

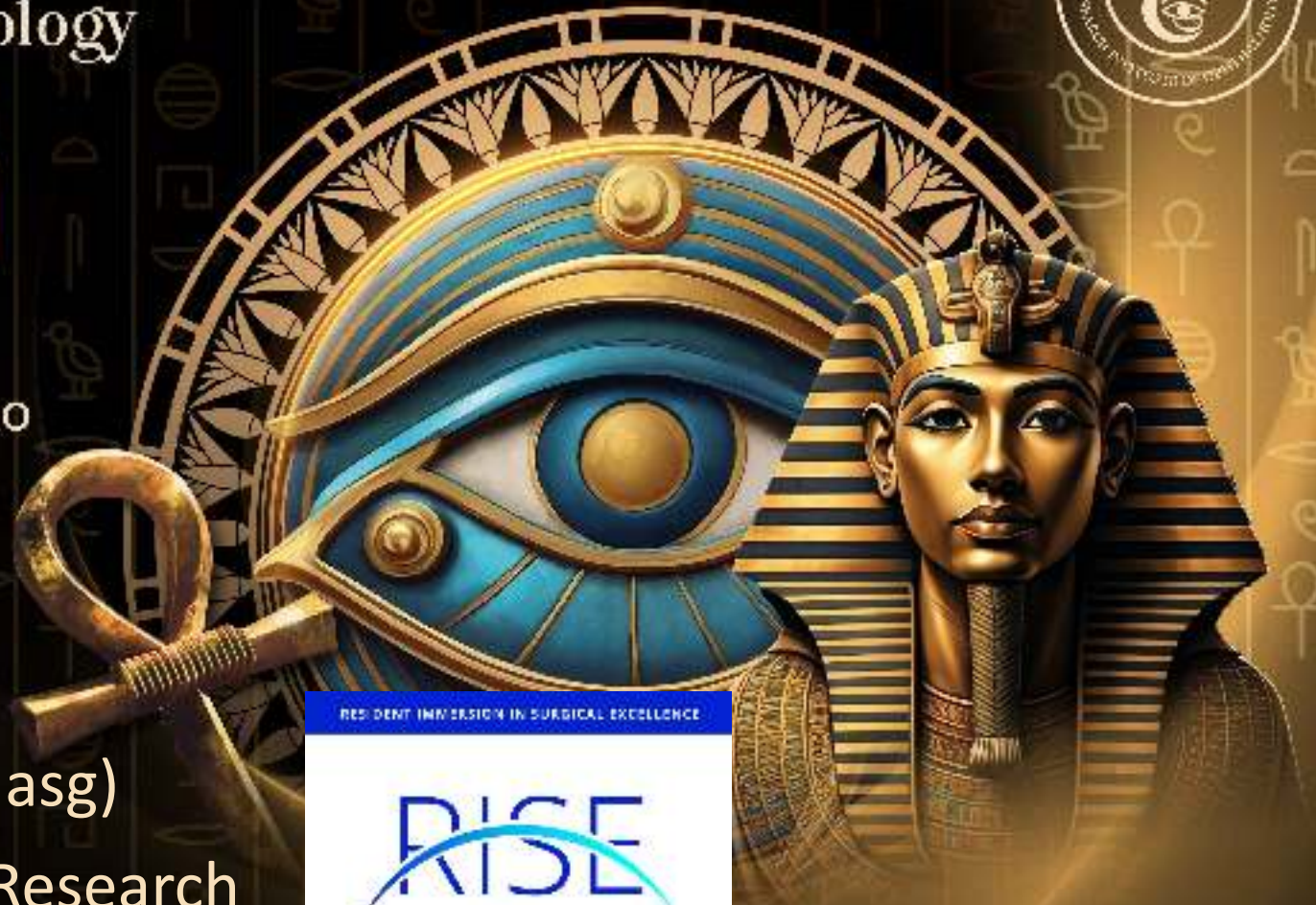
18th International Conference of the
Research Institute of Ophthalmology

RIO 2026

22 -23 JANUARY 2026
ROYAL MAXIM PALACE KEMPINSKI, CAIRO

Advanced Refractive Surgery

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Institute of Ophthalmology (RIO)
A. Professor of Ophthalmology



Current modalities of LVC

- Surface ablation
- LASIK
- KLEx

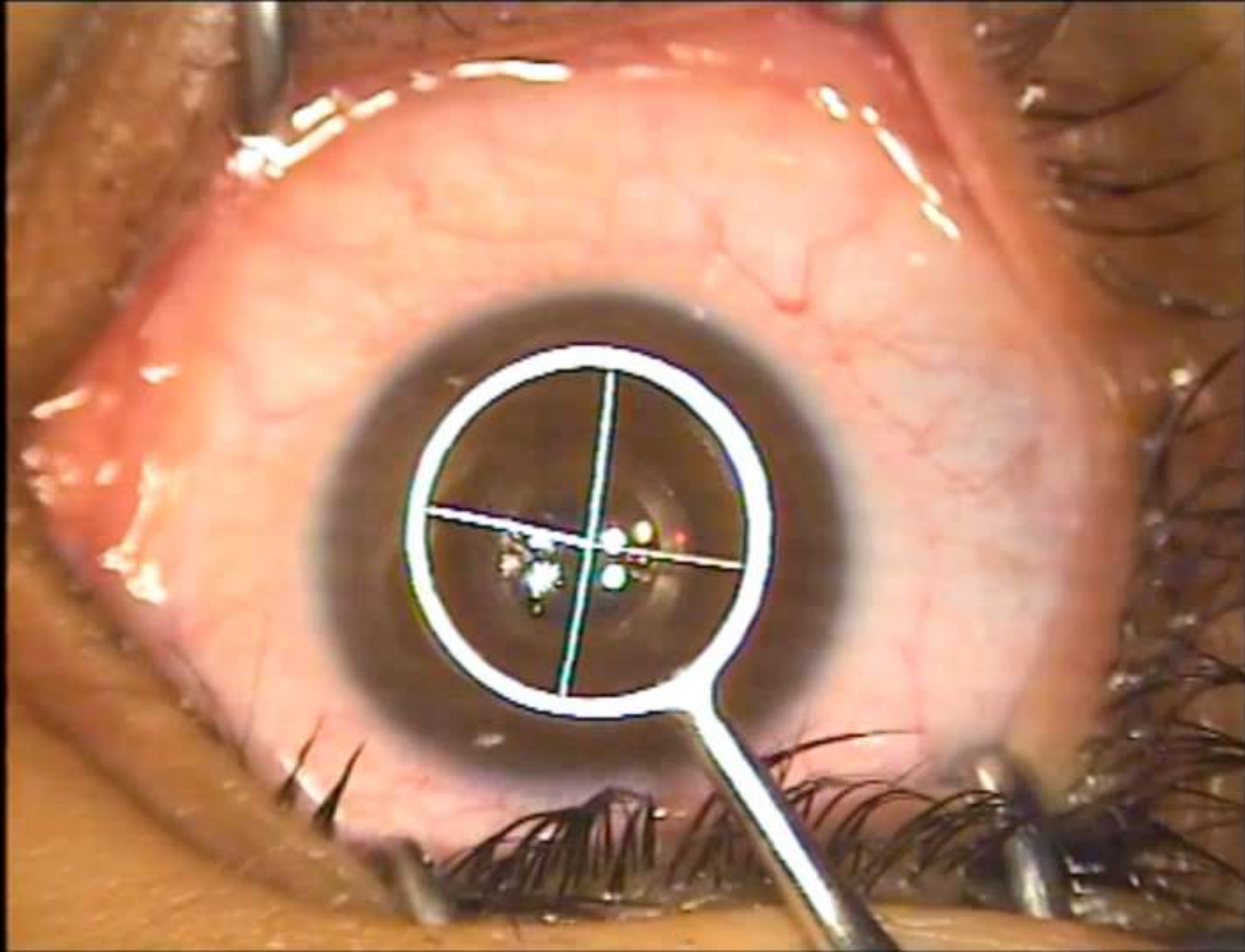
Surface Ablation

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PRK

- The oldest method is to scrape the epithelium off with a blade or semi-sharp spatula.





Advanced Surface ablation Techniques (ASAt)

- A second method is removal of the epithelium with the laser.
- A third method of epithelial removal is Epilasik. With this method a suction device is placed on the eye to hold it, and a blunt blade is used to remove the epithelium in a sheet.
- A fourth method is the use of 20% alcohol on the cornea in a 9 mm holding cup for 30 seconds.

TransPRK

- Everything in one profile (epithelium removal + refraction)
- The epithelium removal is refractive neutral, which means no extra amount of refraction is induced
- Central epithelial thickness 55 μm
- Peripheral epithelial thickness at 8 mm diameter 65 μm
- Calculation is based on two different ablation values per pulse; as laser ablates more tissue per pulse in the epithelium than it does in the stroma

TransPRK in regular corneas

- Compared to LASEK and PRK, treatment with TransPRK speeds up the healing process.
- Visual outcomes are achieved significantly earlier even in high myopic eyes (>8 D).
- It does not require suction of the eye.
- It offers higher safety for the patient

TransPRK in irregular corneas

- TransPRK in combination with corneal wavefront allows maximum correspondence between the corneal topography and the ablation profile.
- It is preferable for patients who need retreatment after RK or corneal transplantation.
- It can be used to treat haze, scarred corneal tissue and keratoconus before corneal collagen crosslinking.

TransPRK: advantages

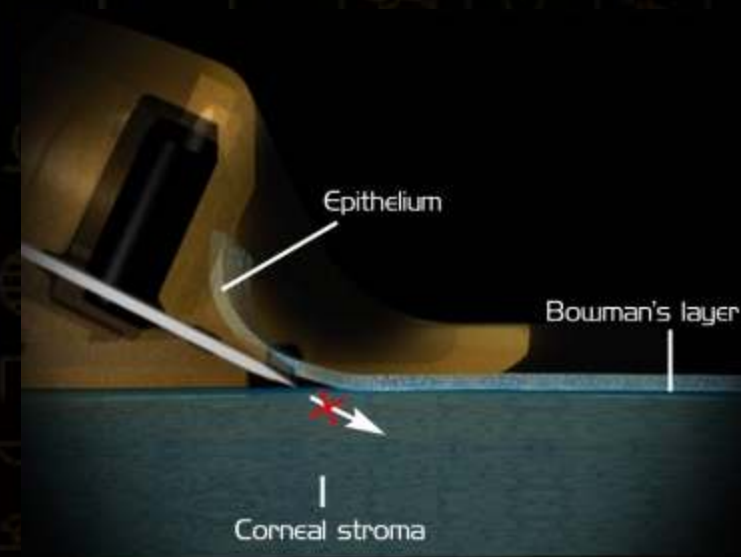
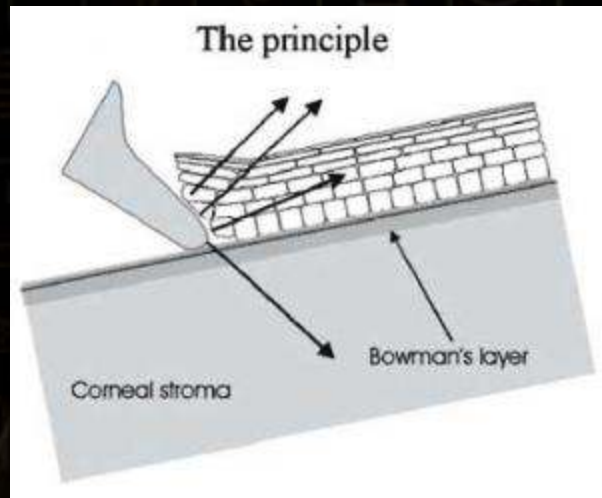
- Only one step (much faster than 2 steps, less dehydration)
- Can be combined with Aberration-Free, Corneal WF and Ocular WF
- No alcohol required
- The removed epithelium has the same diameter like the refractive correction
- Fast healing process
- Easy!!

Epi-LASIK

- Another option for separating the corneal epithelium before surface ablation.
- It evolves from its predecessors PRK and LASEK.
- PRK: Postoperative pain and haze?
- LASEK: The safety of alcohol use in LASEK?

Epi-LASIK: The Idea

- The epikeratome is a blunt blade that excises the epithelial layer without dissecting into the corneal stroma.
- The epithelium is cleaved below its basement membrane and lifted to expose Bowman's membrane.
- Instrument parameters such as suction pressure, head advance speed and oscillation frequency of the blade must be optimized to facilitate a smooth separation of the corneal epithelium.
- Epithelial separators, in comparison with LASIK microkeratomes, provide greater suction pressure and slower head advance speeds.



ASAt: Patient Selection Profile

- Low to moderate myopia and myopic astigmatism
- Thinner corneal thicknesses
- Individuals with steeper or flatter corneas, where the cutting of a LASIK flap could potentially impose flap related complications
- Patients who are apprehensive about the use of the microkeratome to cut a flap of corneal tissue like the idea of a bladeless procedure like epi-LASIK.
- ASAt can also be considered for patients whose lifestyles involve potential ocular trauma, such as athletes or military personnel.

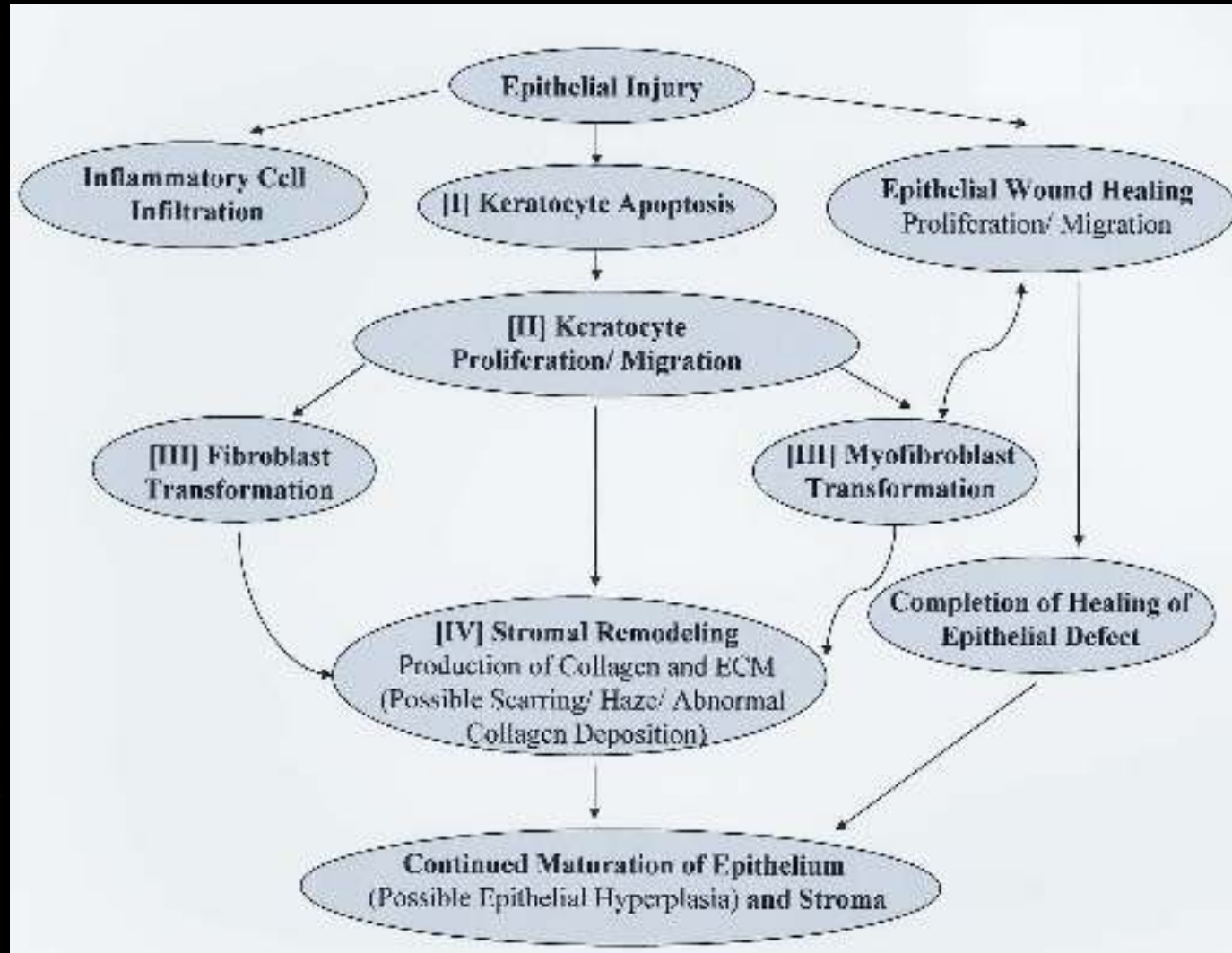
ASAt: Complications

- ASAt involves slower recovery in comparison with LASIK and some degree of pain and discomfort for a few days after the procedure.
- Postoperative haze.
- Prolonged use of steroids → Glaucoma

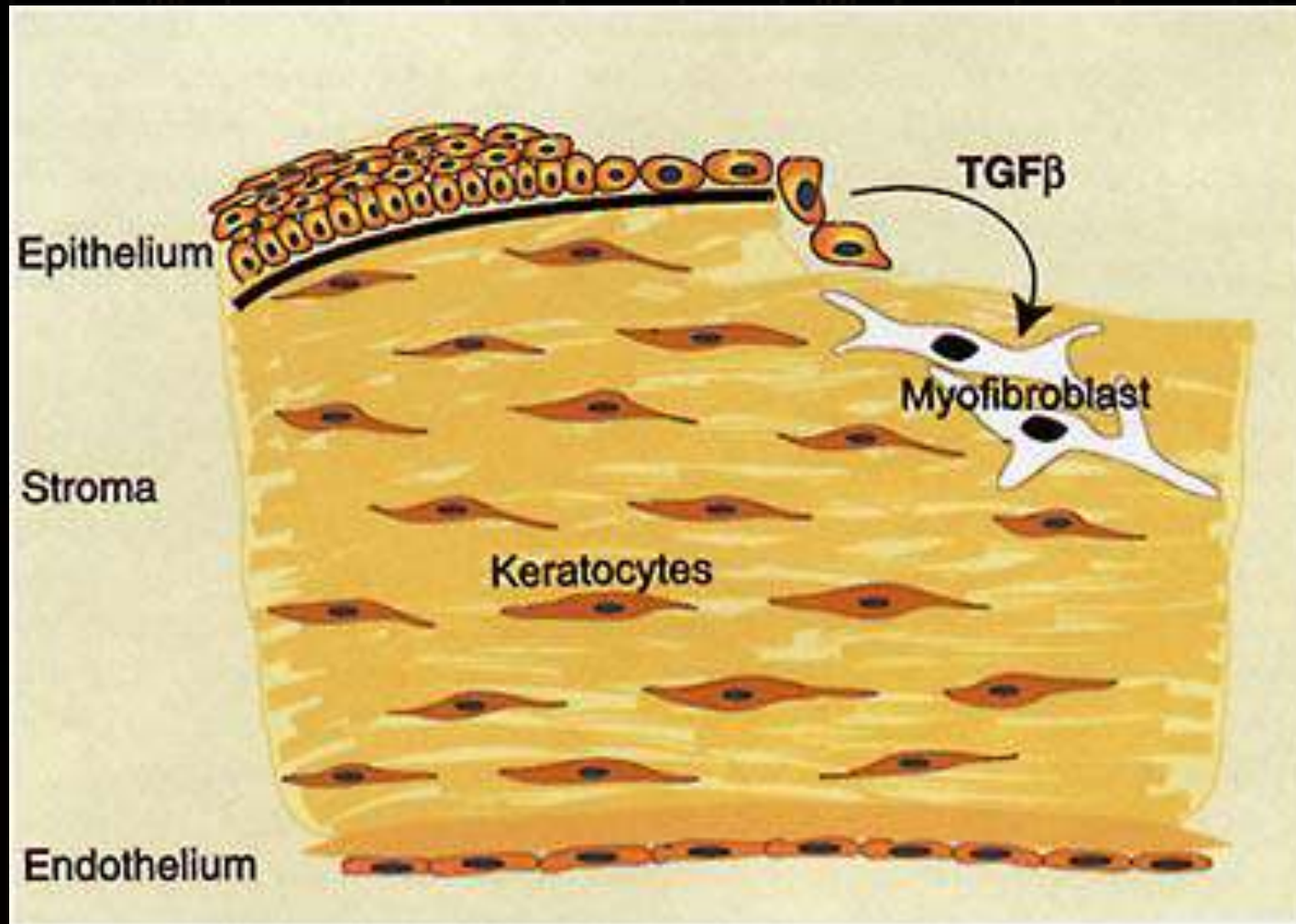
What happened!!

- The wound healing cascade is initiated by epithelial injury and the overall response tends to be proportional to the extent of the epithelial trauma
- In uneventful LASIK, the epithelial trauma is significantly reduced and tends to be confined to the flap edge
- As a result of a direct epithelial-stromal interaction, the wound healing shows a hypercellular fibrotic stromal scar pattern
- Bowman's/epithelial basement membrane complex defects and the resulting increase in epithelial-derived cytokine (TGF- β) access to the stroma play a critical role in myofibroblast generation and haze

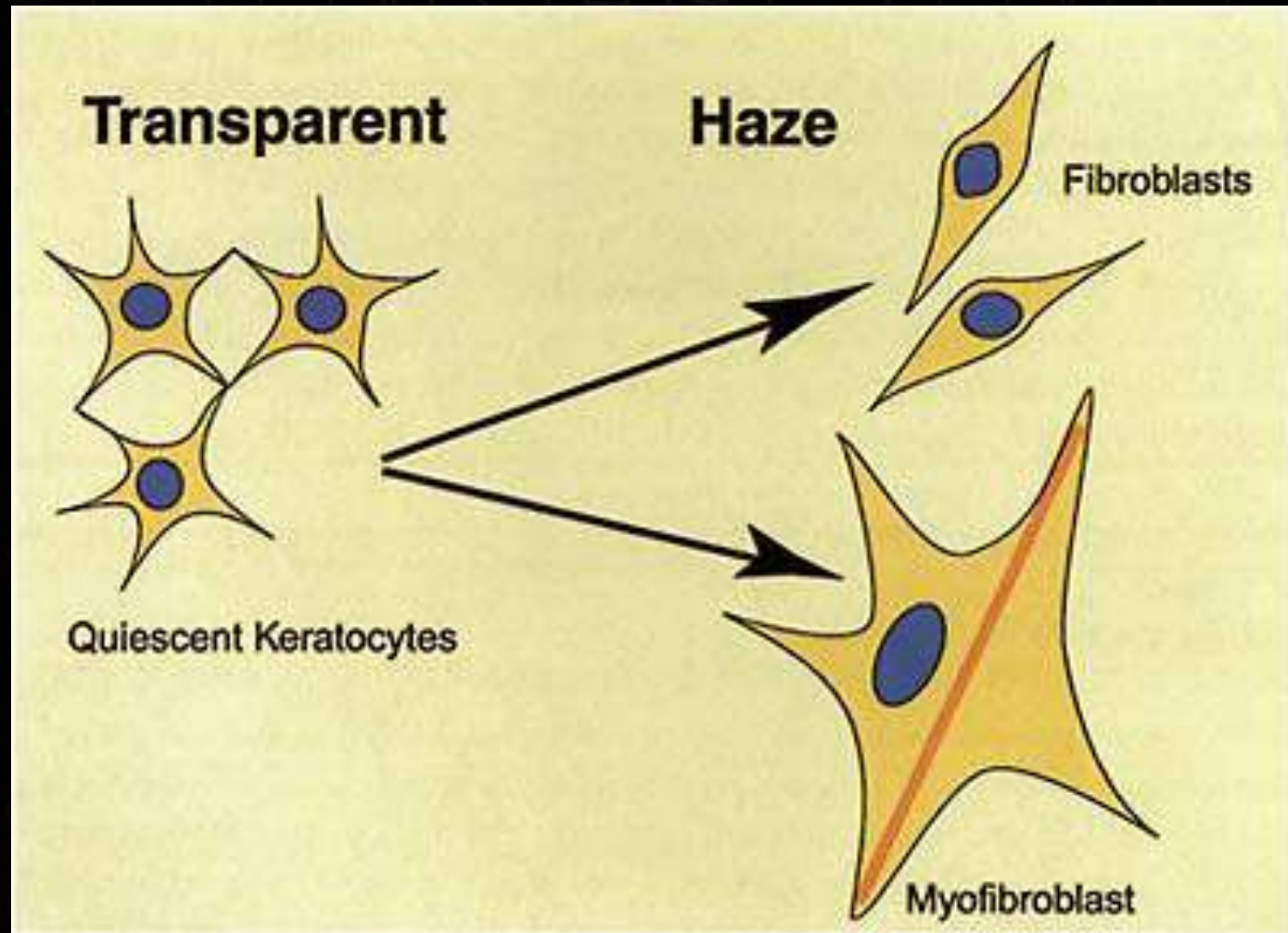
Wound healing cascade



Transforming growth factor β (TGF- β)

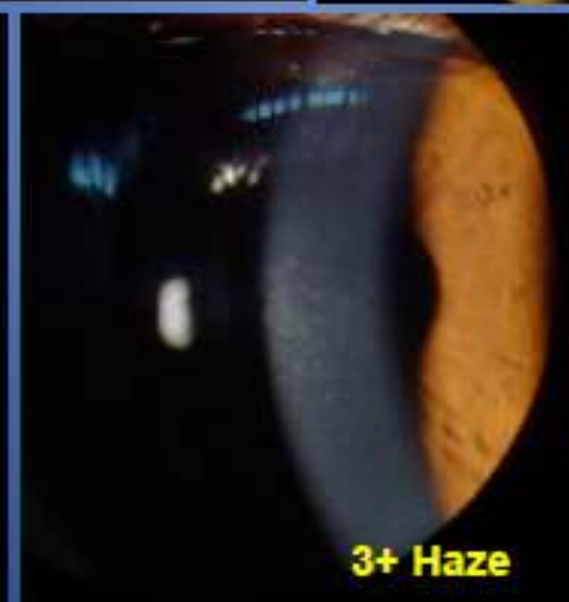


Haze formation



Haze Grading using Fantes scale

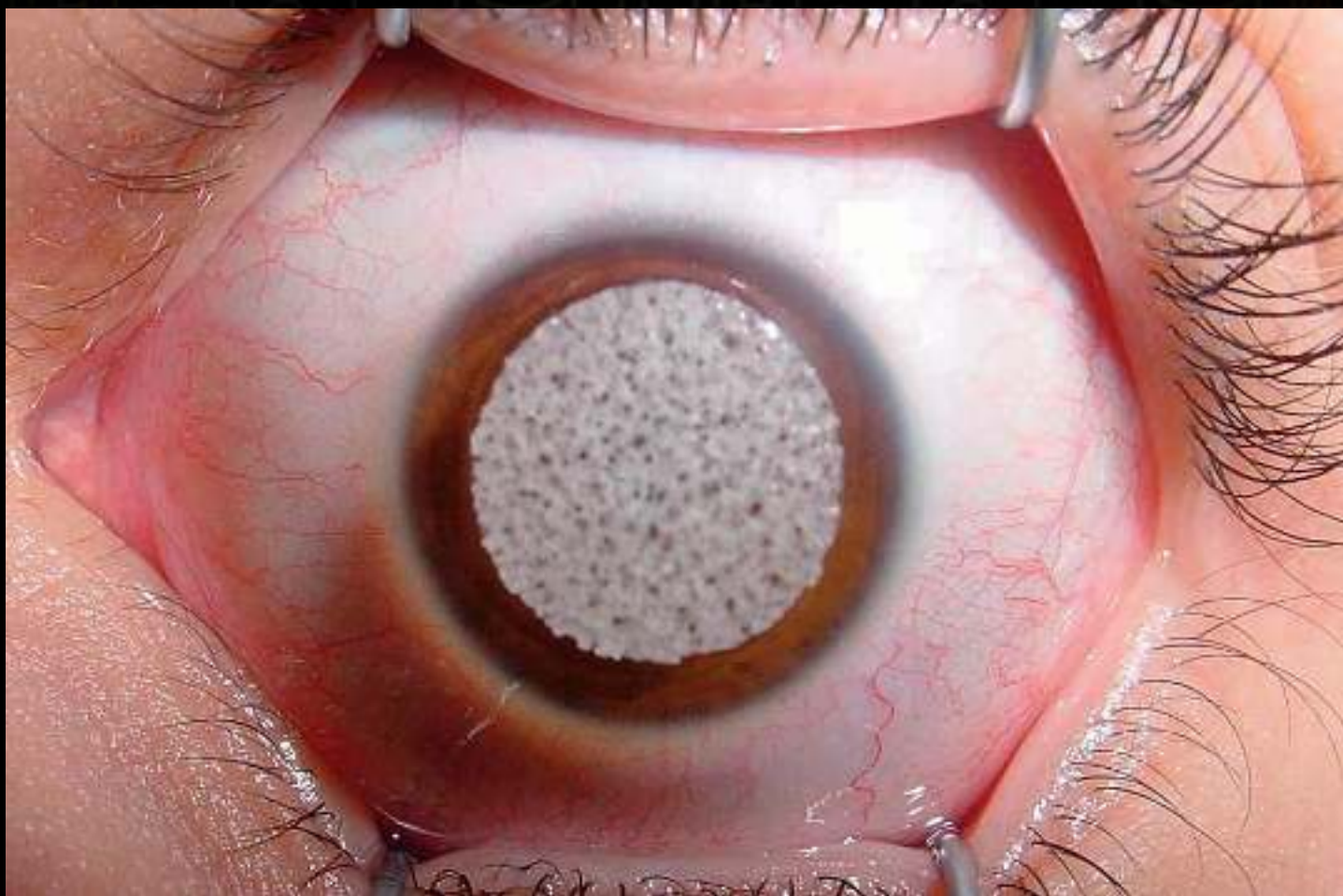
Fantes FE et al. Arch Ophthalmol. 1990 May;108:665-75



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Wound healing modulation

- A sponge soaked in Mitomycin C 0.02% would be placed on the corneal stroma for 10 sec to 2 minutes
- The cornea should irrigated with 30 mL of chilled BSS
- A bandage contact lens is then applied to the eye

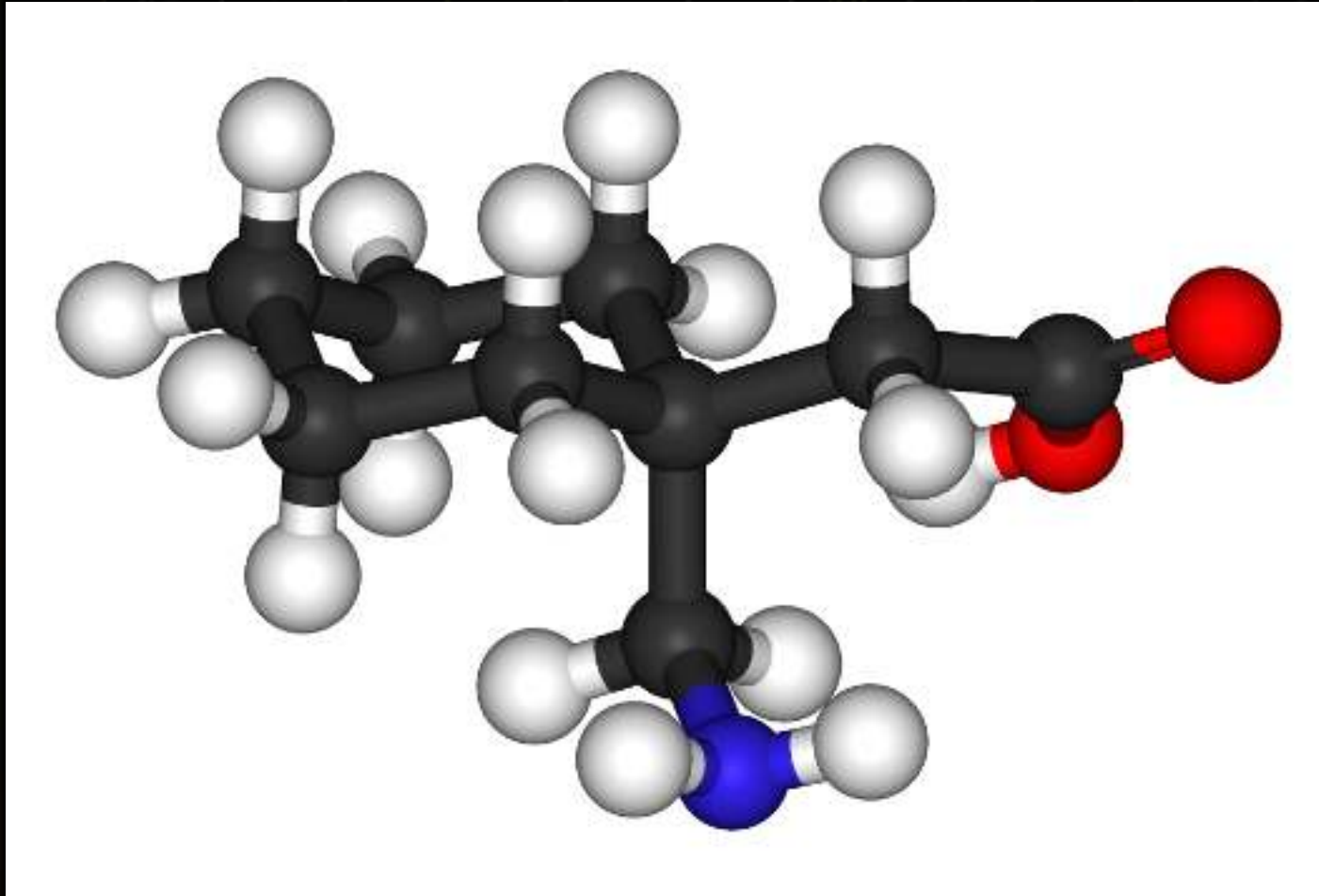


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Mitomycin C Role

- Mitomycin-C (MMC) is derived from *Streptomyces caespitosus*
- Its alkylating properties enable it to cross-link DNA between adenine and guanine, thereby **inhibiting DNA synthesis**
- Thus inhibits keratocyte activity

Pain Modulation



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“GABA IS A PAIN”, Nature Editorial DEC 2005

Pain Modulation

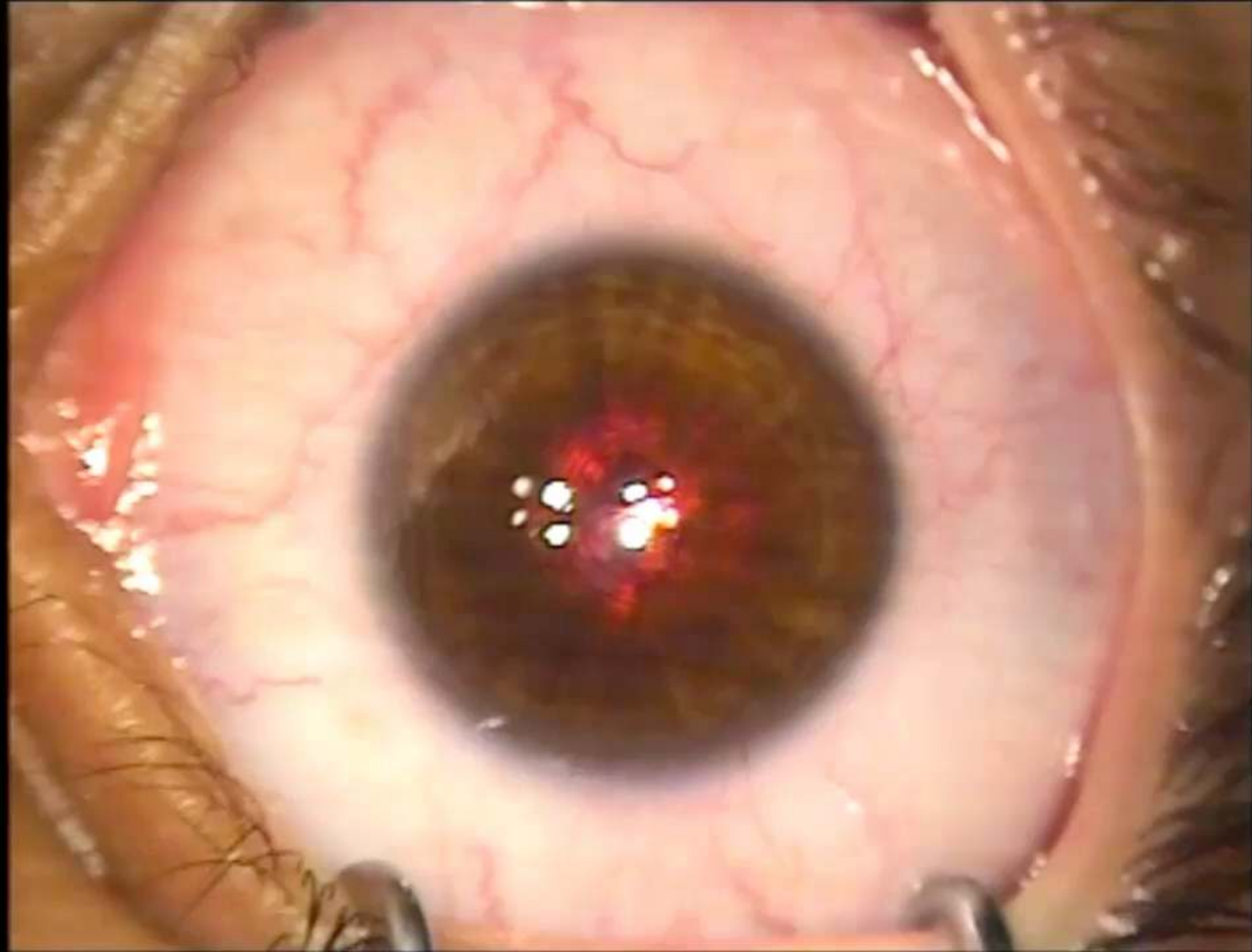
- The neurotransmitter , γ aminobutyric acid GABA, is playing an important role in transmission and perception of neuropathic pain
- GABA analogues 1-2 days before the surgery and continuing 1 or 2 days afterward increase pain threshold and improve comfort
- There are 2 analogues in the market:
 - Gabapentin (Neurontin) 300mg BID
 - Pregabalin (Lyrica) 150/75 mg BID

LASIK

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MK LASIK

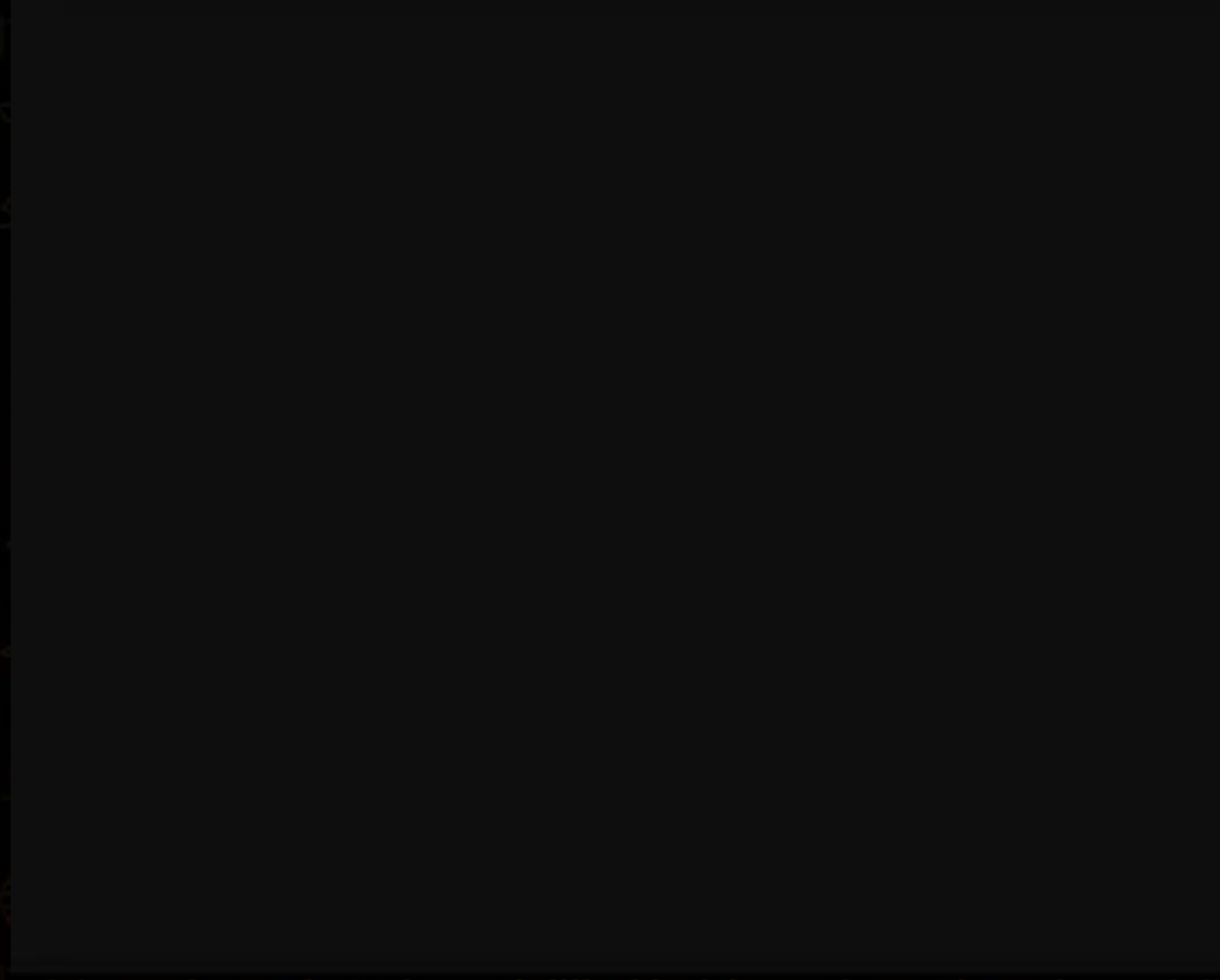
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SBK

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FSLASIK

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Mechanism of corneal femtodissection

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Femtosecond Laser Photodisruption Sequence

1. Focused Ultrashort Pulses

- Femtosecond pulses (10^{-15} s) tightly focused in transparent tissue
- High energy density confined to focal point



2. Nonlinear Absorption & Plasma Formation

- Multiphoton absorption → ionization → plasma generation



3. Plasma Expansion & Shockwave

- Rapid plasma expansion produces a micro-explosion and shockwave



4. Cavitation Bubble Formation

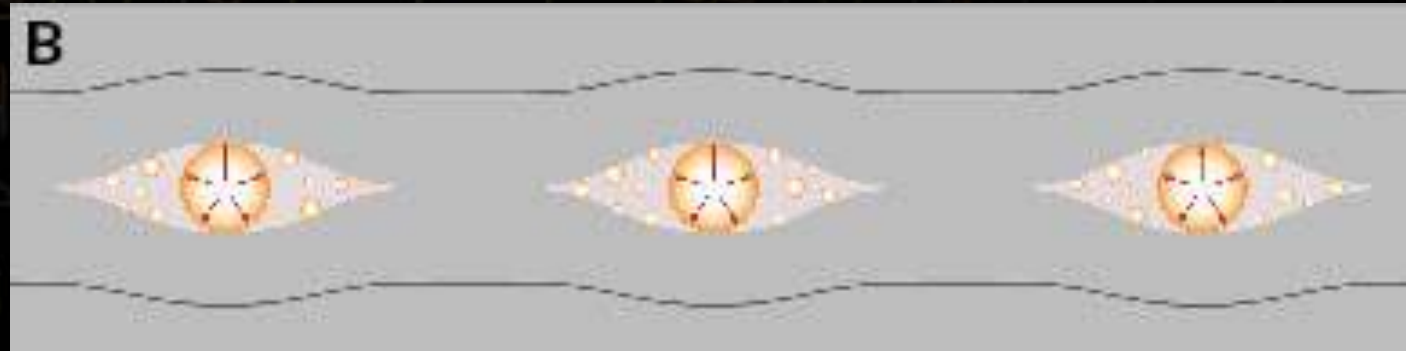
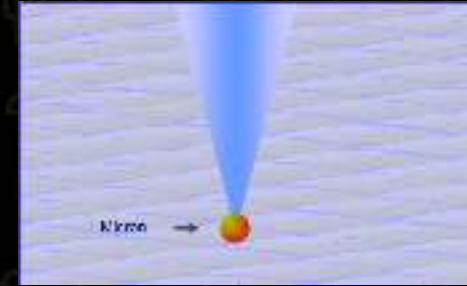
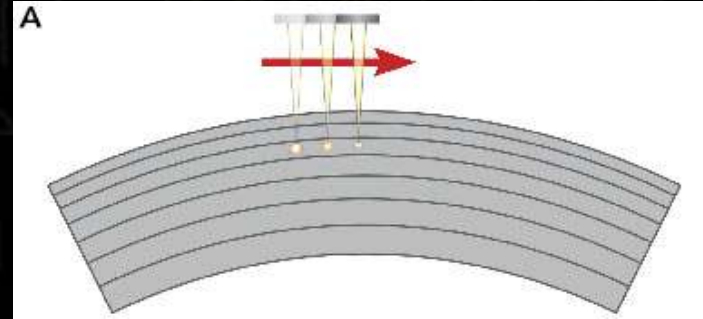
- Vapor/gas bubble expands then collapses → mechanical cleavage

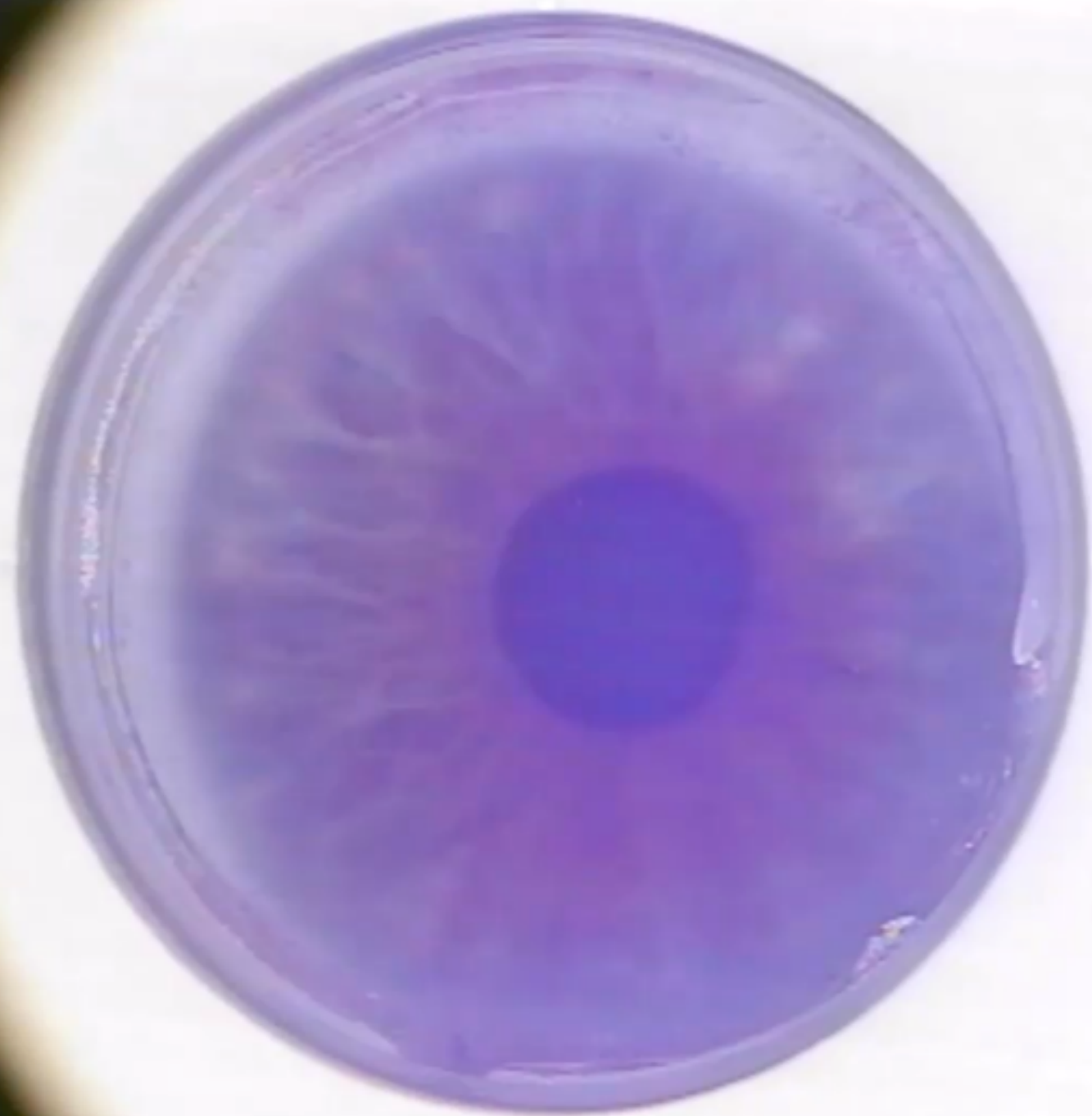


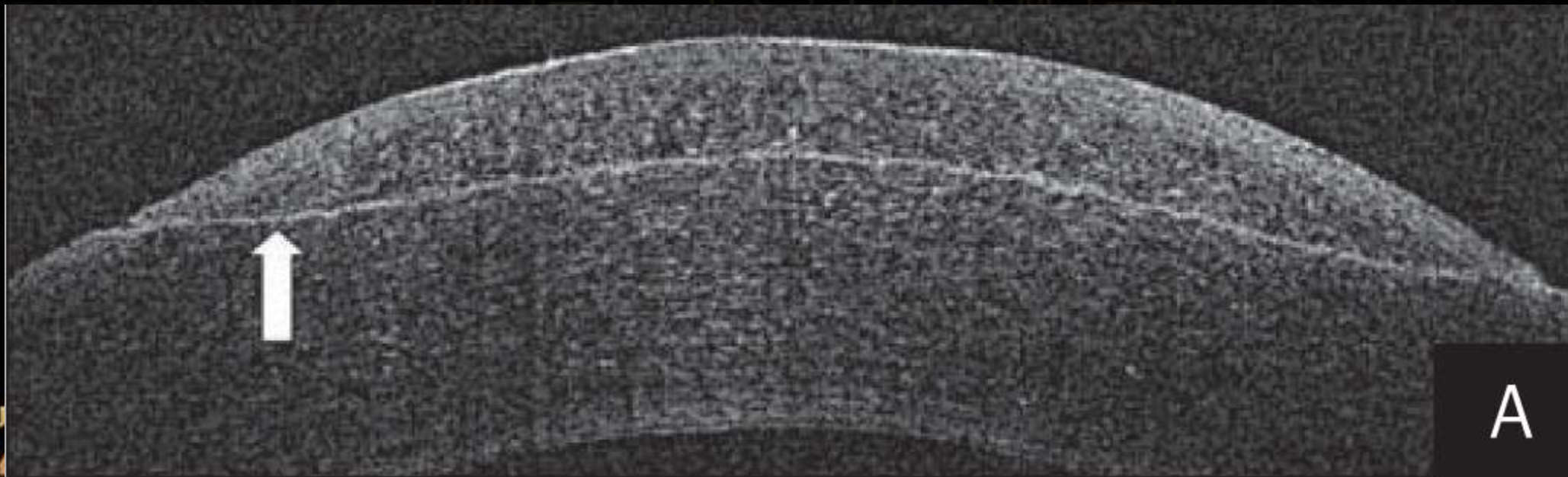
5. Tissue Separation (Photodisruption)

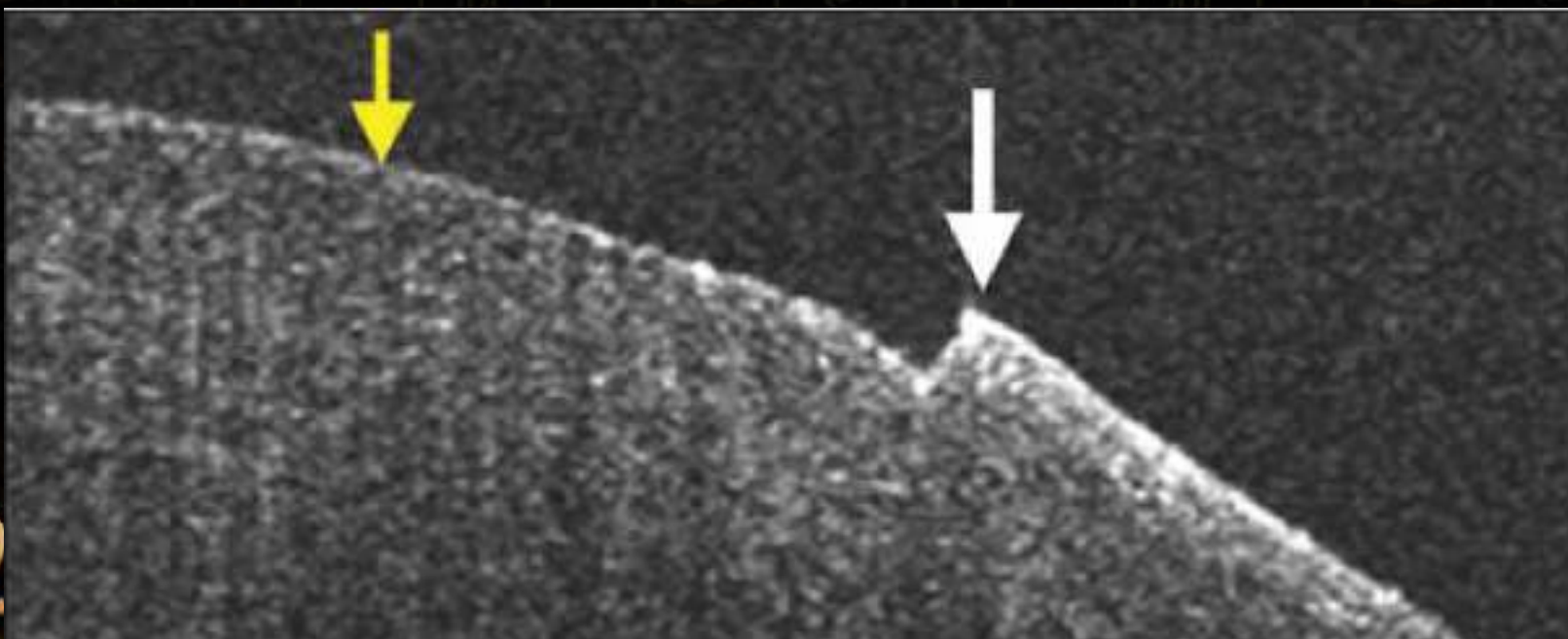
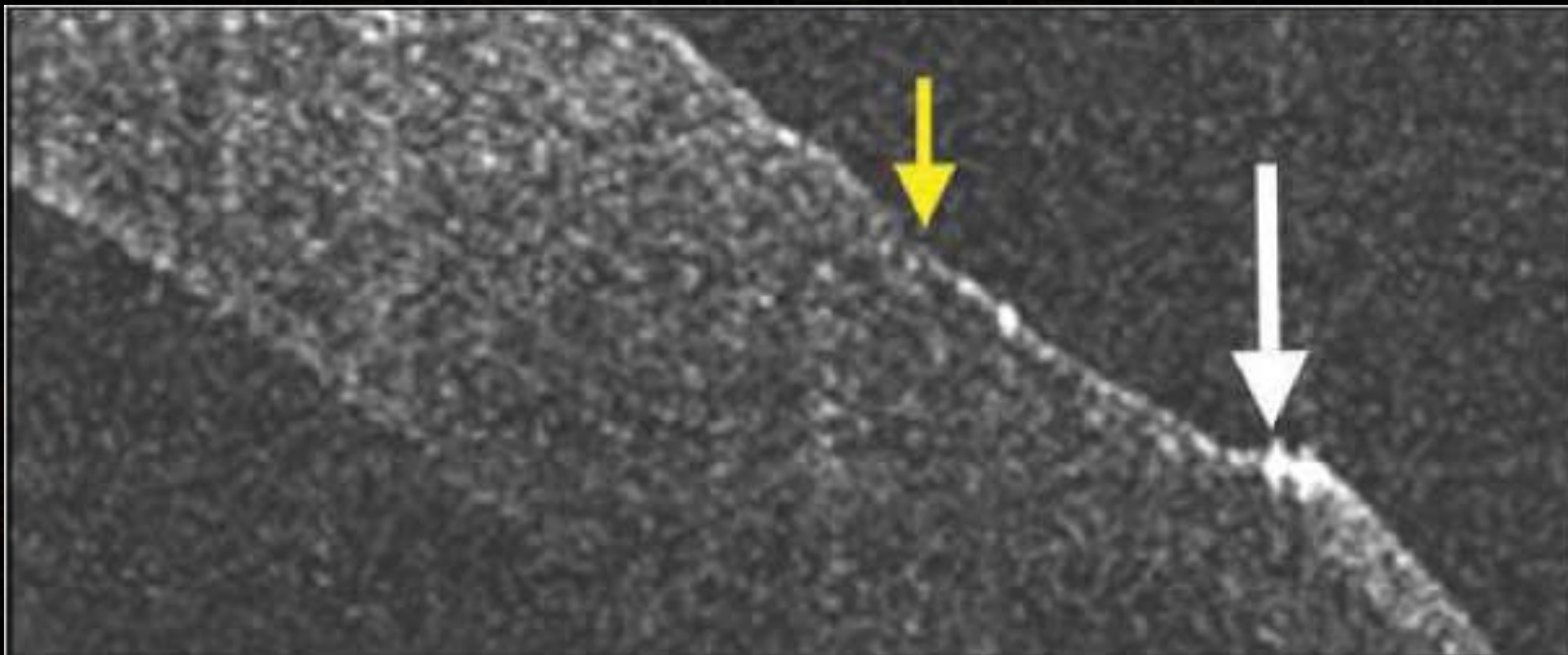
- Overlapping bubbles create a smooth cleavage plane for precise cutting

→ Precise, atraumatic tissue cutting without thermal damage



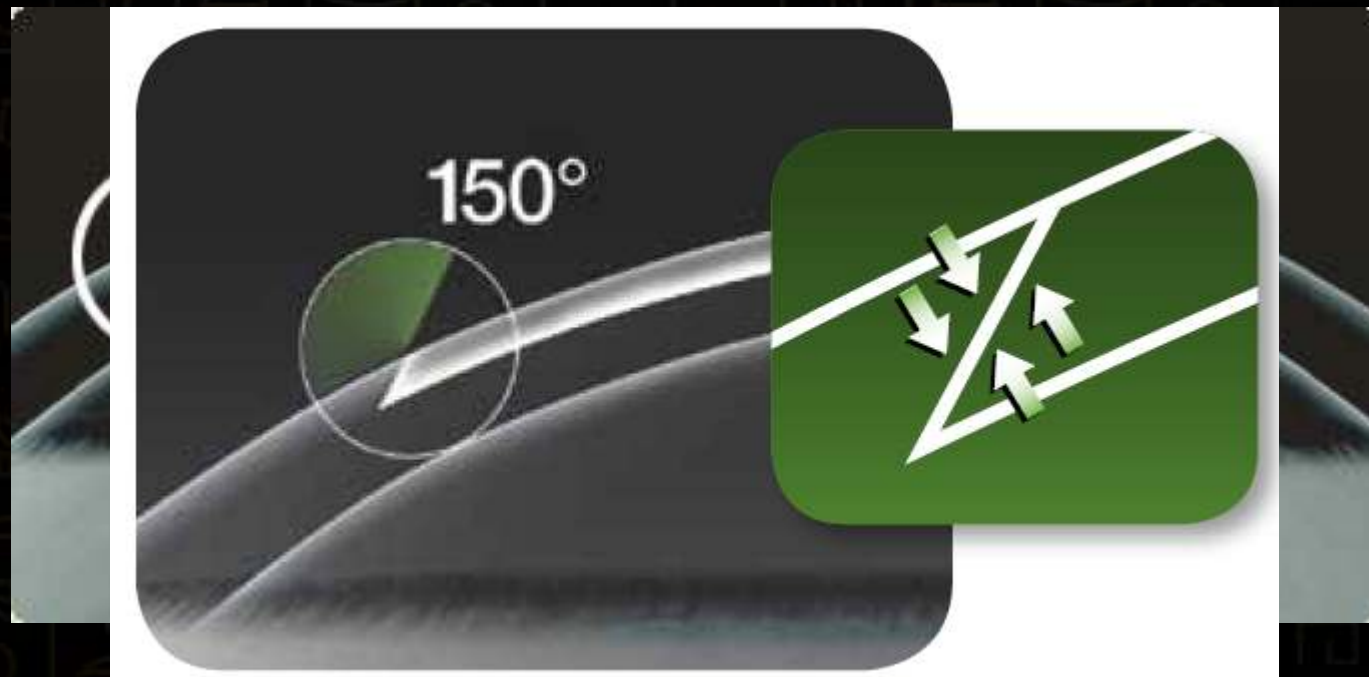






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FS LASIK

Safety, Efficacy, Predictability & Stability

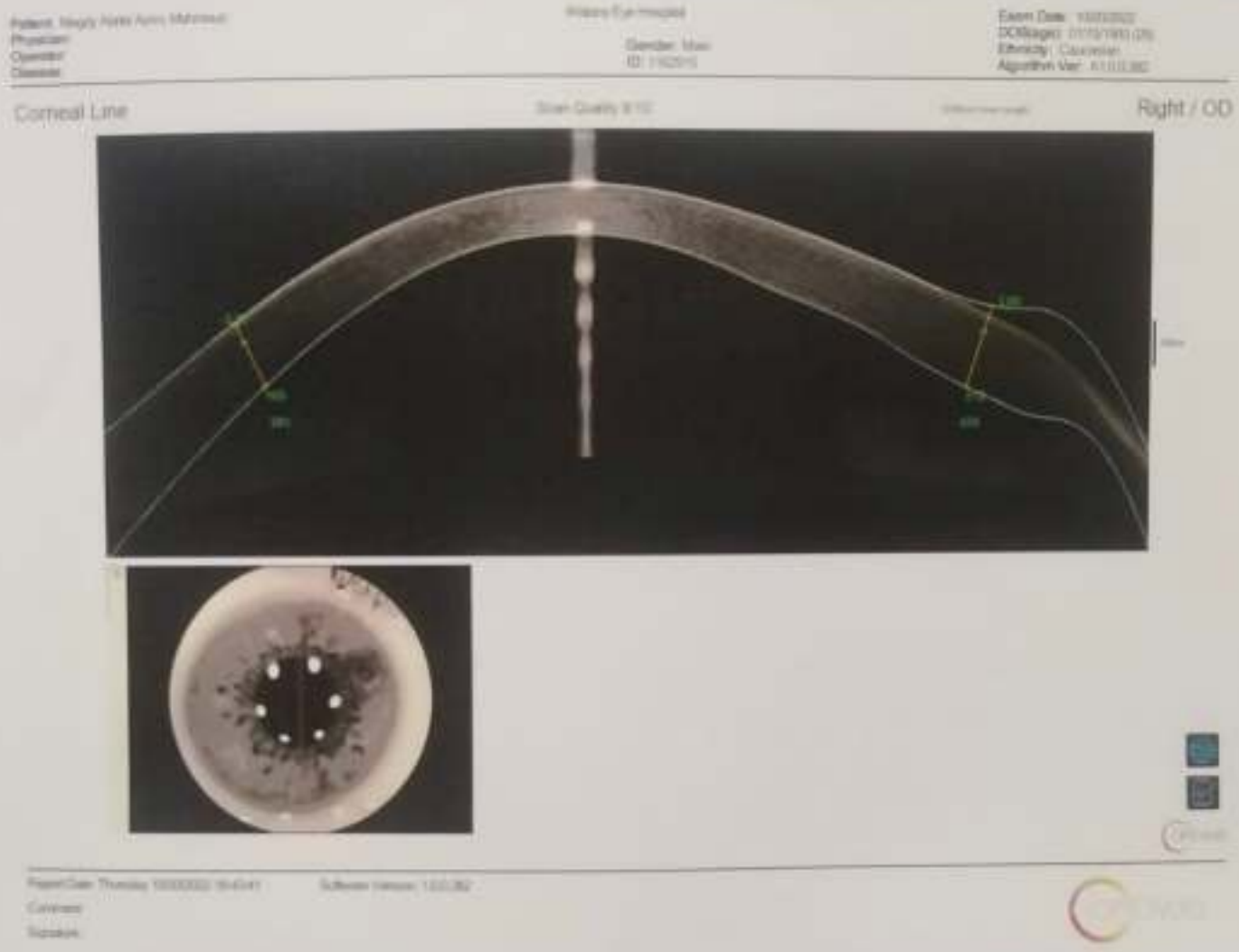
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OCULUS OCULUS OCULUS OCULUS DENTACAM 4 Mass Selectable

Last Name: [REDACTED]	Last Name: [REDACTED]
First Name: [REDACTED]	First Name: [REDACTED]
ID: [REDACTED]	ID: [REDACTED]
Date of Birth: 15/01/1993	Date of Birth: 15/01/19
Exam Date: 25/10/2018	Exam Date: 22/10/20
Exam Info:	Exam Info:

90° 0° 180° 270° Pi: 7.81 mm Pc: 7.63 mm Pm: 7.72 mm Q5: OK Q-vol: 0.45 R-per: 8.08 mm	90° 0° 180° 270° Pi: 7.79 mm Pc: 7.60 mm Pm: 7.70 mm Q5: OK Q-vol: 0.43 R-per: 8.09 mm
90° 0° 180° 270° Pi: 6.56 mm Pc: 6.32 mm Pm: 6.44 mm Q5: OK Q-vol: 0.36 R-per: 6.90 mm	90° 0° 180° 270° Pi: 6.58 mm Pc: 6.30 mm Pm: 6.44 mm Q5: OK Q-vol: 0.39 R-per: 6.91 mm
90° 0° 180° 270° Pi: 6.58 mm Pc: 6.30 mm Pm: 6.44 mm Q5: OK Q-vol: 0.39 R-per: 6.91 mm	90° 0° 180° 270° Pi: 6.58 mm Pc: 6.30 mm Pm: 6.44 mm Q5: OK Q-vol: 0.39 R-per: 6.91 mm

Pupil Center: + 516 µm	Pupil Center: + 514 µm
Pachy Apoc: 517 µm	Pachy Apoc: 514 µm
Thinnest Locat: 514 µm	Thinnest Locat: 512 µm
K Max (Front): 44.8 D	K Max (Front): 44.8 D
Cornea Volume: 55.7 mm	Cornea Volume: 55.2 mm
Chamber Volume: 202 mm	Chamber Volume: 202 mm
A. C. Depth (Int.): 3.20 mm	A. C. Depth (Int.): 3.23 mm
Enter IOP: IOP(Sun) +1.3 mmHg	Enter IOP: IOP(Sun) +1.4 mmHg

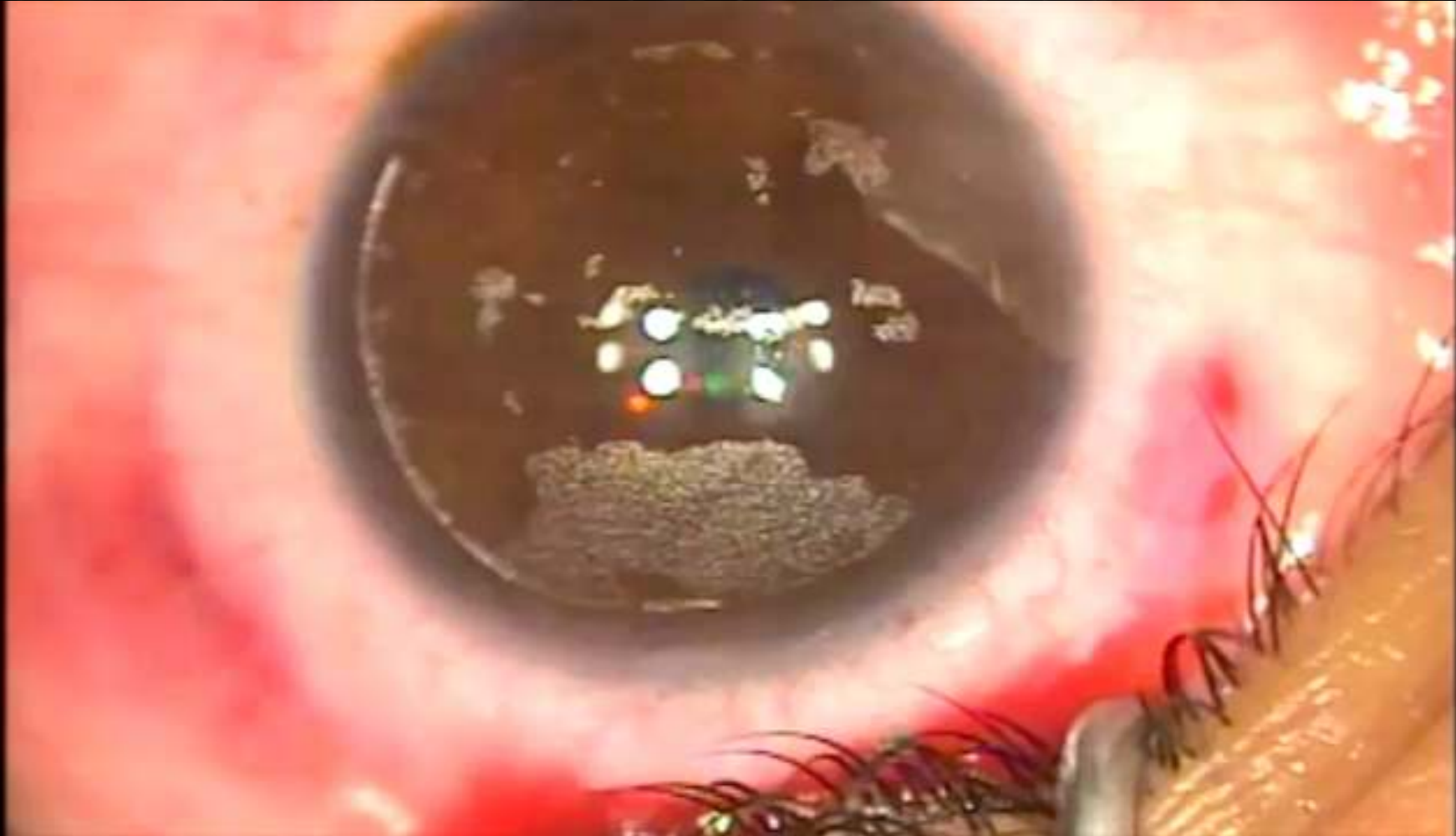


Flap lifting



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Flap lifting for beginners



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Customized Flap

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Elliptical Flap

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Why elliptical flap with **wide hinge**

- The cornea is horizontally oval (vertical diameter 11 mm and horizontal diameter is 12 mm)
- Elliptical flaps can fit symmetrically into the oval shape of the normal cornea.
- Cutting slightly fewer peripheral corneal lamellae and fewer corneal nerves may help retain more corneal structure strength and sensation.

Flap

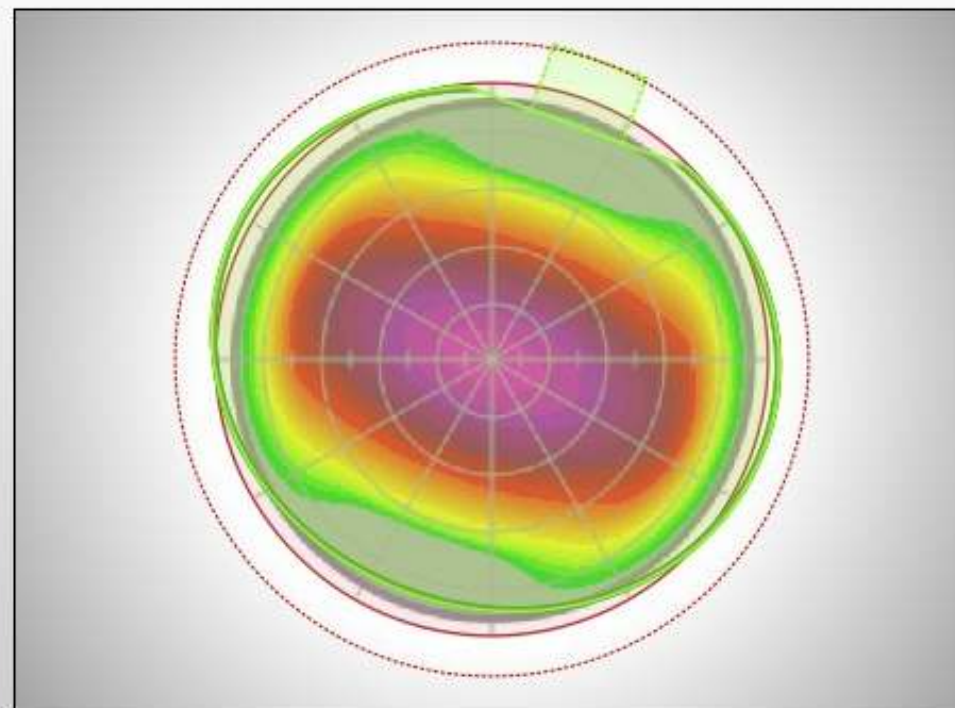
Size D1* 9.3 D2* 8.5 Phi1* -20.0
Thickness* 120.0 μm ☒ Canal
Side Cut Angle* 120 $^{\circ}$ Width 1.7 mm

Hinge

Position* superior
Size Length* 3.8 mm
Angle* 52.2 $^{\circ}$
Width* 0.4 mm

Flap/Ring View

☐ Top View ☒ Profile View ☐ Cross Section



Linked Parameters & Elements

11.04.2015 12:46:28 WF-optimized

Pachymetry

11.04.2015 12:46:23 c 561

Flap

Size D1* 8.5 D2* 9.3 Phi1* 0.0
Thickness* 120.0 μm ☒ Canal
Side Cut Angle* 120 $^{\circ}$ Width 1.7 mm

Hinge

Position* superior
Size Length* 3.9 mm
Angle* 50 $^{\circ}$
Width* 0.5 mm

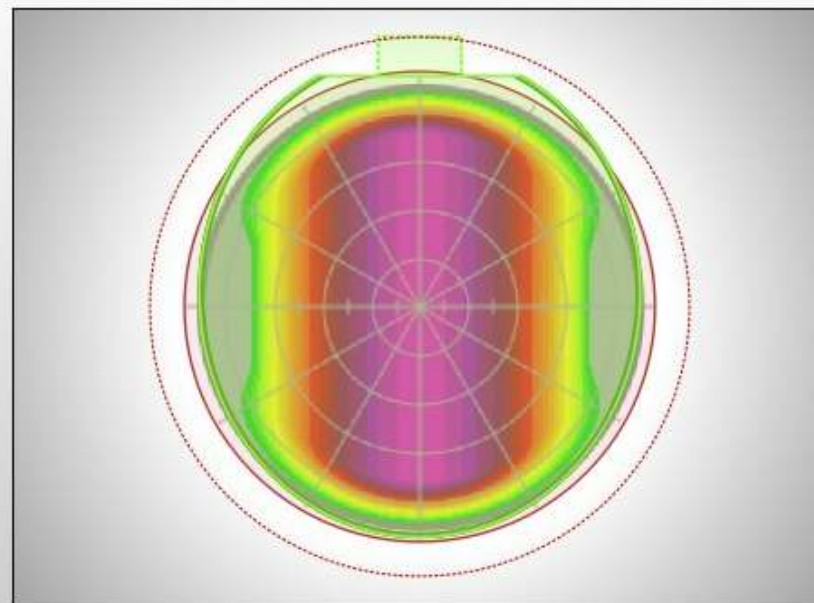
Rotation

Ablation Zone 9.0 mm Max. Depth 22 μm

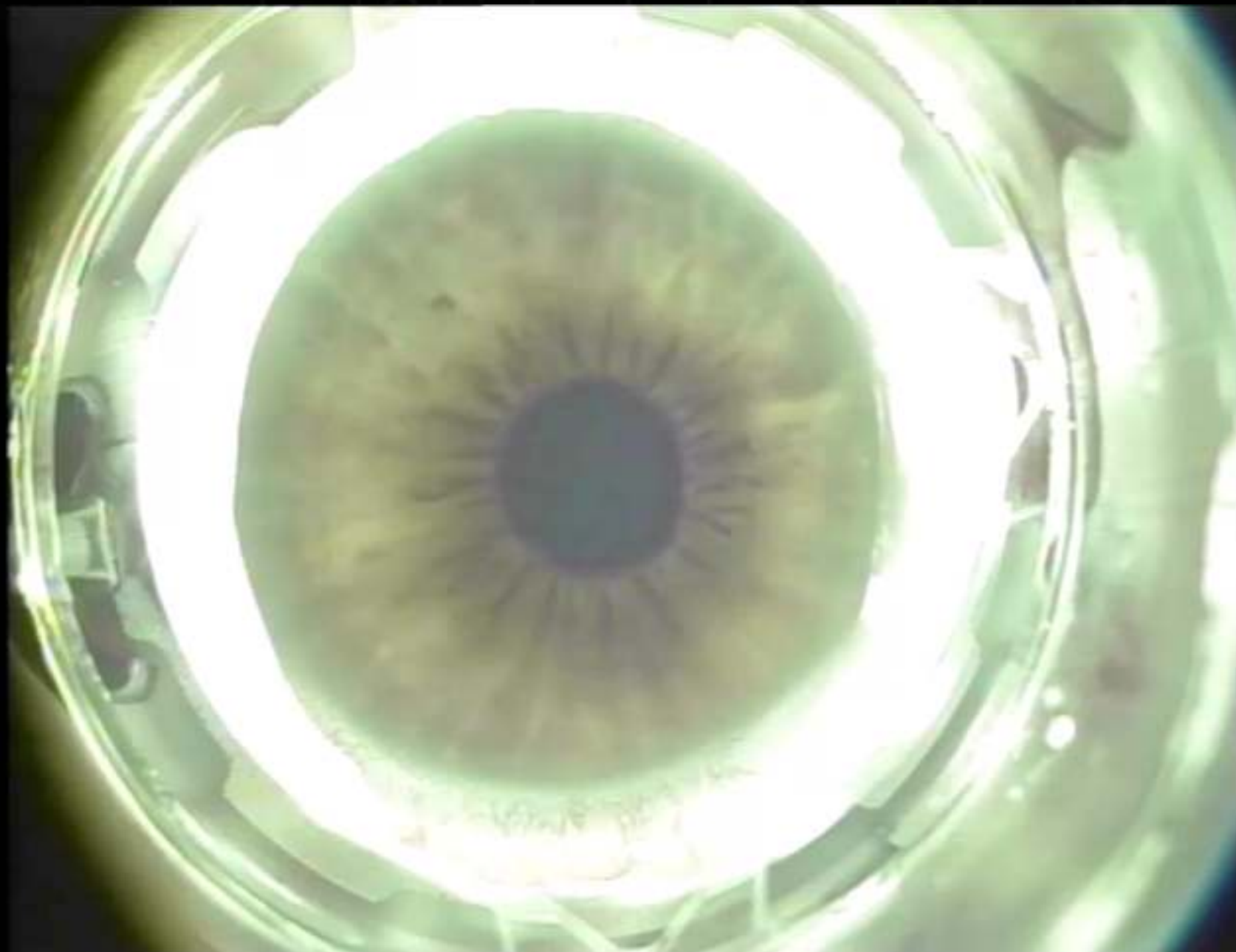
Min. Pachymetry 561 μm Res. Stroma 418 μm

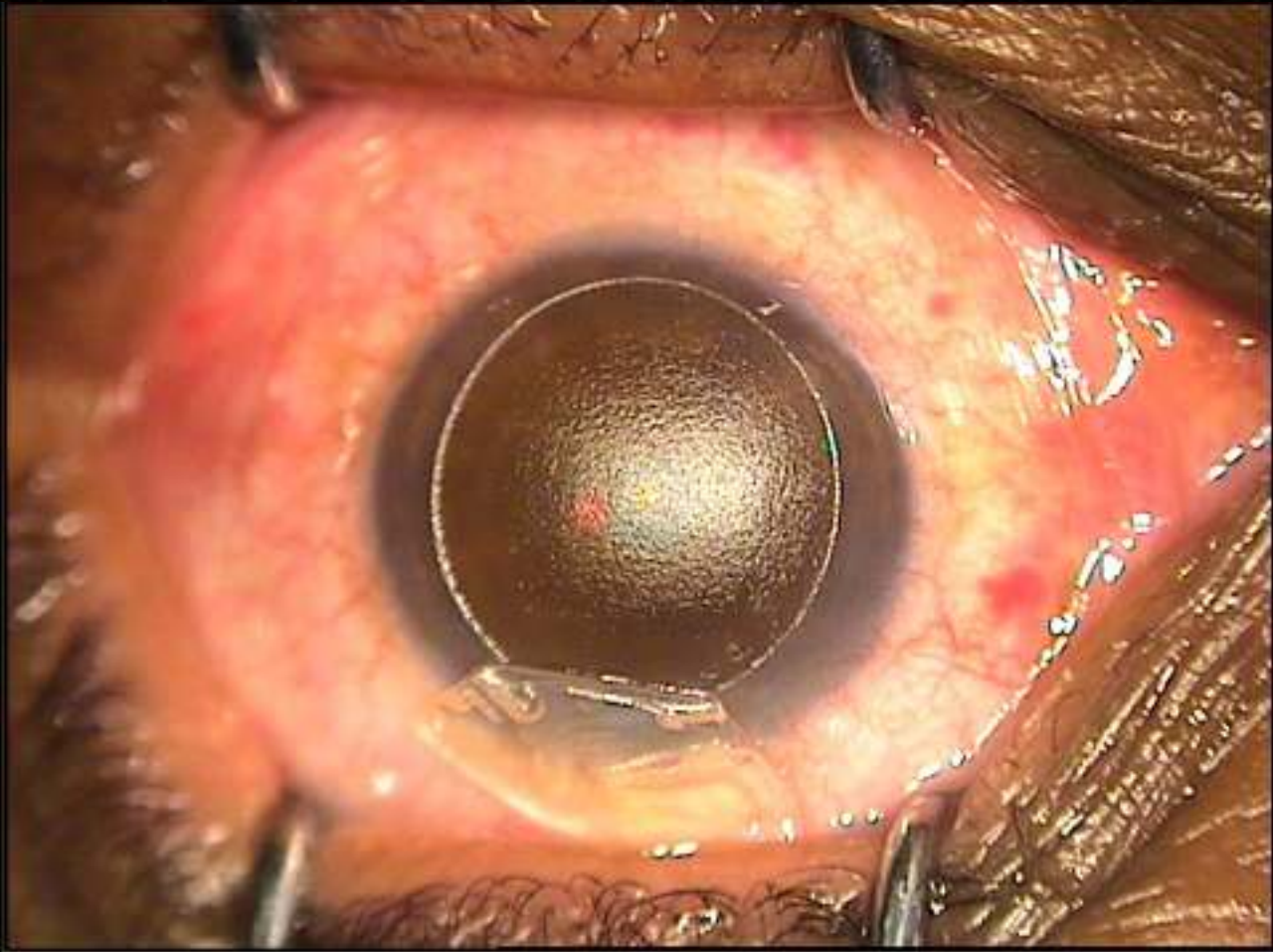
Flap/Ring View

☐ Top View ☒ Profile View ☐ Cross Section

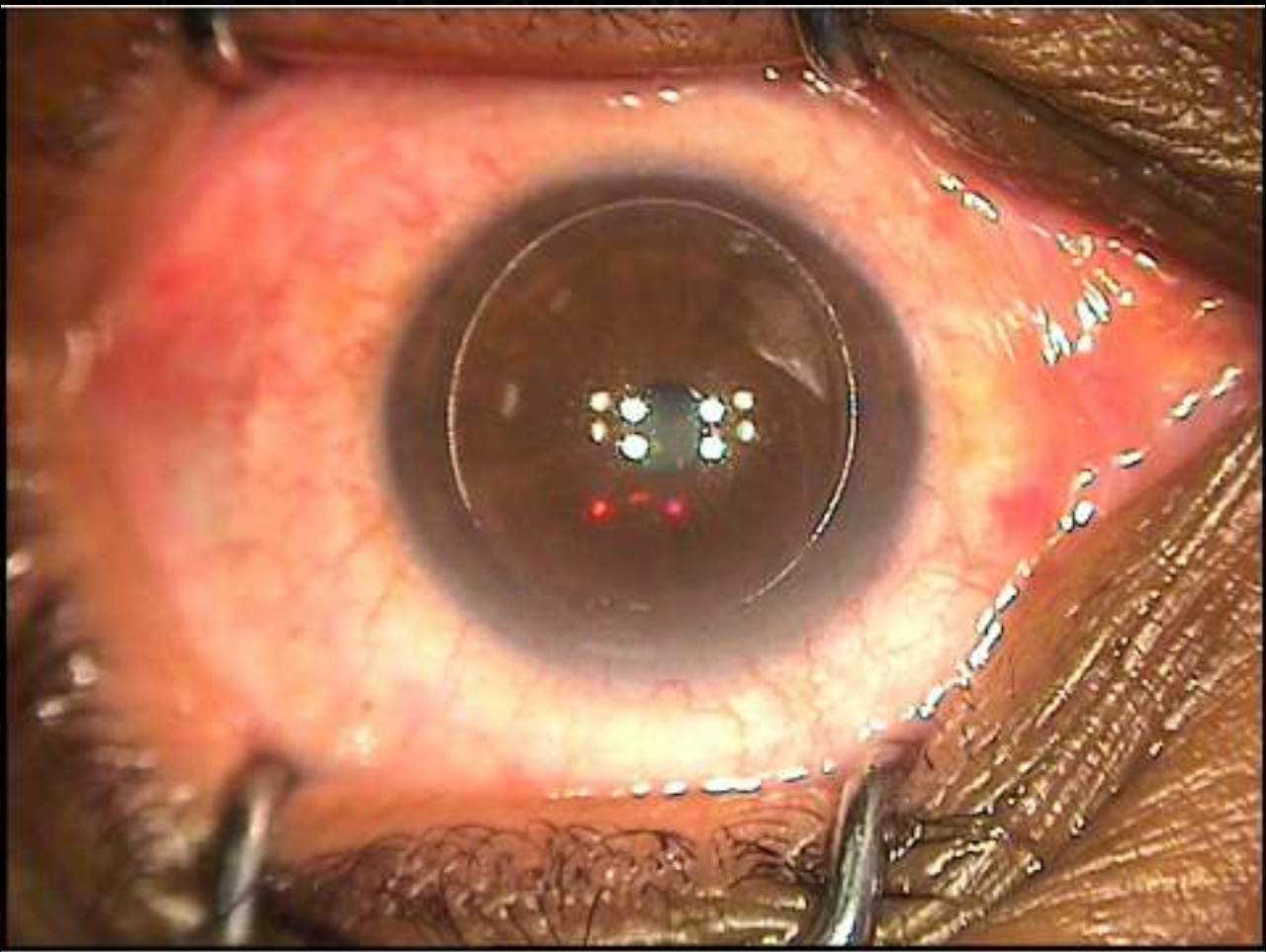


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Flap Design

TREATMENT DETAILS

Diameter 1 mm D2 mm

D1 Angle °

Thickness μm

Residual Stroma μm

Side Cut Angle °

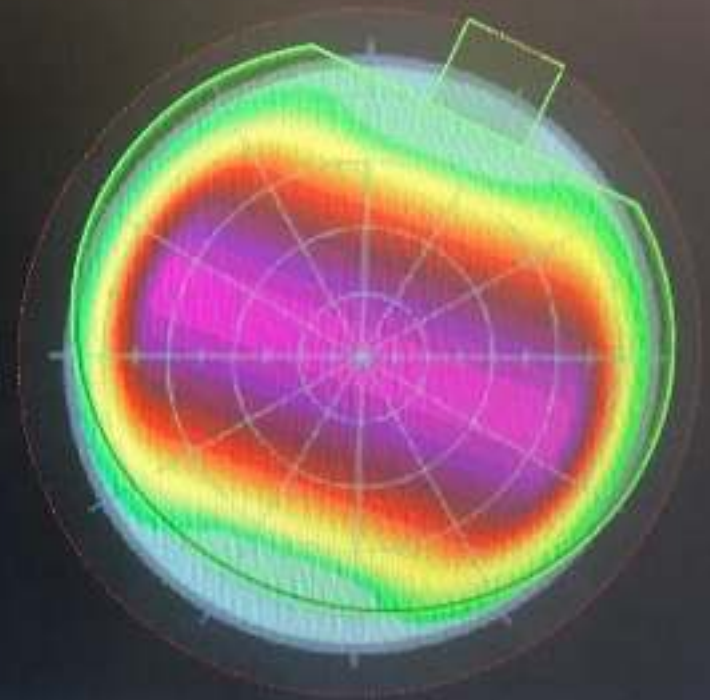
☒ Canal Width mm

Hinge Position °

Hinge Length mm

PREVIEW

Cross Section



Max. Ablation μm

Thinnest Pachy. μm



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Round flap with wide hinge



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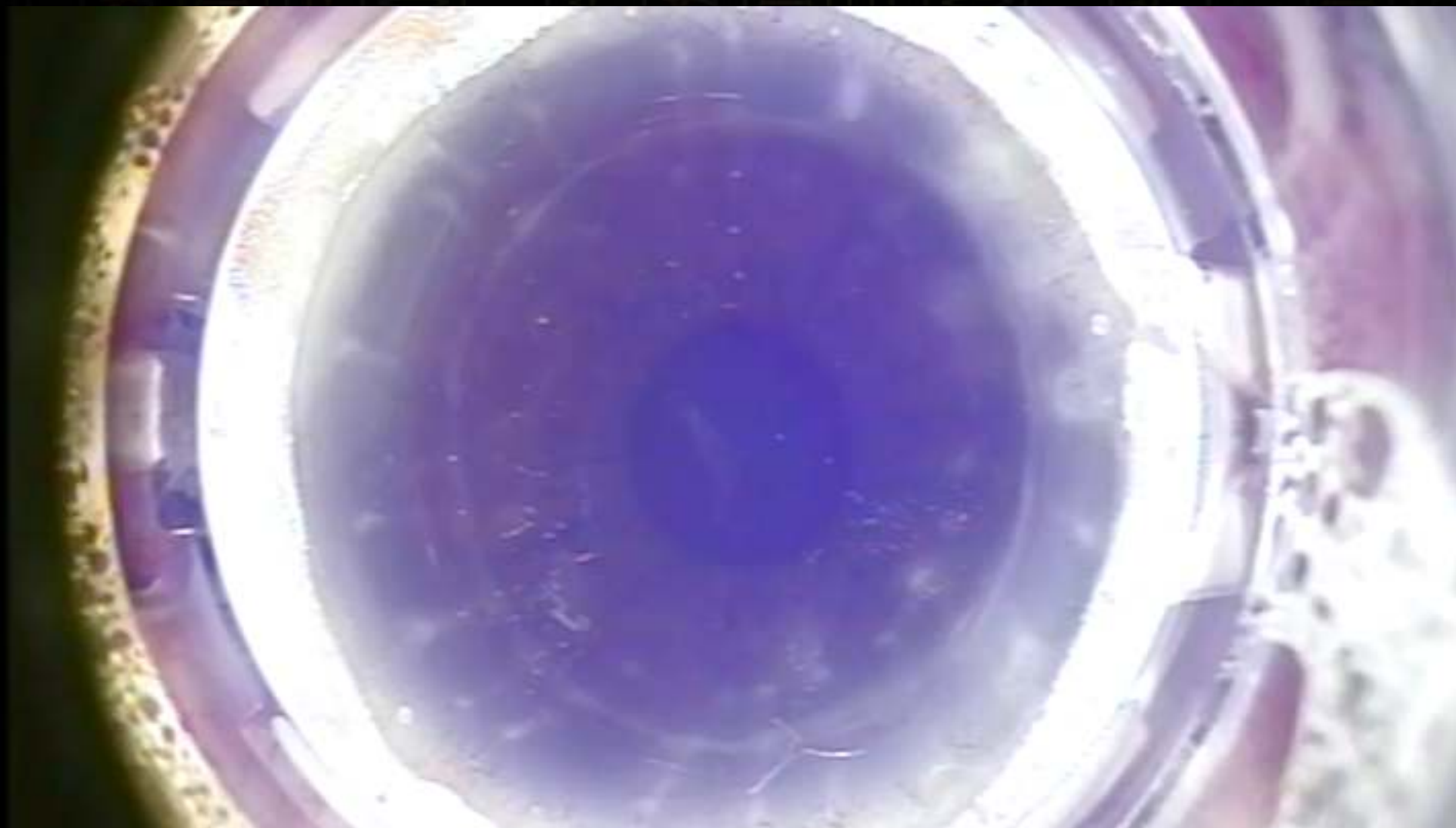
Round flap with wide hinge



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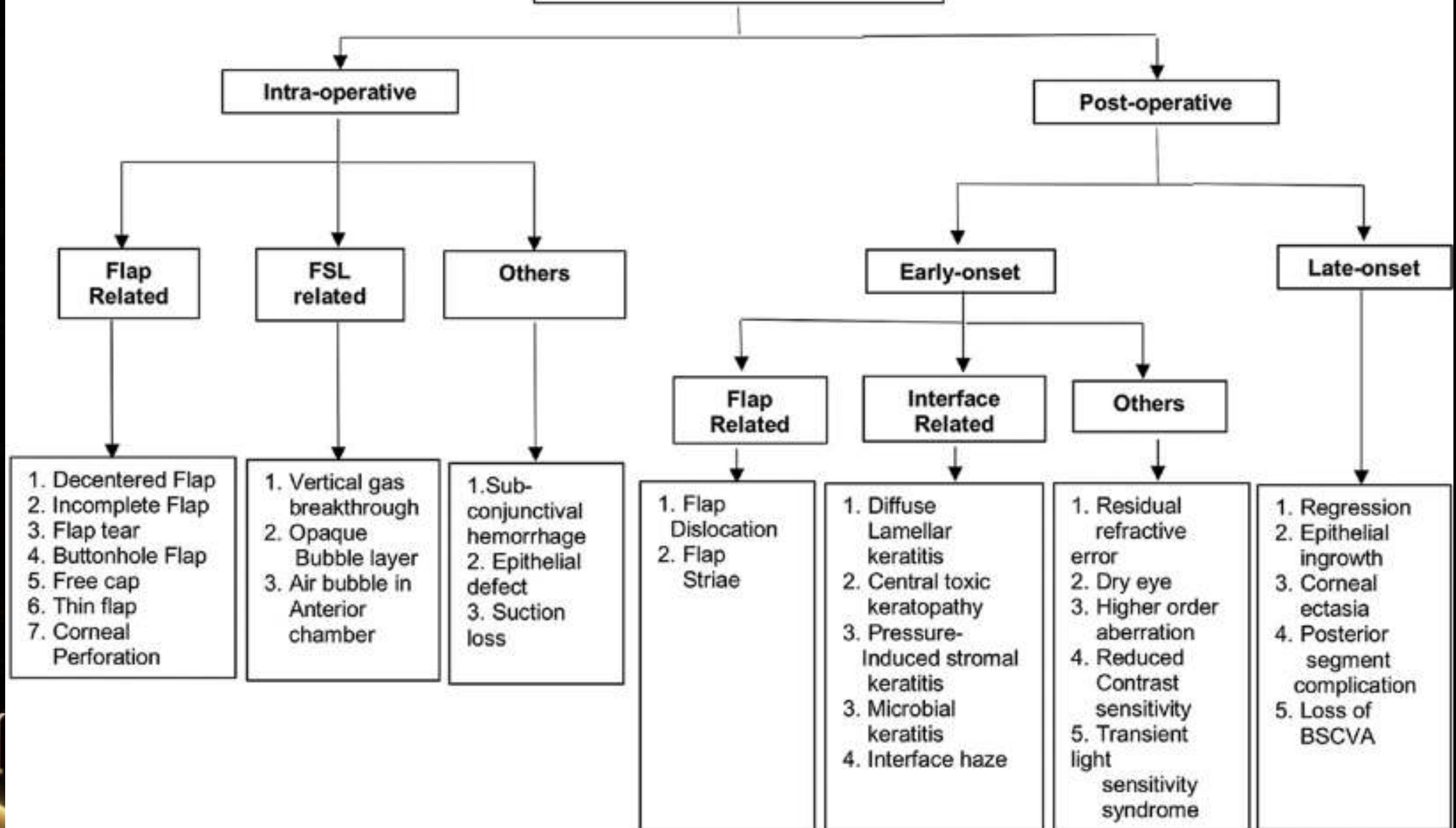
FS LASIK Post KP

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Complications of LASIK



What if? Opaque Bubble Layer (OBL)

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What if? Dark spots

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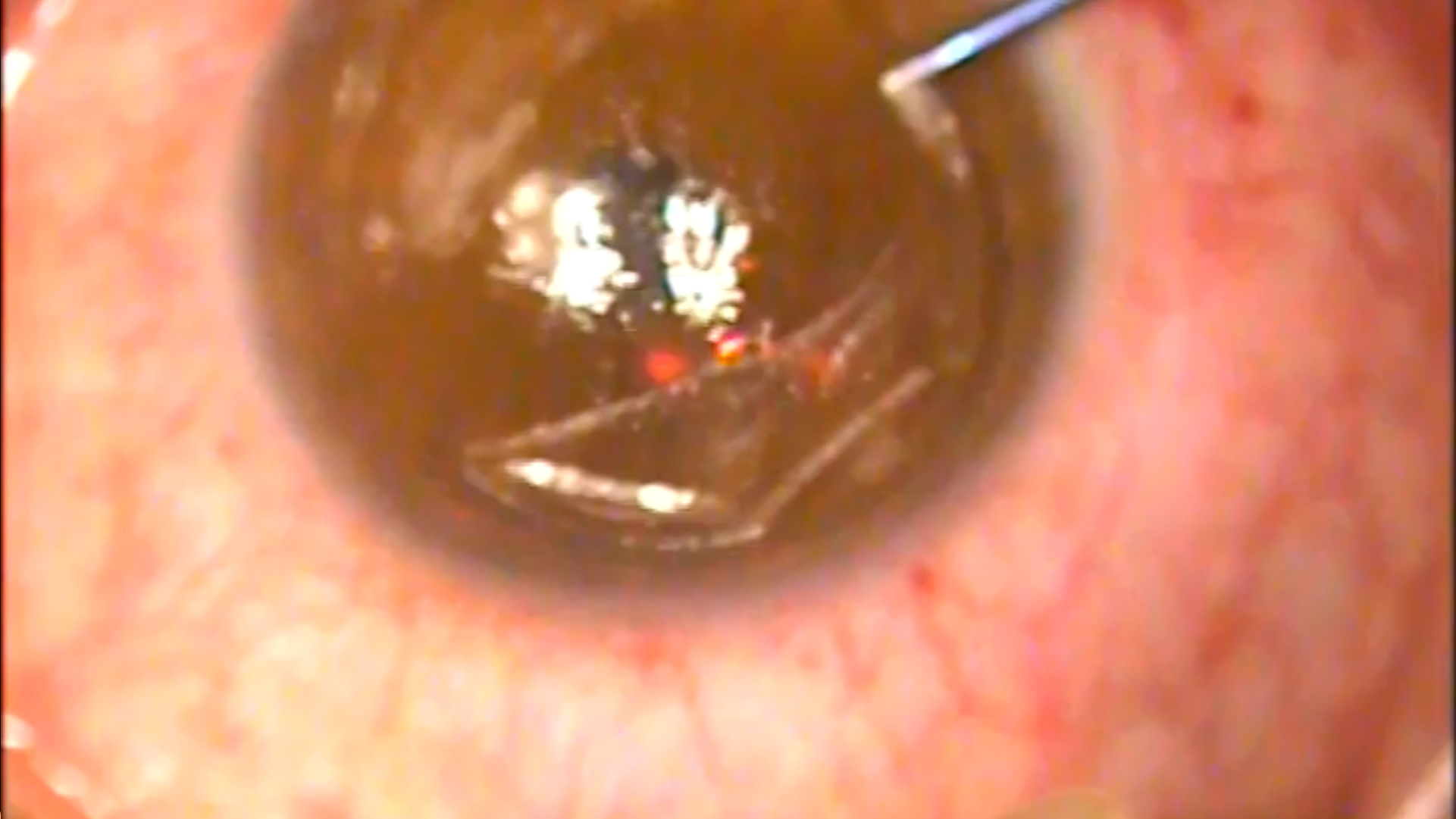




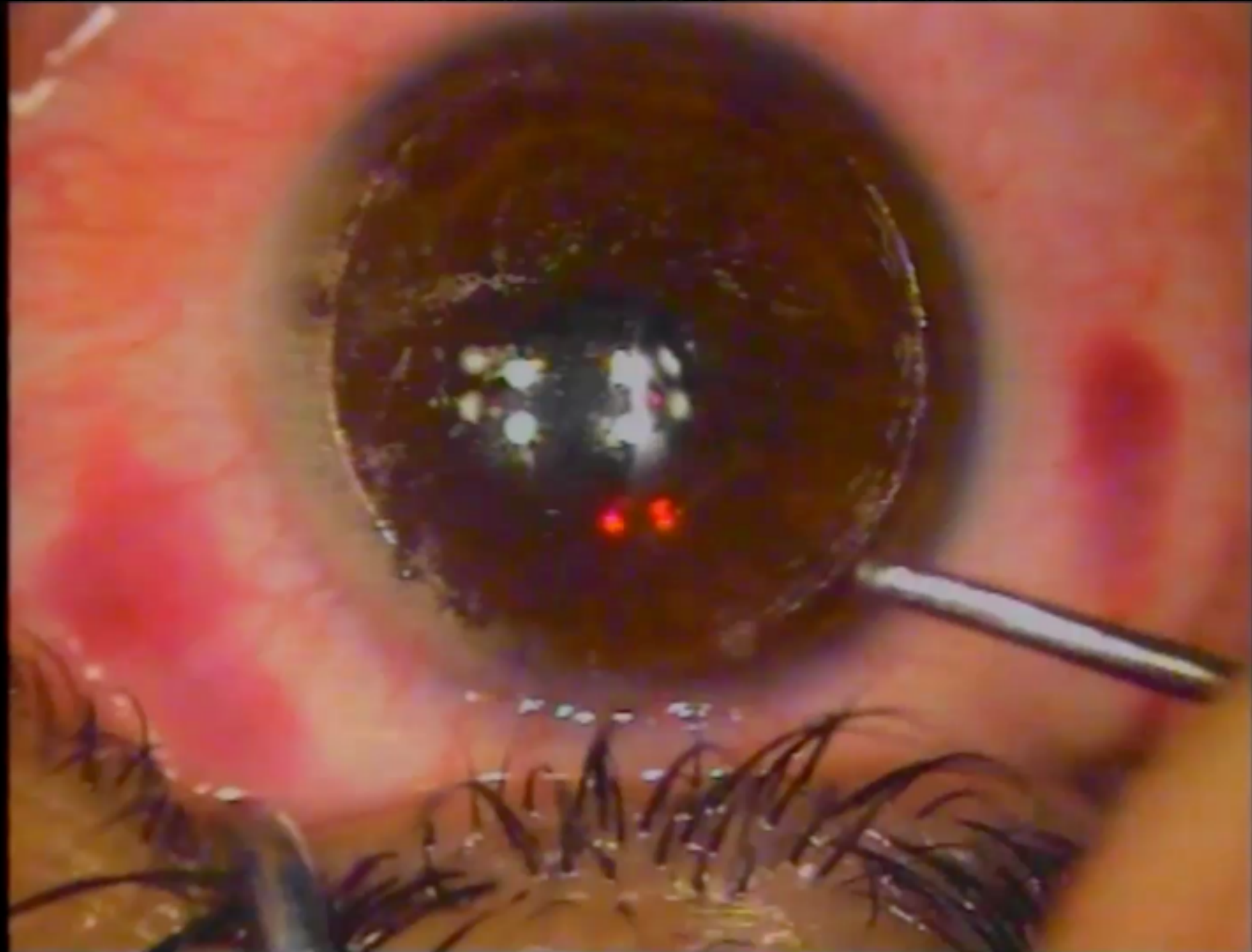


What if? Sticky flap

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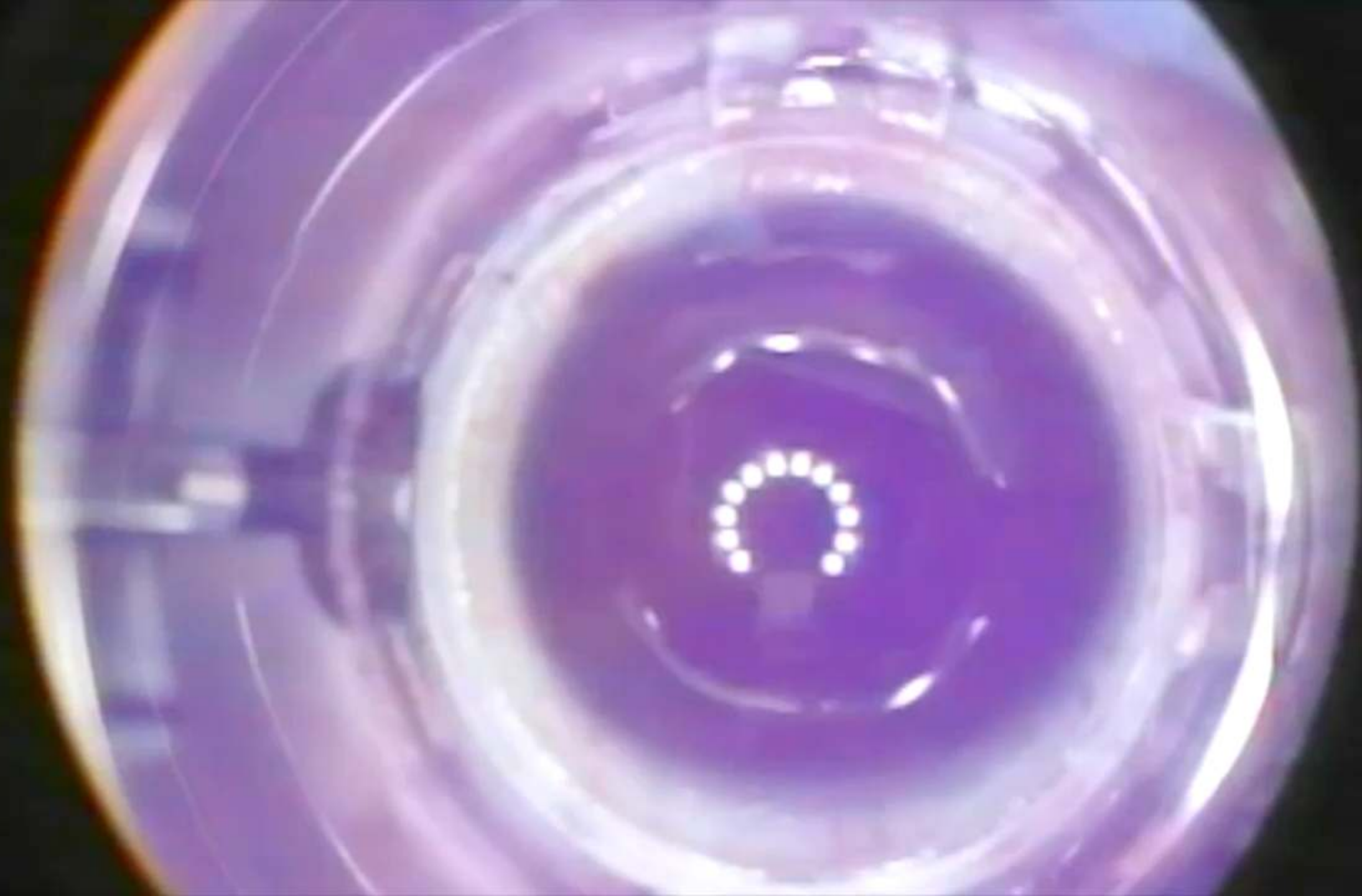


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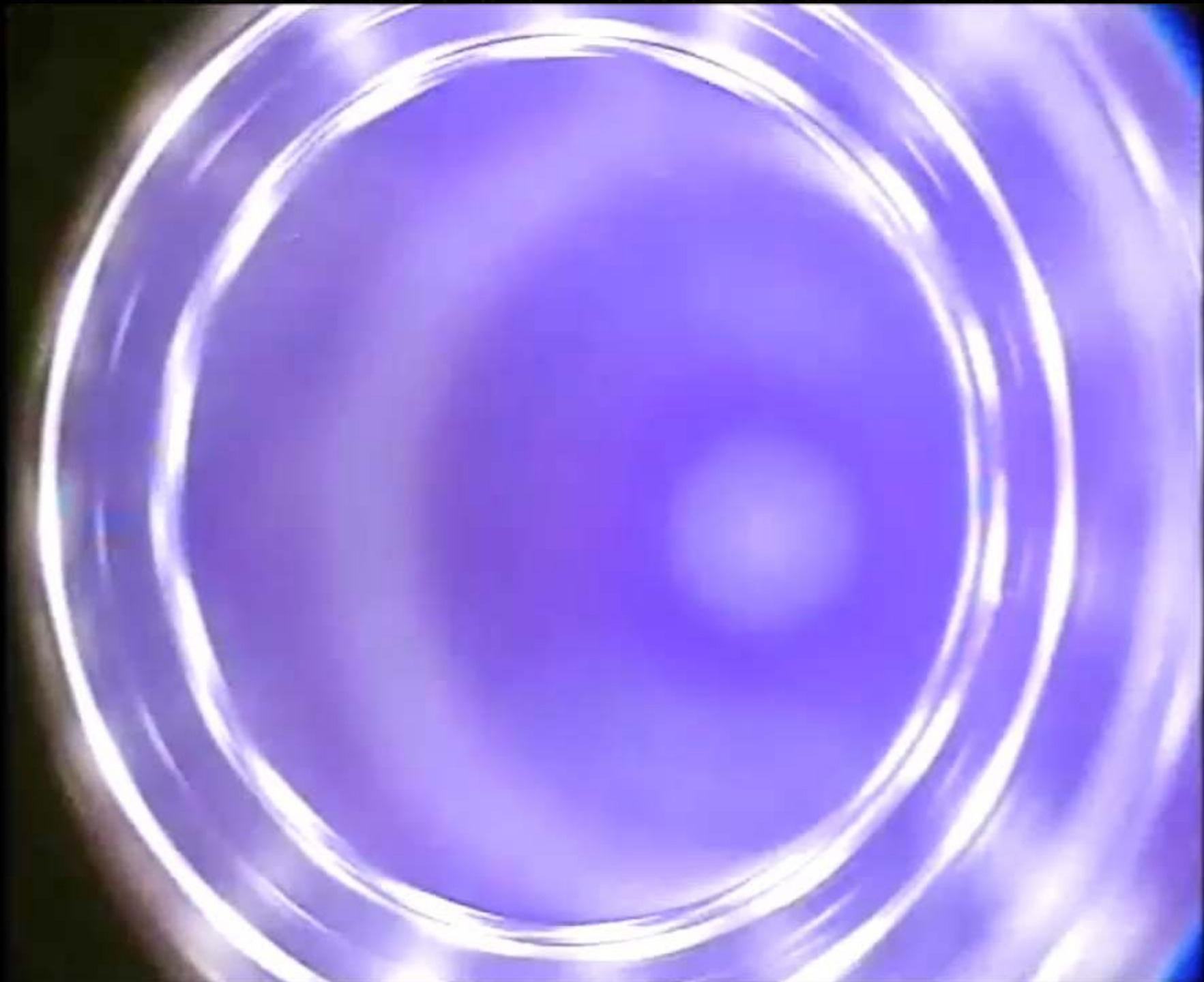
What if? Difficult Docking

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What if? Suction Loss

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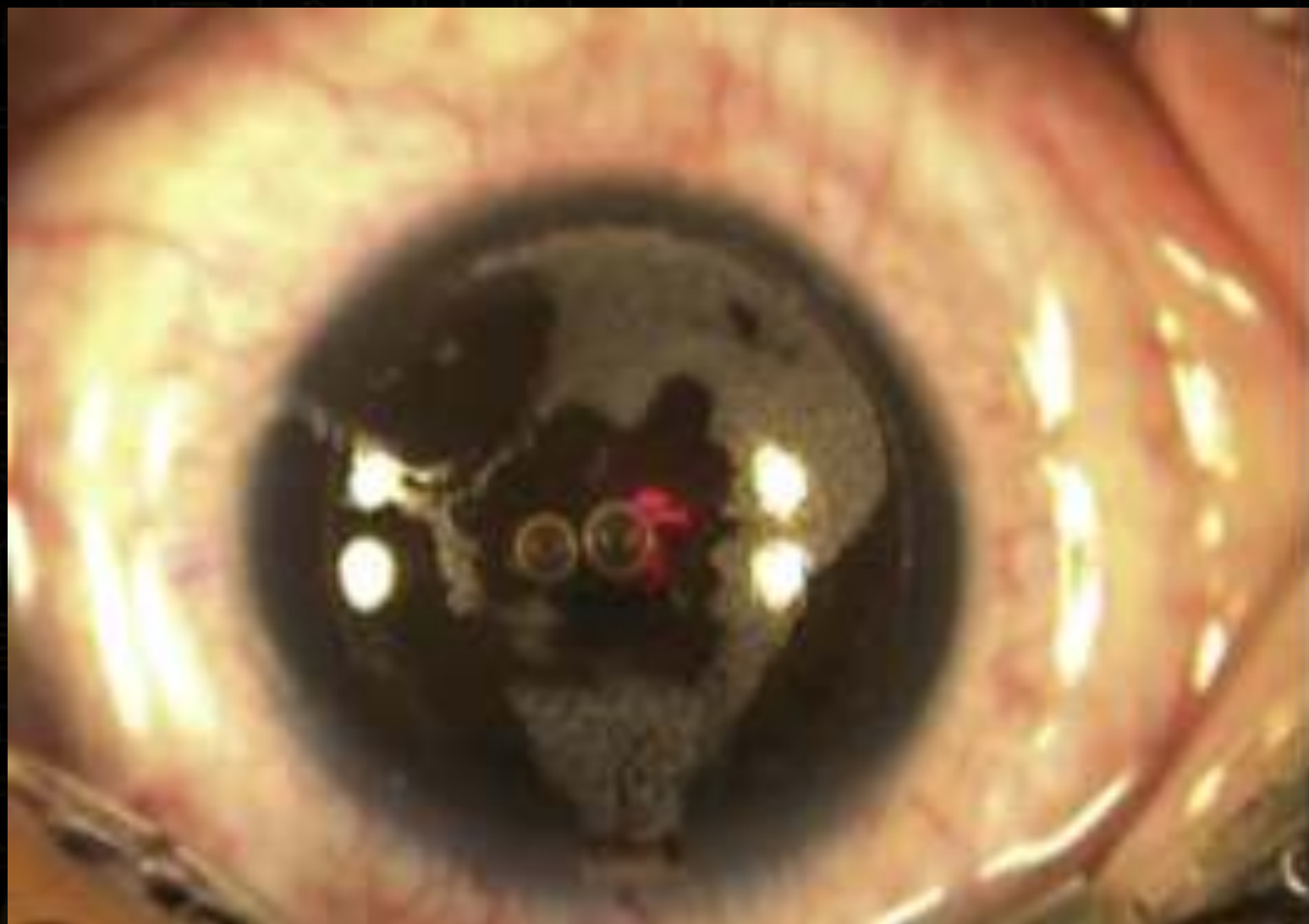


Suction Loss

- Inadequate initial suction
- Patient movement, eye rotation, and/or head tilt
- Smaller palpebral fissure
- Deep set eyes
- Incarcerated conjunctiva

What if? Air in the AC

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Causes

- Cavitation bubbles dissecting across a lamellar plane may gain retrograde access to the anterior chamber through the trabecular meshwork via Schlemm's canal

Management

- Proceed
- Wait
- Postpone
- Alternative technique

What if? Vertical Gas Breakthrough (VGB)

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VGB

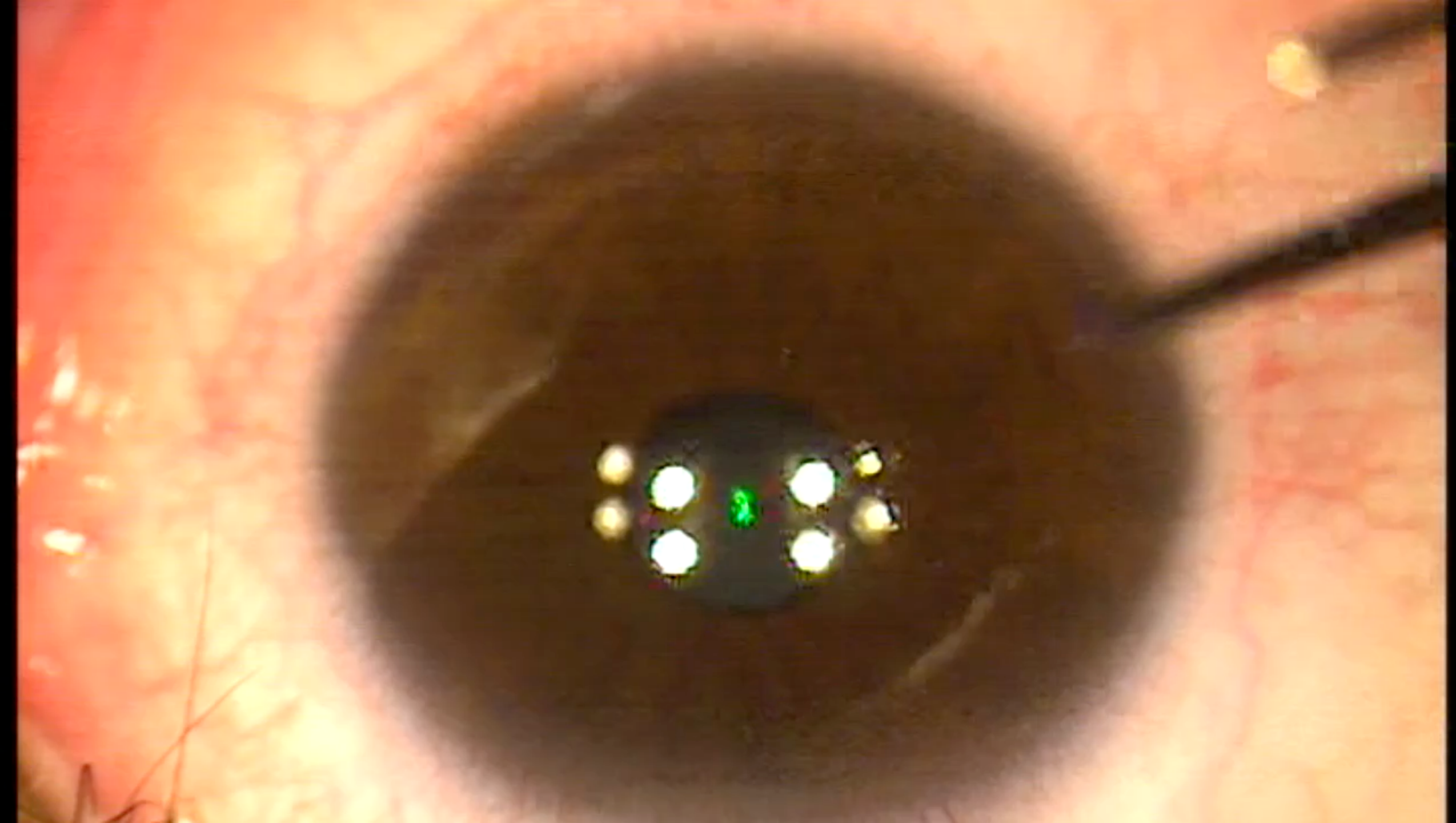
- Focal defects in the Bowman membrane
- Corneal abrasion
- Corneal scarring and thinned stroma
- EBM dystrophy

Take home message!

- FS LASIK offers high precision and predictability in flap creation.
- Provides better centration, thickness accuracy, and reproducibility compared to mechanical MK.
- Associated with lower risk of flap complications.
- Ensures enhanced safety and patient satisfaction with customizable flap parameters.

Enhancement

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KLEx / SMILE

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‘You are a true surgeon from the moment you are able to deal with your complications’.

Owen H Wangenstein (1898–1981)

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Thank you

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