University of L'Aquila - ITALY
Eye Clinic
Head: Prof. Leopoldo Spadea

"Custom excimer laser transplantations"

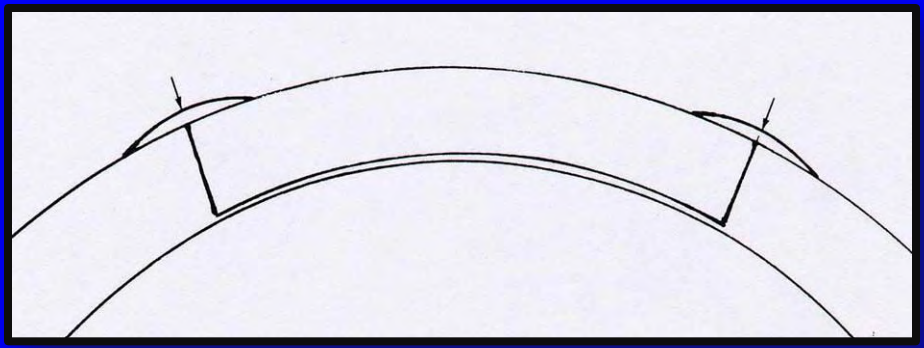
L. Spadea, A. Di Gregorio, G. Viola

NOK2008

XXXVIII Nordic Congress of Ophthalmology

June 14-17 2008

Excimer Laser Lamellar Keratoplasty: Surgical Techniques

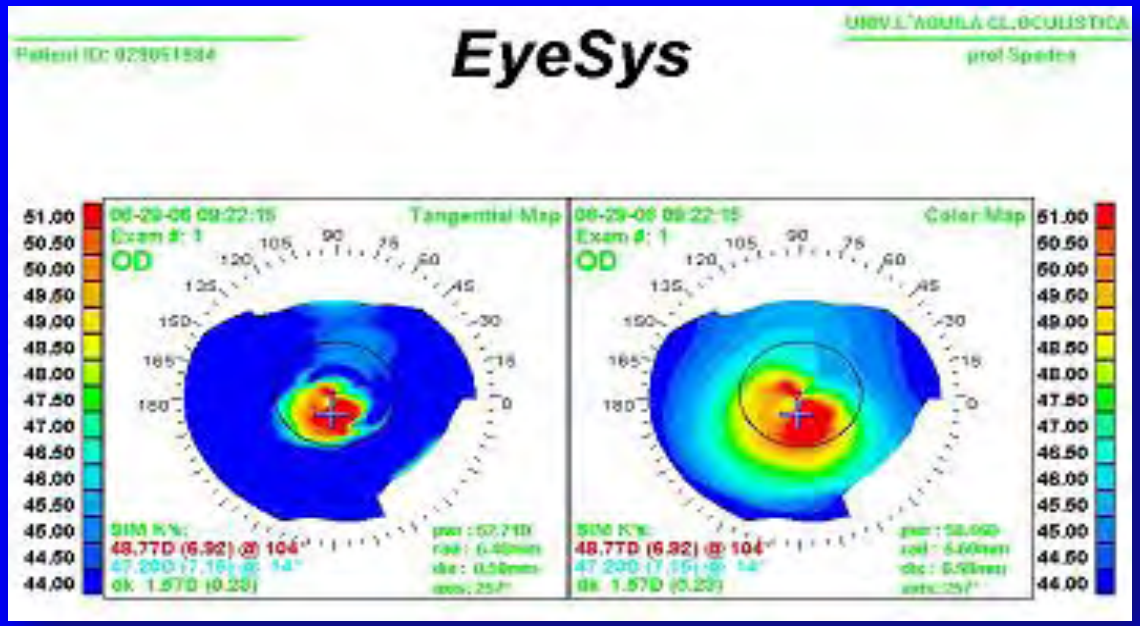


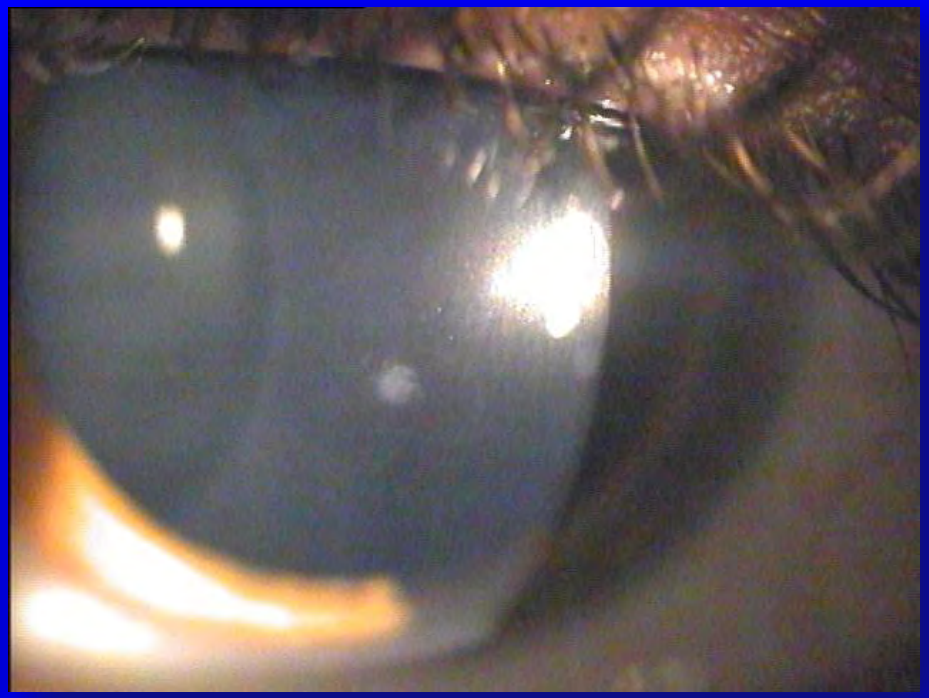
Excimer Laser-Assisted Lamellar Keratoplasty
ELLK

Corneal Lamellar Ablation for Transplantation
CLAT

Surgical Indications

- Contact lens intolerance
- BSCVA <5/10
- Pachymetry >350µm
- No deep striae

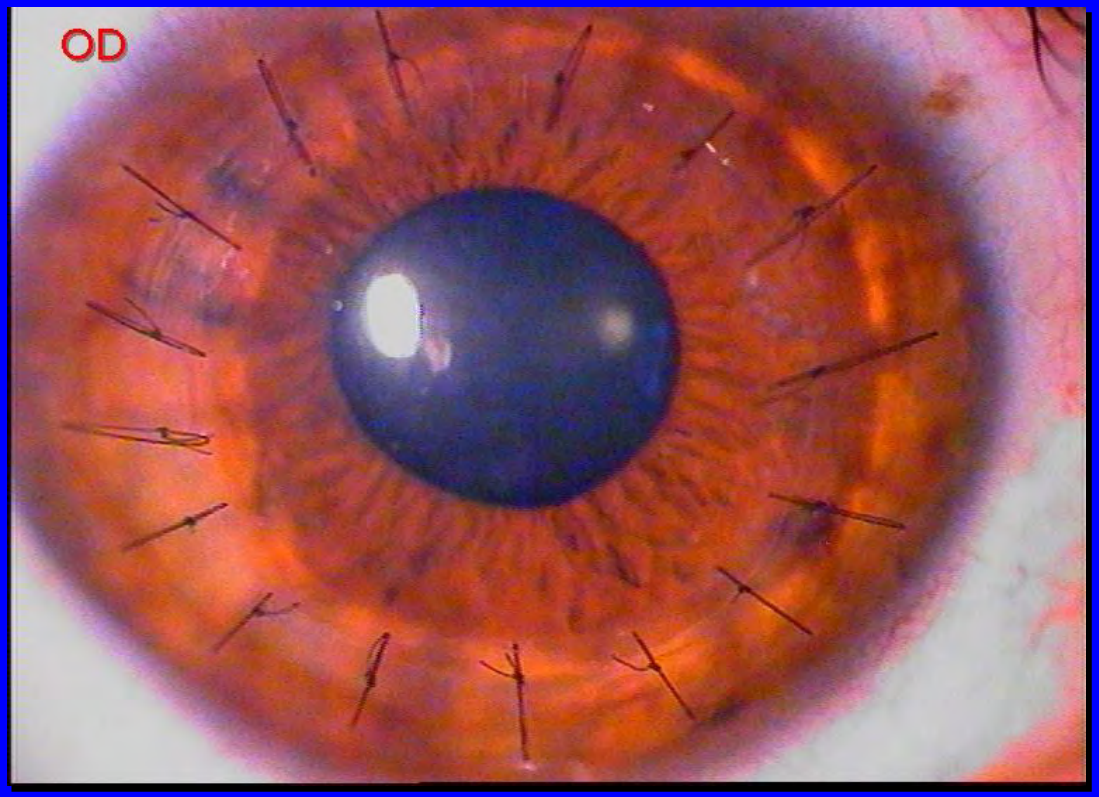


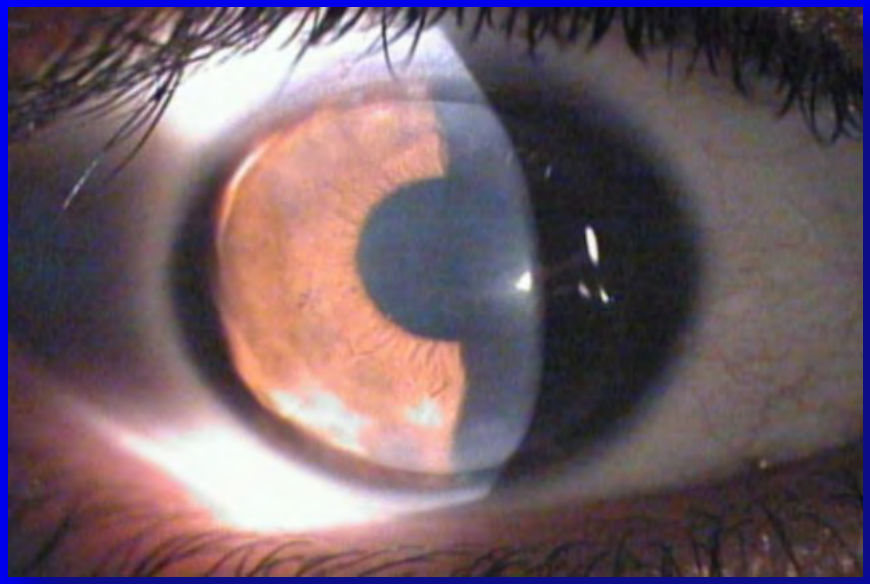


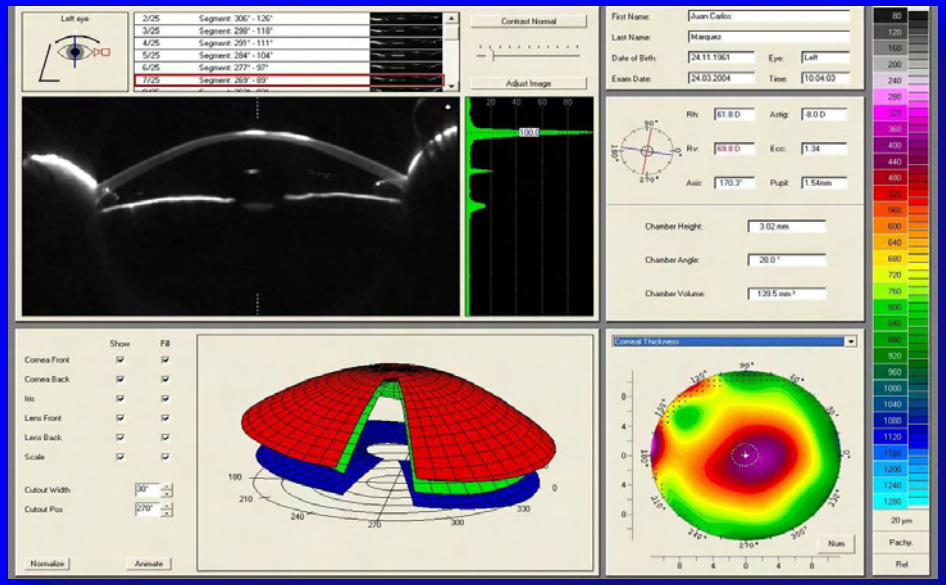
Excimer Laser-Assisted Lamellar Keratoplasty (ELLK)

Replacement of anterior stromal corneal layers

Goal: to restore a physiological corneal thickness (>500µm) with a normal corneal shape (<50D).



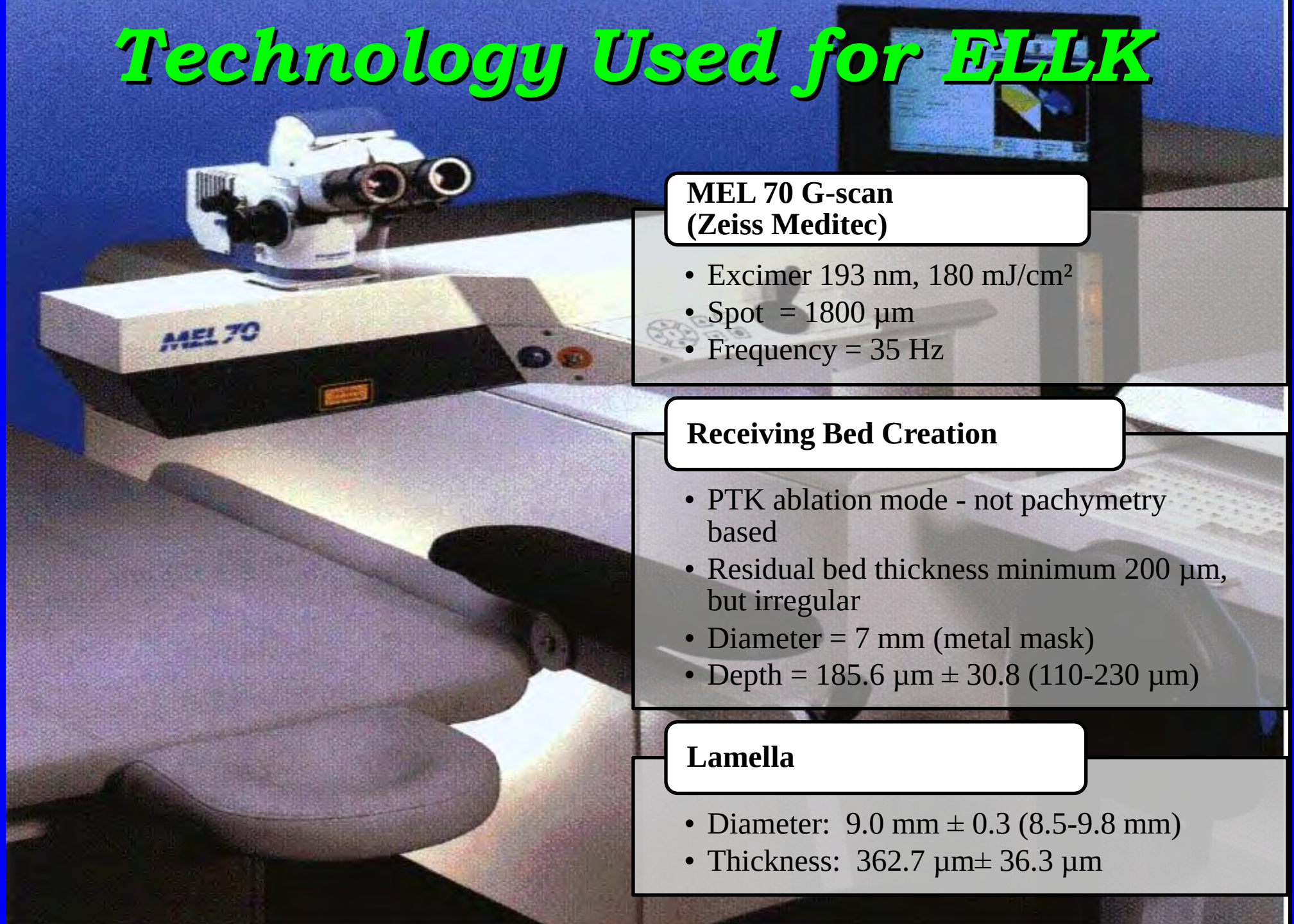




ELLK Example:

PreOp Pachymetry		460µm
PTK Ablation	-	260µm
Lamellar Addition	+	380µm
Post-Op		580µm

Technology Used for ELLK



MEL 70 G-scan (Zeiss Meditec)

- Excimer 193 nm, 180 mJ/cm²
- Spot = 1800 µm
- Frequency = 35 Hz

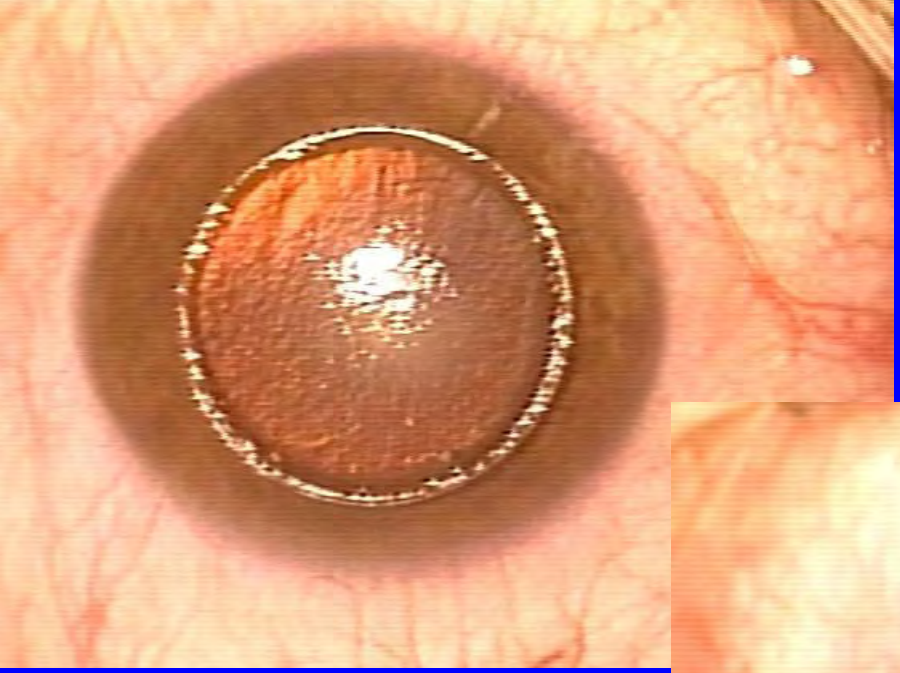
Receiving Bed Creation

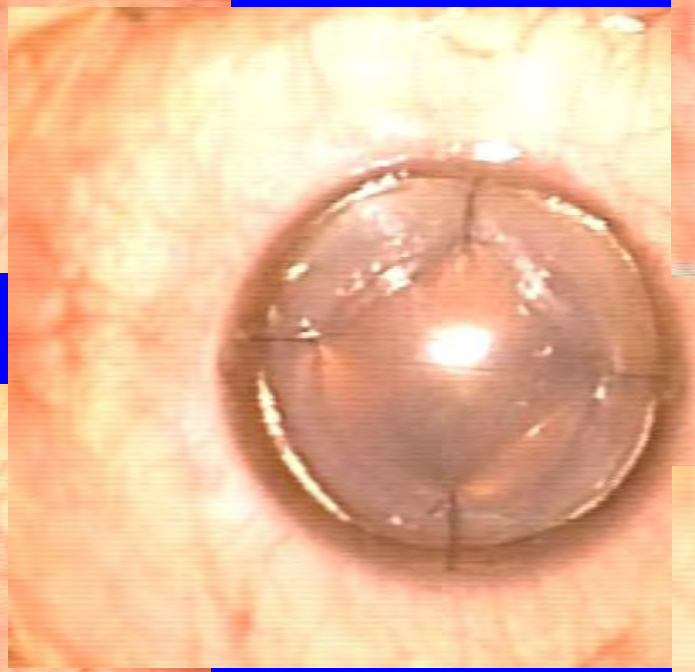
- PTK ablation mode - not pachymetry based
- Residual bed thickness minimum 200 µm, but irregular
- Diameter = 7 mm (metal mask)
- Depth = 185.6 µm ± 30.8 (110-230 µm)

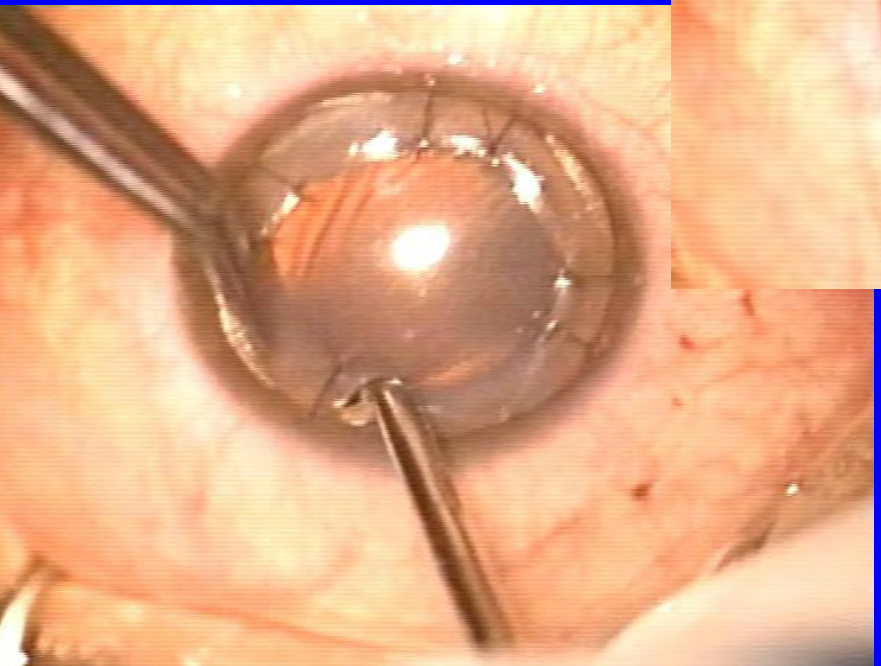
Lamella

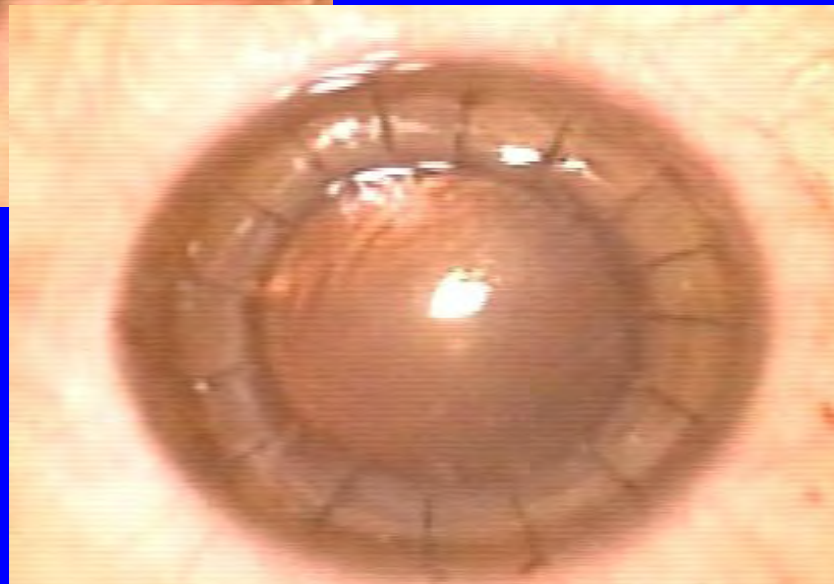
- Diameter: 9.0 mm ± 0.3 (8.5-9.8 mm)
- Thickness: 362.7 µm± 36.3 µm

ELLK









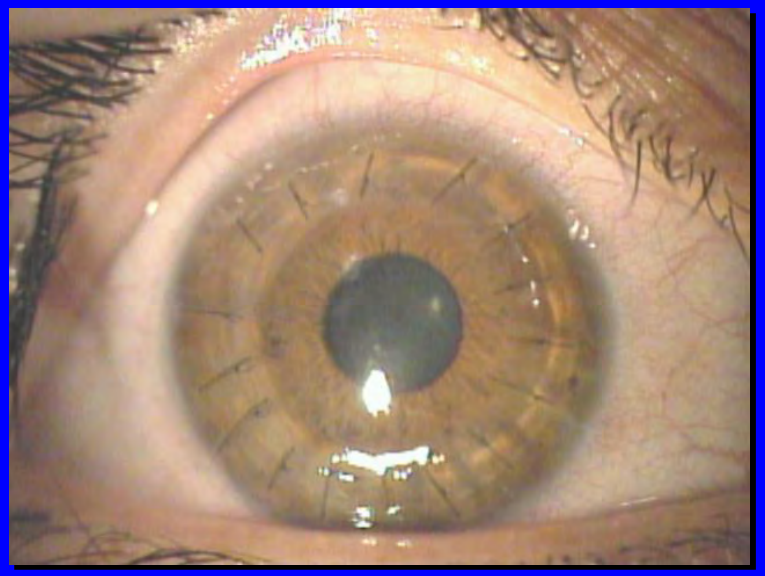
Patients and Methods ELLK

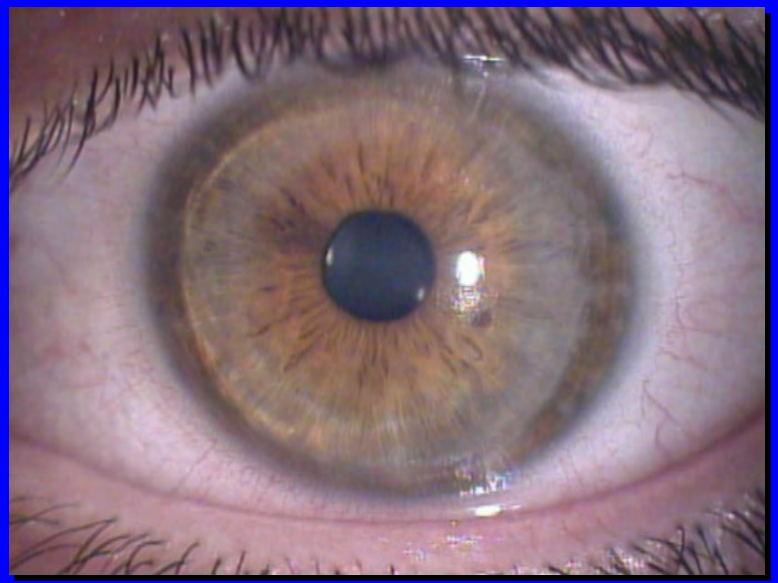
Enrollment: Feb 2000 – May 2006
60 eyes of 60 patients
(39♂, 21♀)

Age: 33.4 ± 8.9ys (22 - 53)

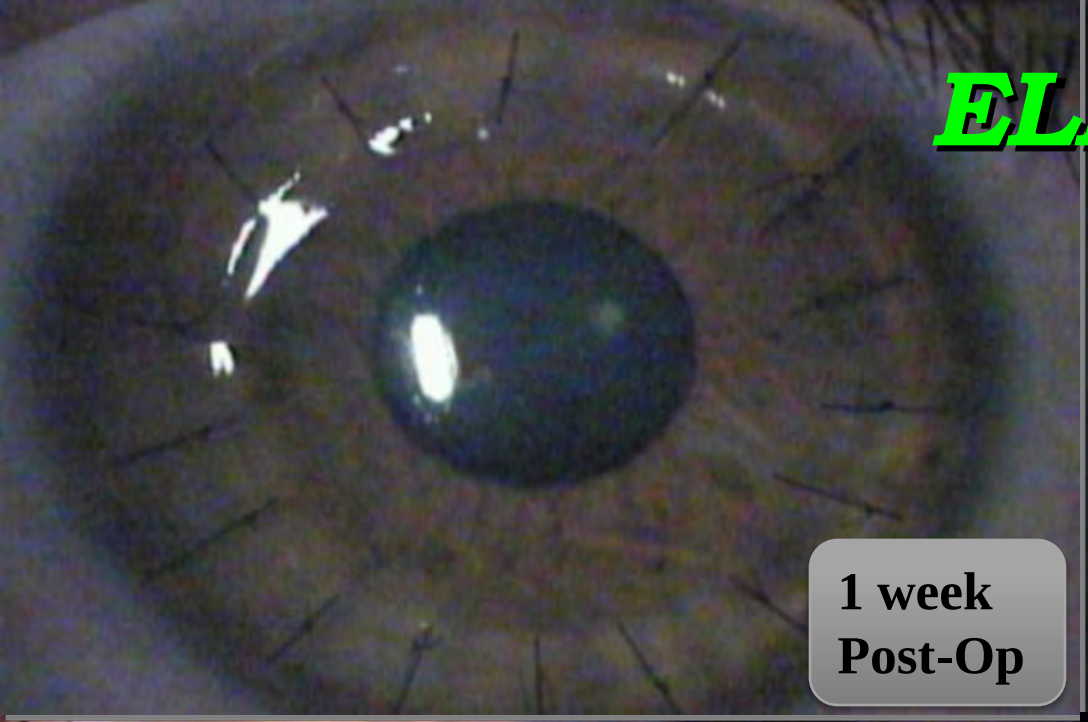
Pachymetry: 440.1 ± 49.1µm
(384-503)

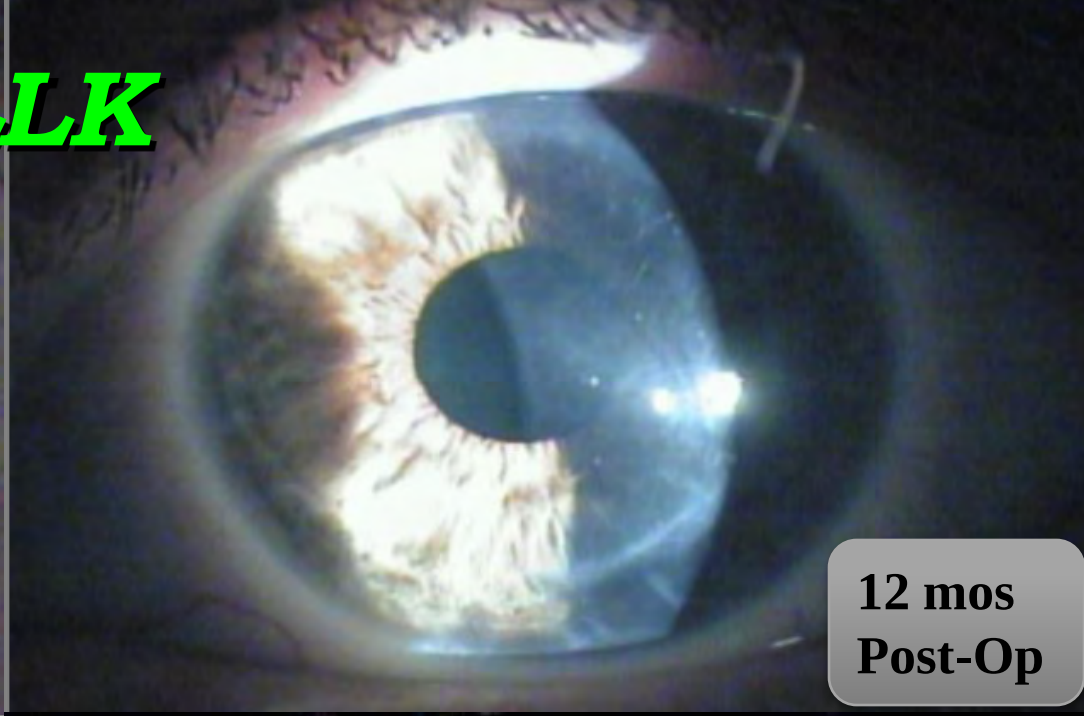
BSCVA: 3/10 (1/10 - 6/10)

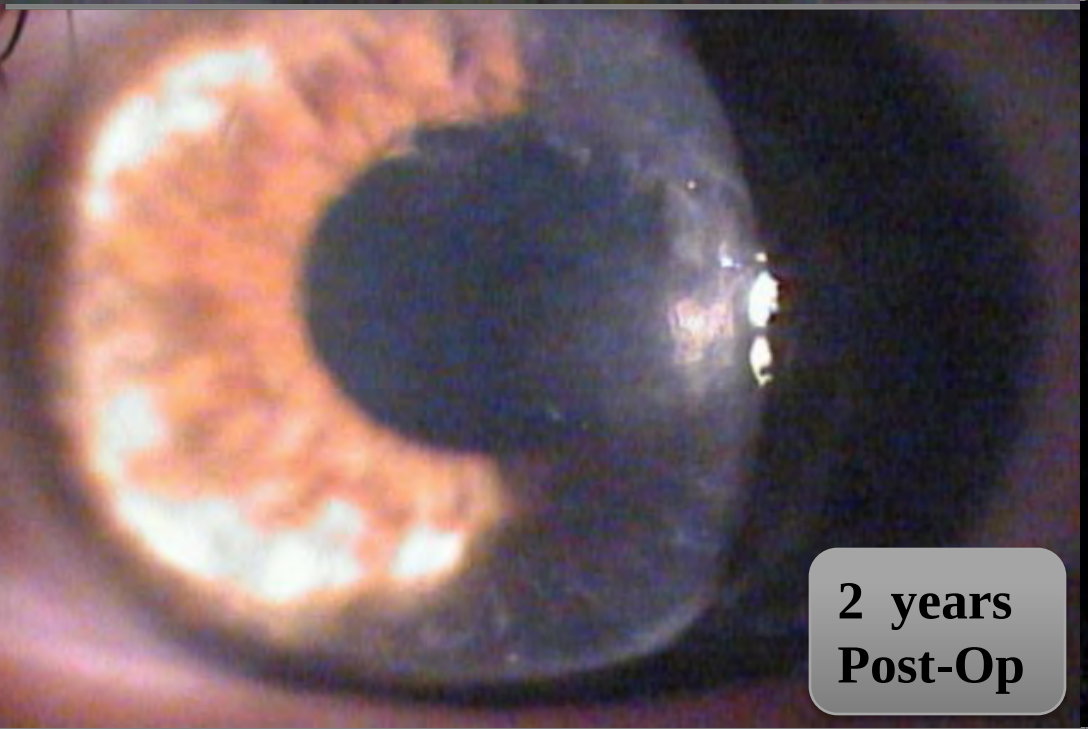


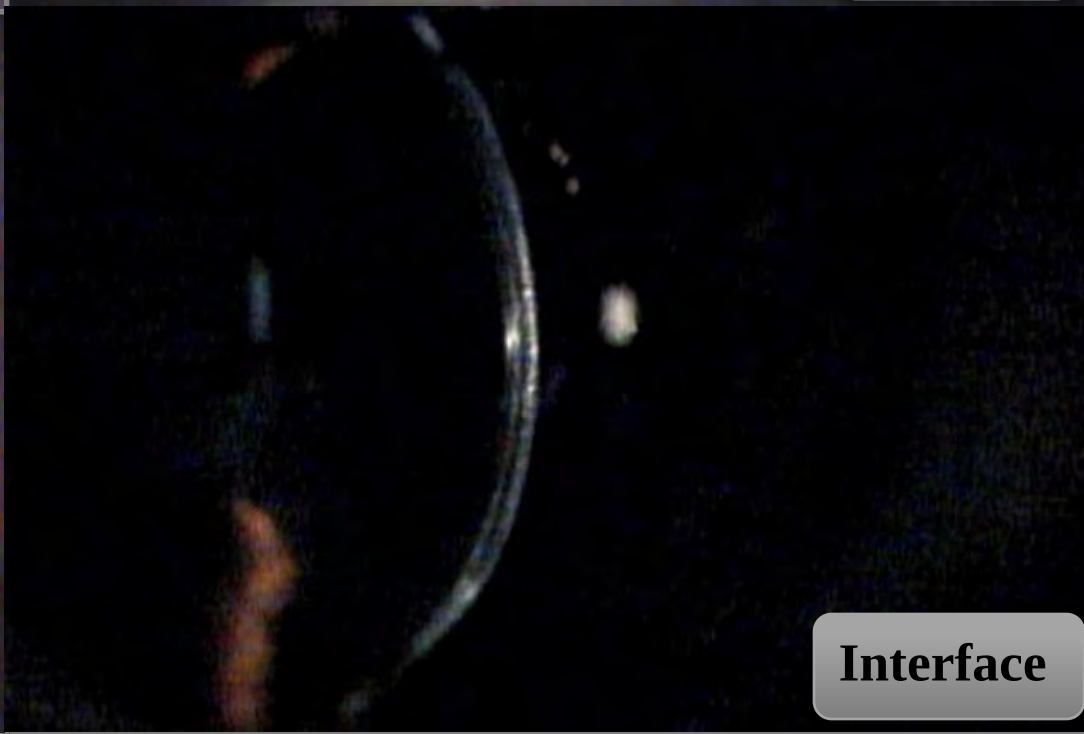


ELLK

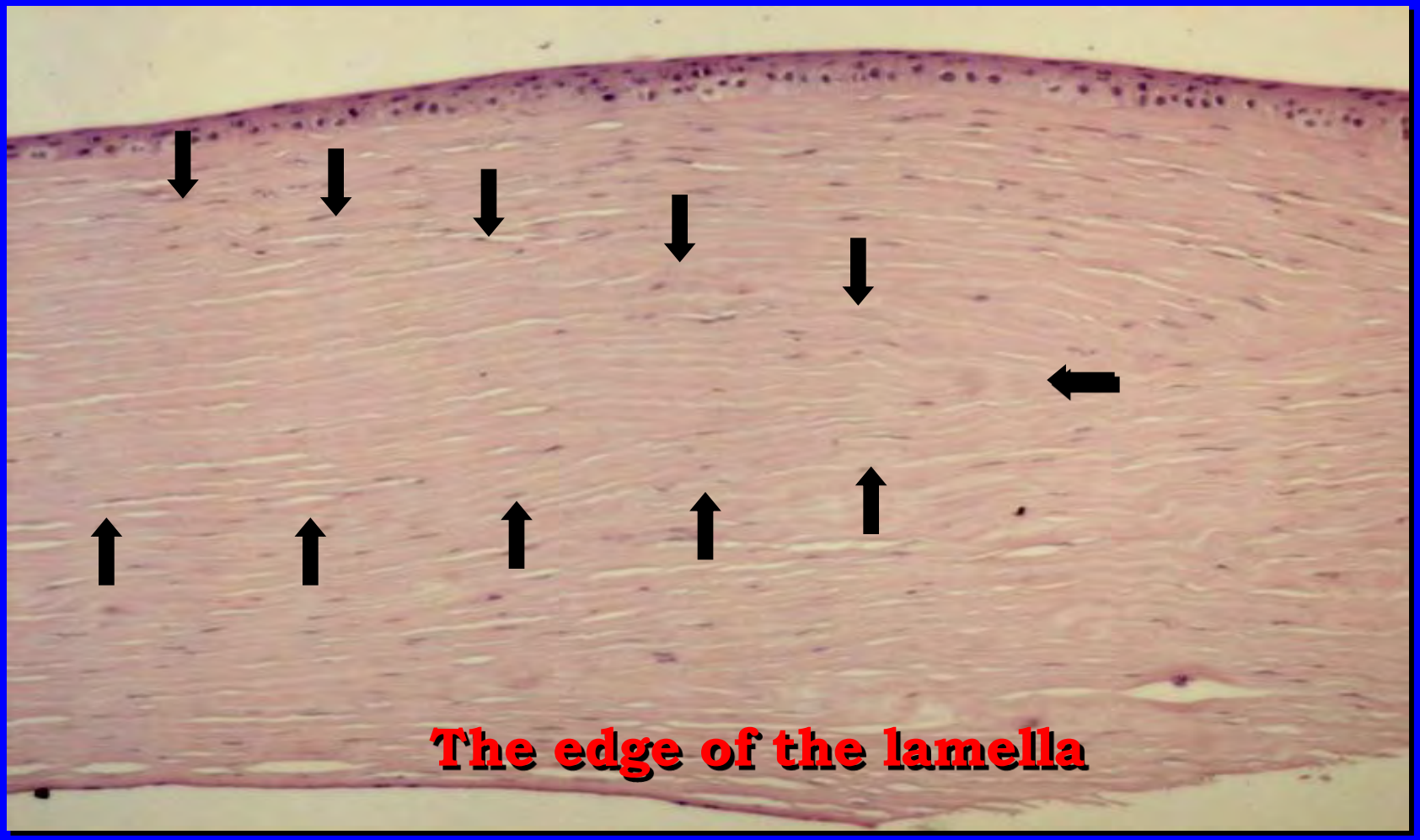




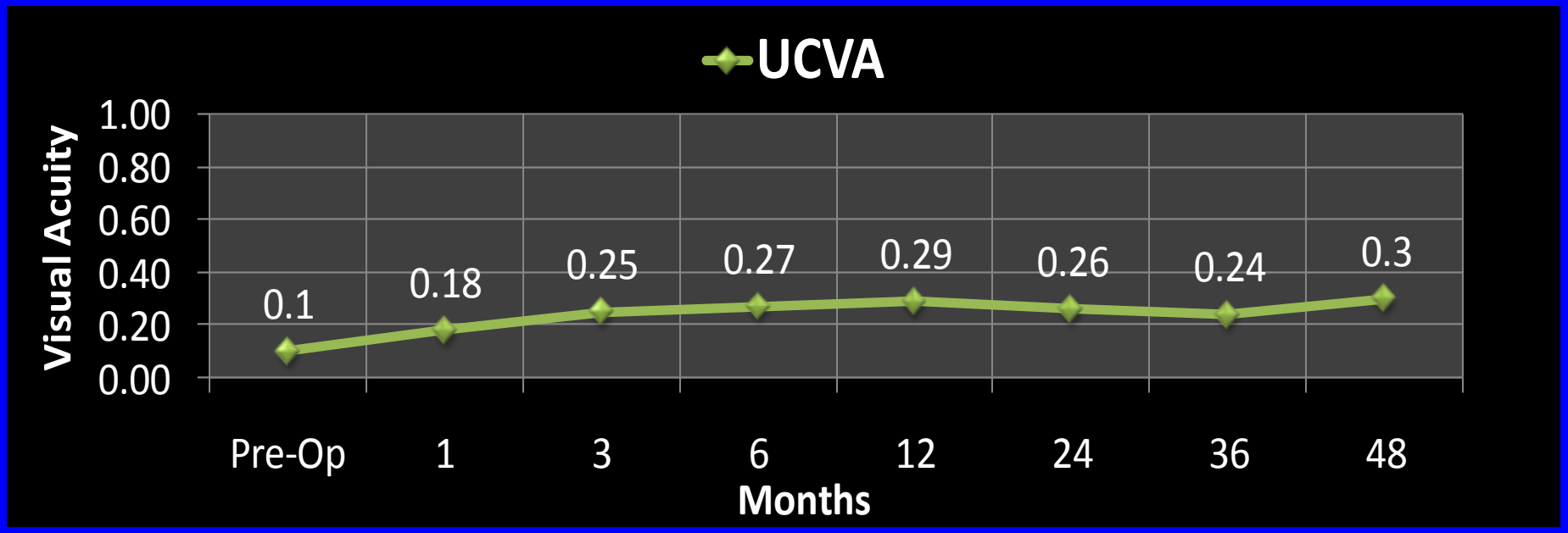


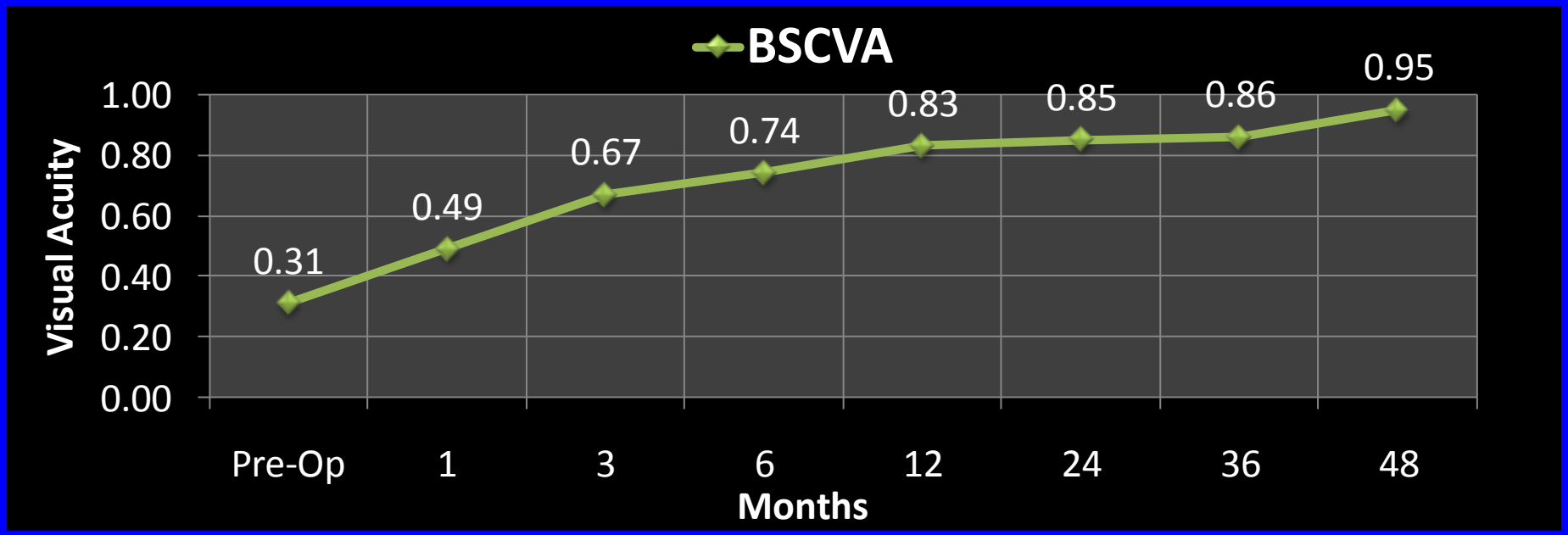


ELLK Histological findings

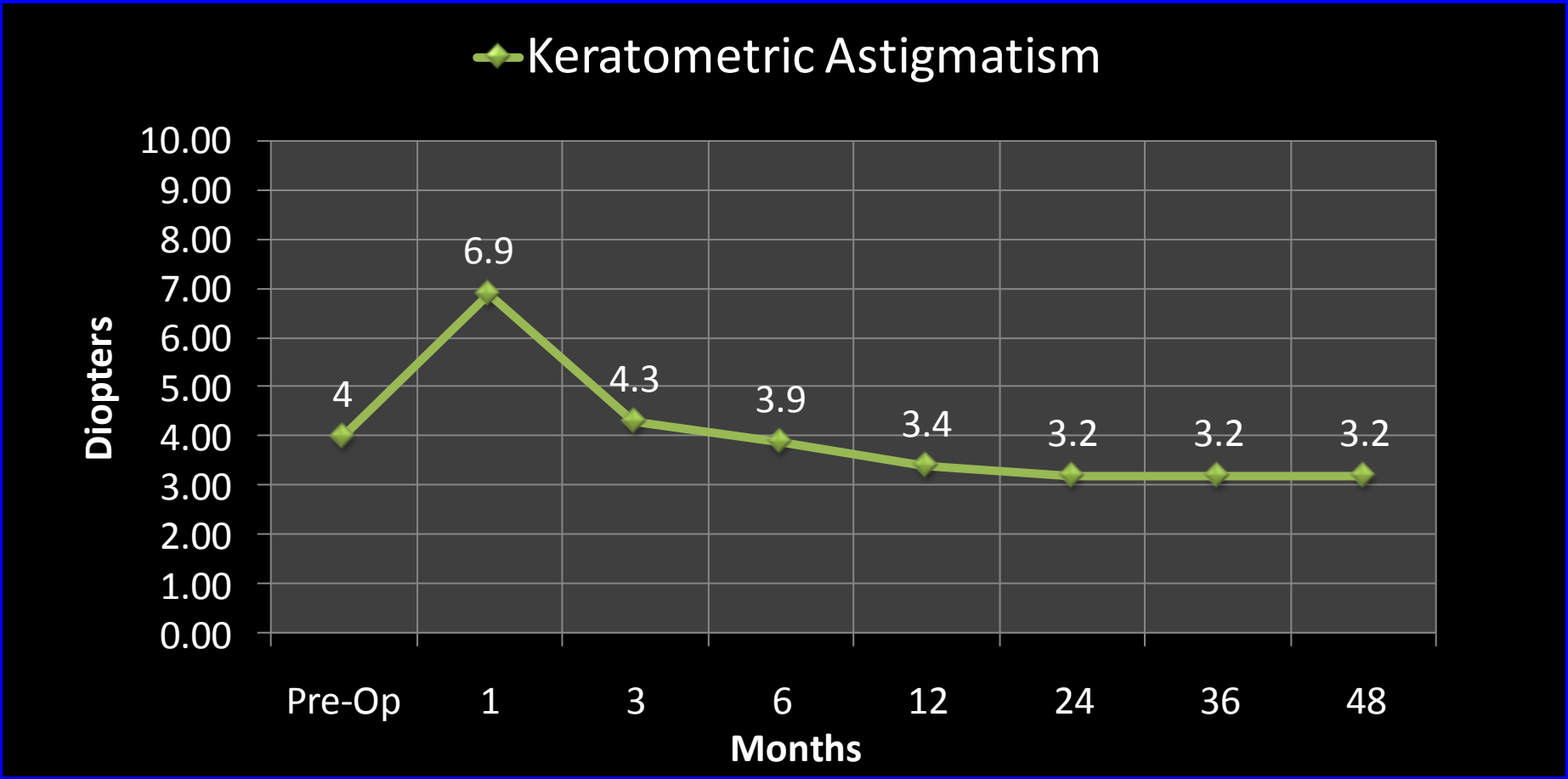


ELLK: Results





ELLK: Results



CLAT®: Corneal Lamellar Ablation for Transplantation

Measure 3-D pachymetry map

Plan ablation to create "Receiving Bed"

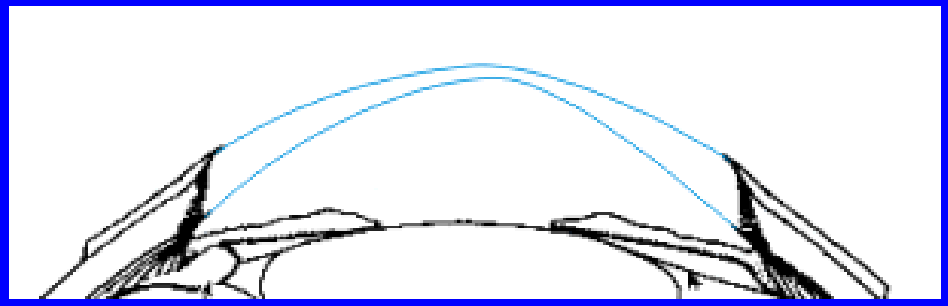
Leave uniform thickness bed of 180-200 µm

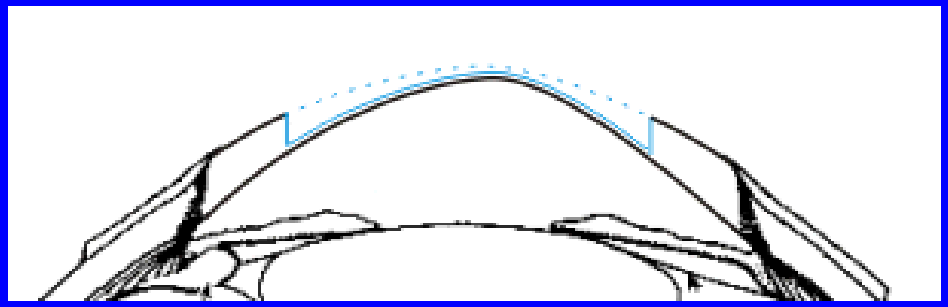
Mount donor tissue

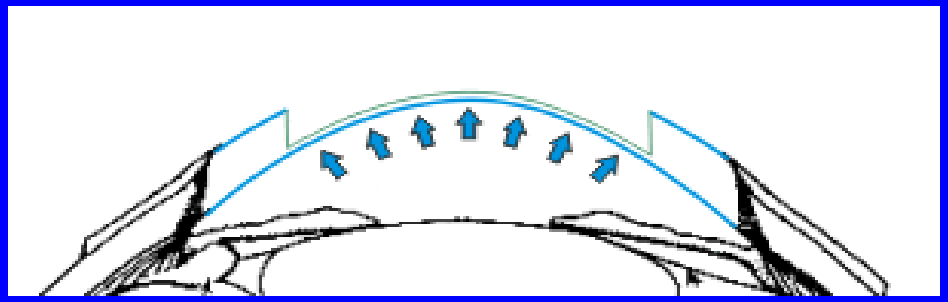
Custom ablate donor to Receiving Bed dimensions

Insert donor into Receiving Bed and secure

Receiving Bed





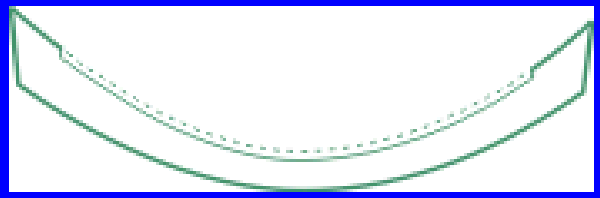


Pre-Op irregular thickness cornea

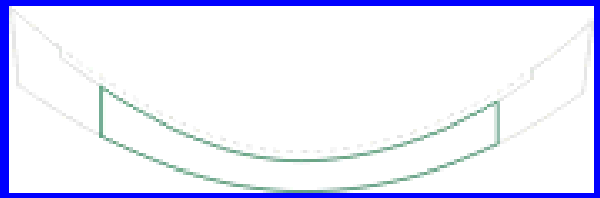
New uniform thickness with membrane properties …

… and no transversal rigidity

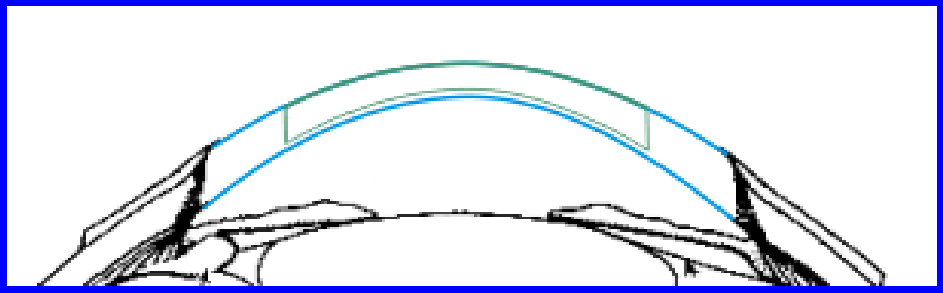
Donor Lamella



From the endothelial aspect, the thickness is customized to equal the receiving bed …

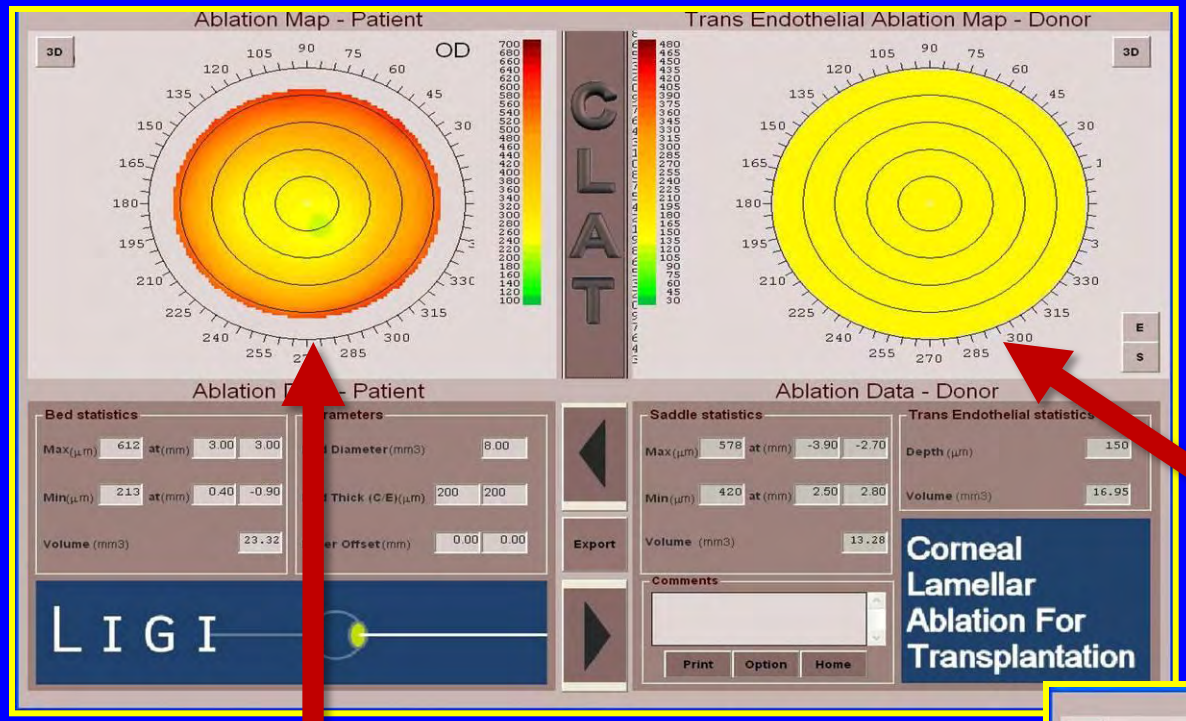


… with a diameter just slightly larger than the diameter of the receiving bed



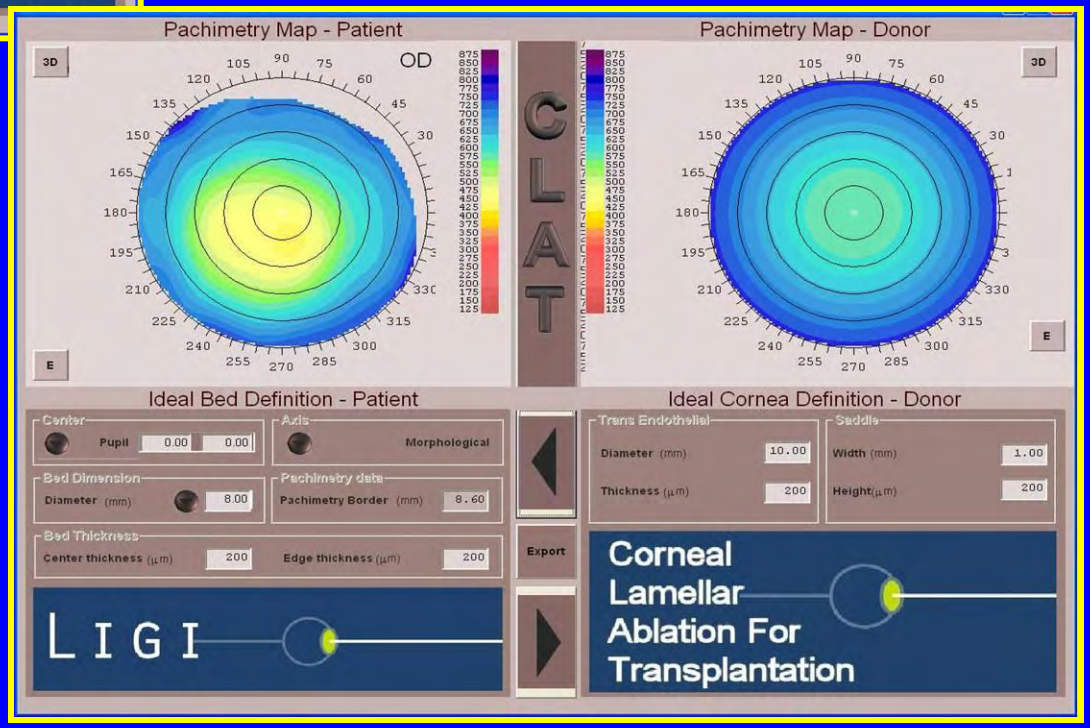
The donor is positioned on the receiving bed

Preoperative pachymetric maps



Donor Trans-endothelial Ablation Map

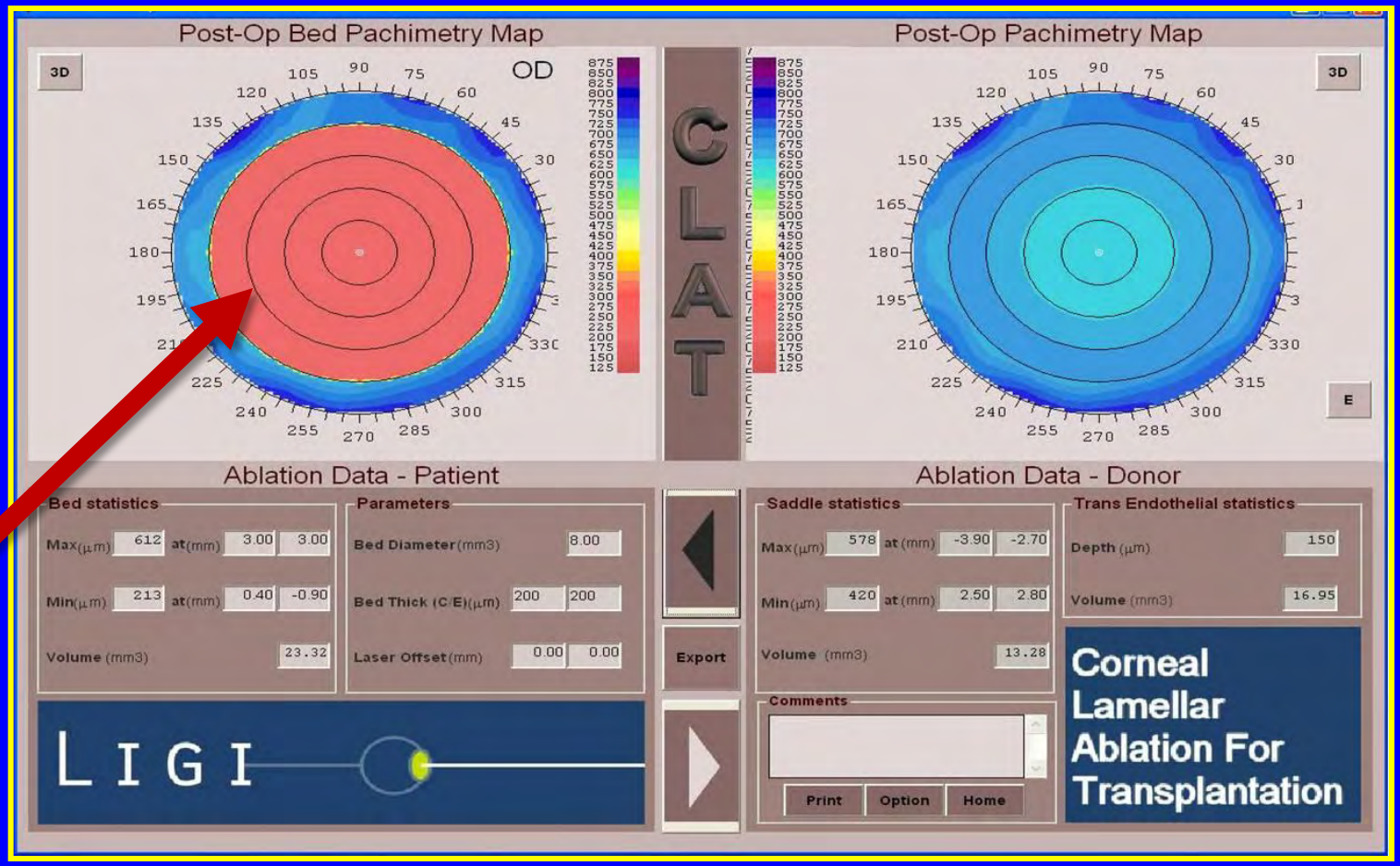
Recipient Ablation Map



Simulation of post-CLAT pachymetry map

With the receiving bed ablated, the cornea is now uniformly thin.

Note regular (red) thickness



Patients and Methods
CLAT

Material: 25 eyes of 25 patients (17♂, 8♀)
12 RE, 13 LE

Age: 34.9 ± 8.76ys (21-50)

Pachymetry: 411.2 ± 25.6µm (382-484)

UCVA: 1/10

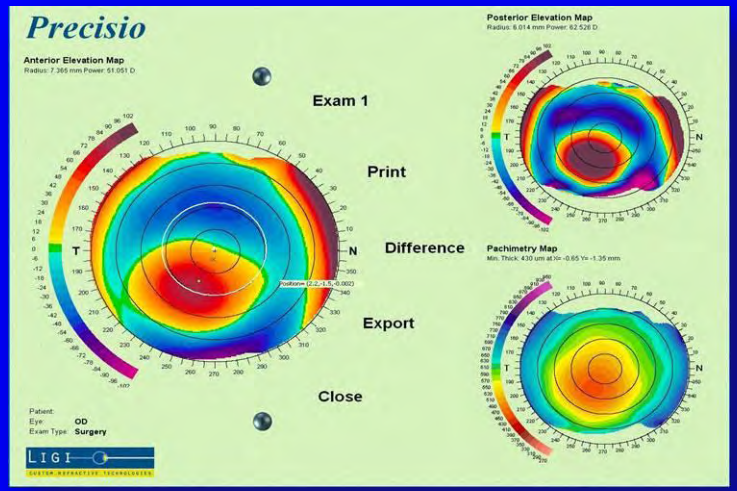
BSCVA: 3/10

Transepithelial Ablation:

depth: 194.9 ± 35.7µm (158-260)

diameter: 7.5/8mm (mask)

Minimum residual bed: 180/200µm



iRES
The Ultrafast Excimer Laser

Type

- Excimer 193 nm
- 650 micron gaussian spot

Frequency

- 1,000 Hz
- Constant frequency / area

Setup / Calibration

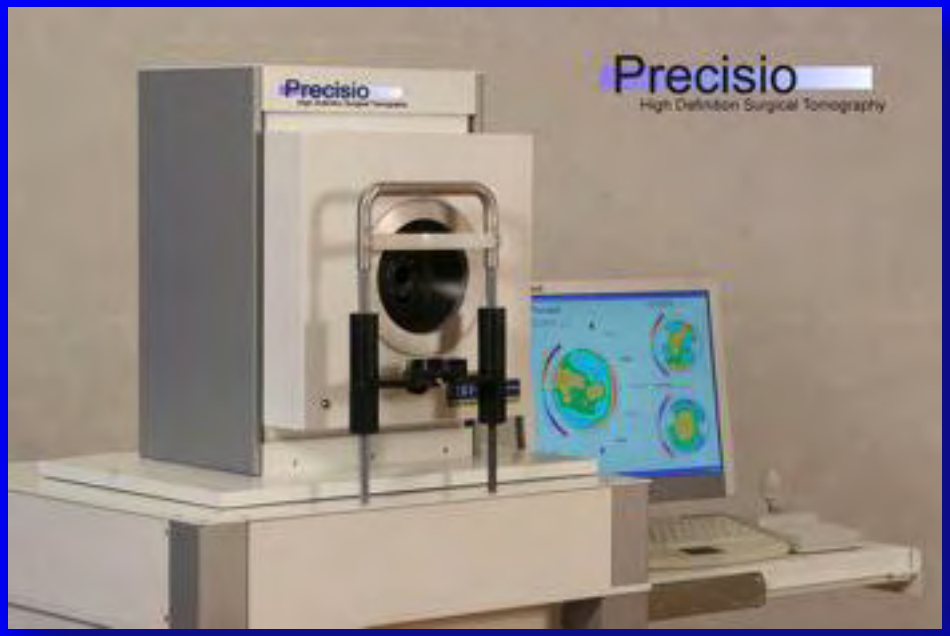
- Automated

Data Link

- Precisio
- pMetrics
- CLAT and CIPTA

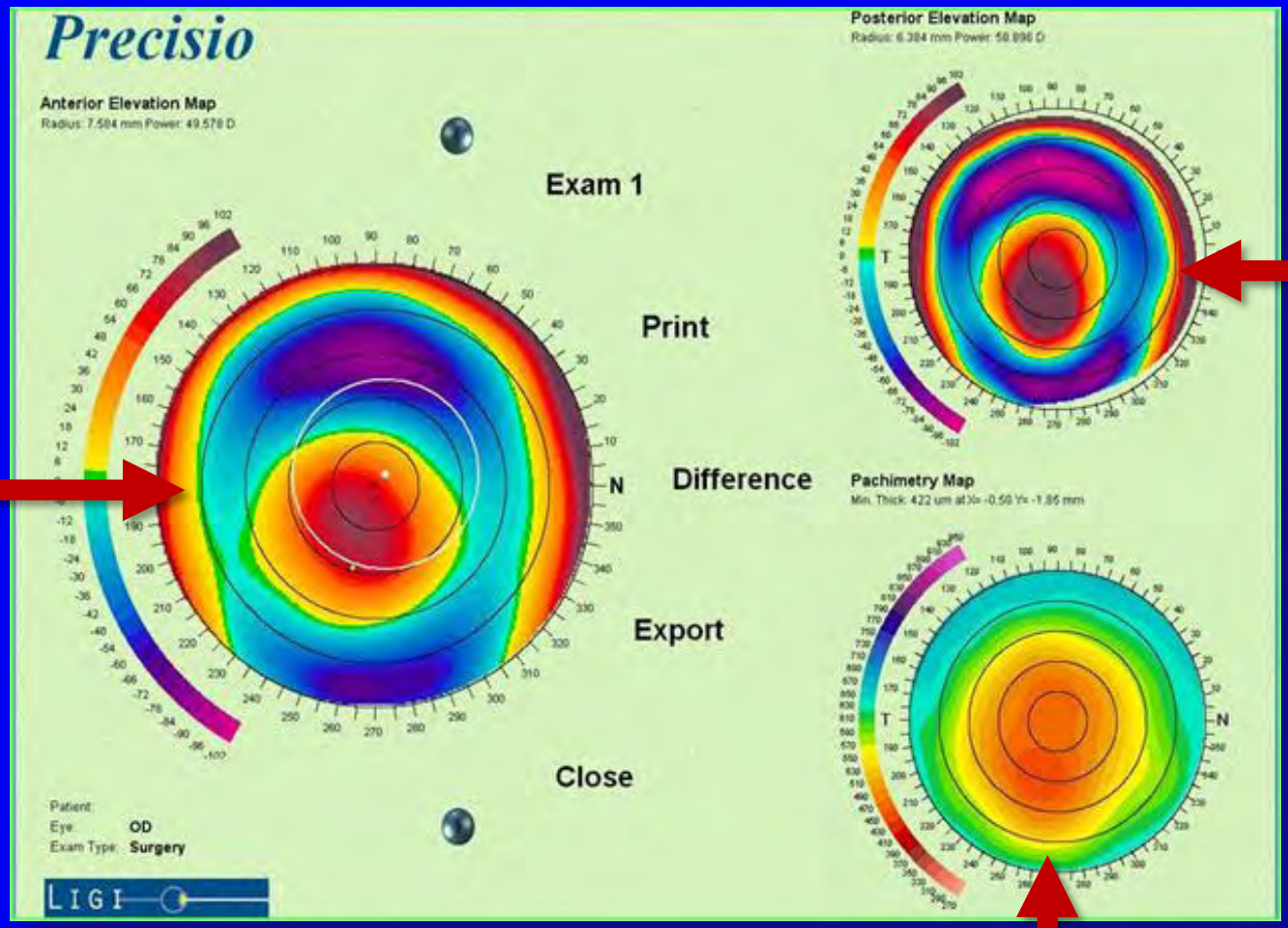
Preoperative Evaluation

Precisio
Corneal topography



pMetrics
Pupillometer

Precisio Elevation Topography



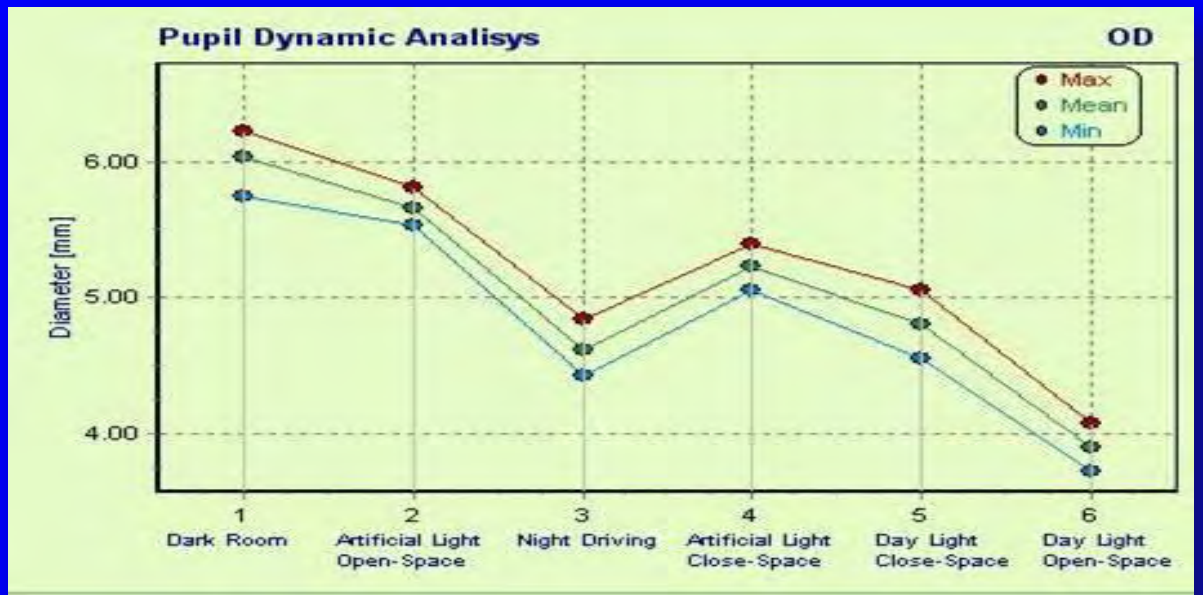
Anterior Elevation Map

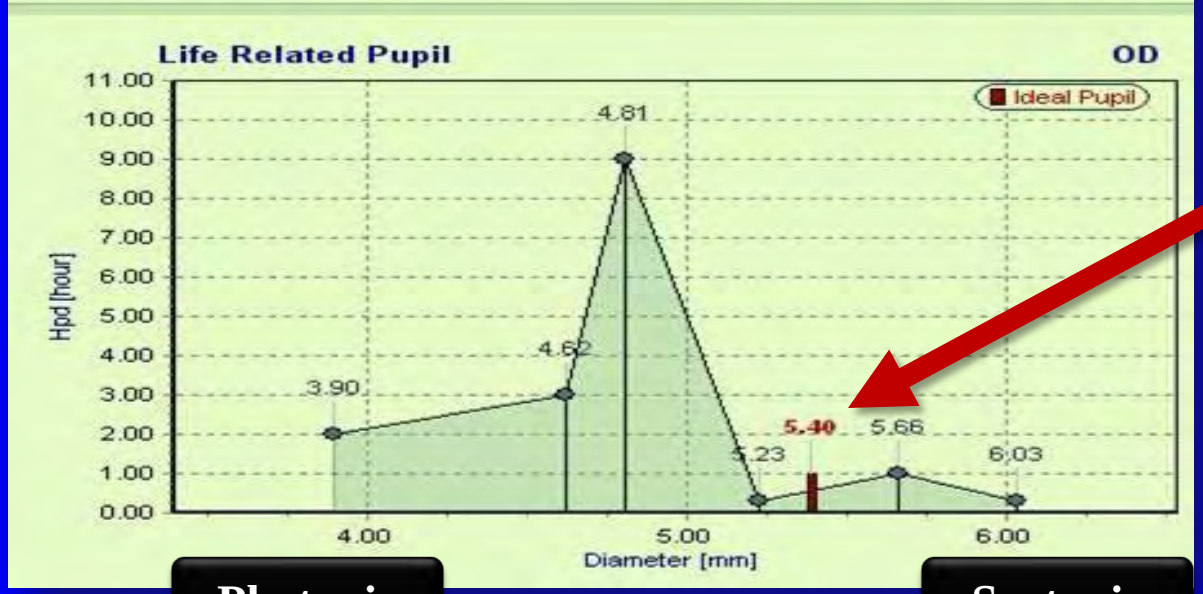
Posterior Elevation Map

3-D Pachymetry Map

CLAT is based upon high resolution pachymetry data

Pupillometry: pMetrics





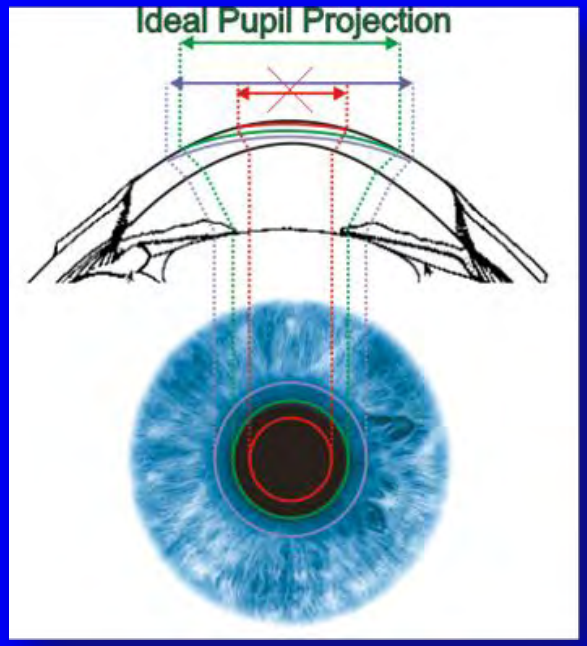
Photopic

Scotopic

Pupil size is determined in six lighting environments and statistically analyzed with lifestyle weightings.

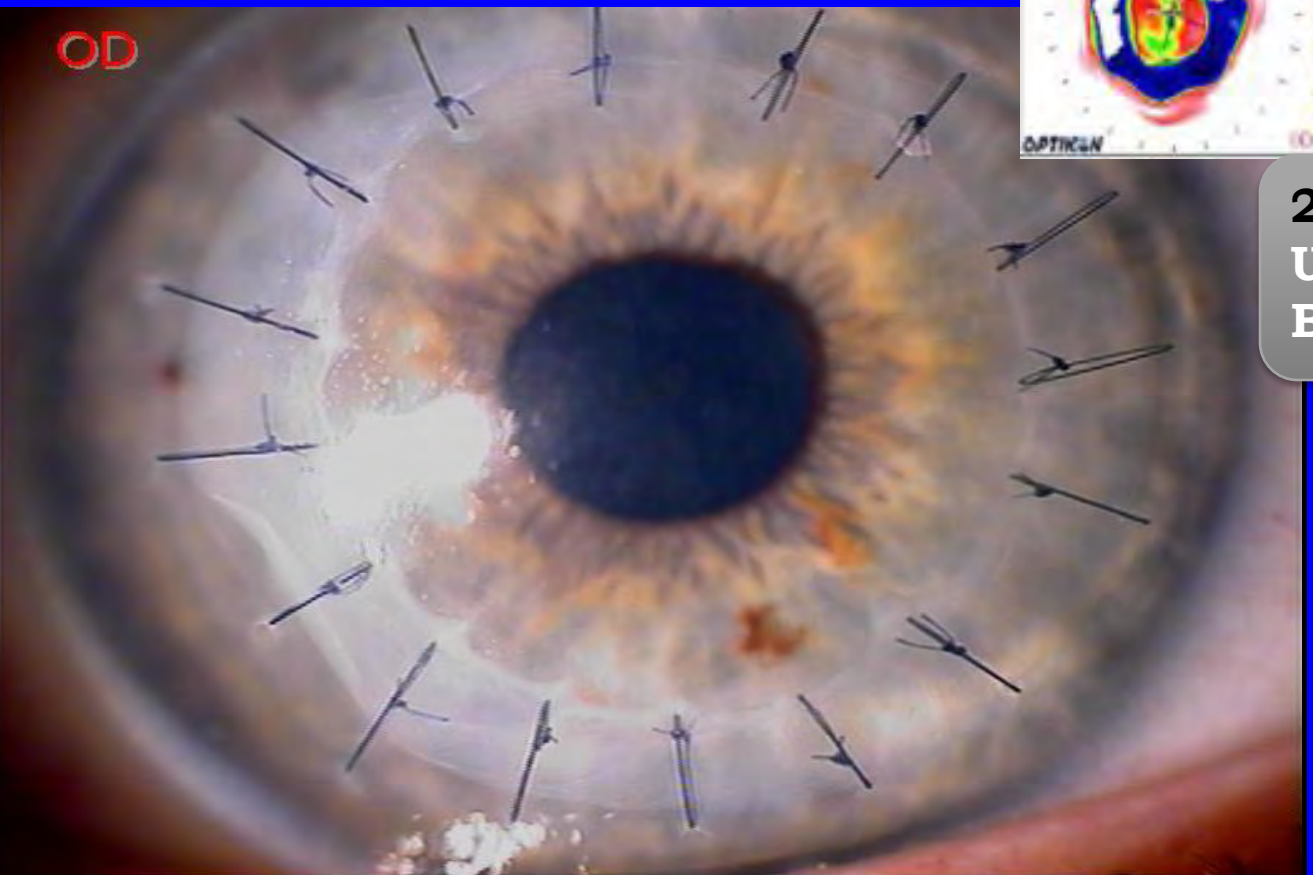
The result = the Ideal Pupil

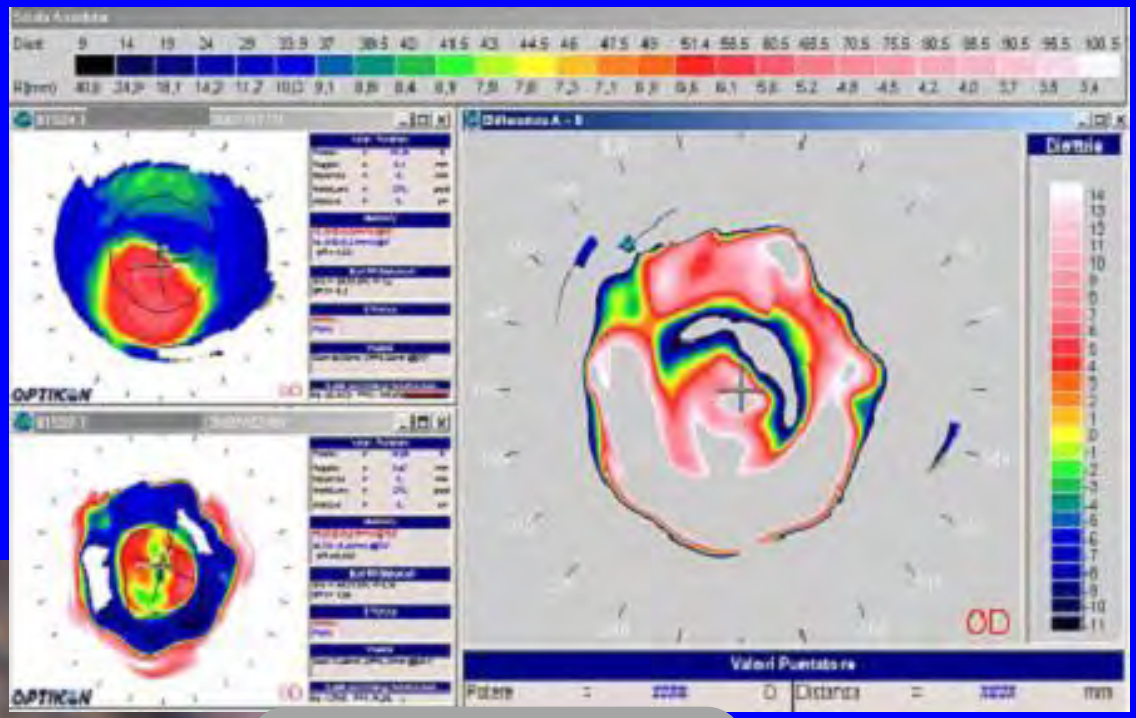
Ideal Pupil™



Case Study

F.D. ♂
21YO RE

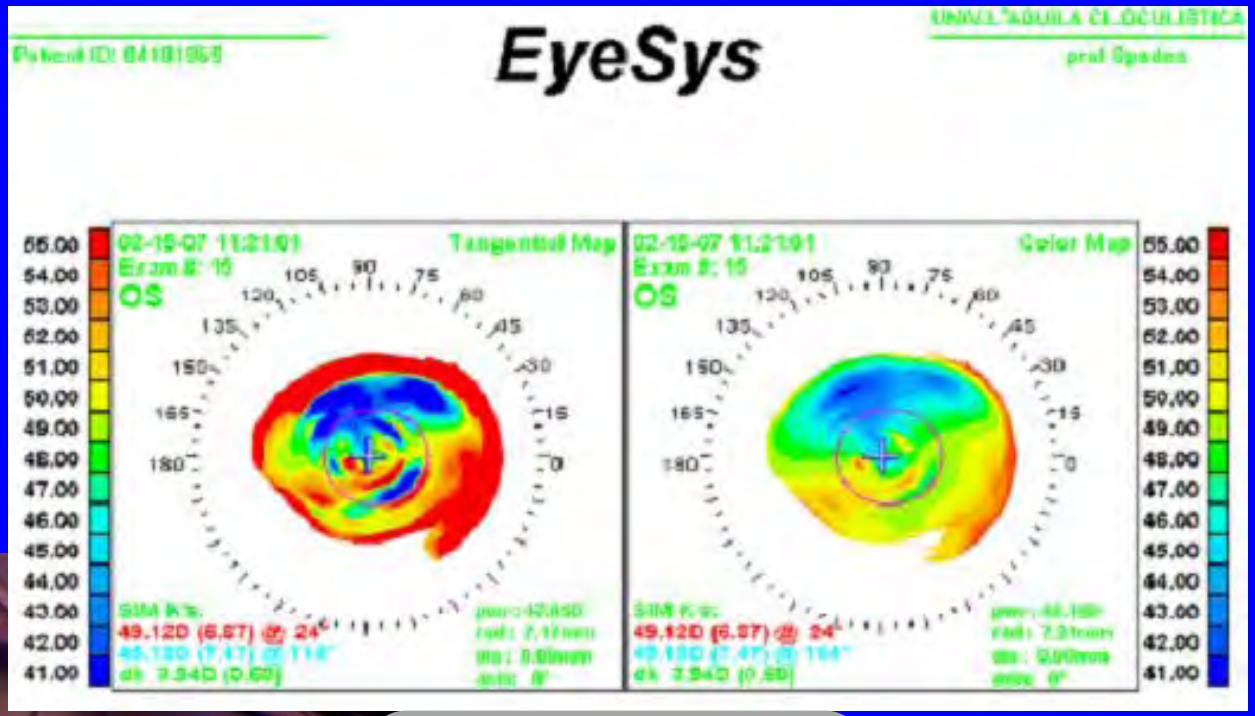


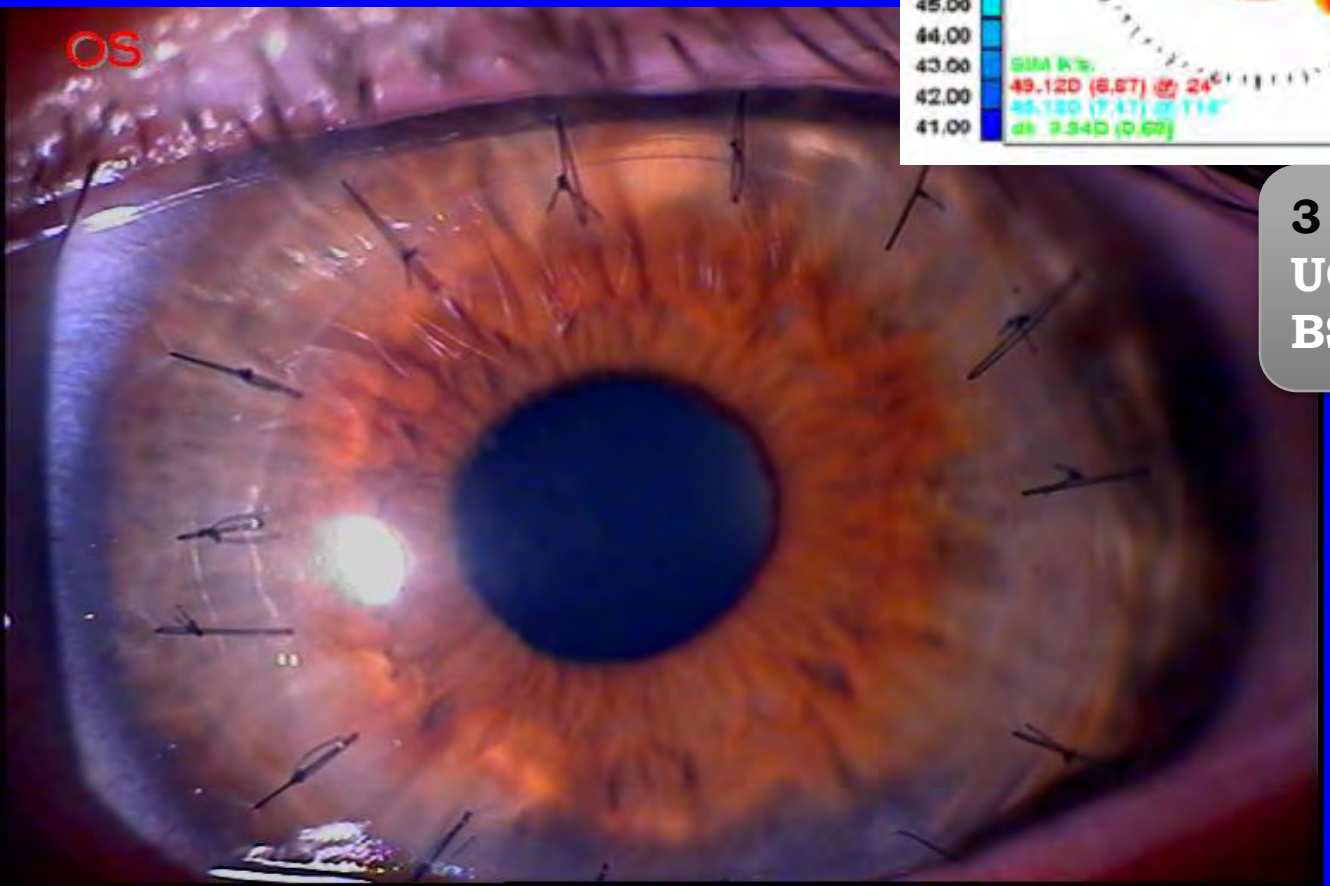


2 mos Post-Op
UCVA 3/10
BSCVA 5/10

Case Study

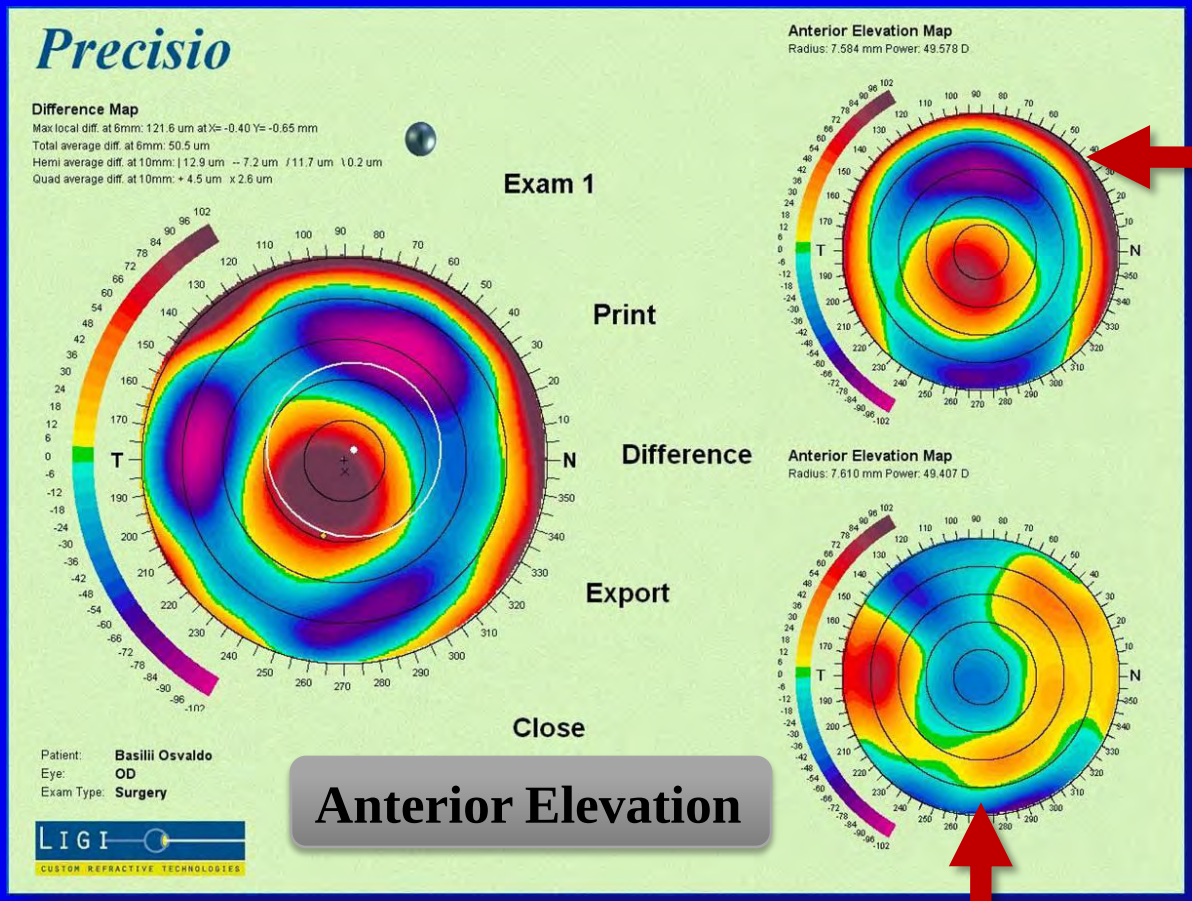
C.R. ♂
49 YO LE





3 mos Post-Op
UCVA 2/10
BSCVA 7/10

Case Study: BO

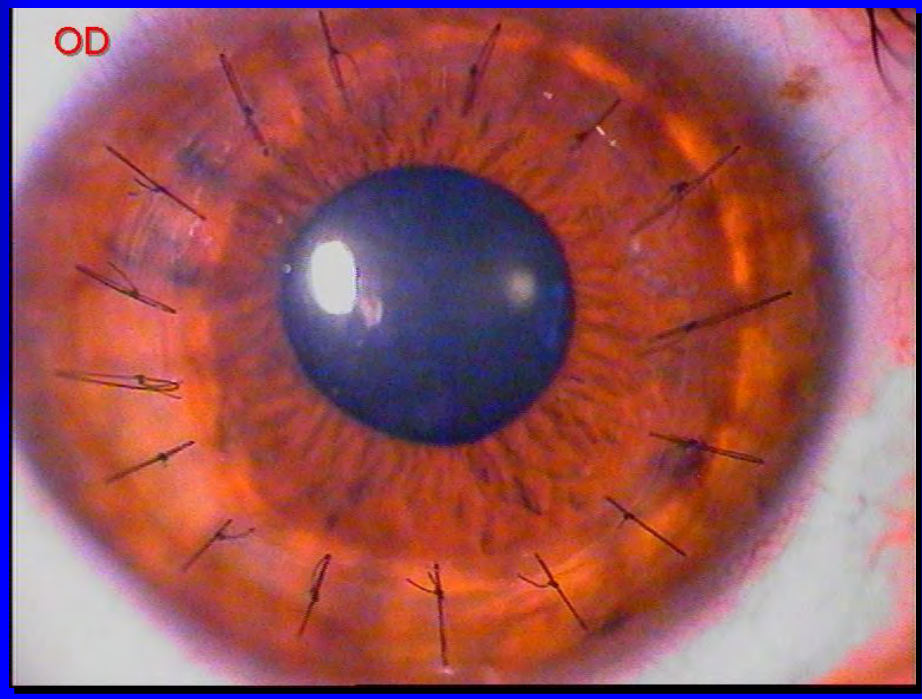


Anterior Elevation

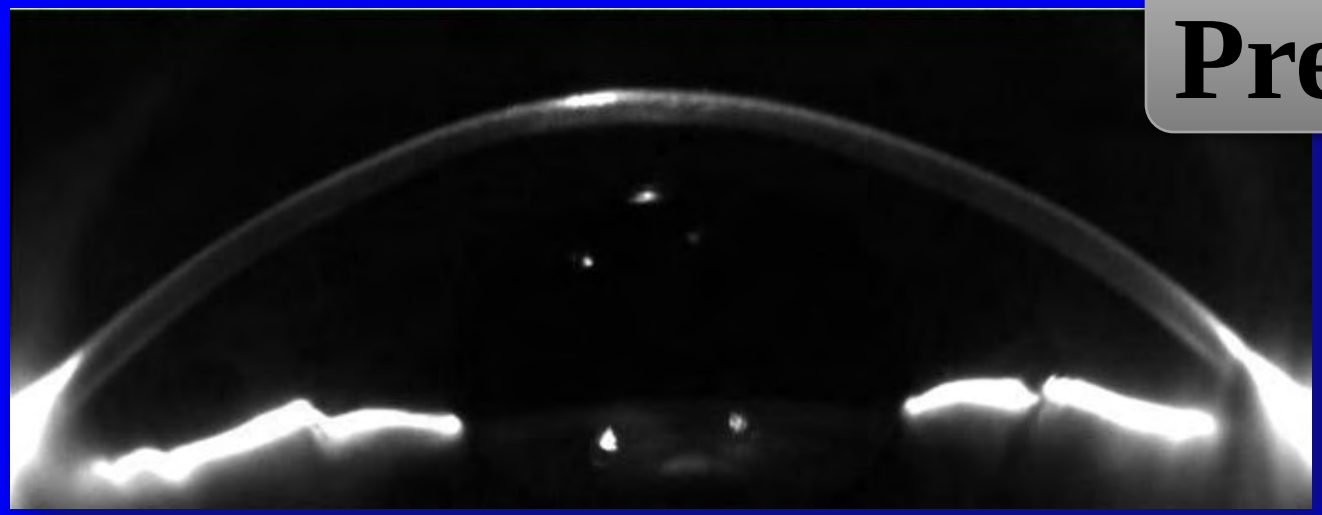
46 YO ♂ RE

Pre-Op
-8.00 -5.00 X 180 4/10
K: mean 54.60 D
apex 62.80 D

Post-Op
-1.00 -0.75 X 180 8/10
K: mean 41.20 D
vertex 32.67 D

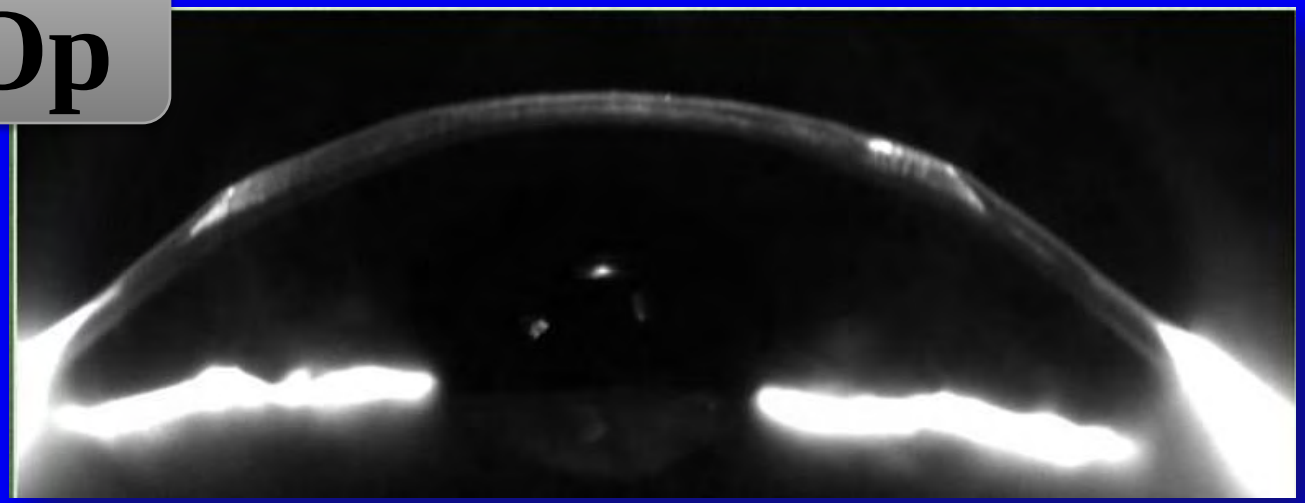


Case Study: BO



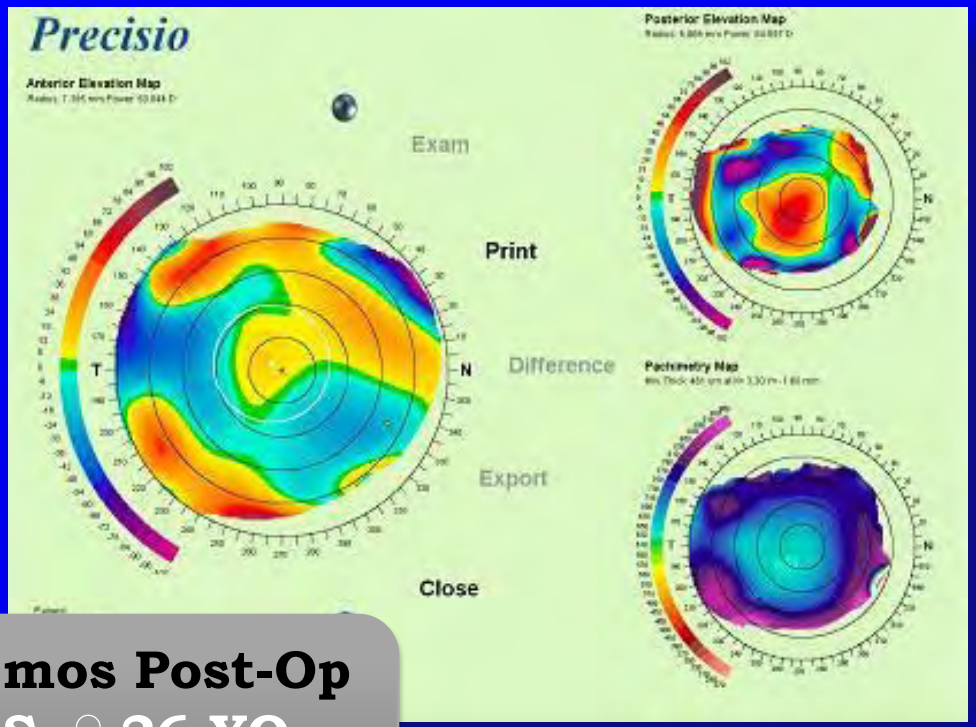
Pre-Op

Post-Op

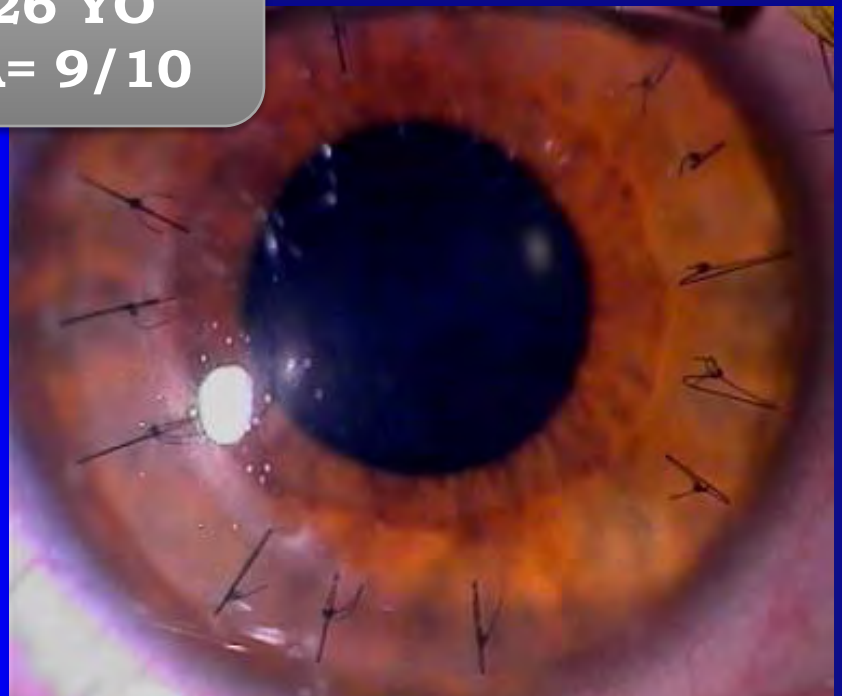


Case Studies

3 mos Post-Op
M.L. 29ys ♂ LE
BSCVA = 6/10



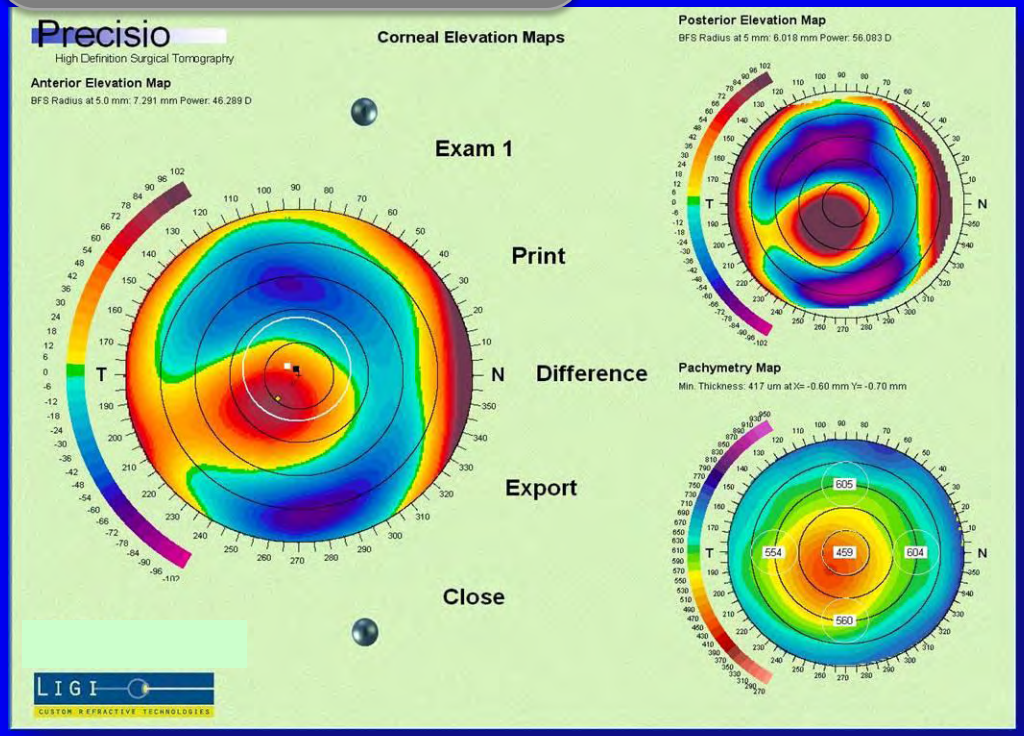
6 mos Post-Op
P.S. ♀ 26 YO
BSCVA= 9/10



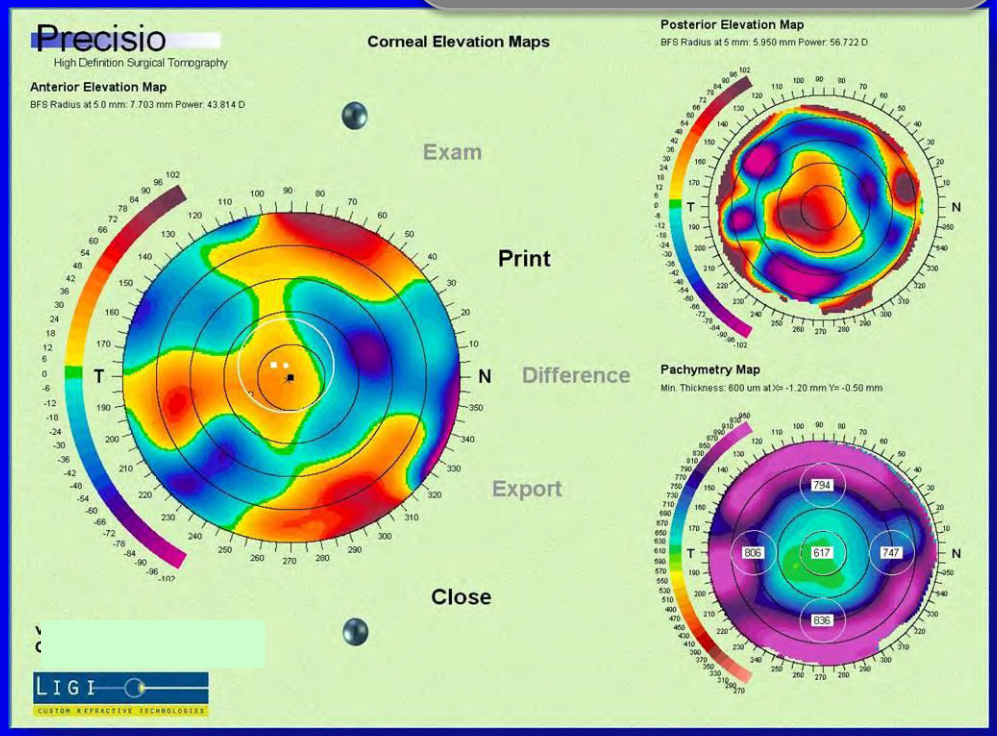
Case Study

V.V. ♂ 30 YO

Pre-Op
-11.00 -2.50 X 160
BSCVA = 4/10

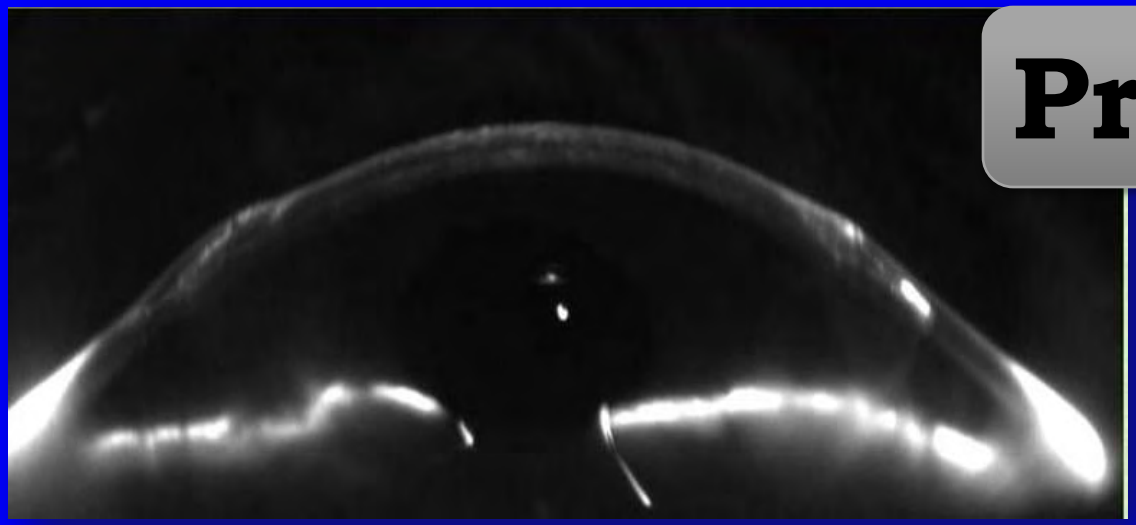


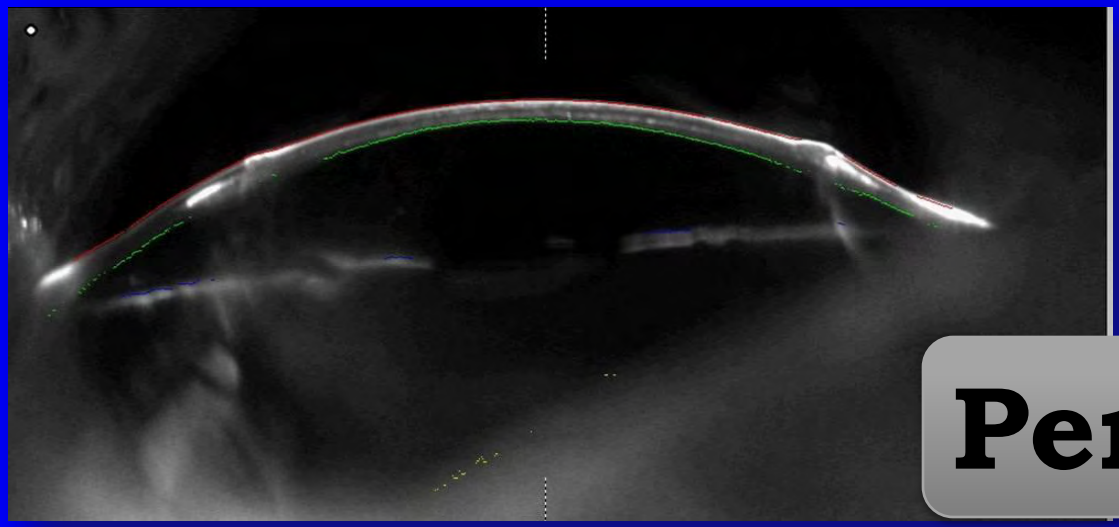
6 mos Post-Op
-1.00 +1.50 X 20
BSCVA = 8/10



Case Study

V.V. ♂ 30 YO

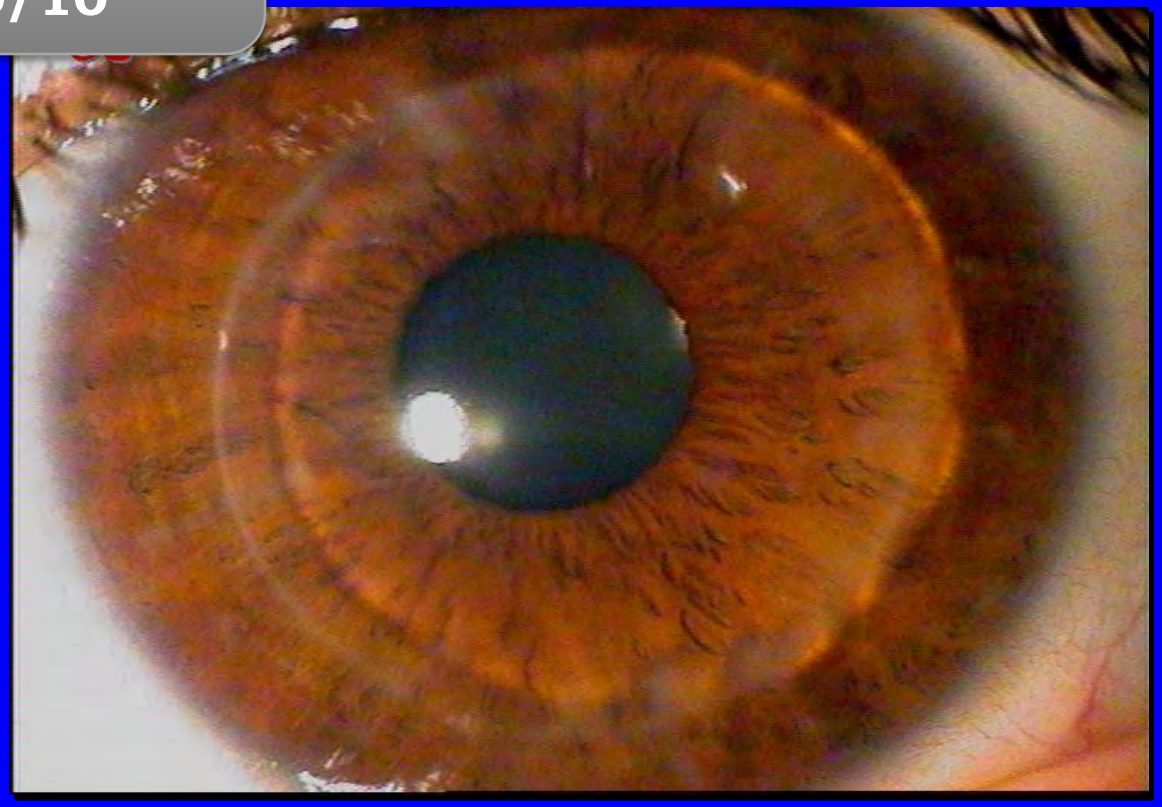




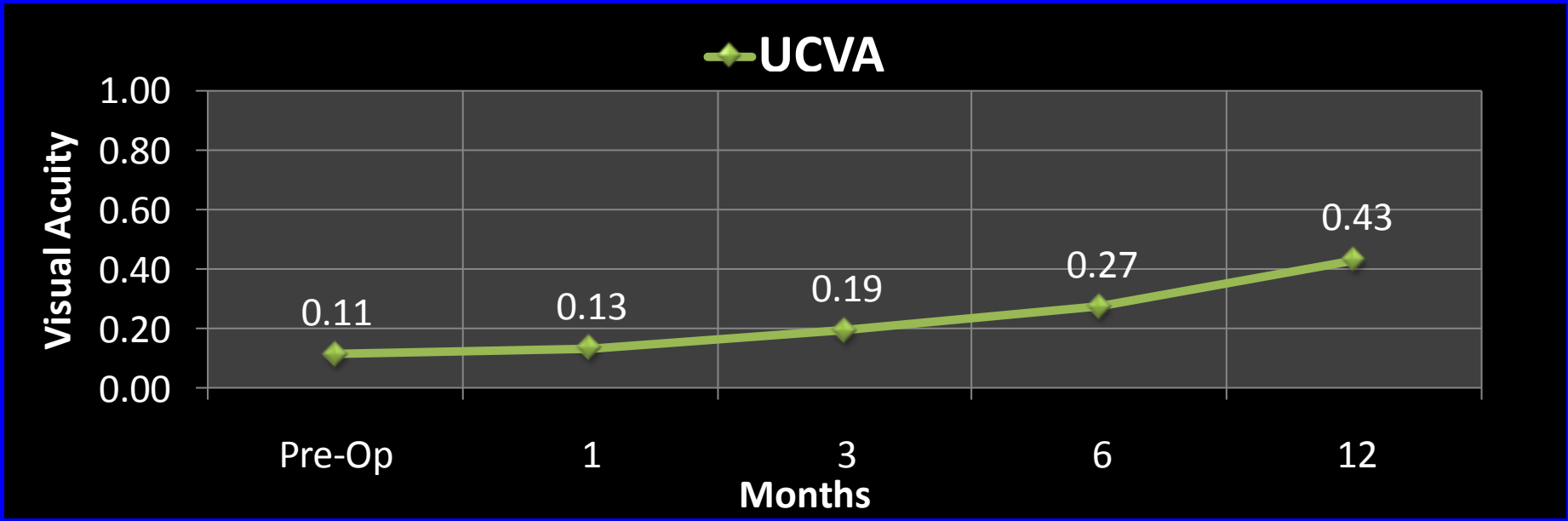
Case Study

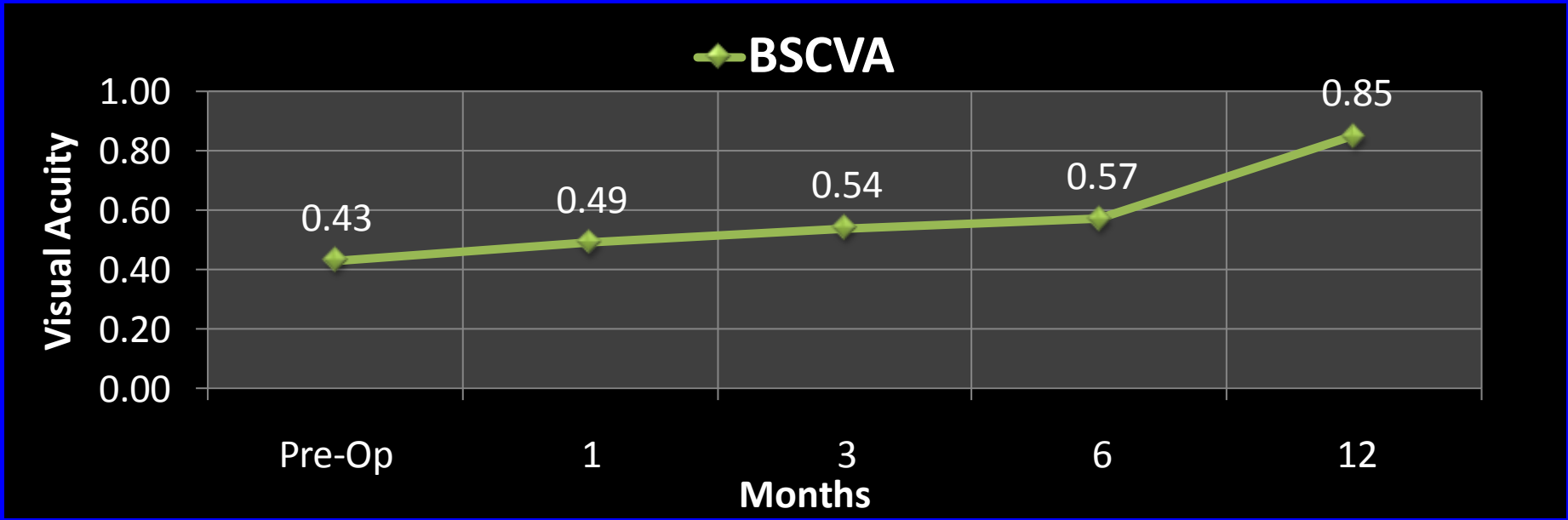
R.L. ♀ 38 YO

18 mos Post-Op
UCVA = 5/10
BSCVA= 10/10

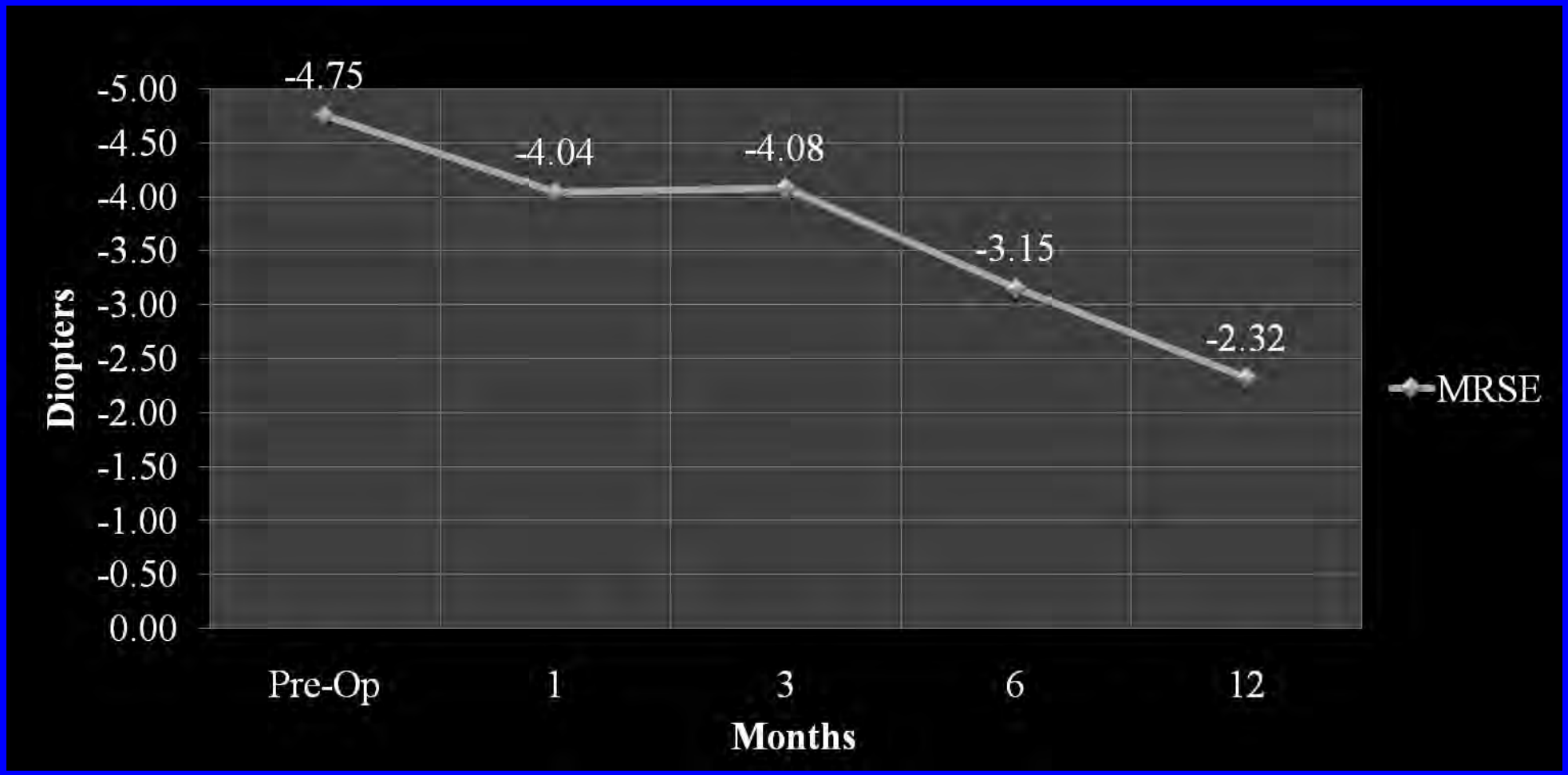


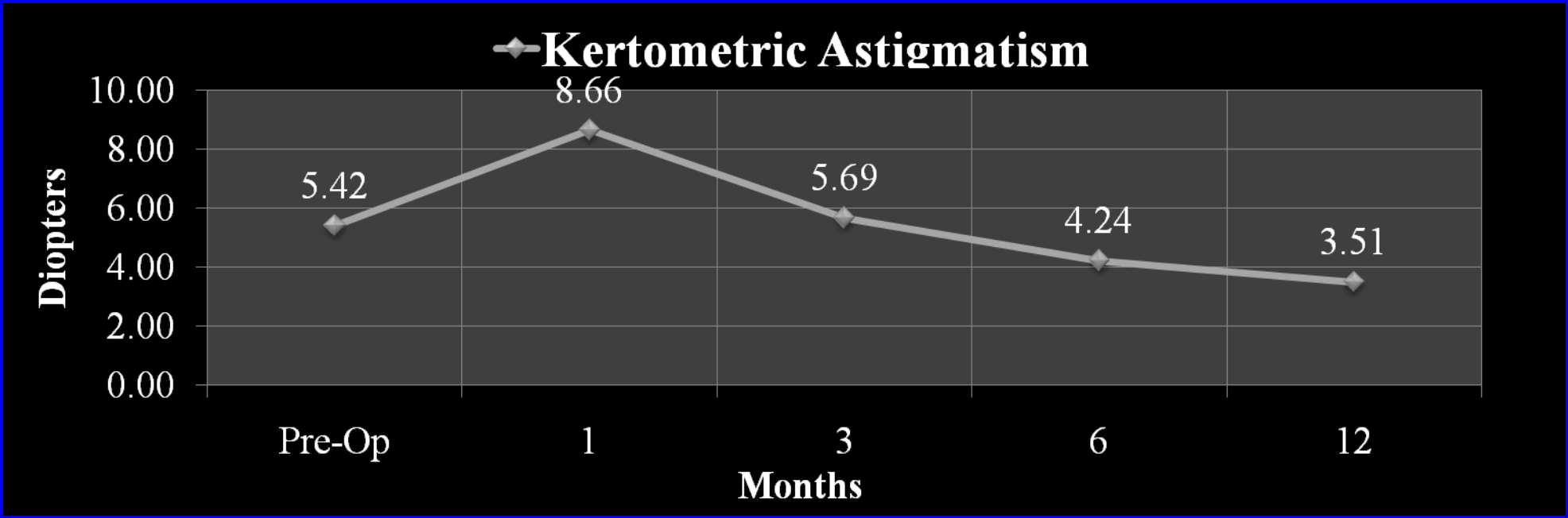
CLAT: Results

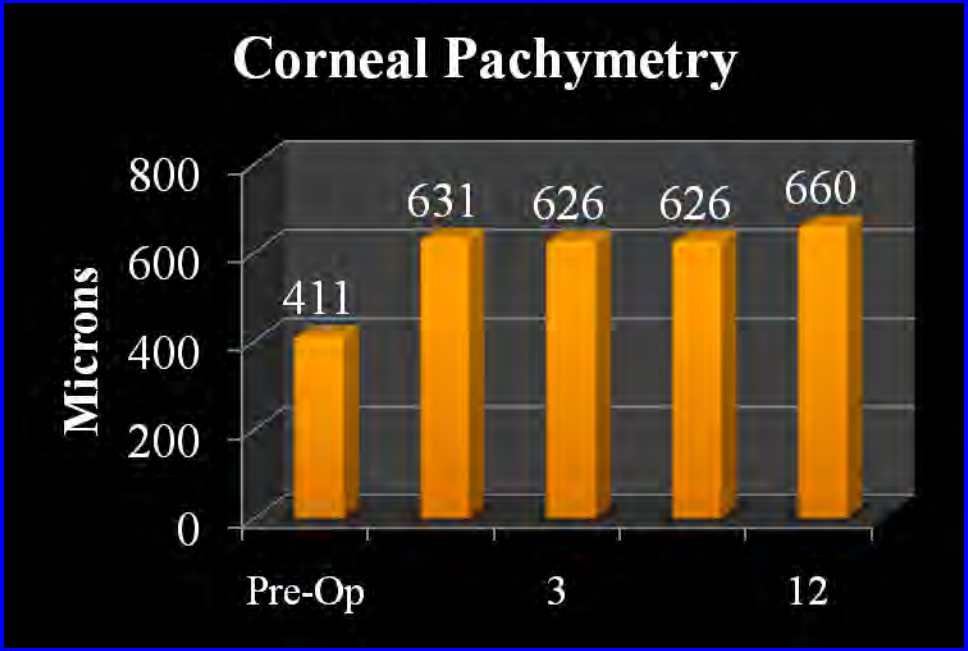


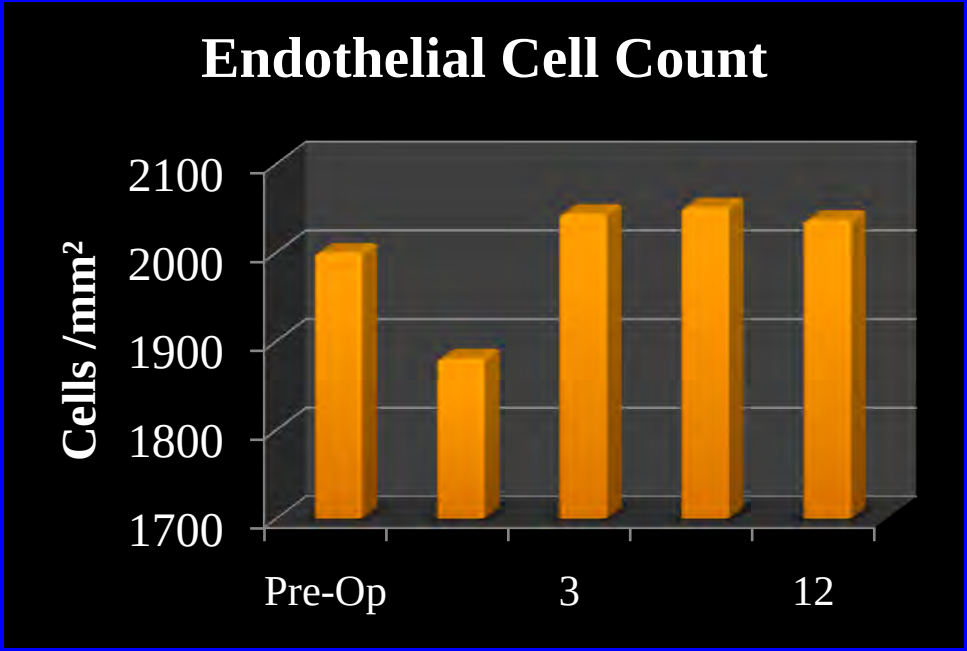
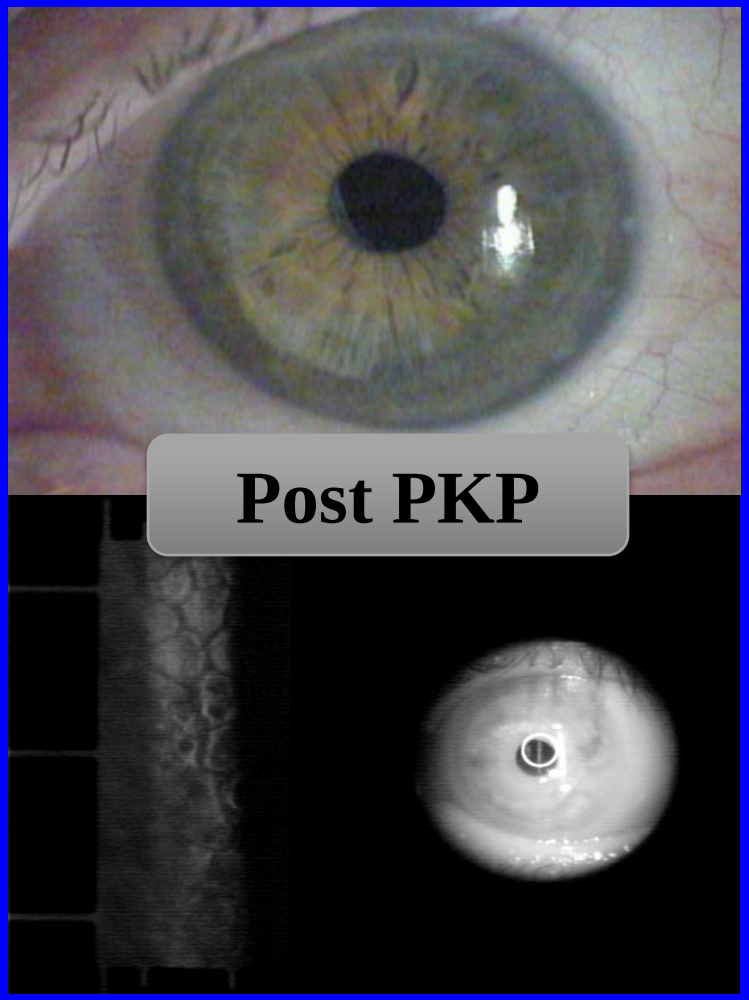
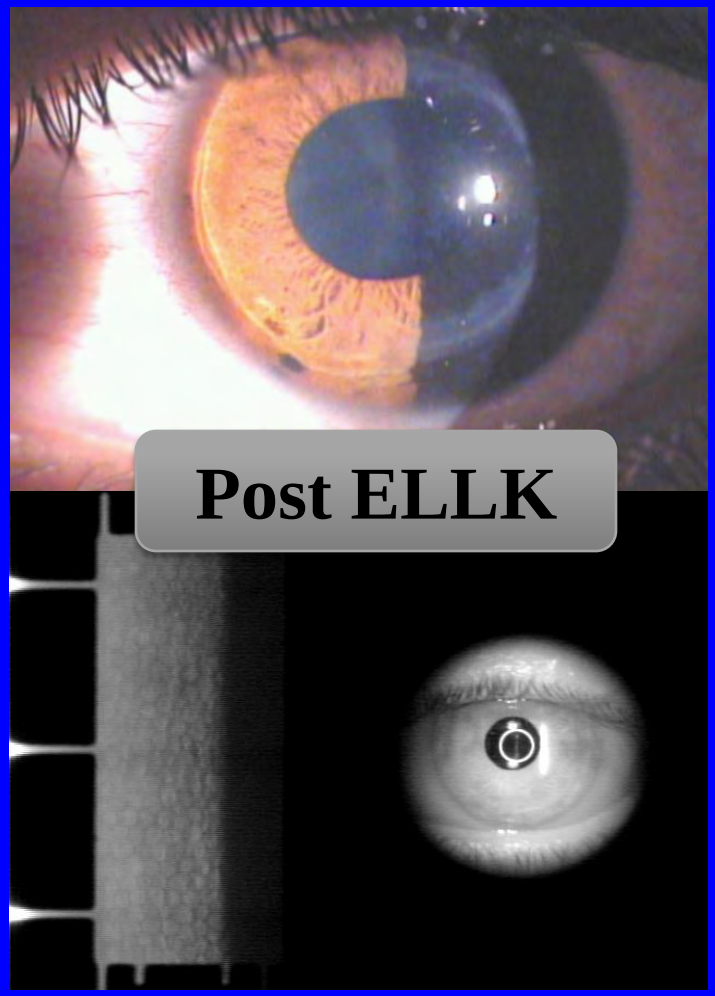
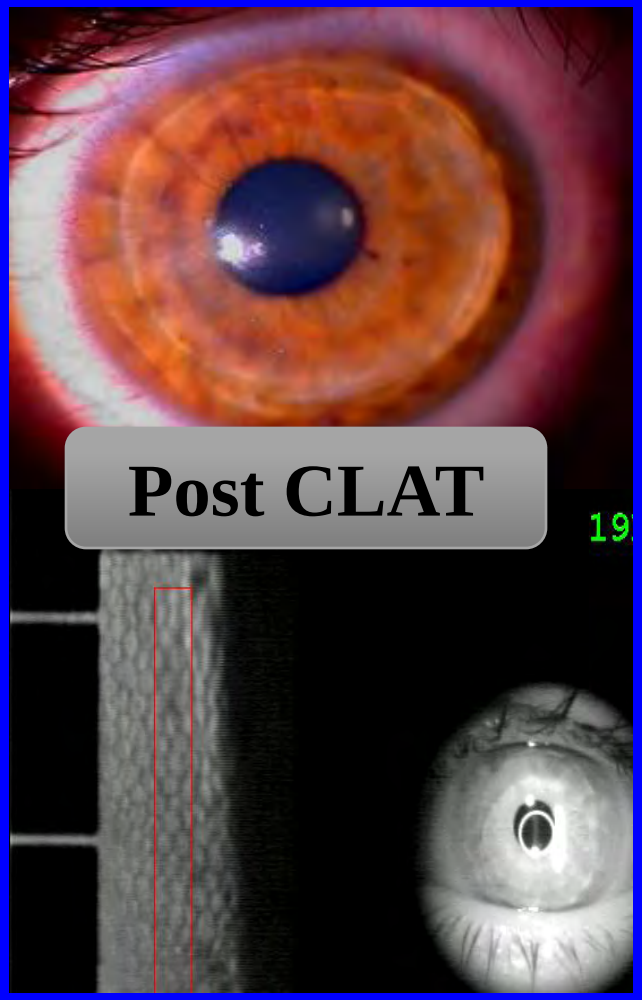


MRSE


-5.00
-4.50
-4.00
-3.50
-3.00
-2.50
-2.00
-1.50
-1.00
-0.50
0.00
Diopters
-4.75
-4.04
-4.08
-3.15
-2.32
Pre-Op
1
3
6
12
Months
MRSE


Kertometric Astigmatism
Diopters
10.00
8.00
6.00
4.00
2.00
0.00
5.42
8.66
5.69
4.24
3.51
Pre-Op
1
3
6
12
Months


Corneal Pachymetry
Microns
800
600
400
200
0
411
631
626
626
660
Pre-Op
3
12


Endothelial Cell Count
Cells /mm²
2100
2000
1900
1800
1700
Pre-Op
3
12

Endothelial pattern