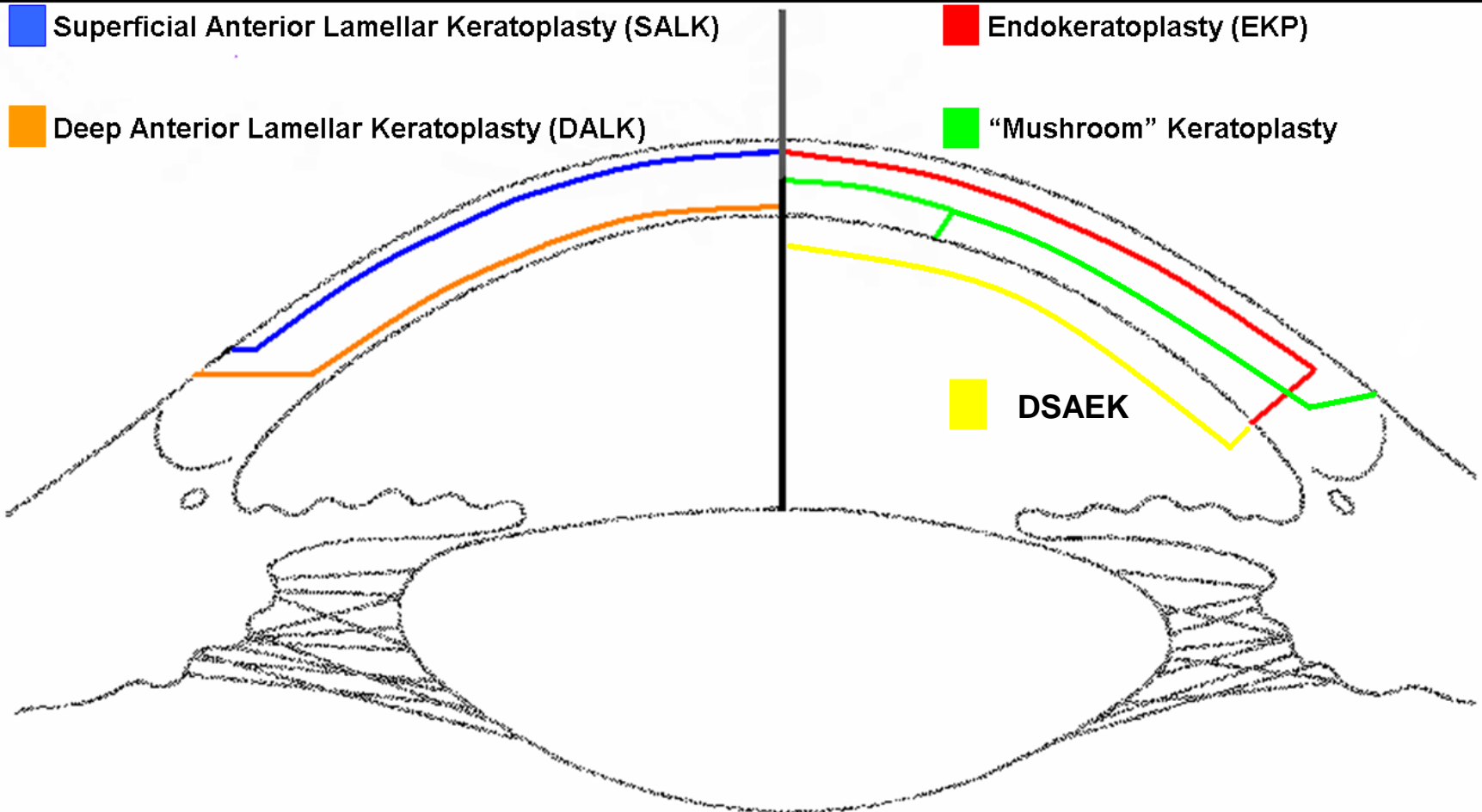
A NEW DIMENSION



**Selective Keratoplasty
& New Solutions**



SELECTIVE CORNEAL TRANSPLANTATION



“NEW” KERATOPLASTY

Corneal
Disease

```
graph TD; A[Corneal Disease] --> B[Healthy Endothelium]; A --> C[Diseased Endothelium]; B --> D[Anterior LK (Mushroom)]; C --> E[Posterior LK (PK)];
```

The diagram is a flowchart on a dark blue background. At the top center is a white-bordered box containing the text 'Corneal Disease'. Two orange arrows curve downwards from this box to two separate white-bordered boxes. The left box contains 'Healthy Endothelium' (with 'Healthy' in green and 'Endothelium' in white), and the right box contains 'Diseased Endothelium' (with 'Diseased' in red and 'Endothelium' in white). From each of these boxes, a straight orange arrow points down to a final white-bordered box. The left final box contains 'Anterior LK (Mushroom)' (with 'Anterior' in yellow, 'LK' in white, and '(Mushroom)' in yellow). The right final box contains 'Posterior LK (PK)' (with 'Posterior' in yellow, 'LK' in white, and '(PK)' in yellow).

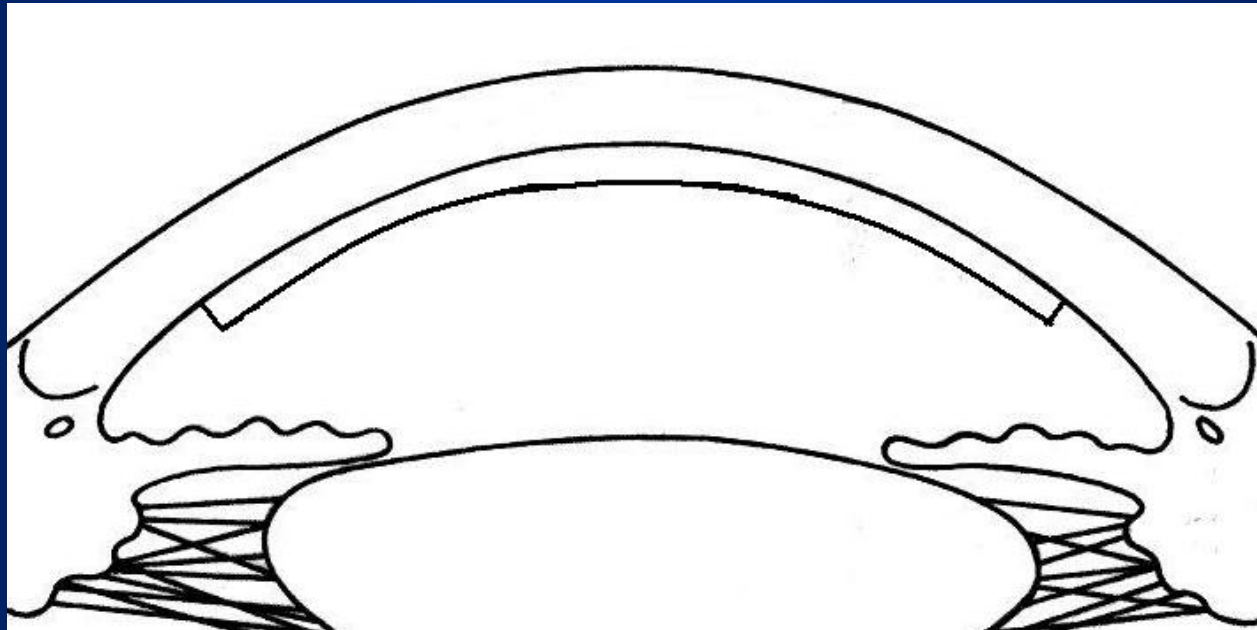
Healthy
Endothelium

Diseased
Endothelium

Anterior
LK
(Mushroom)

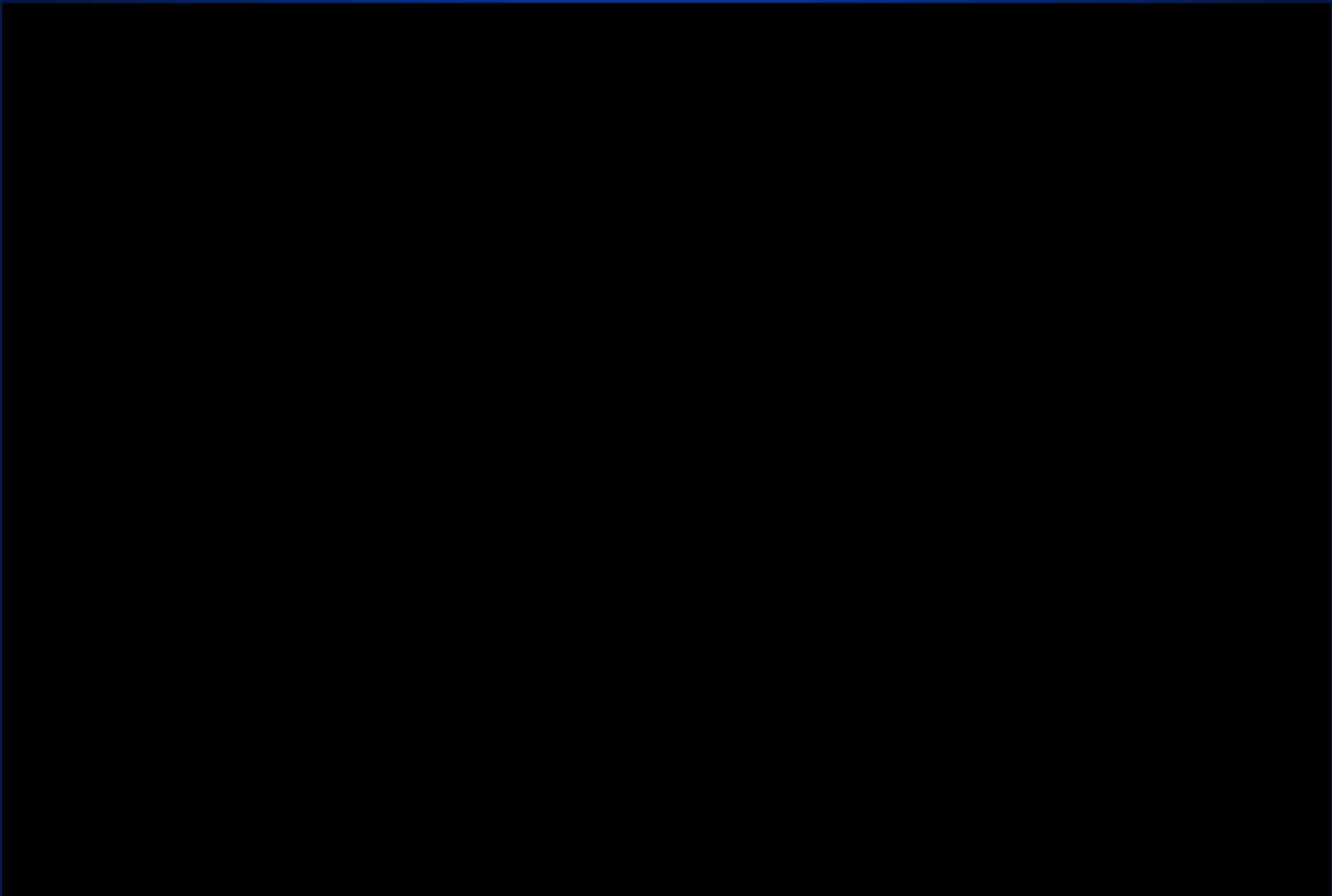
Posterior
LK
(PK)

POSTERIOR ONLY LK (DSAEK)



TISSUE REMOVAL = Endothelium

NEW LAMELLA = 100-200 μm



DSAEK GRAFT PREPARATION

- ✓ **System Closed vs. Open**
- ✓ **Pressure ↑↑↑ Depth +++**
- ✓ **Cut Speed ↑↑↑ Depth -**
- ✓ **Safe Removal (from Front)**
- ✓ **Slit width ↑↑↑ Precision ↓↓↓**

OUR SETTINGS

- ✓ Tissue Culture Storage
(Thickness Usually < 600 μ m)
- ✓ Closed System
- ✓ Pressure $\uparrow\uparrow\uparrow$ (Roller)
- ✓ Speed $\downarrow\downarrow\downarrow$
- ✓ 300 μ m Head

OUR PROS

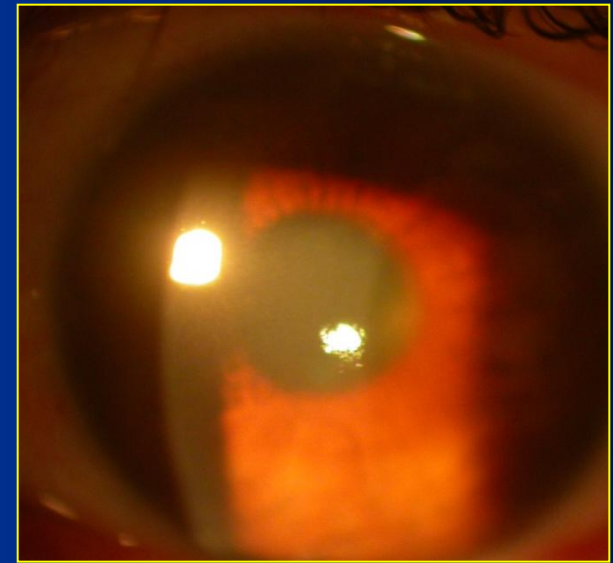
- ✓ **Easy**
- ✓ **Standardized**
- ✓ **No Tissue Waste**
- ✓ **Endothelium Friendly !!!**

OUR CONS

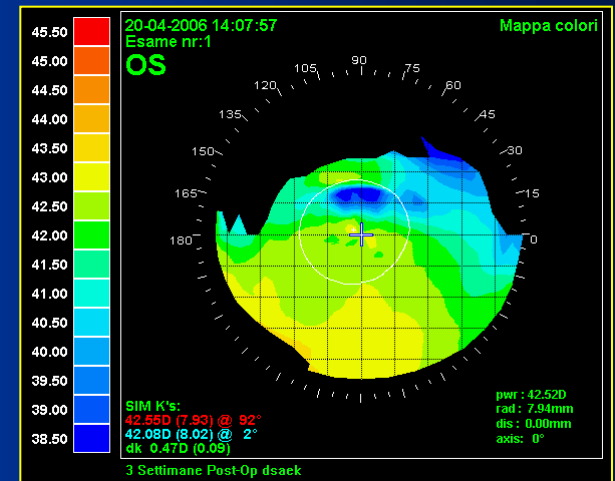
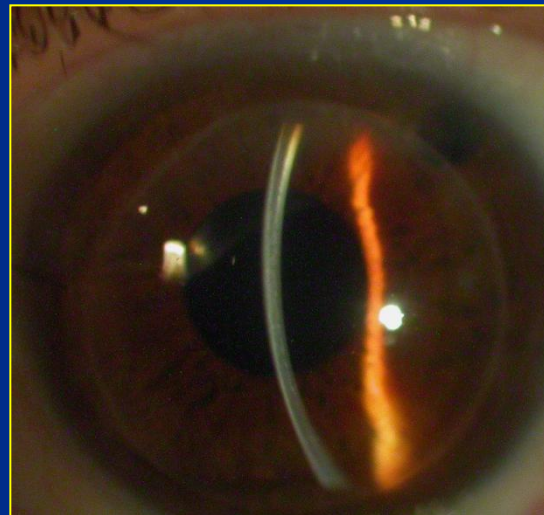
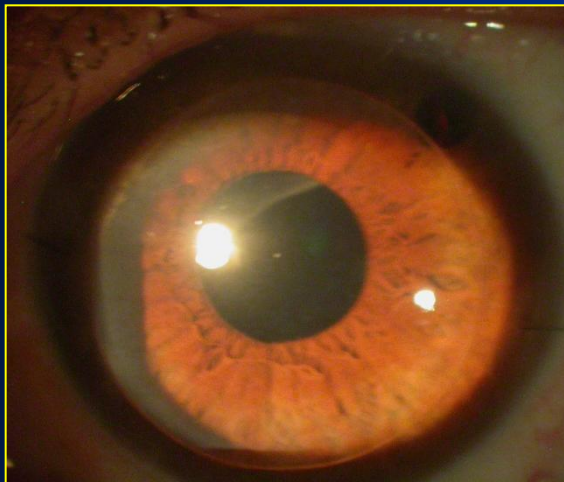
- ✓ **Variable Central Thickness**
- ✓ **Oblique Cut**
- ✓ **Different Settings for 4° C Preservation**

55-Year Old Patient with Fuchs' Dystrophy and Cataract

BSCVA preop: **20/100**



BSCVA 1 m postop: **20/20**



DSAEK vs DMIEK

Patients with BSCVA \geq 20/20

DSAEK = 0% to 33%*

DMIEK = 20% to 45%

*DSAEK Personal Data

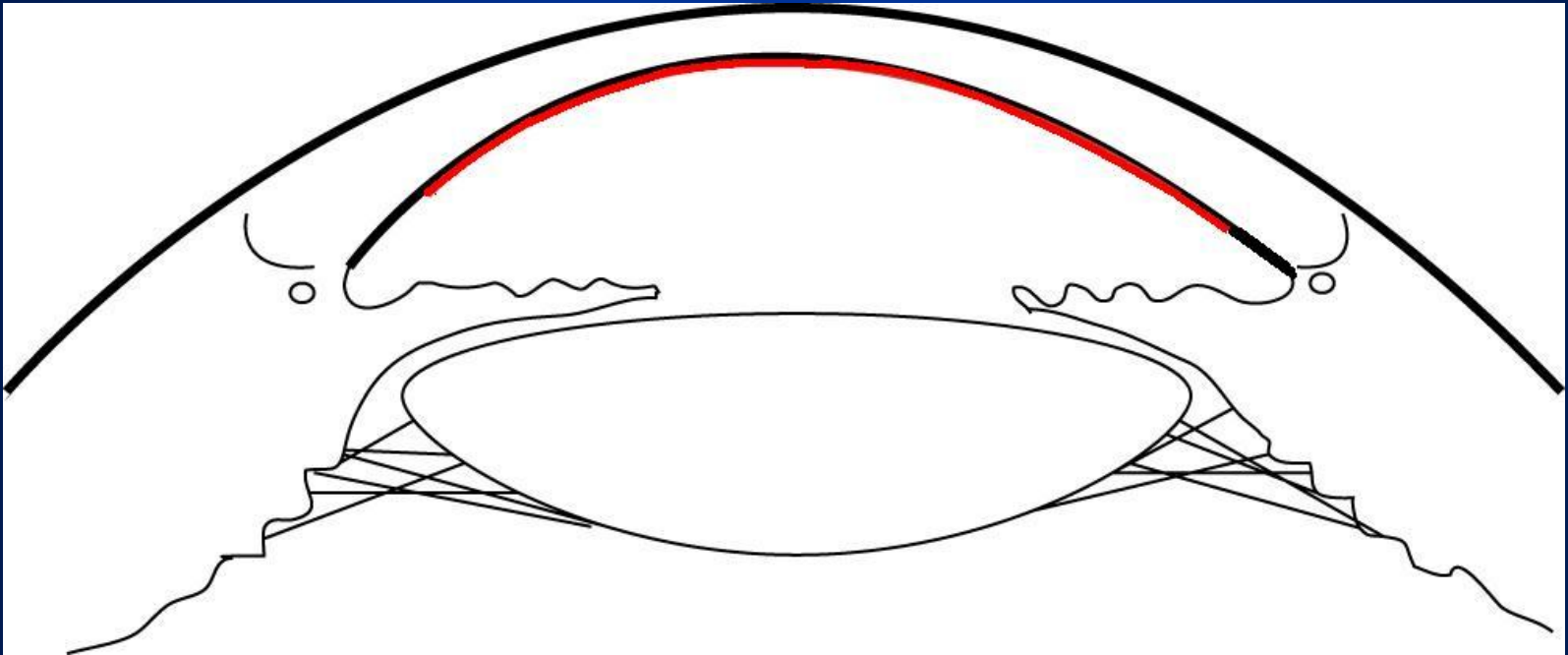
DSAEK vs DMIEK

Graft Rejection Rate in Fuchs'

DSAEK = 2% - 18%

DMIEK = < 1% (13%)

POSTERIOR ONLAY LK (DMEK)



TISSUE REMOVAL = Desc. + End.

NEW TISSUE = 20 μm !!!

Pneumatic Dissection and Storage of Donor Endothelial Tissue for Descemet's Membrane Endothelial Keratoplasty

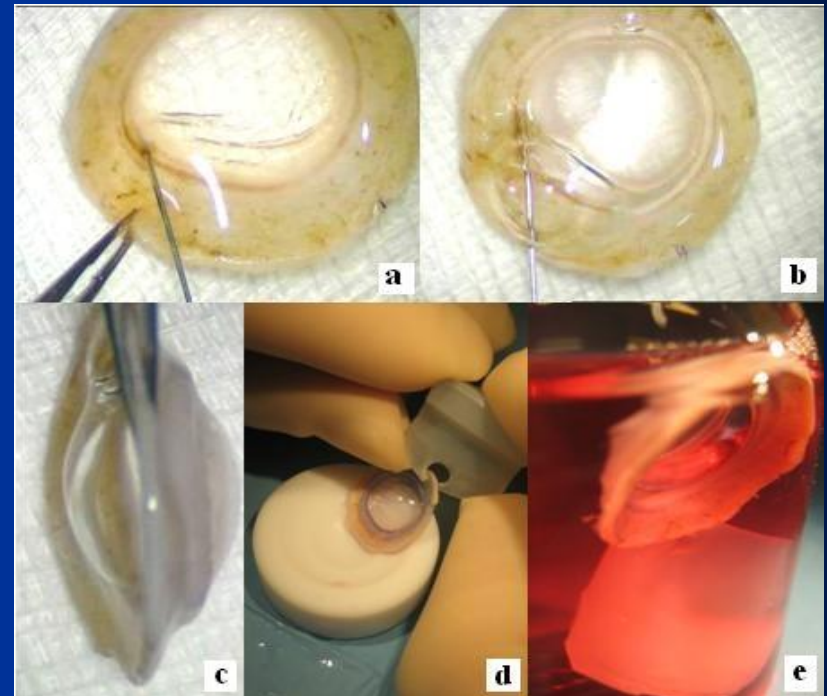
A Novel Technique

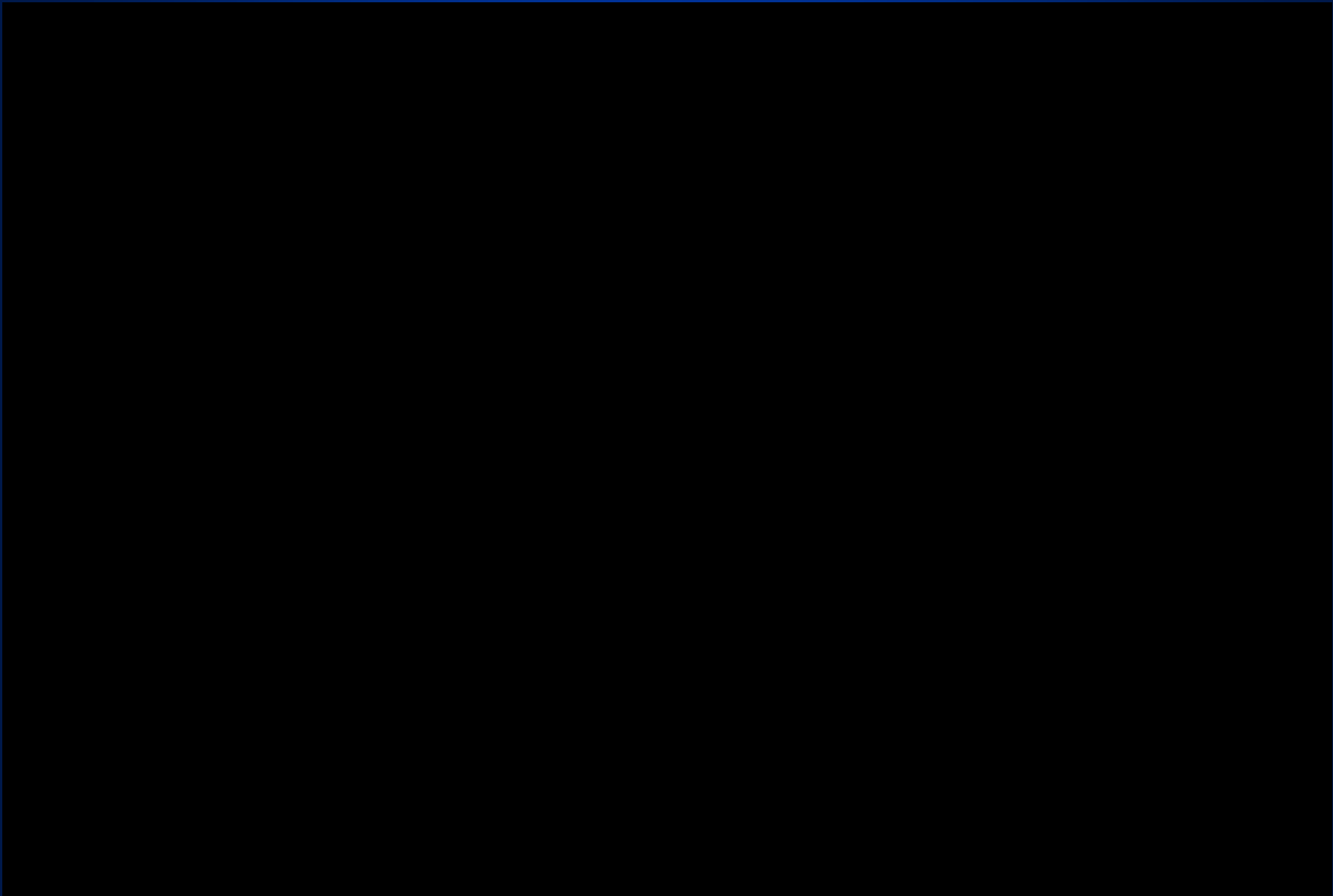
Massimo Busin, MD,^{1,2,3} Vincenzo Scorcia, MD,^{1,2} Amit K. Patel, FRCOphth,^{1,3} Gianni Salvalaio,³
Diego Ponzin, MD³

¹ "Villa Serena" Hospital, Department of Ophthalmology, Forlì, Italy.

² University of Magna Graecia, Department of Ophthalmology, Catanzaro, Italy.

³ Fondazione Banca degli Occhi del Veneto, Venice, Italy.

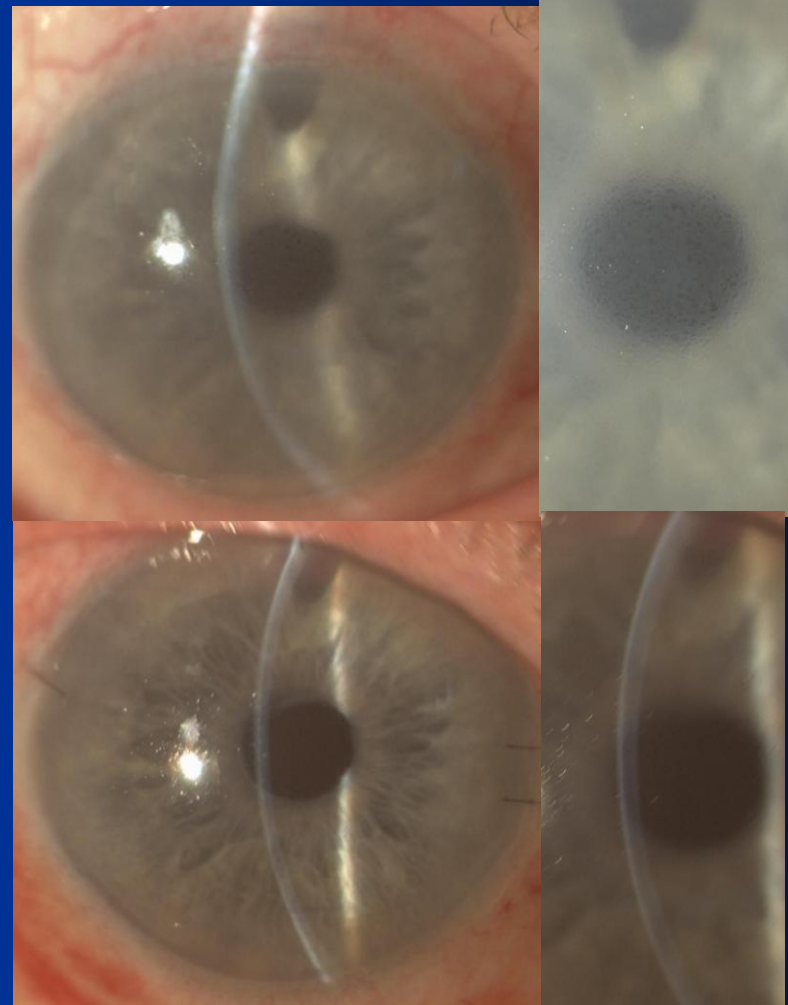




DMEK

SURGICAL CHALLENGES

- ✓ Preparation
- ✓ Delivery into AC
- ✓ Positioning
- ✓ Attachment

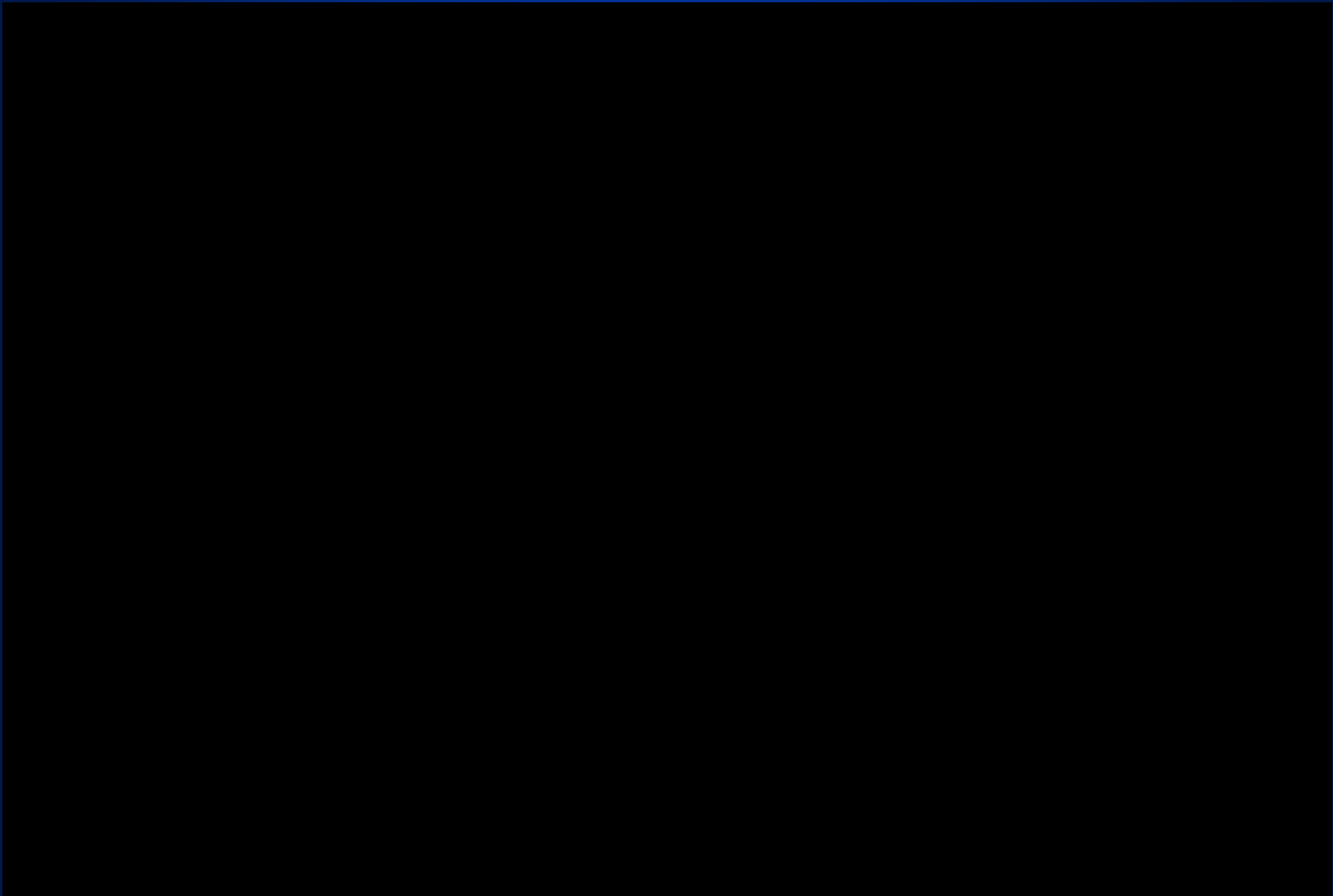


EK IN THE USA

In 2011:

DSAEK **n ± 21,000**

DMEK **n = 343**



“RING” DMIEK

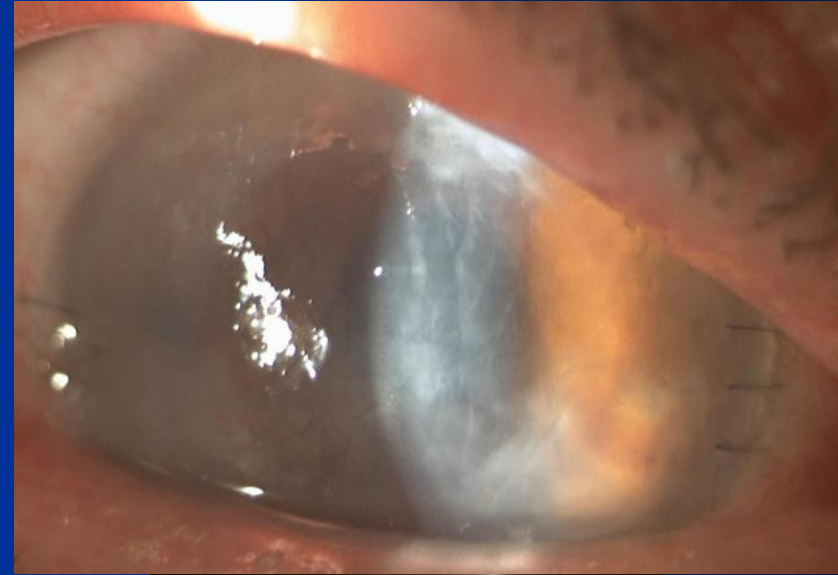
The Donor
Membrane
INITIALLY

ATTACHES to the
Posterior Corneal
Surface !!!



“RING” DMIEK

The Donor
Membrane
DETACHES from
the Posterior
Corneal Surface
after Air Is
Reabsorbed!!!



Stromal Support for Descemet's Membrane Endothelial Keratoplasty

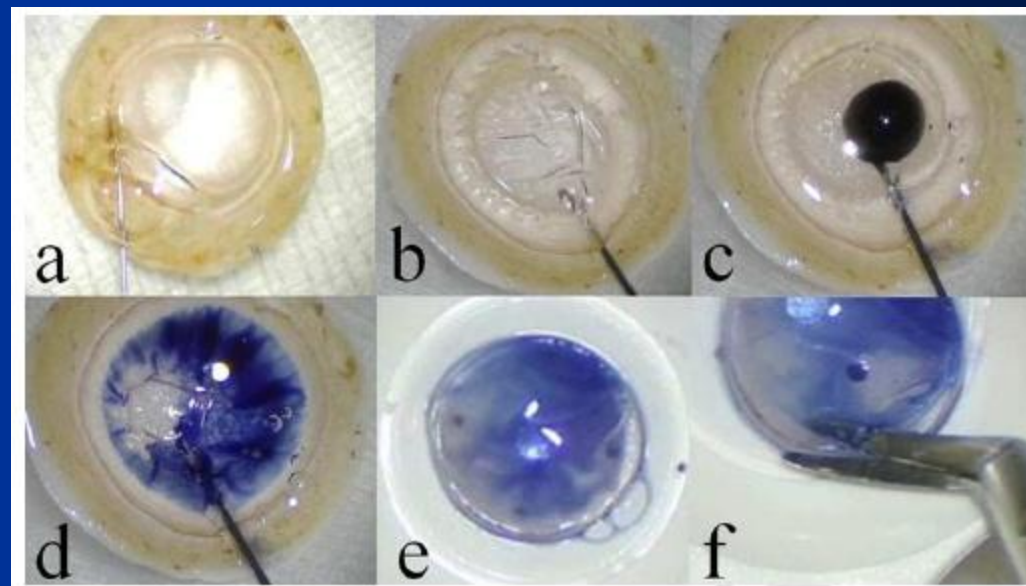
Massimo Busin, MD,^{1,2,3} Amit K. Patel, FRCOphth,^{1,3} Vincenzo Scorcia, MD,^{1,2} Alessandro Galan, MD,^{3,4} Diego Ponzin, MD³

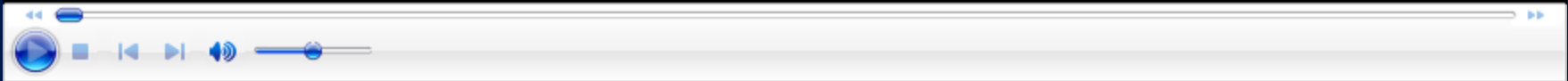
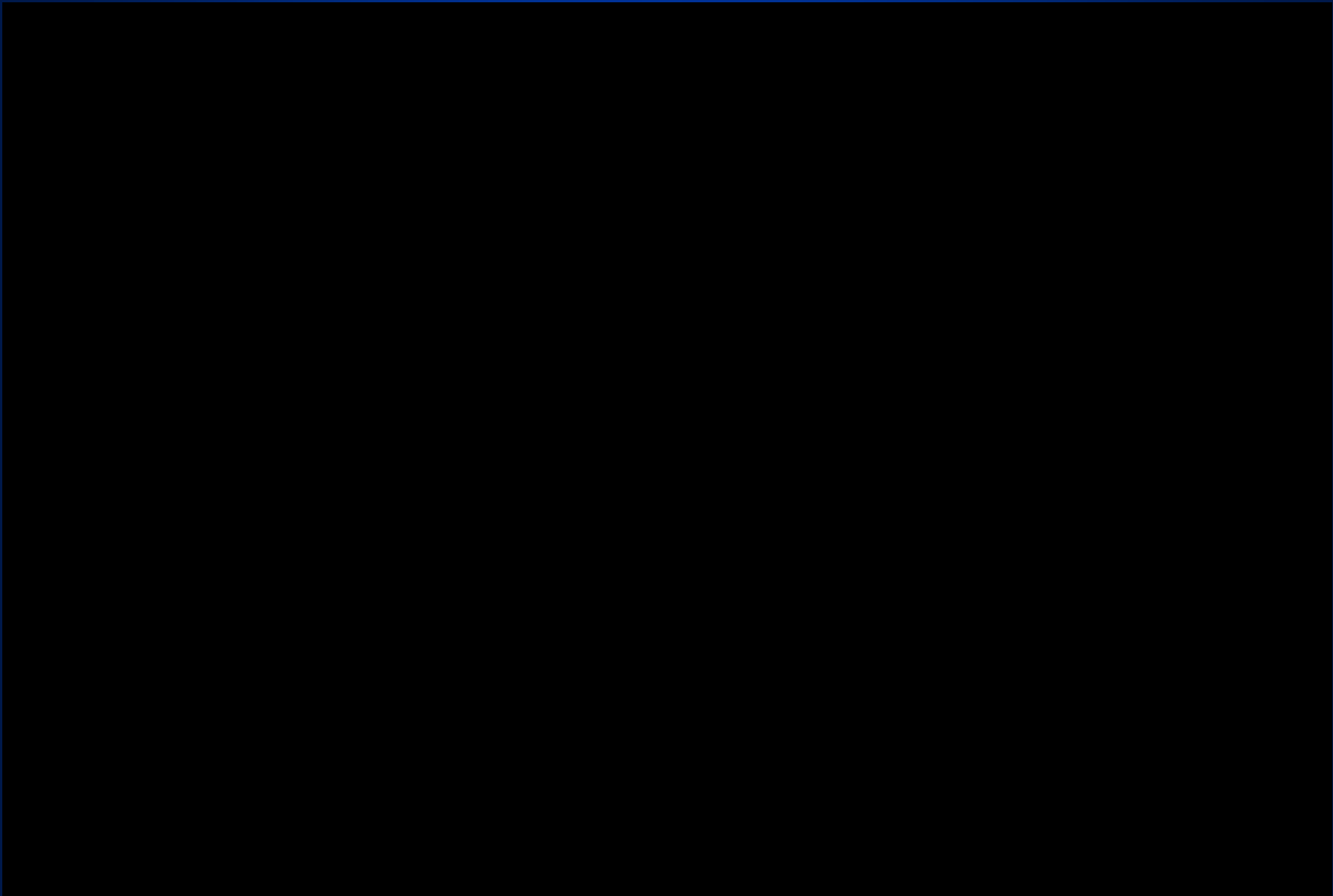
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³ Fondazione Banca degli Occhi del Veneto, Venice, Italy.

⁴ "S. Antonio" Hospital, Department of Ophthalmology, Padova, Italy.

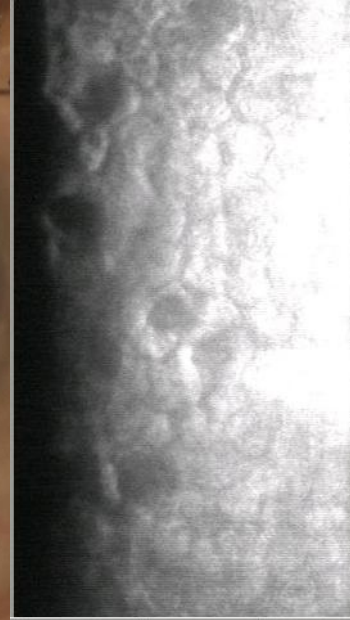




“SICKLE” DMEK

At 1 month

**CLEAR
GRAFT**

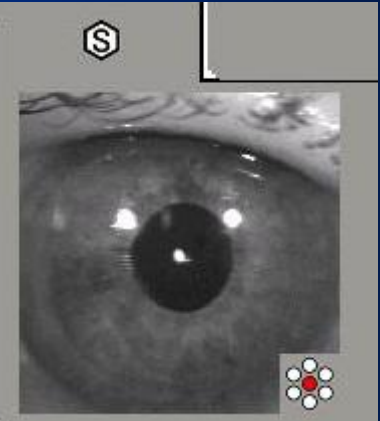


At 6 Months

± 35%

**Endothelial
Cell Loss**

Number		17
CD	/mm ²	1485
AVG	um ²	874
SD		371
CV		55
Max	um ²	1644
Min	um ²	186



OUR SETTINGS

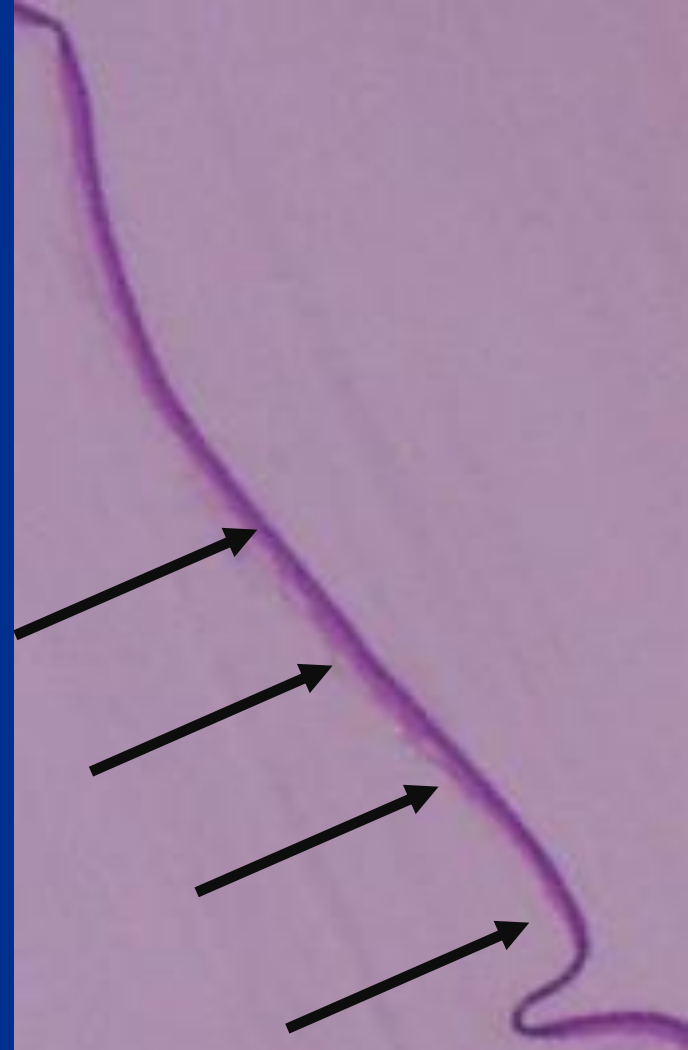
- ✓ Tissue Culture Storage
(Thickness Usually < 600 μ m)
- ✓ (Anterior Stroma Removal)
- ✓ 25 (27) G Needle
- ✓ 10 (5) cc Syringe

OUR PROS

- ✓ **Easy & Fast**
- ✓ **“Scuba Technique” Still Possible !!!**
- ✓ **Minimal Tissue Waste**
- ✓ **Graft Lies Flat on Stromal Support**

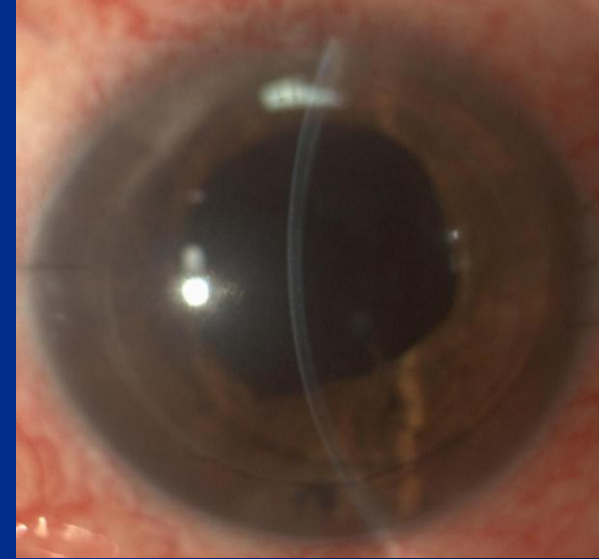
OUR CONS

- ✓ Still Thin Layer
Posterior
Stroma ($\pm 20\mu\text{m}$)
- ✓ Non-
Standardized
- ✓ Multiple
Injections



ULTRATHIN DSAEK

**DSAEK Grafts
Thinner Than 131 μm
Lead to Improved
Visual Outcomes
(Neff et al. 2010)**



DSAEK GRAFT PREPARATION

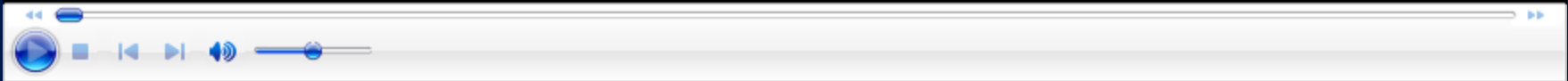
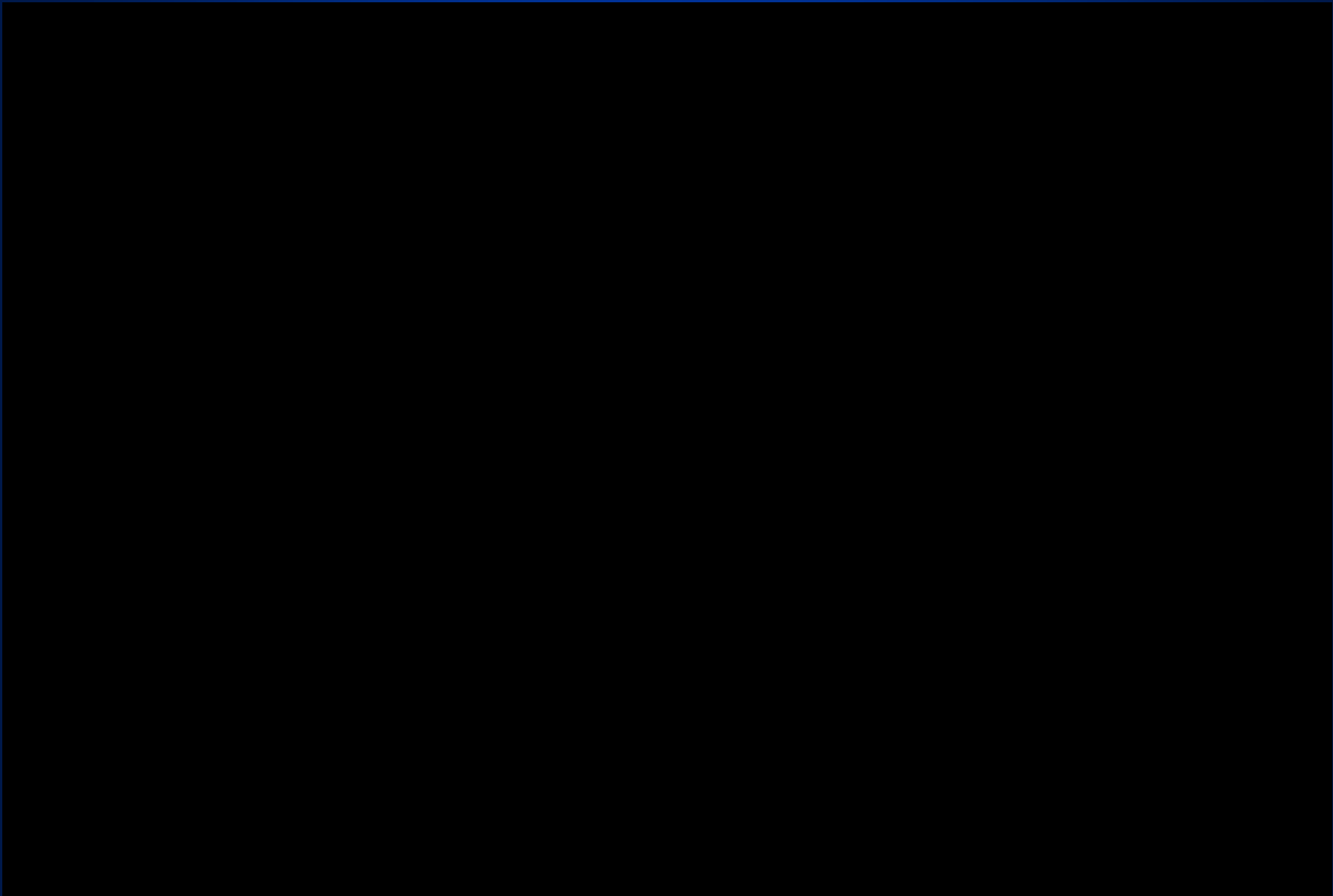
- ✓ **System Closed vs. Open**
- ✓ **Pressure ↑↑↑ Depth +++**
- ✓ **Cut Speed ↑↑↑ Depth --**
- ✓ **Safe Removal (from Front)**
- ✓ **Slit width ↑↑↑ Precision ↓↓↓**

UT-GRAFT PREPARATION (Double Pass)

✓ 1st CUT (Debulking Step):
300 μ m (350 μ m)

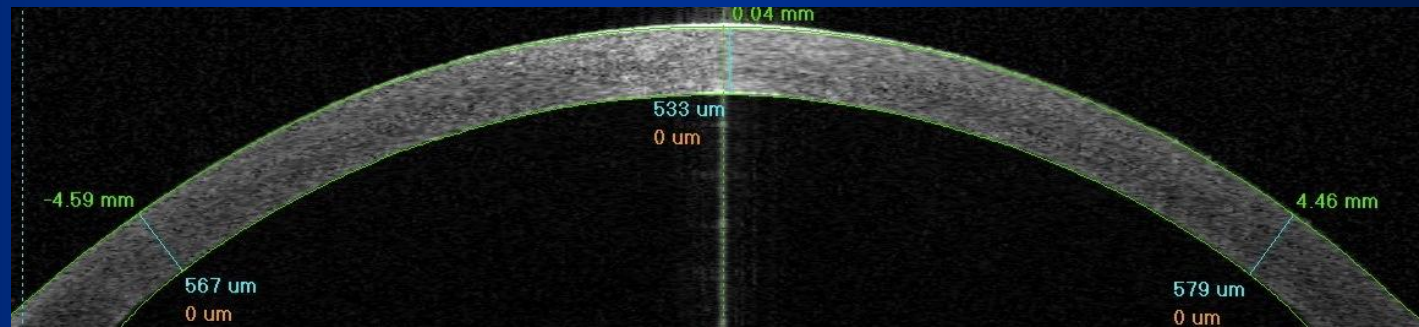
✓ 2nd CUT (Refinement Step):
50 μ m - 200 μ m



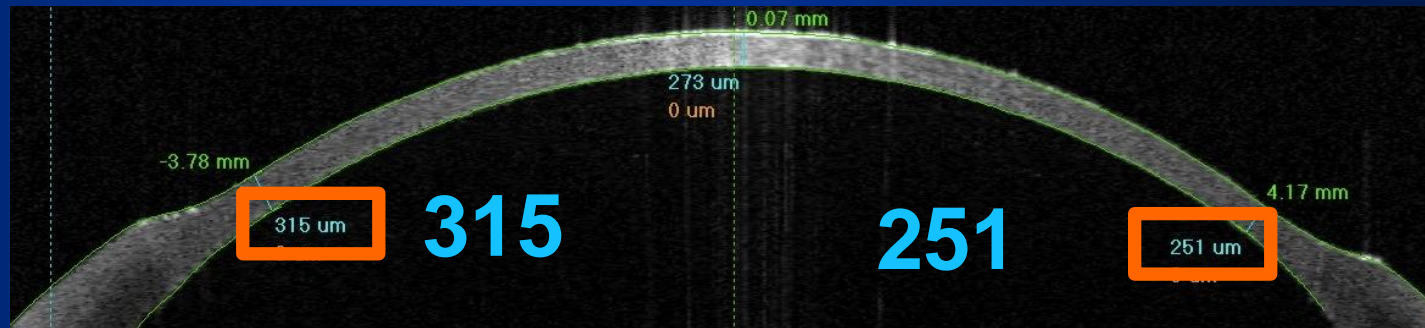


UT-DSAEK (Double-Pass)

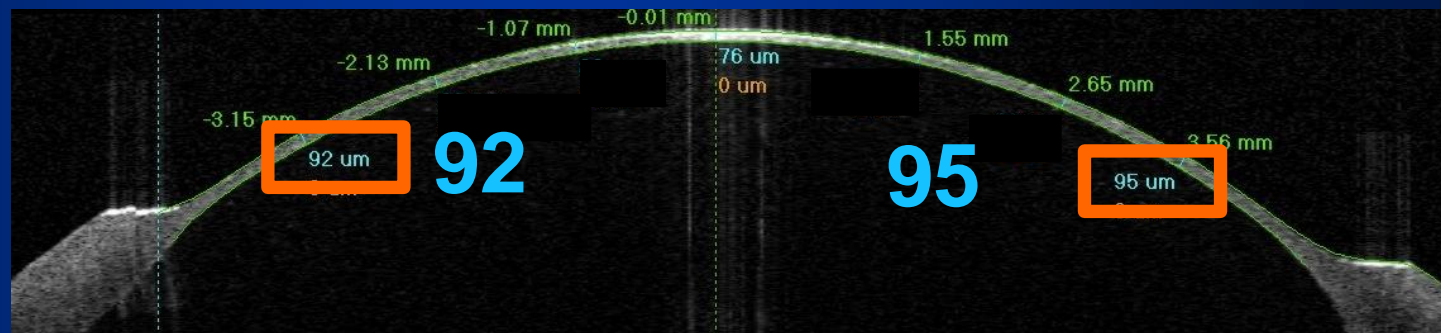
PRE
CUT



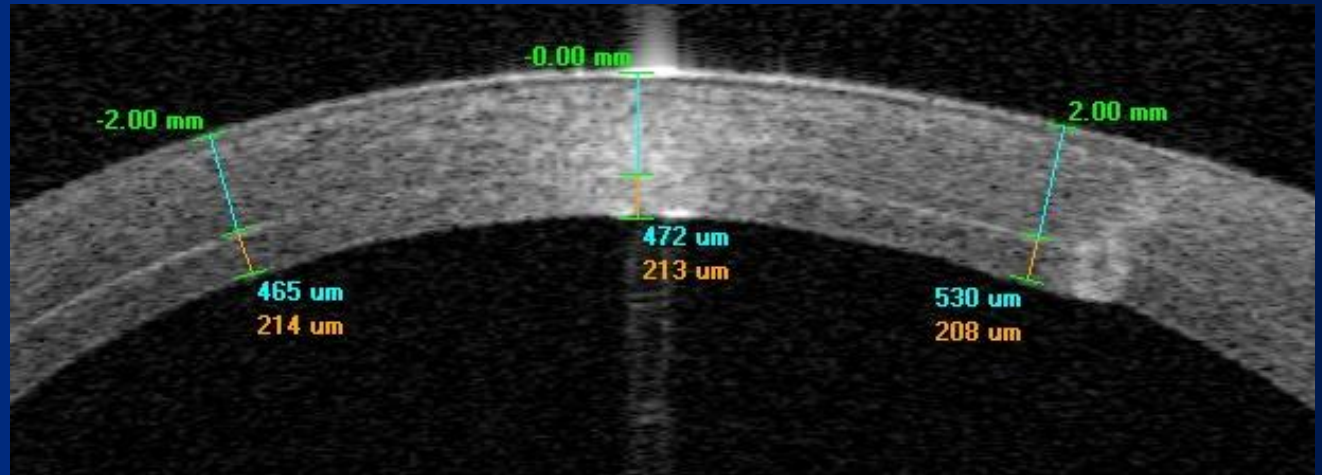
1st
CUT



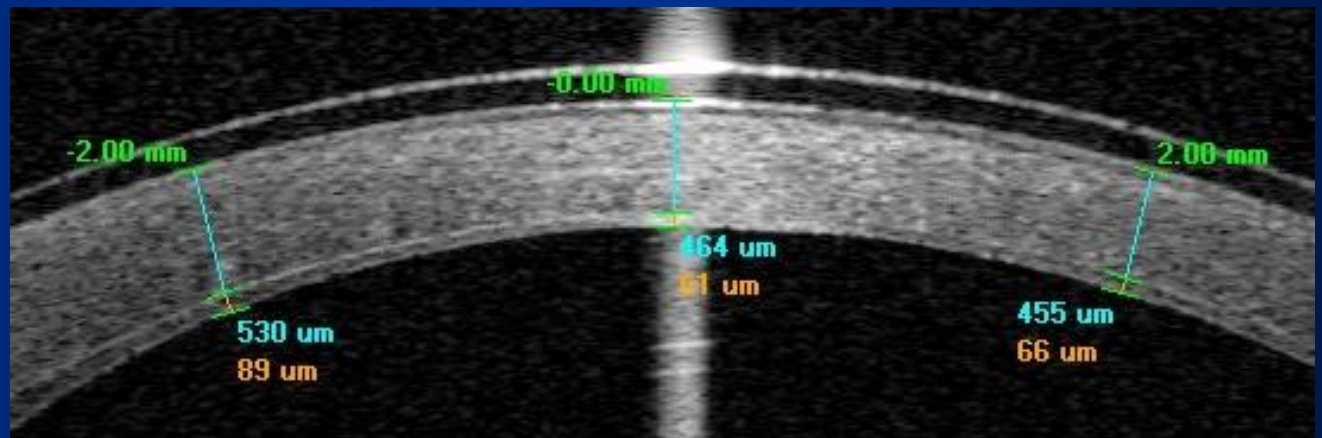
2nd
CUT



Conv. DSAEK

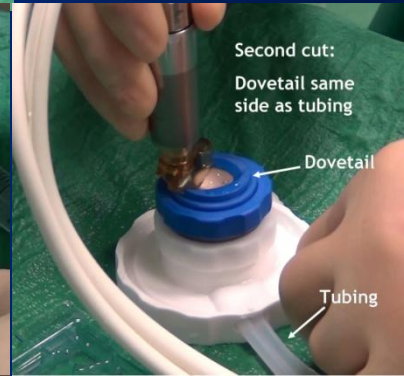
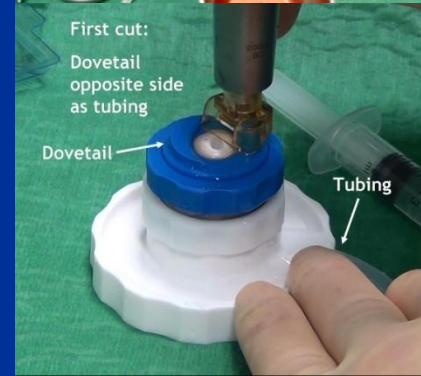
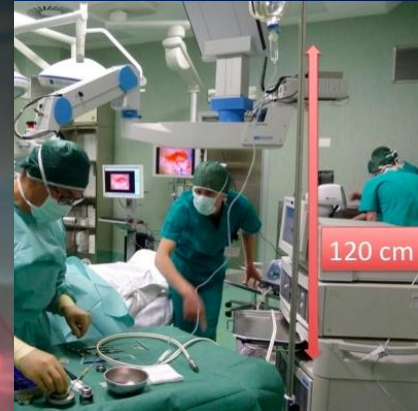


Ultrathin DSAEK



OUR SETTINGS

- ✓ Tissue Culture Storage
(Thickness Usually < 600 μ m)
- ✓ Bottle at 120 cm (Pressure \pm 80-90 mm Hg)
- ✓ Clamp at 50 cm to Close System
- ✓ Intraoperative Pachymetry
- ✓ First Cut with 300 μ m Microkeratome Head
- ✓ Move Dove Tail 180°, Repeat Pachymetry and 2nd Cut from Opposite Direction



Busin Nomogram for 2nd Cut

< 150 μ m

> 150 < 180 μ m

> 180 < 210 μ m

> 210 < 230 μ m

> 230 μ m

No Second Cut !!!

50 Head (CAVE !!!)

90 Head

110 Head

130 Head



OUR PROS

- ✓ **Easy**
- ✓ **Standardized**
- ✓ **Minimal (No) Tissue Waste**
- ✓ **Endothelium Friendly !!!**

OUR PROS

(vs DSAEK)

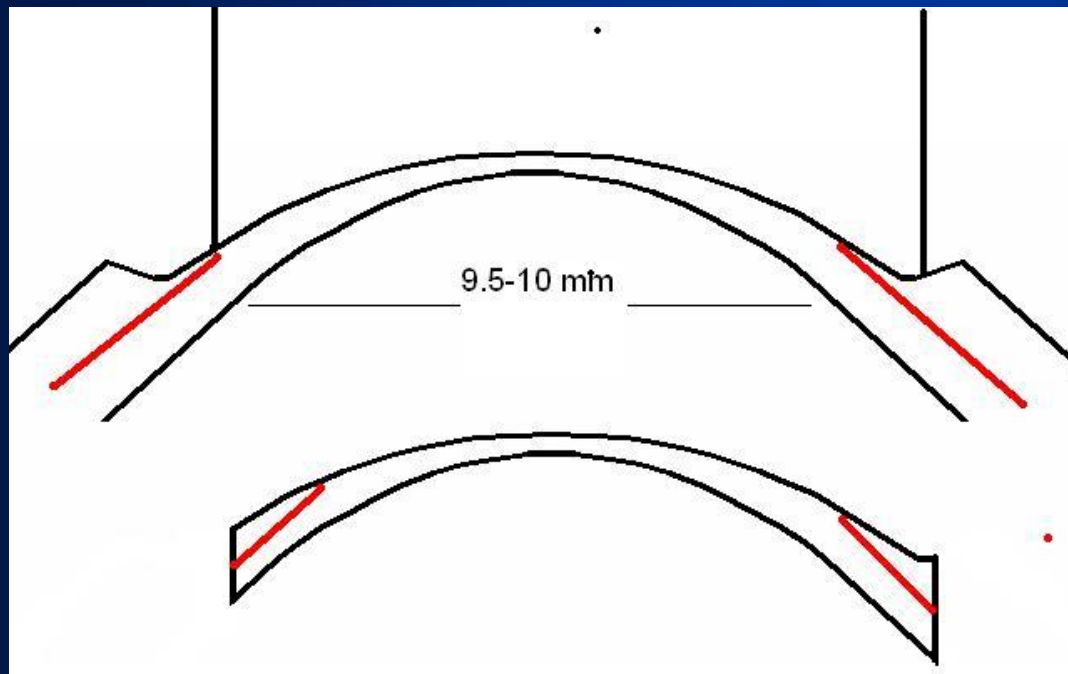
- ✓ **Final Thickness <100 μm**
- ✓ **Homogeneous Thickness**

OUR CONS

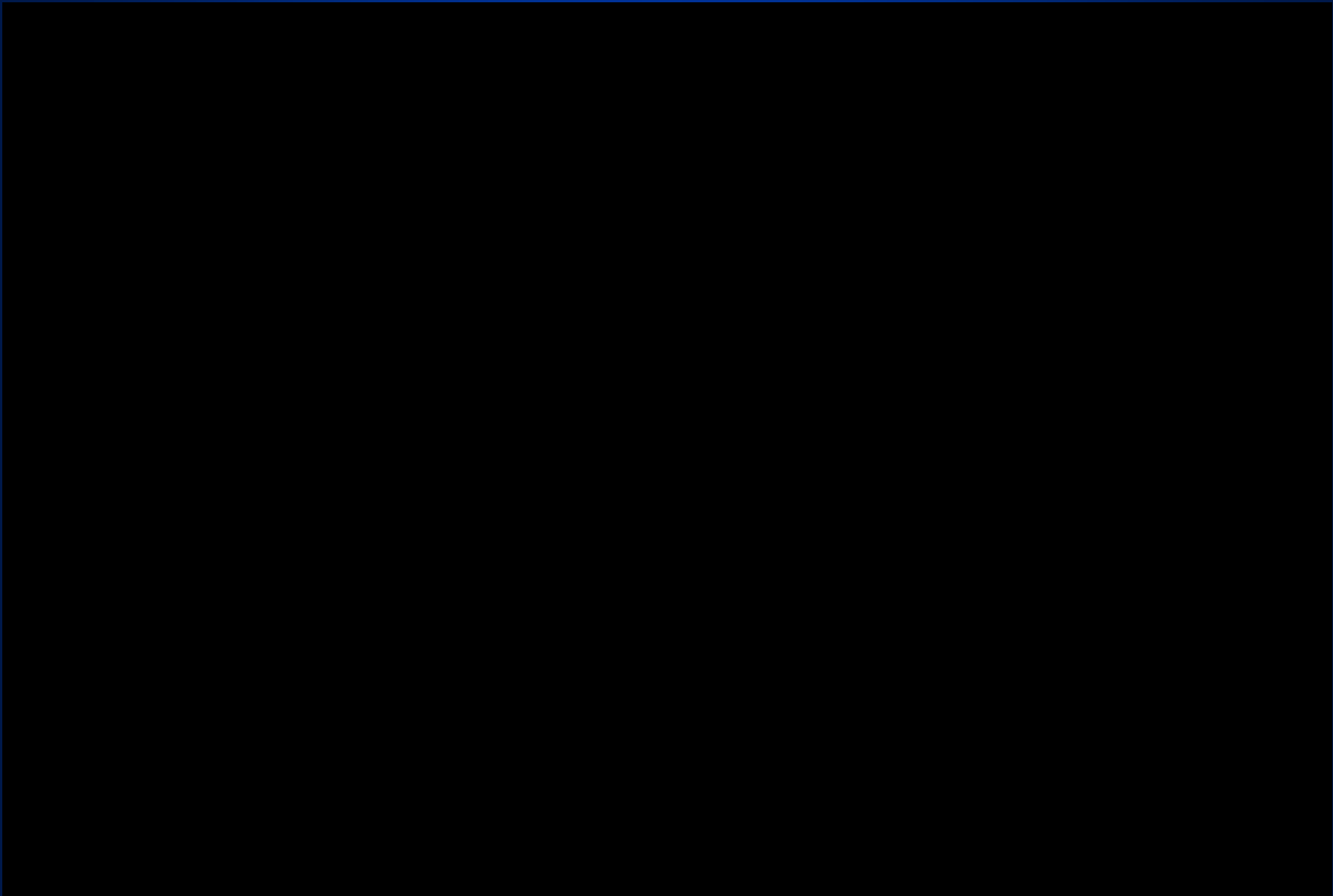
- ✓ Possible Perforation
(CAVE 2nd Cut when CCT ≤ 150 μm)
- ✓ Irregular Stromal Surface
(Buttonholes)
- ✓ Different Settings
(for 4° C Preservation)
- ✓ Small Diameter
(Complete by Hand)

DSAEK in BUPHTHALMOS

DIFFERENCE

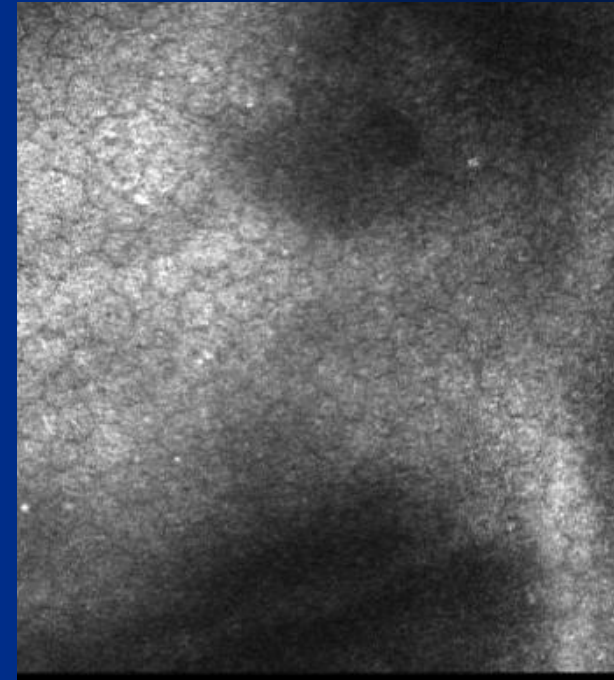


GRAFT LARGER THAN USUAL (≥ 9.5 mm)



EYE BANK STANDARDS

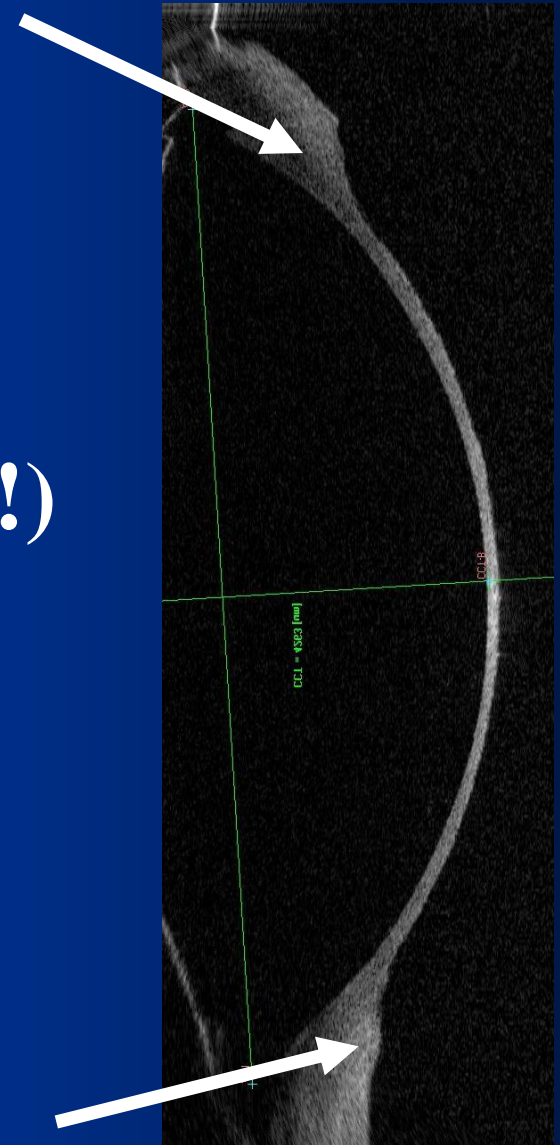
- ✓ Cellular Density of Endothelium (>2500 cell/mm²)
- ✓ Cellular Morphology (Polymorphism & Polymegetism)



EYE BANK NEW ISSUES

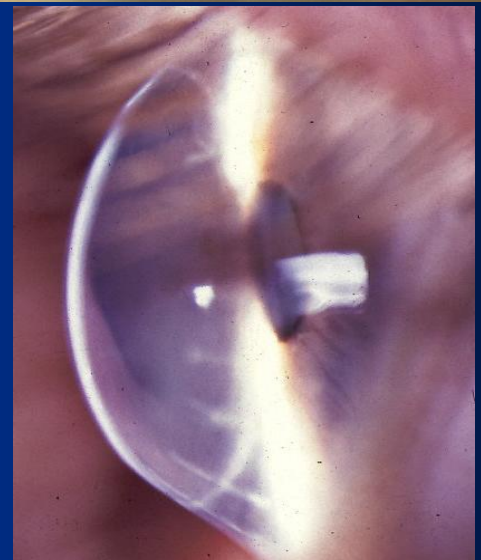
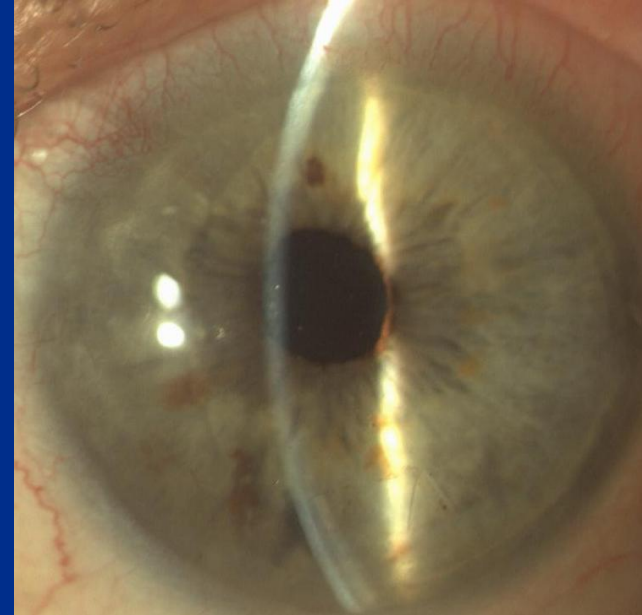
✓ Graft Shape
(Posterior Corneal Curvature!)

✓ Graft
Thickness



EYE BANK NEW ISSUES

Same Cornea for
Multiple
Procedures !!!



THE FUTURE

DONOR TISSUE

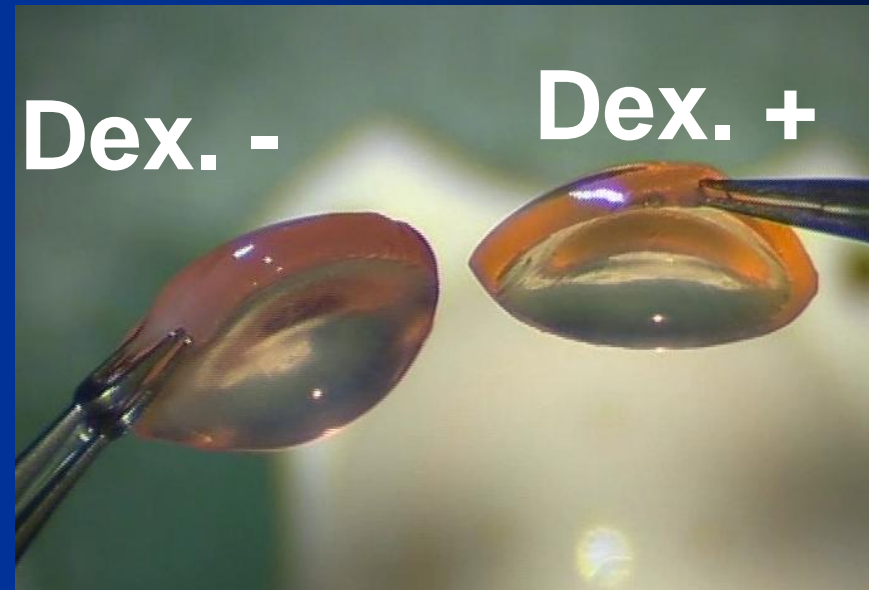
EK = PK = Dehydrated !!!

✓ **4°C Preservation**

(Dextran 1% +
CSA 2.5%)

✓ **Organ Culture**

(Dextran 6-8%)



UT-DSAEK (Double-Pass)

Non-DEHYDRATED (NDH)
TISSUE (ORGAN CULTURE)

Standard

Thickness

$1123 \pm 91 \mu\text{m}$



UT-DSAEK (Double-Pass)

NDH TISSUE (ORGAN CULTURE)

Standardized

Procedure:

1st Pass = 300 μm

2nd Pass = 200 μm

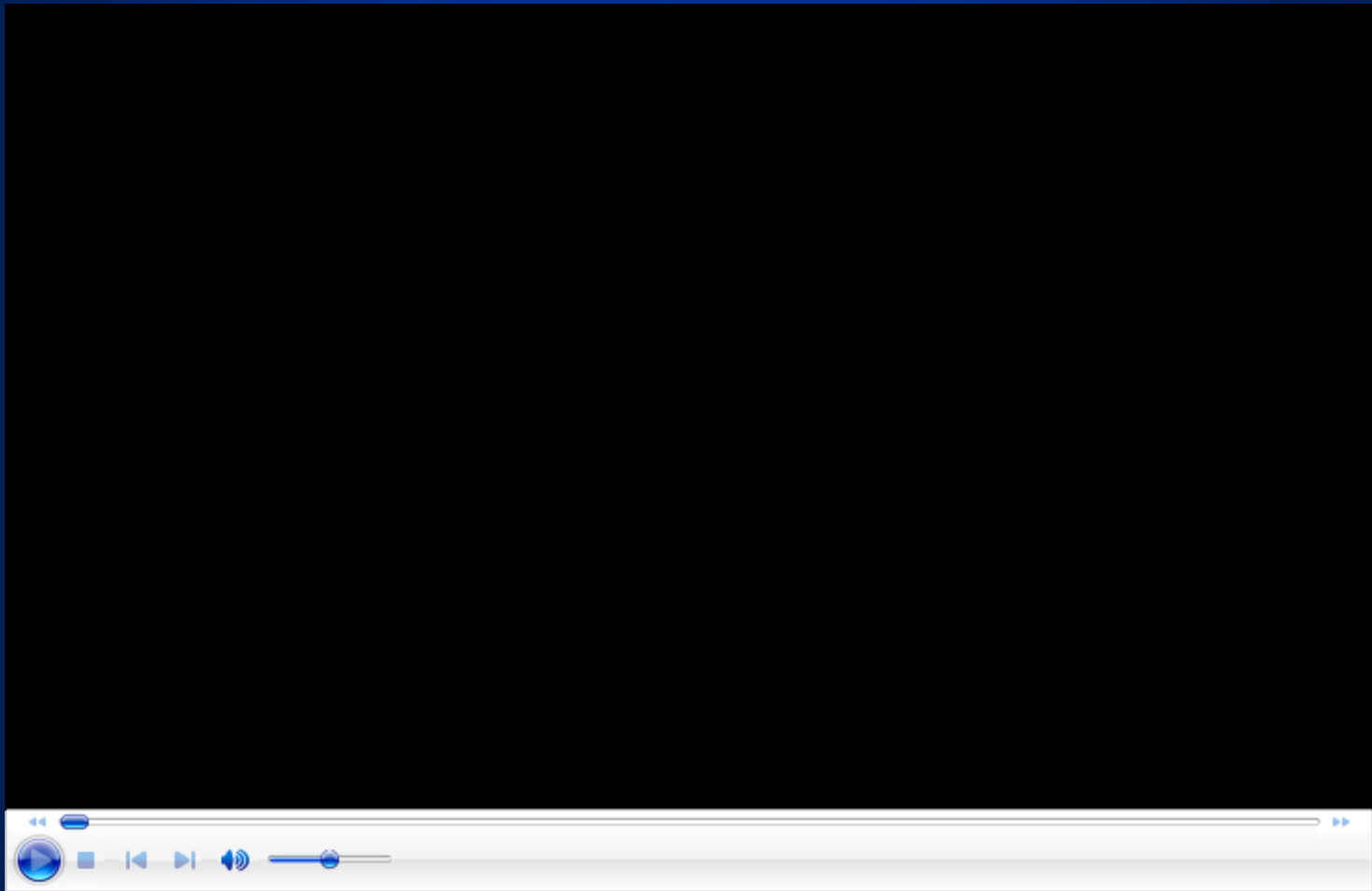
BEWARE !!!

MK Cuts Much Deeper
(about Double as Deep)



UT-DSAEK (Double-Pass)

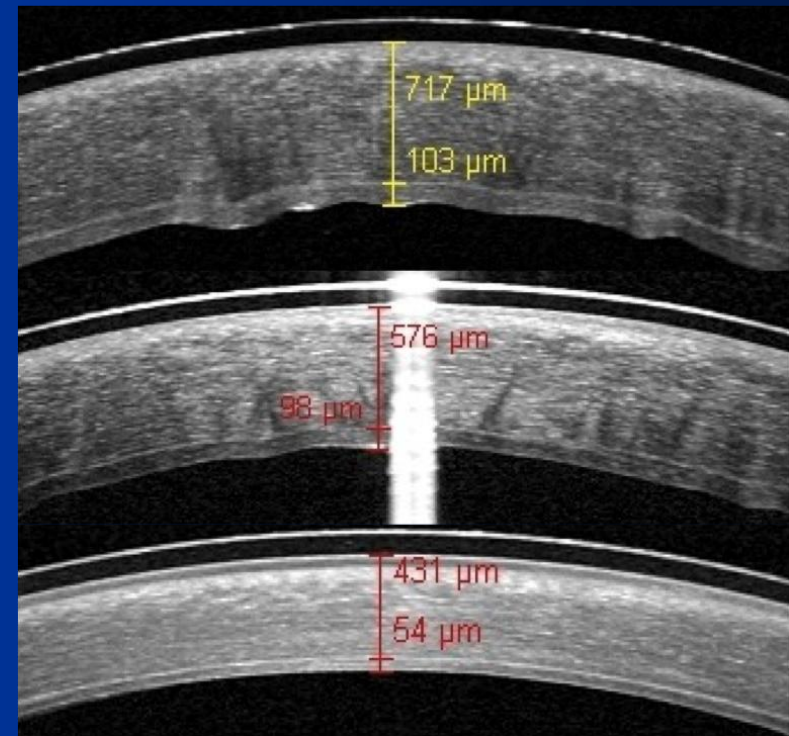
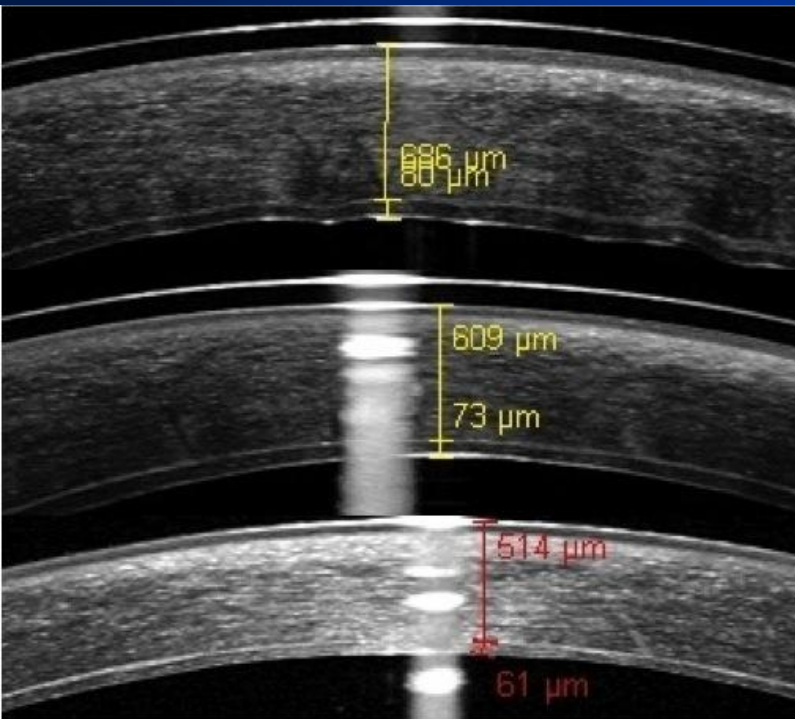
NDH TISSUE FOR UT-DSAEK



UT-DSAEK (Double-Pass)

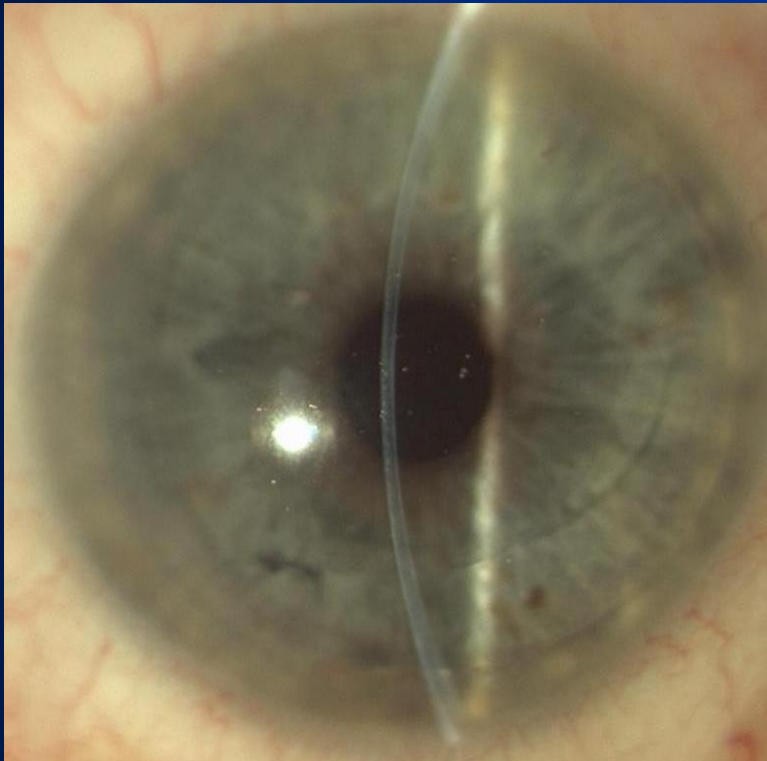
Dehydrated (DH)

NDH

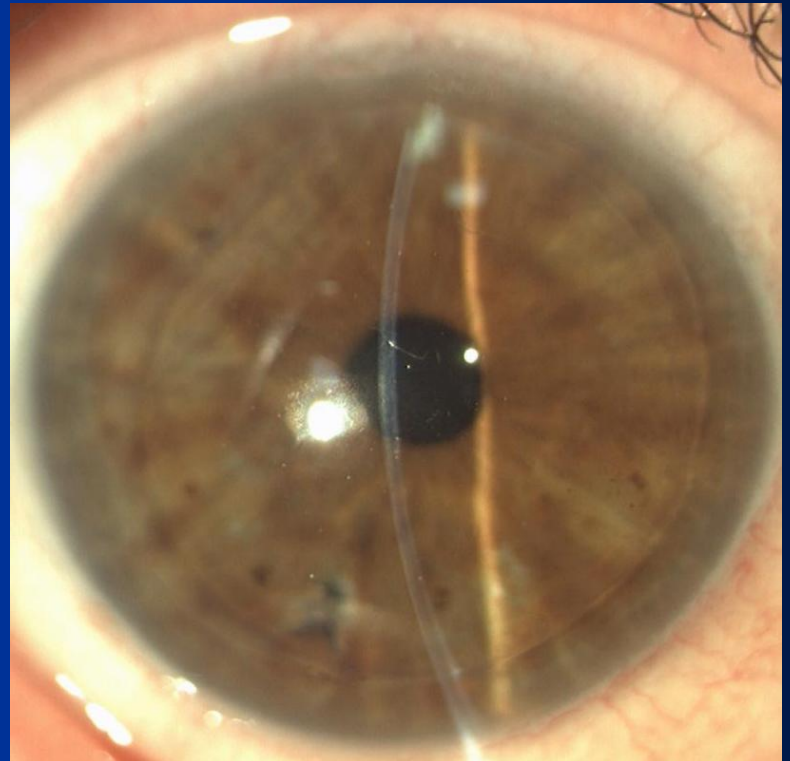


UT-DSAEK (Double-Pass)

DH



NDH



3 mos postop BSCVA = 20/17 (1.2)

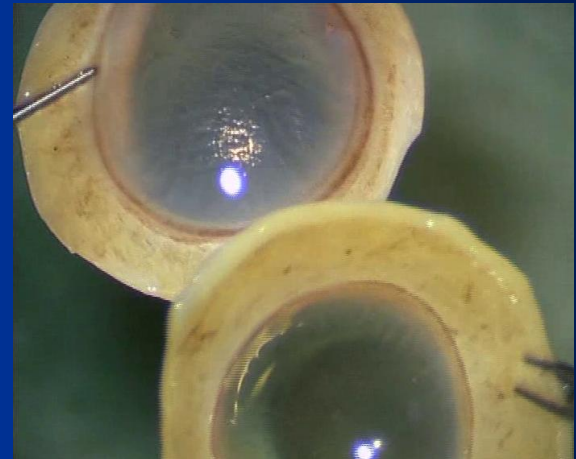
METHODS

PROSPECTIVE COMPARATIVE STUDY

25 DH UT-DSA EK



VS



25 NDH UT-DSA EK

METHODS

PRIMARY OUTCOMES

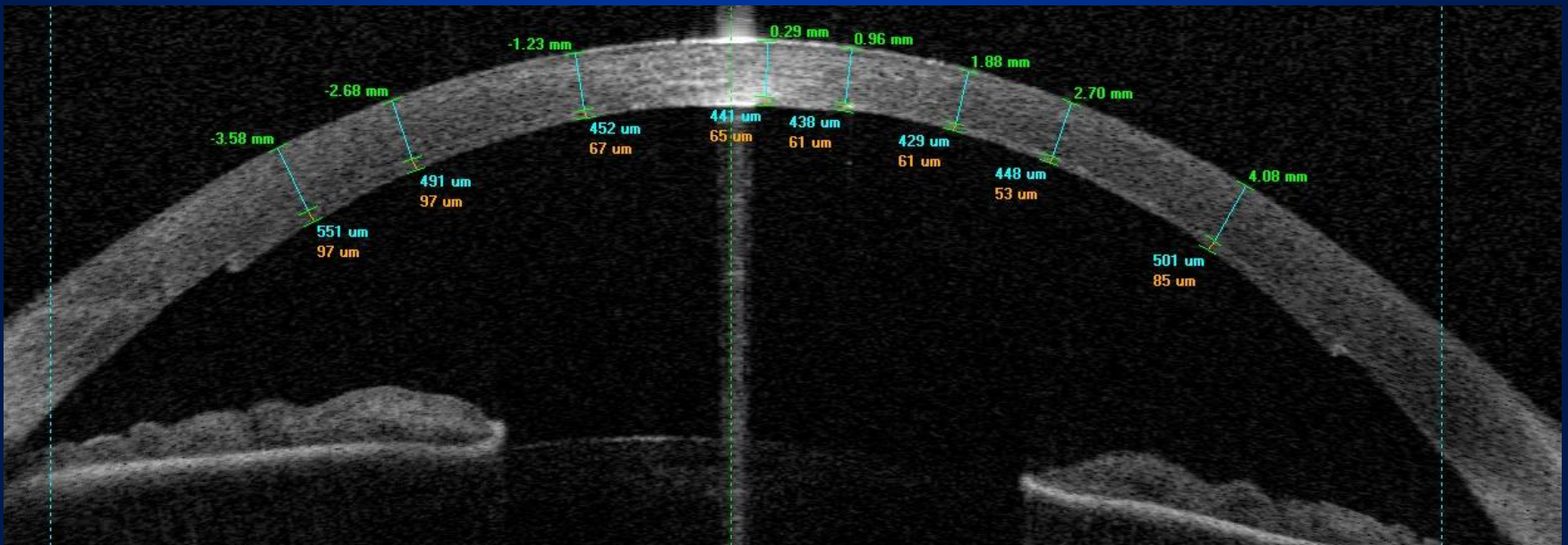
- ✓ **Central Graft Thickness (CGT)**
- ✓ **BSCVA**
- ✓ **Endothelial Cell Loss**

Follow-Up: 6 months

RESULTS

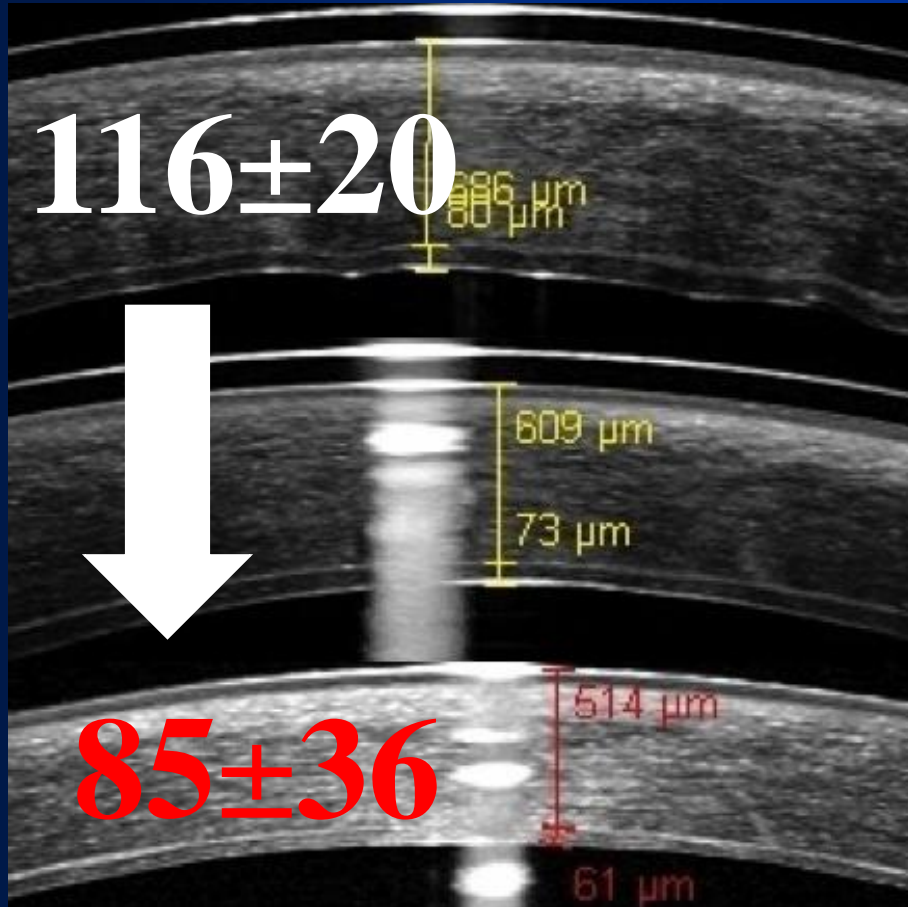
CGT (2 mos = 6 mos)

DH $85 \pm 36 \mu$ NDH $61 \pm 26 \mu$
($p=0.003$)

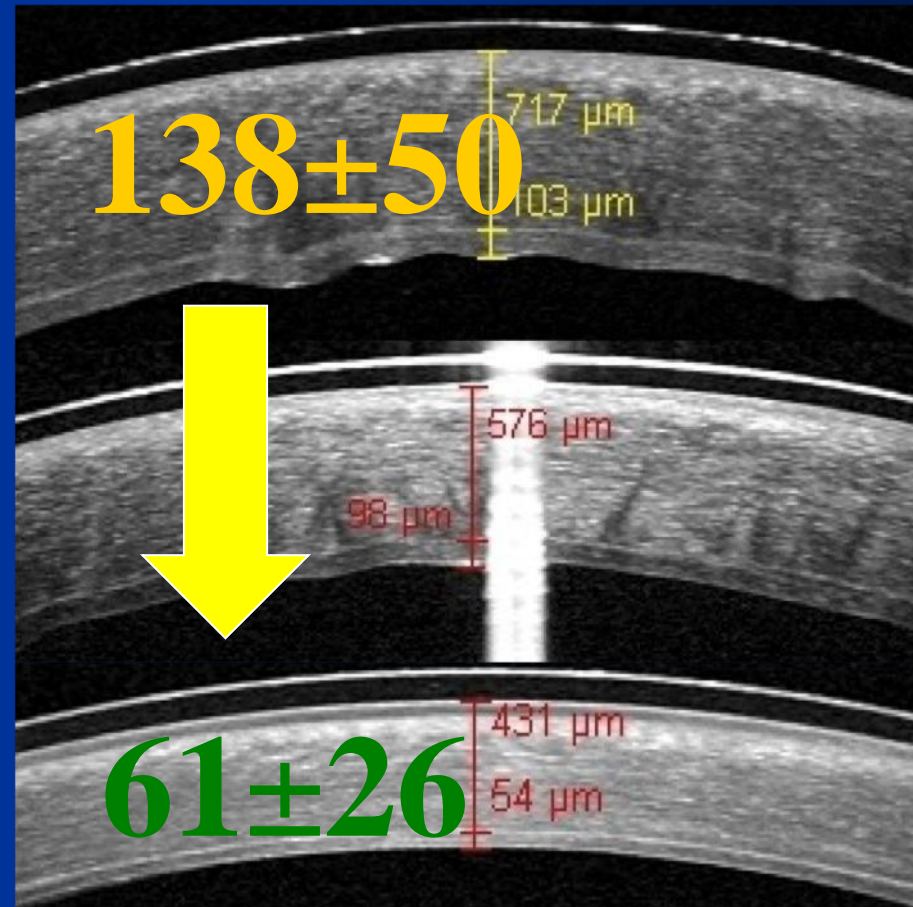


RESULTS

Deswelling in μm (h1 vs m2)



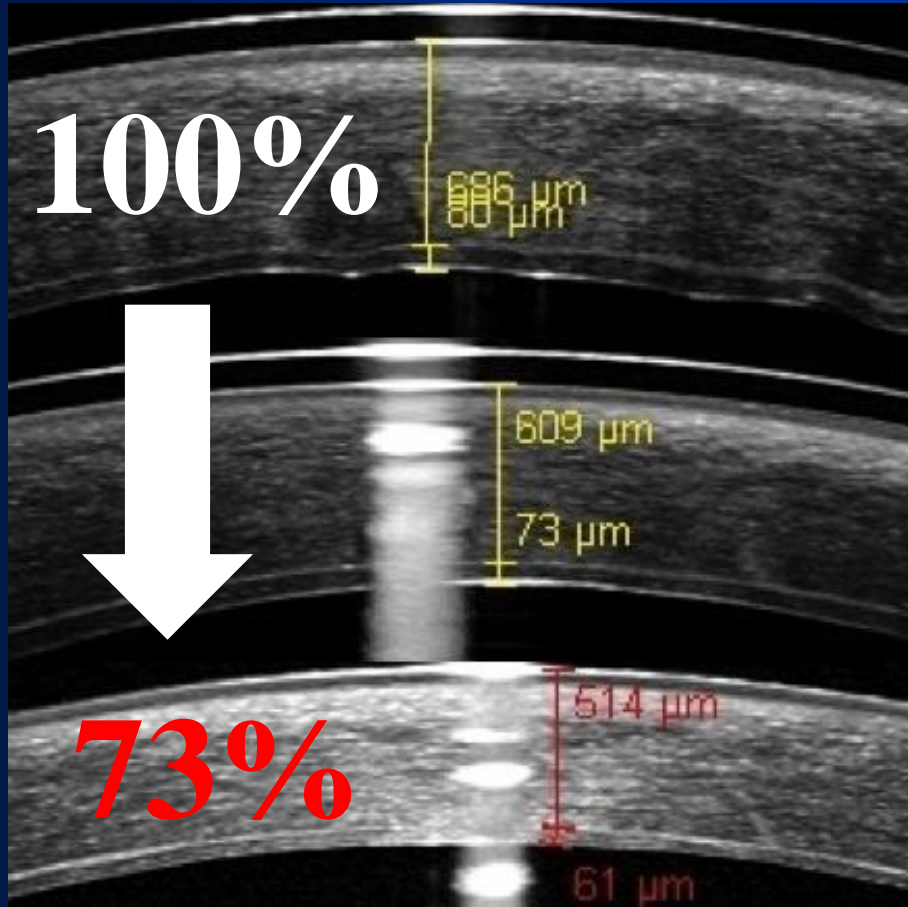
DH



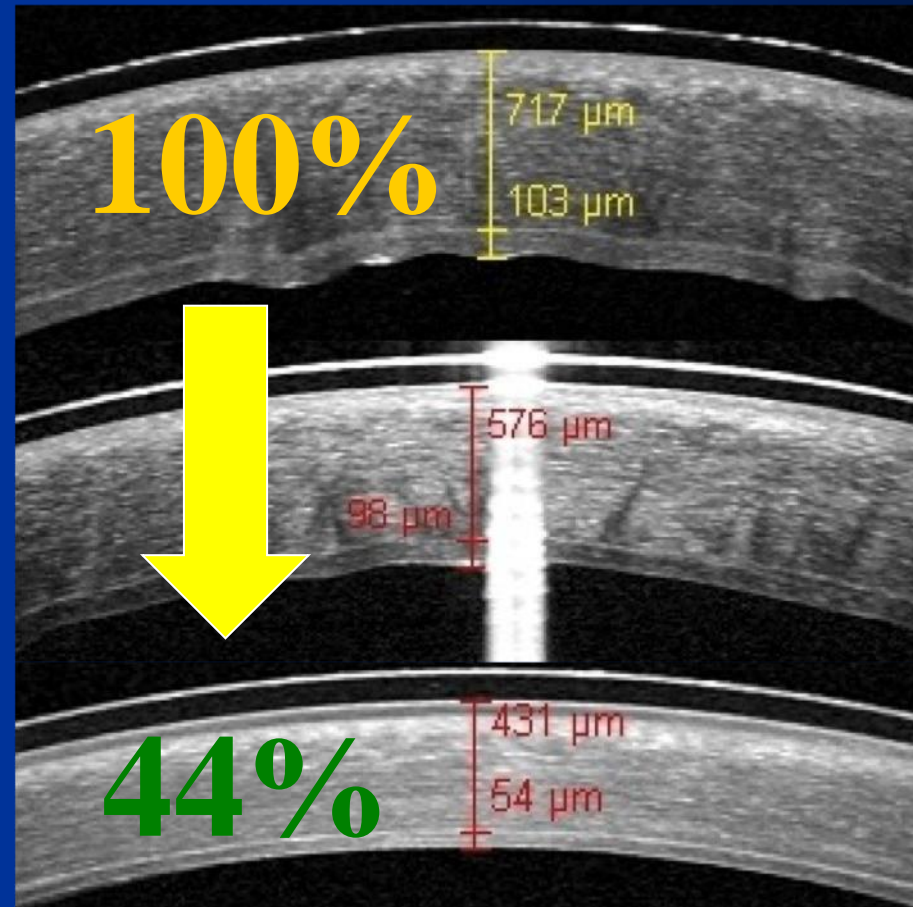
NDH

RESULTS

%Deswelling (h1 vs m2)



DH



NDH

UT-DSAEK (Double Pass)

CGT < 101 μm

DH = 69%

(OPHTHALMOLOGY in press)

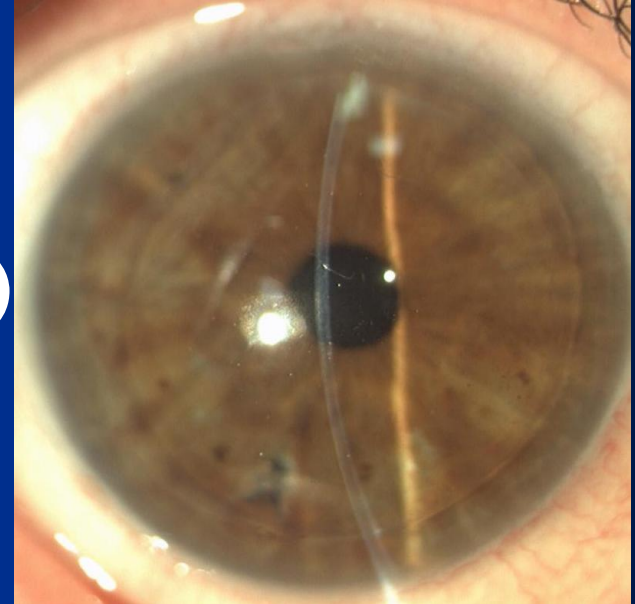
DH¹ = 72%

(Present Study)

HH = 96%

(Present Study)

P (HH vs DH¹) = 0.049 (Fisher test)



RESULTS

20/20 BSCVA in Healthy Eyes

DH (n=18)

NDH (n=17)

3m 4/18 (22%)

7/17 (41%)

6m 5/18 (28%)

8/17 (47%)

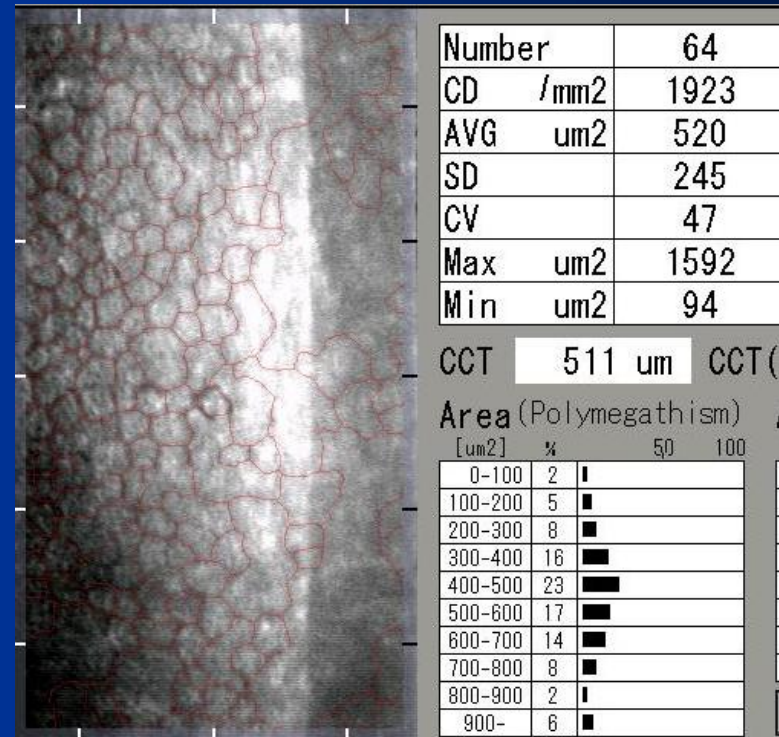
(p>0.05)

RESULTS

Endothelial Cell Loss

	DH	NDH
3m	29%	33%
6m	33%	37%

($p > 0.05$)

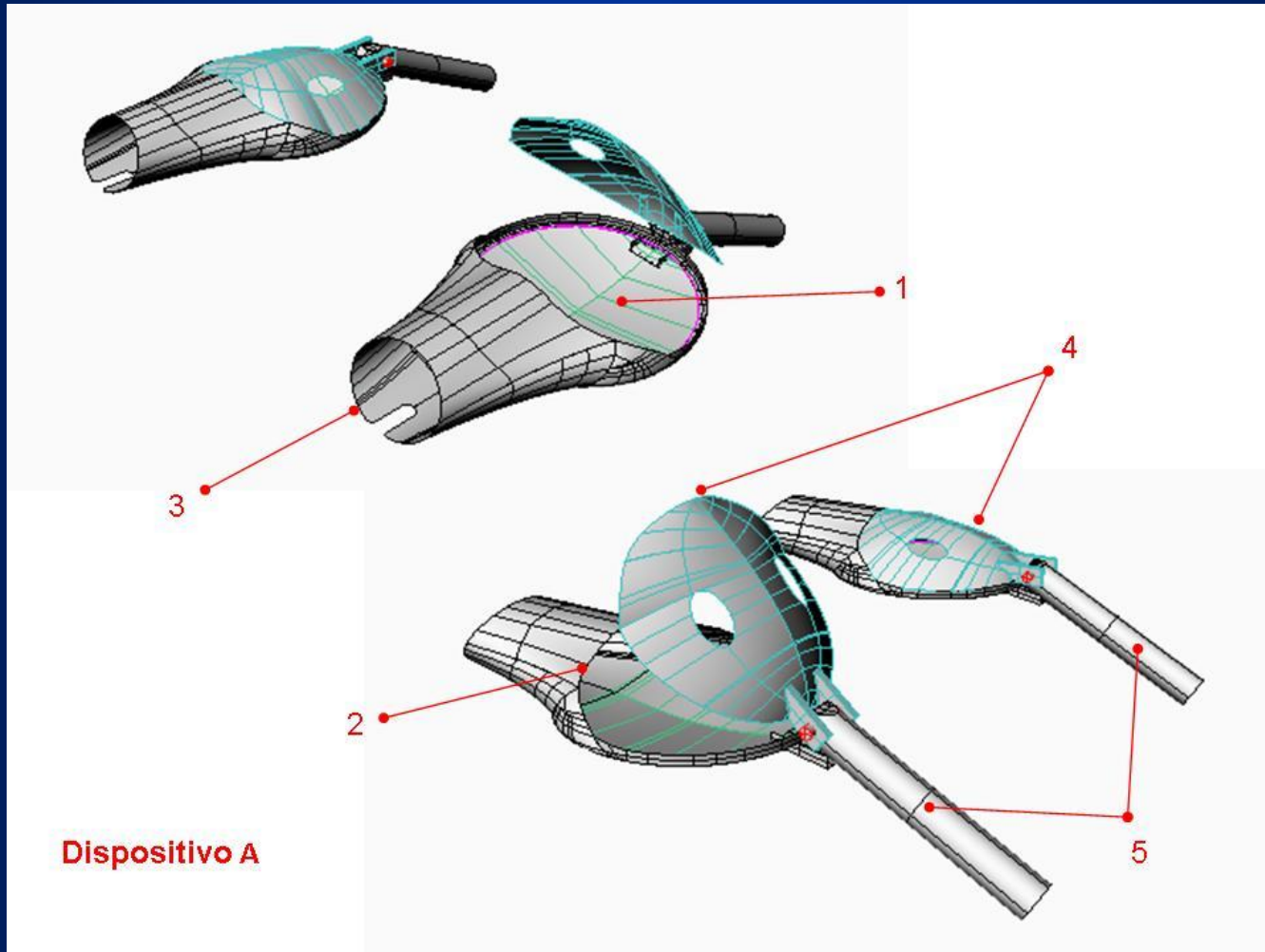


CONCLUSIONS

Dedicated NDH Donor Tissue:

- ✓ Standardized Preparation
- ✓ Ease of Handling/Delivery
- ✓ Significantly Thinner Grafts
- ✓ Improved Outcome

PRELOADED TISSUE



PRELOADED TISSUE

