XXXII[nd] Congress of the ESCRS,
London, September 13, 2014
Instructional Course # 7

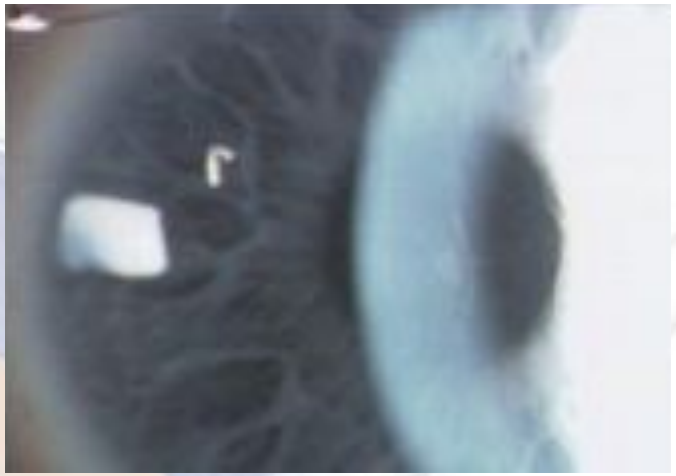
LASIK: basic steps for safety and great results

Dr. J.C. Vryghem

Microkeratomes

Jérôme C. VRYGHEM, M.D.
Brussels Eye Doctors
Brussels
Belgium

Creation of the flap



Flap/Bed mismatch

- Myopic LASIK
  - surface of the bed is smaller than that of the flap: **wrinkling**
  - faceting of the epithelium: smoothening the refractive surface
  - in higher myopes: risk of irregular astigmatism

Creation of the flap

Flap/Bed mismatch

- Hyperopic LASIK
  - surface of the flap is less than that of the bed: **stretching**
  - increasing regular astigmatism due to crowding of tissue in the midperiphery

Ideal microkeratome: considerations

- Quality of cut
  - consistency in flap thickness
  - flap diameter
  - hinge position
  - smoothness of the bed
- Safety
- Ergonomics
  - ease of assembly
  - ease of insertion
  - quality of suction
  - translation
- Economics

Thickness of the flap

- flap thickness is **correlated with pre-operative corneal thickness and keratometry**
  - thicker flaps in corneas which are flatter and thicker
    - average flap thickness (M2 keratome, R. Stein 2002):

      161 microns in eyes measuring 535 to 575 µ

      175 microns in eyes > 575 µ

      141 microns in eyes < 535 µ

- in bilateral cases, using the same blade:
  - **the flap of the second eye is thinner**

Thickness of the flap

Thinner flaps

\+ less risk of ectasia ?
less dry eyes
fewer epithelial defects
increased stretchability

\- more risk of irregular astigmatism,
especially in the treatment of higher myopias

Thickness of the flap

Thinner flaps

Flap stretching manoeuver:

First in a direction from the flap hinge to the opposite end
Followed by several radial movements

Thickness of the flap

Thicker flaps

\+ less risk of irregular astigmatism

\- more risk of ectasia ?

in the past: myopic keratomileusis with residual beds of 140 to 190 μ: (nearly) no ectasia after 20 y

more risk of undercorrection

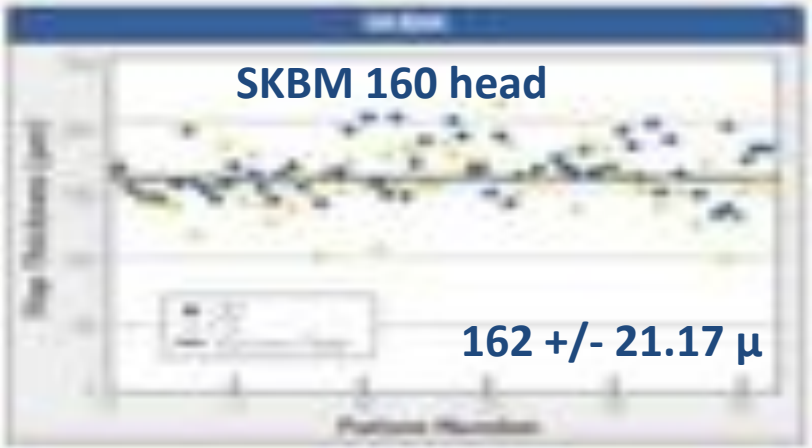
Thickness of the flap

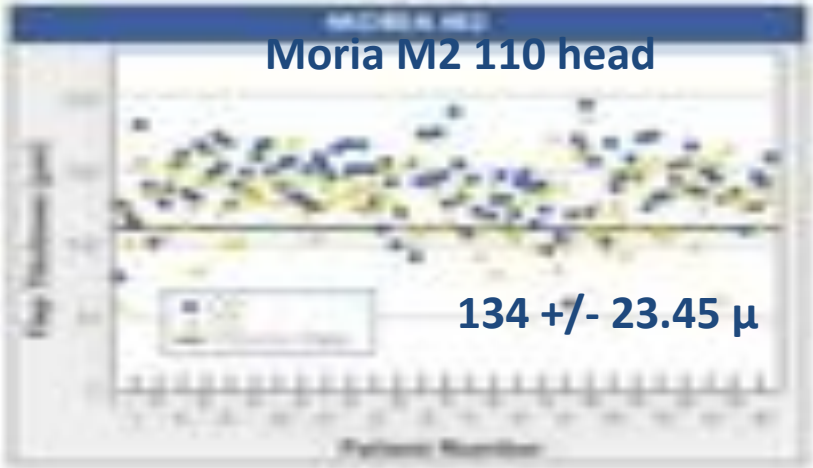
- most commonly used: 100 to120 µ

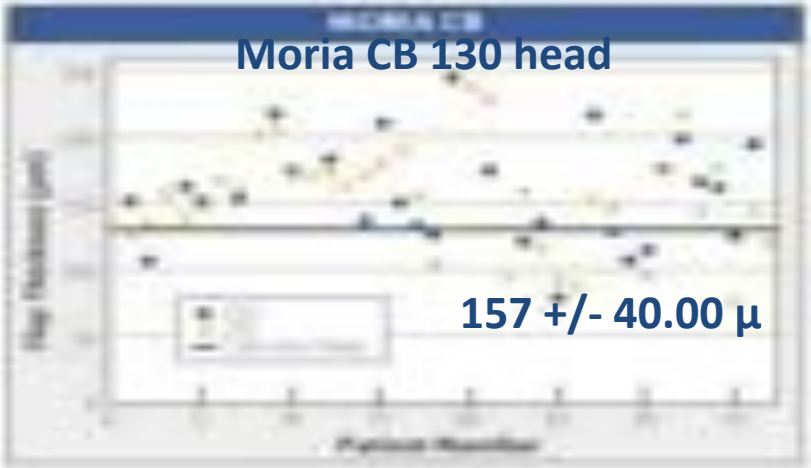
- not under 80 – 100 µ: risk of scarring of the Bowman's membrane

- residual bed limit of 250 µ ?

Consistency in flap thickness







R. Krueger 2002

Diameter of the flap

Predictability of flap dimensions:

Choosing the right microkeratome head

Choosing the right suction ring and footplate

Large, flat corneas tend to produce too small flaps

Small, steep ones tend to buttonhole.

Diameter of the flap

most commonly used: 9.5 mm

8.5 mm: in small eyes, vascularised corneas

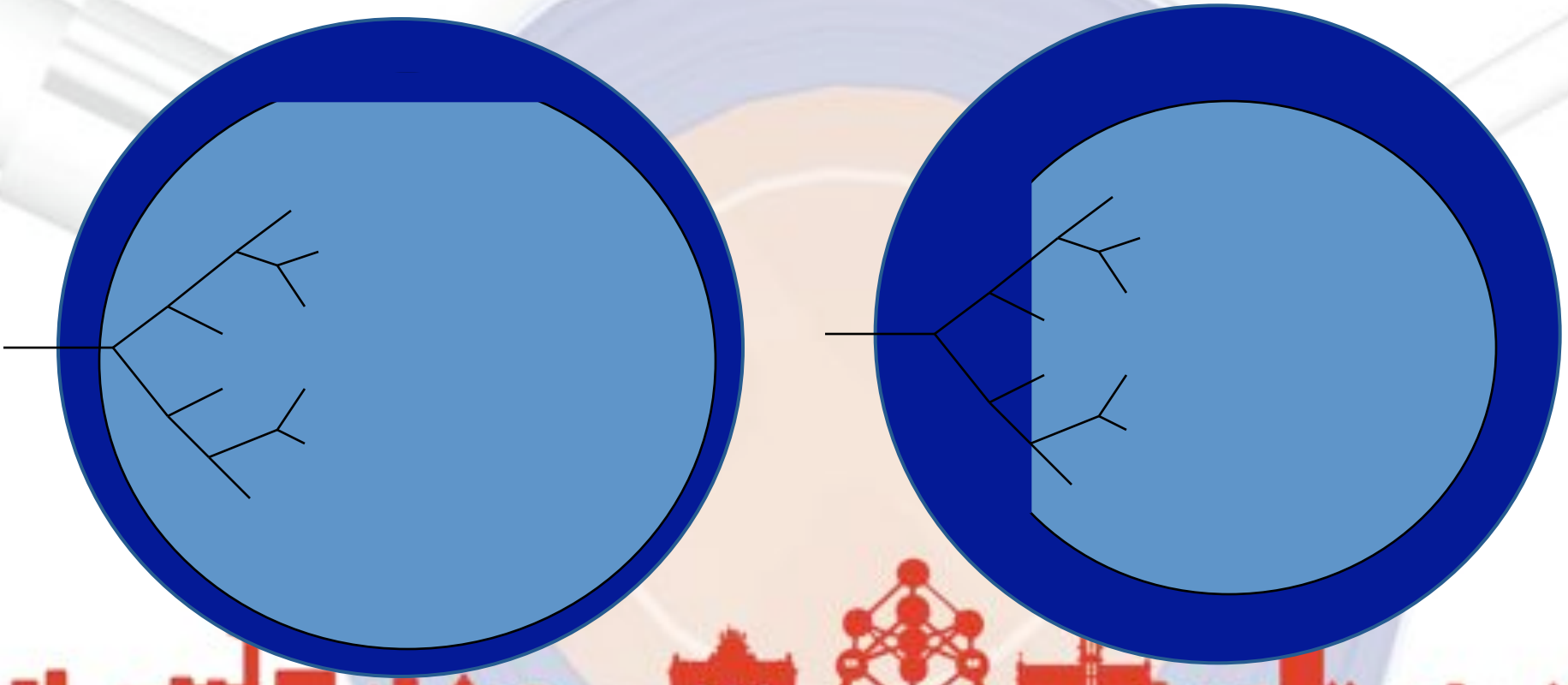
Diameter of the flap

at least 9.5 mm: in case of **hyperopic or astigmatic** ablation

- important in terms of performing the ablation
- ablating the epithelium at the edge of the bed could invite epithelial ingrowth
- Risk of bleeding if flap approaching 10 mm in diameter

Hinge position

Transient neurotrophic keratitis



Hinge position

Refractive effect of the hinge position
- nasal hinge flaps appear to induce minus cylinder at 90º
- superior hinge flaps appear to induce minus cylinder at 180º

This effect is more pronounced with large, thick flaps and steep corneal curvatures (wider hinges).

Induction of aberrations
- superior hinge flaps induce coma

Hinge position

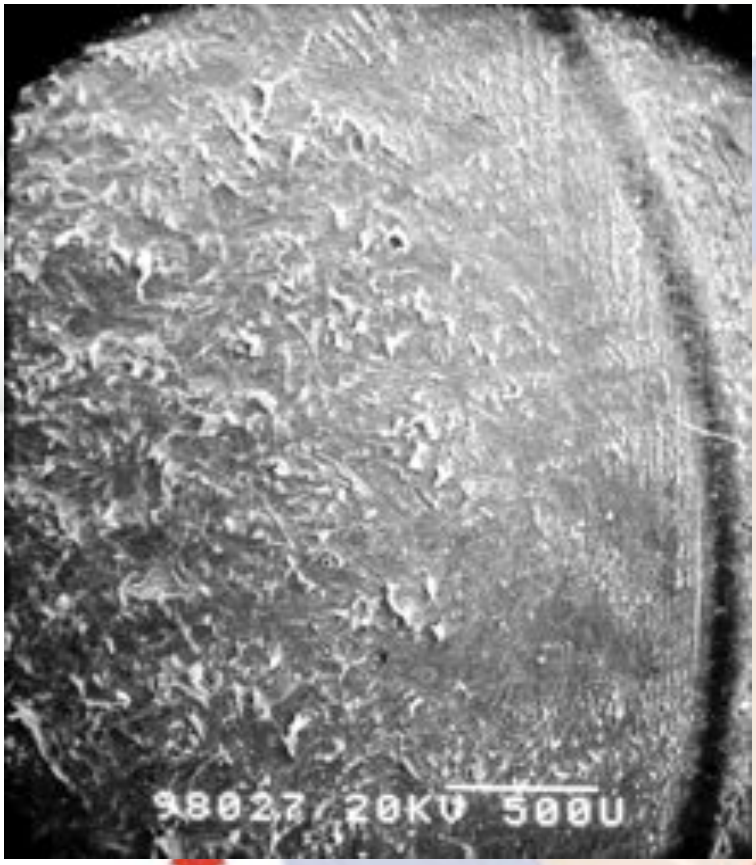
Surgically induced astigmatism **if the hinge is ablated**

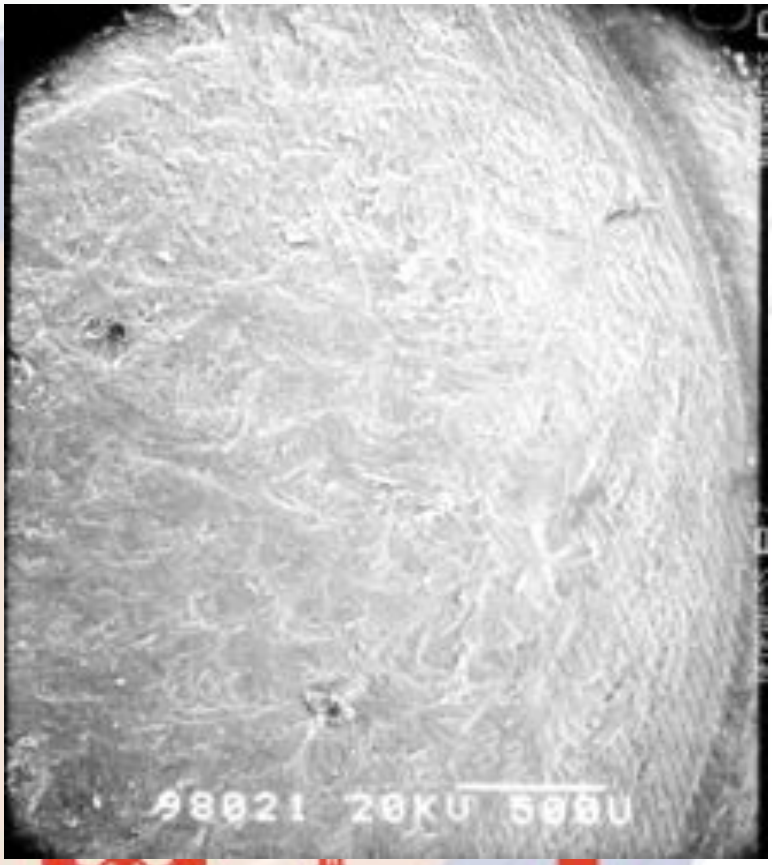
- in the axis of the hinge

- + during hyperopic treatments
- + during astigmatic treatments if improper hinge position

360° hinge placement

Quality of the surface of the bed





Nidek MK 2000

Chiron ACS

Safety

- fixed gap: unable to perforate globe
- blade stop if suction lost
- no cutting on microkeratome reversal
- Automated
- single use keratomes: less manipulation
  - best blade characteristics
  - sterility
- able to visualize cornea

Ergonomics (ease of use)

- Keratome prefixed into suction ring
- Simple attachment of suction, power
- Automated
- *Gearless:* minimizes risk of obstruction, case abort
- Disposable ?

Economics

- Low initial investment
- Reasonable per case cost
- Minimize “associated” costs
  - downtime in between cases
  - need for specialized staff
  - reduced maintenance

Conclusion : The ideal flap

- Thin flaps with a high consistency in the flap thickness: 100 to 120 µ
- Large flaps especially in hyperopic and astigmatic correction, but vascularisation !!!
- Minimal manipulation of blade and keratome
- Easy insertion
- Affordable

Flap Making Trouble using Microkeratomes

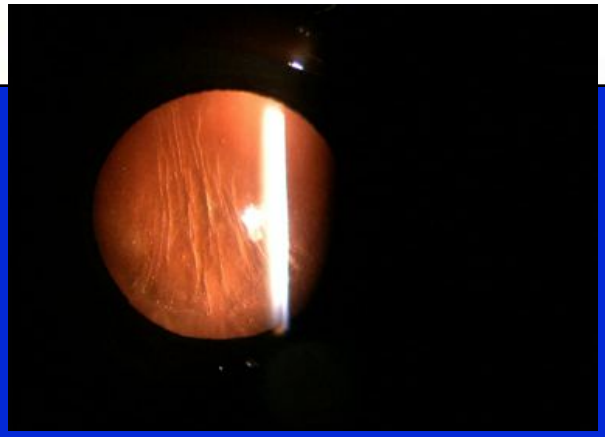
Jérôme C. VRYGHEM, M.D.
Brussels Eye Doctors
Brussels
Belgium

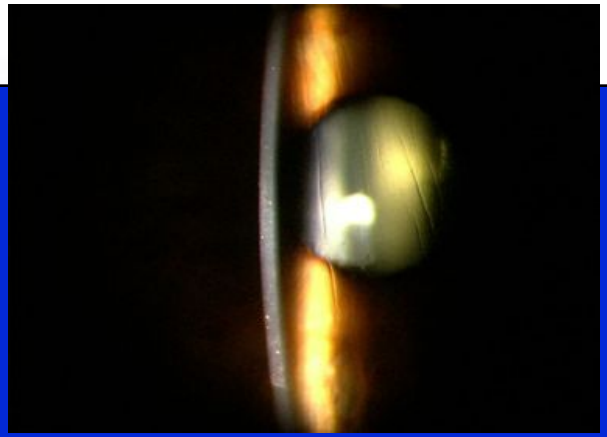
Flap bound complications

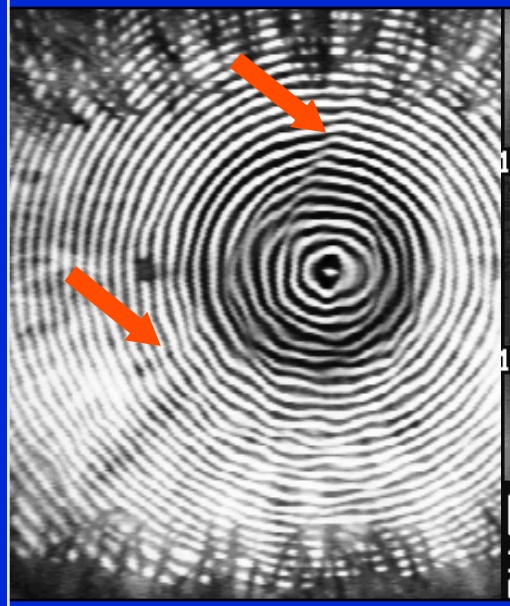
- **Flap dislocation (wrinkles, folds, shifted)**
  - **Rubbing** eye post-op
  - Mechanical trauma
  - Irregular flap
  - Thin flap
  - Poorly repositioned
  - Excess fluid in interface & flap edema
  - Inadequate air drying
  - Poor technique removing lid speculum
  - **Poor post-op tear film**

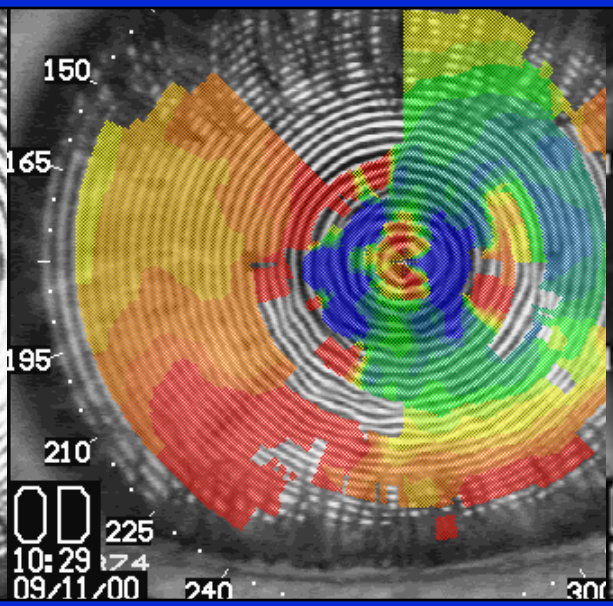
Folds

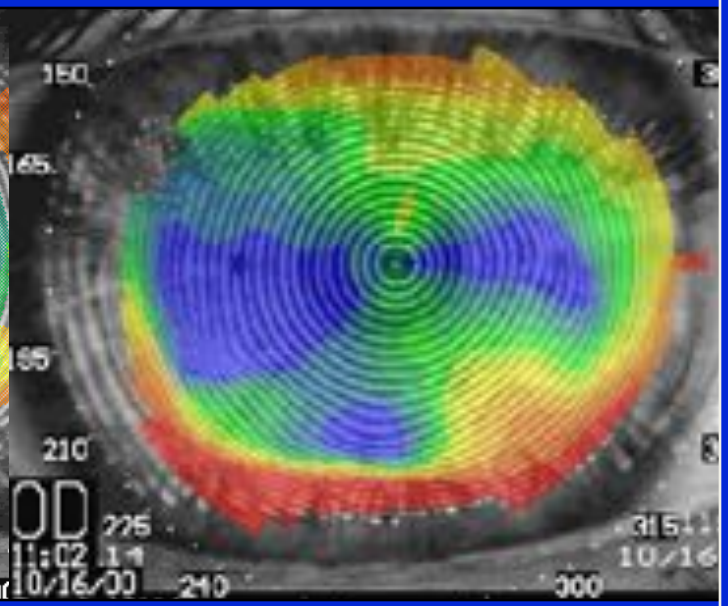
Flap bound complications











Microkeratome bound complications

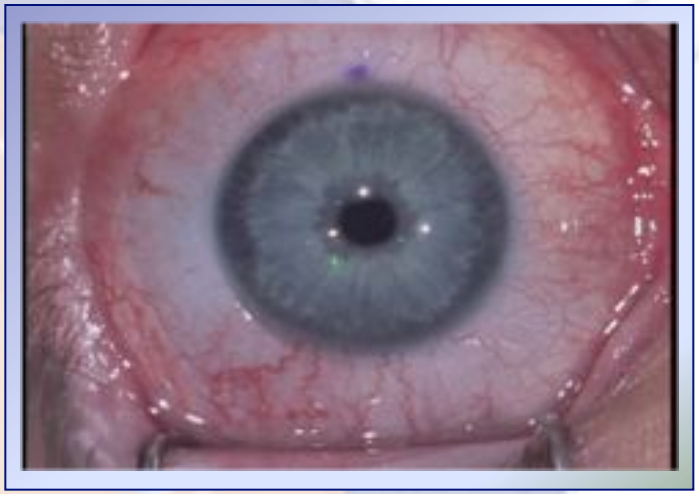
- **No (more)suction**
- No cut
- Interrupted cut (half flap)
- Blade exit within optical zone (Scalp)
- Blade extension to hinge (Free Cap)
- Small / Thin / Decentered flap
- **Large flap (Hemorrhage)**
- **Epithelial Abrasion**
- **Perforation (*Button Hole*)**
- **Near Perforation (Bowman island)**
- Multi-layered stromal strands (recut)
- Dysjunction of flap segments (RK)

Flap Making Trouble

Introduction

Are mostly related to high level of compression required

- **Epithelial adhesion is abnormal (Map-dot-fingerprint dystrophy)**
  - Abrasion, DLK, invasion, melt
- **Extreme corneal shape**
  - < 510 µm or > 46 D
    - Buttonhole, ectasia
  - < 40 D or > 13.5 mm
    - Suction loss
    - Small / incomplete flap
    - Decentered or free cap
  - < 11.5 mm and > 46 D
    - Large flap with hemorrhage
    - Small hinge and displacement



Can be avoided

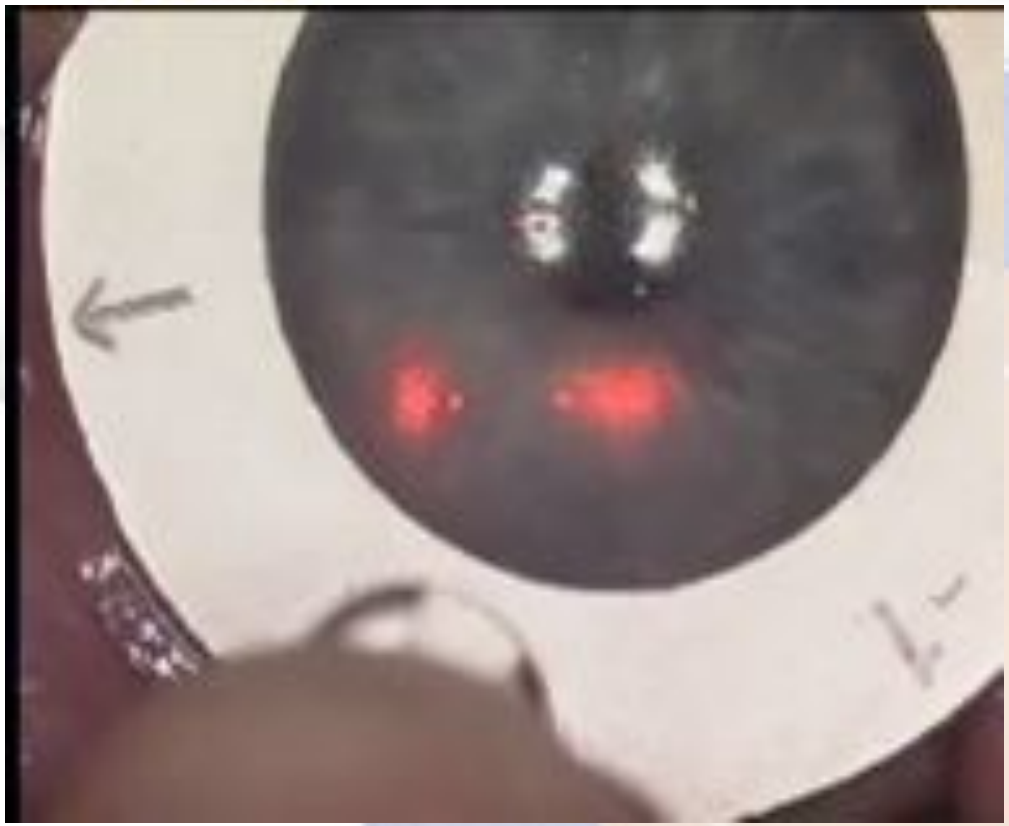
- By careful selection
- By zero compression head, XP keratomes
- by Femtosecond laser !

Flap Making Trouble

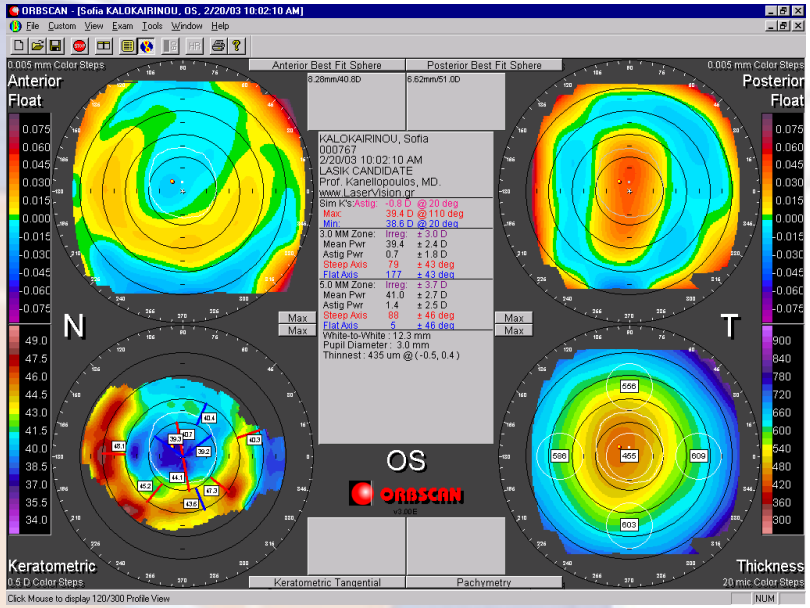
No Flap

Flap Making Trouble

Free Flap



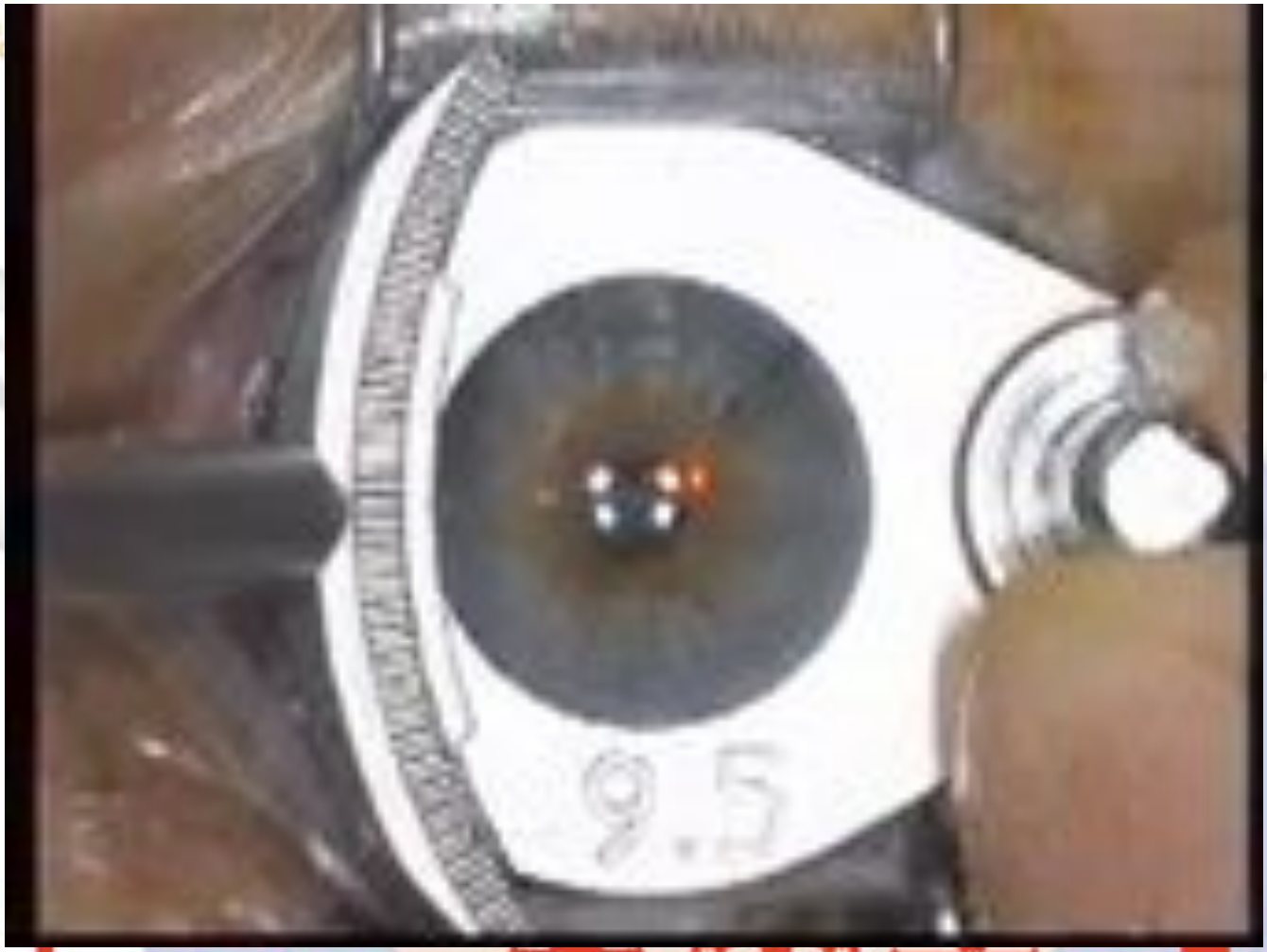
(J. C. Vryghem)



(AJ Kanellopoulos)

Flap Making Trouble

Thin Irregular Flap



(J . C. Vryghem)

Flap Making Trouble

Interrupted Cut

(J . C. Vryghem)

Flap Making Trouble

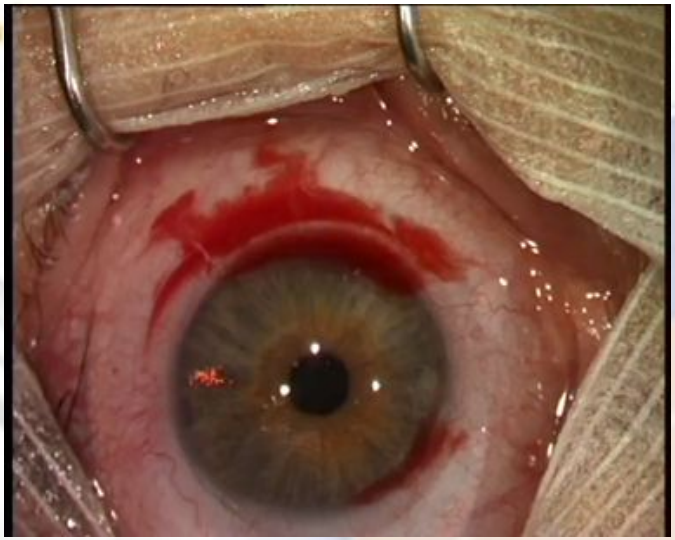
Hansatome block from speculum

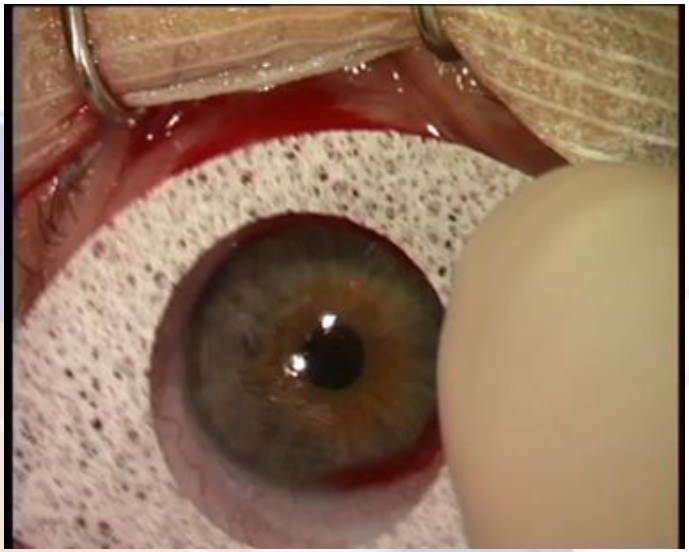
Flap Making Trouble

Suction Loss and Partial Flap

Flap Making Trouble

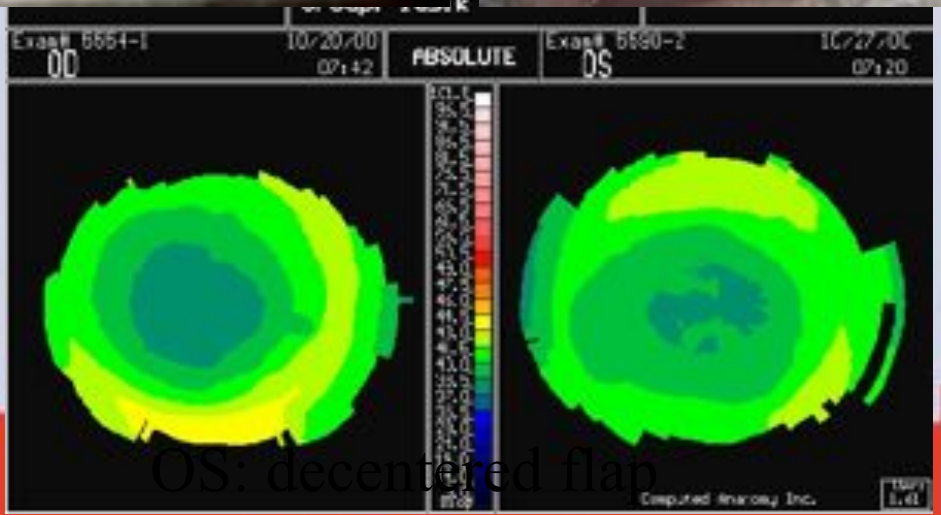
Large Flap with Bleeding (Hyperopic)





Flap Making Trouble

Decentered flap - Centered ablation



OS: decentered flap

Button Holes

Cause: **Bad fit keratome-eye**

- Inadequate suction
  - Suction setting inadequate
  - Suction tubing defective
  - Suction ring occluded by improper cleaning
- Pseudosuction
  - Conjunctiva plugged aspiration hole
  - Scleral irregularity (buckle, scars)
  - Flat cornea
- Loose epithelium

Button Holes

Cause: **Buckling of excess cornea tissue**

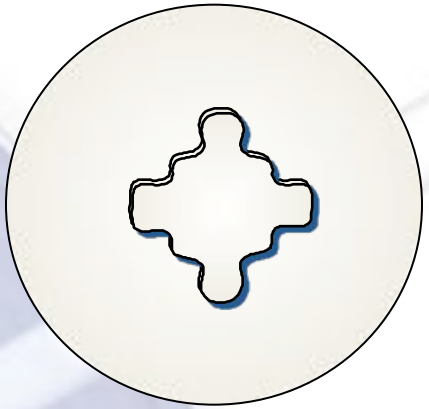
- Steep cornea (>46 D)
- Toric cornea (> 3 D)
- Defective/ Blunt blade

Button-hole

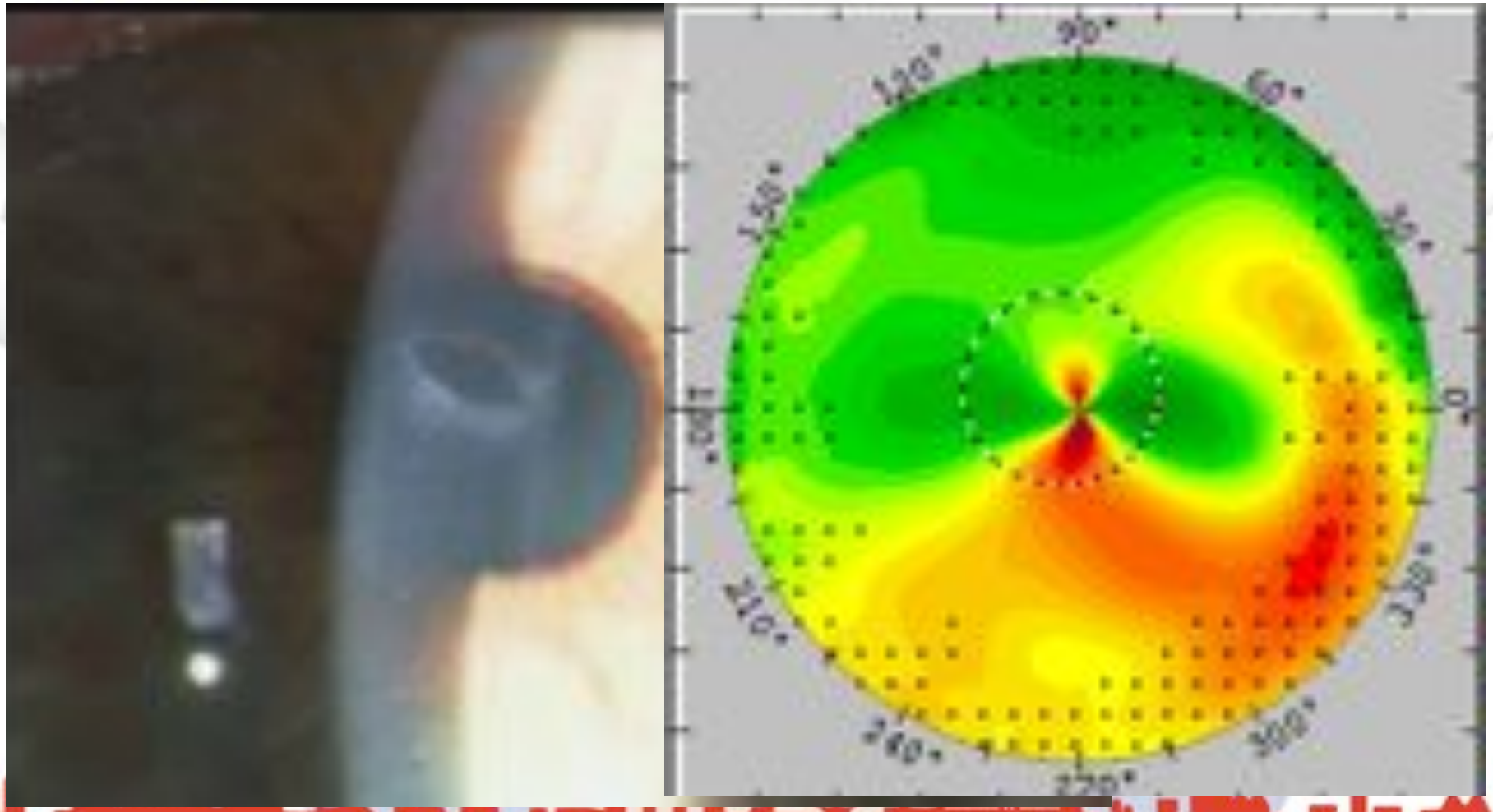
Button Holes

Treatment

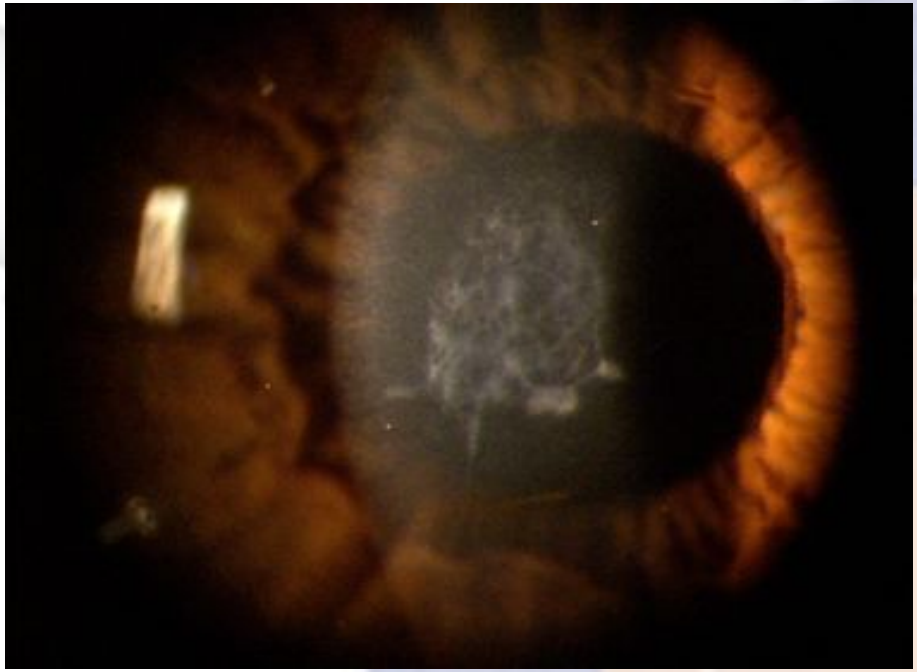
- Management *intraoperatively*
  - Check flap before lifting
  - If buttonhole is suspected or evident
    - lift the flap very carefully (no ablation)
    - Careful but meticulous irrigate interface
    - Reposition flap like a micro- jigsaw puzzle
    - Dry edges of hole to prevent epithelial ingrowth
  - Bandage contact lens if needed

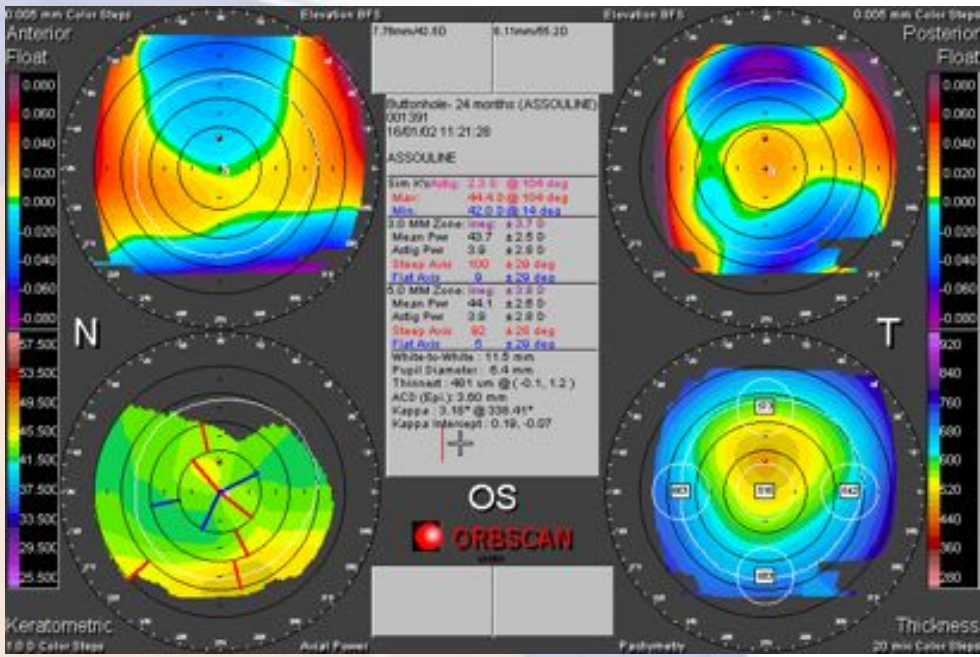


Buttonhole

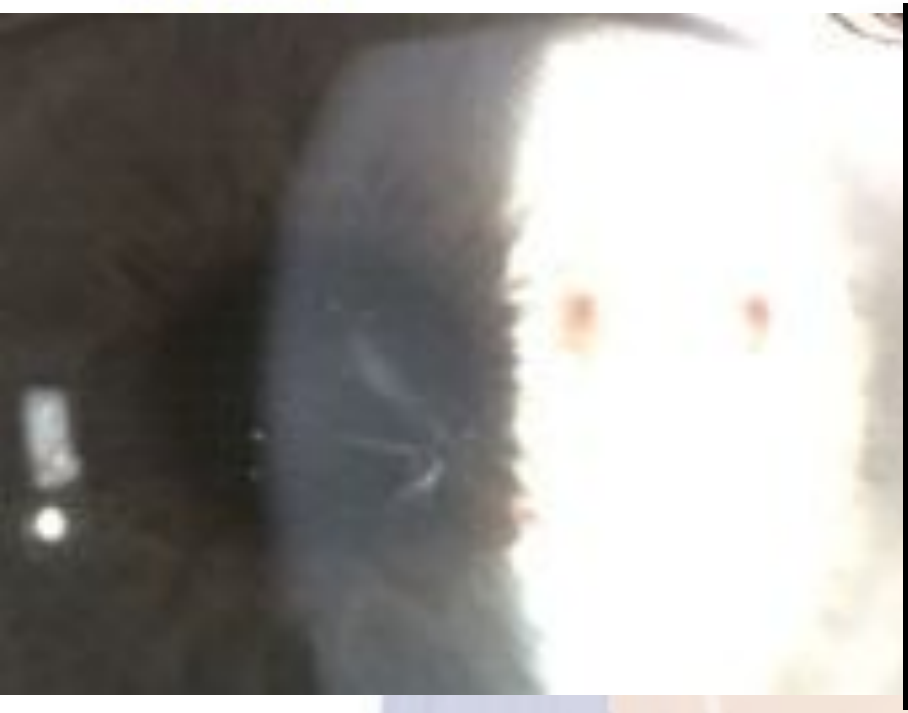


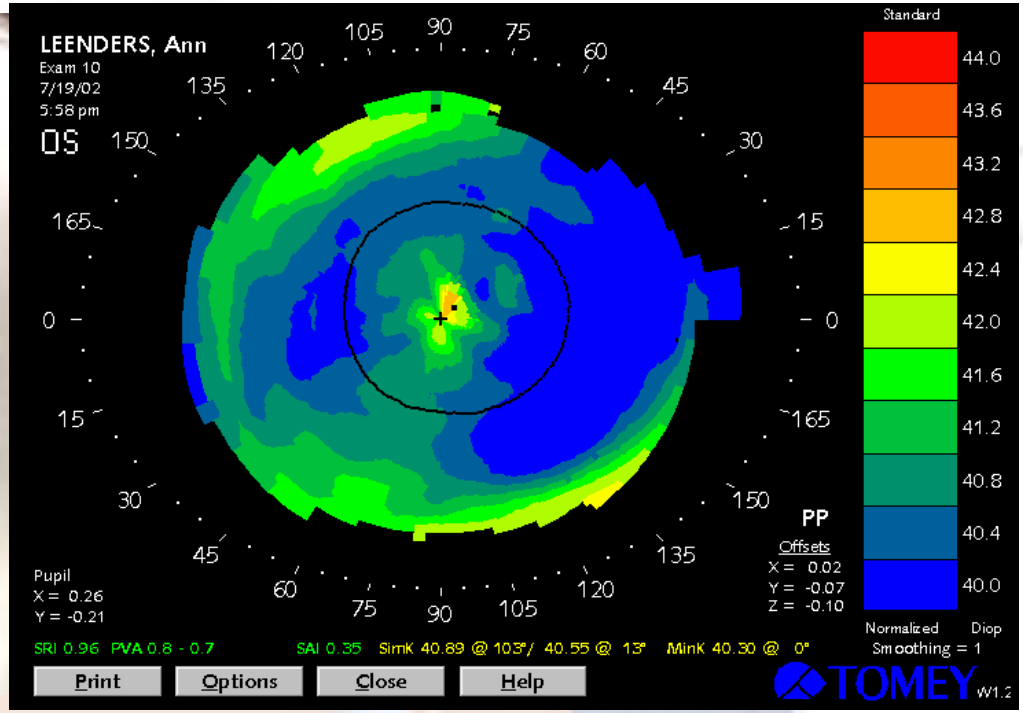
Near Button Hole (Bowman)





Near Button Hole (Bowman)





Button Holes

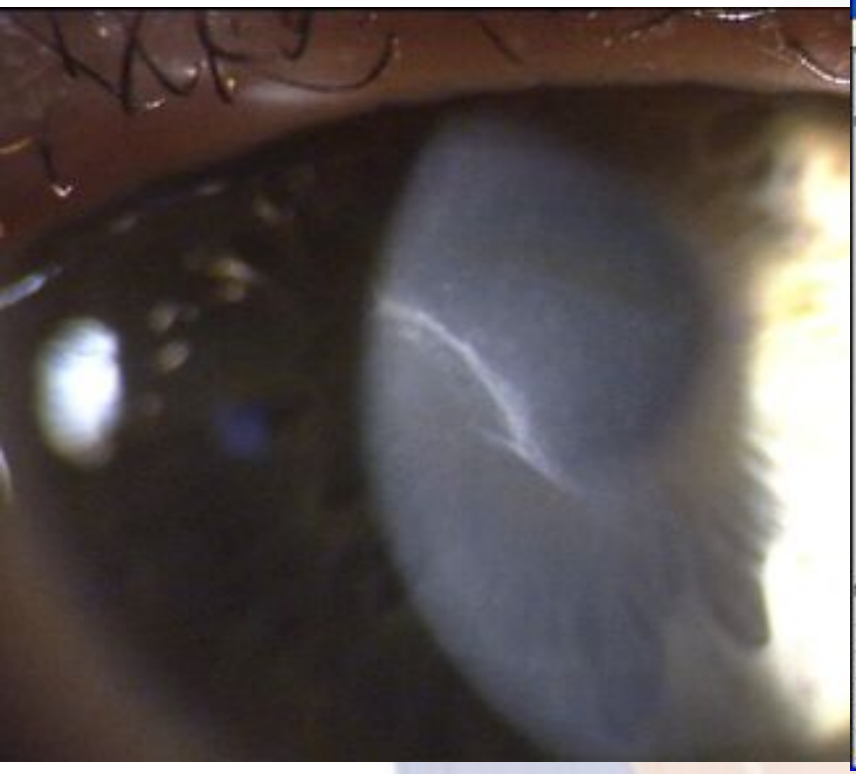
Prevention

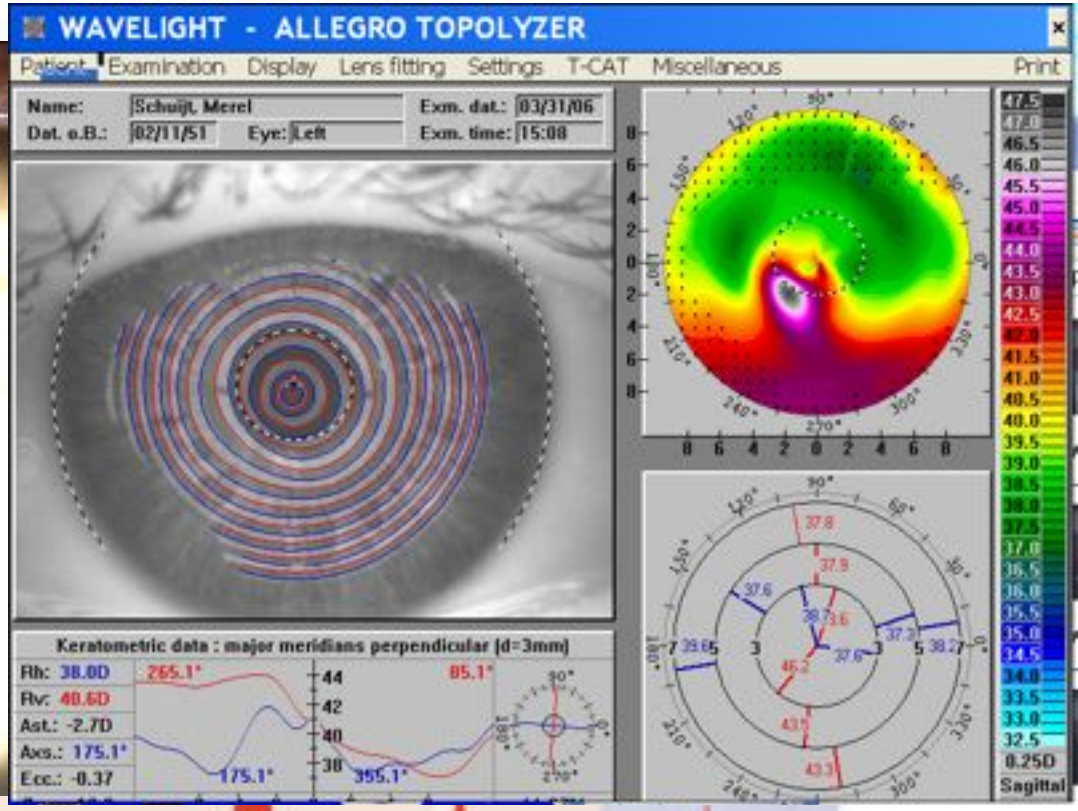
- Know your microkeratome!
  - Adequate suction
  - Meticulous cleaning & assembling protocol
- Careful preop. ‘reading’ of corneal and scleral anatomy
- Customize microkeratome - settings to cornea
  - Thicker flap and smaller ring for extreme K and Cyl
  - Hinge on steep meridian
  - Avoid cheap unknown blades
- Learning curve

Recut after Button-hole

Multi-layered flap !!!

Recut after Button-hole





Multi-layered flap !!!

XXXIIIst Congress of the ESCRS, London
Instructional Course # 112, Tueday September 16, 2014
14h30 – 16h30

Complications in Lasik: Prevention and Management

Organizer: **Jérôme C. VRYGHEM**, Brussels, Belgium
Moderator: **Michael ASSOULINE**, Paris, France
Panel: **Sheraz M. DAYA** , London, United Kingdom
A. John KANELLOPOULOS, Athens, Greece
Arthur CUMMINGS, Dublin, Ireland
Michiel LUGER, Utrecht, The Netherlands

Thank you for your attention!!

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