Laser Vision Correction

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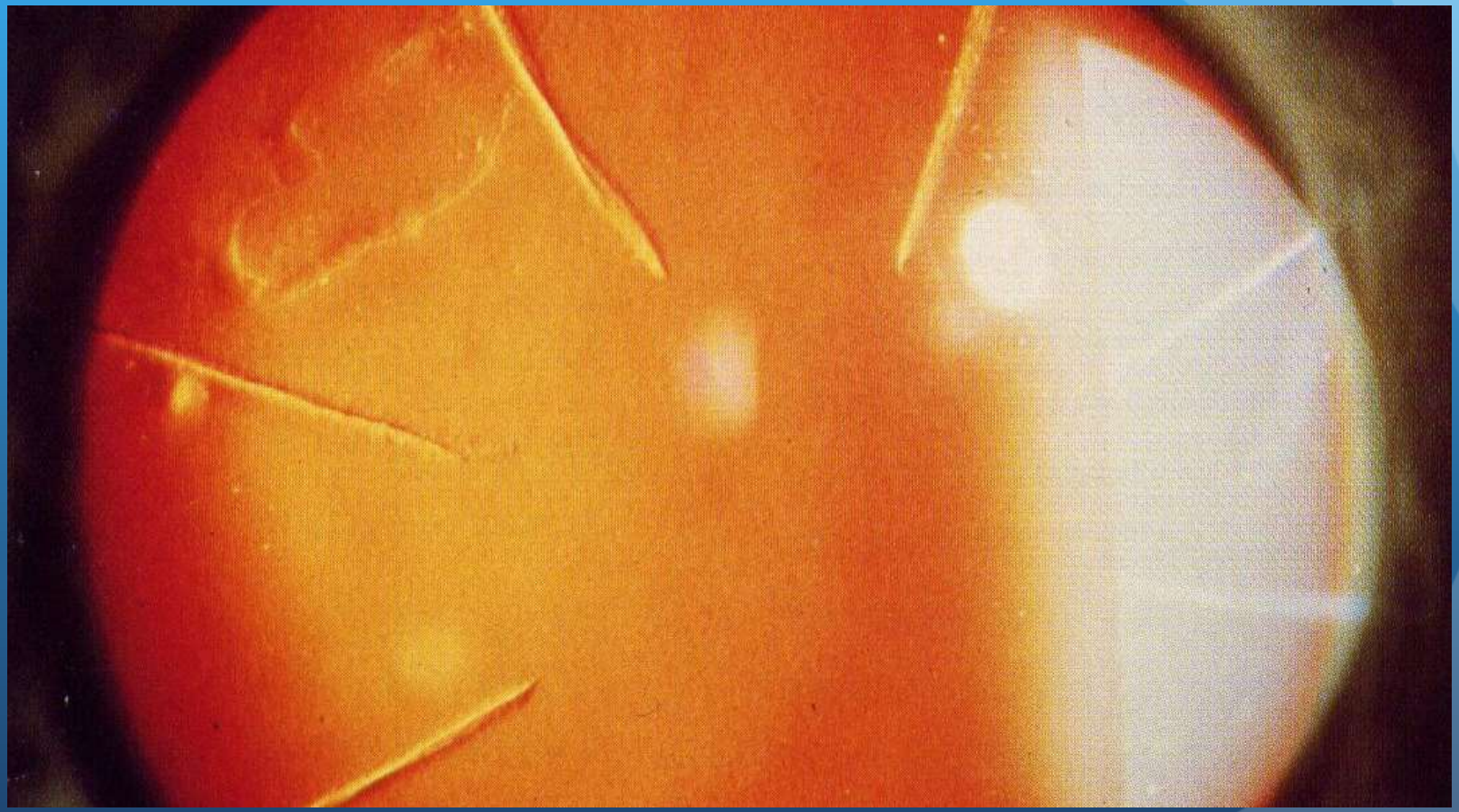
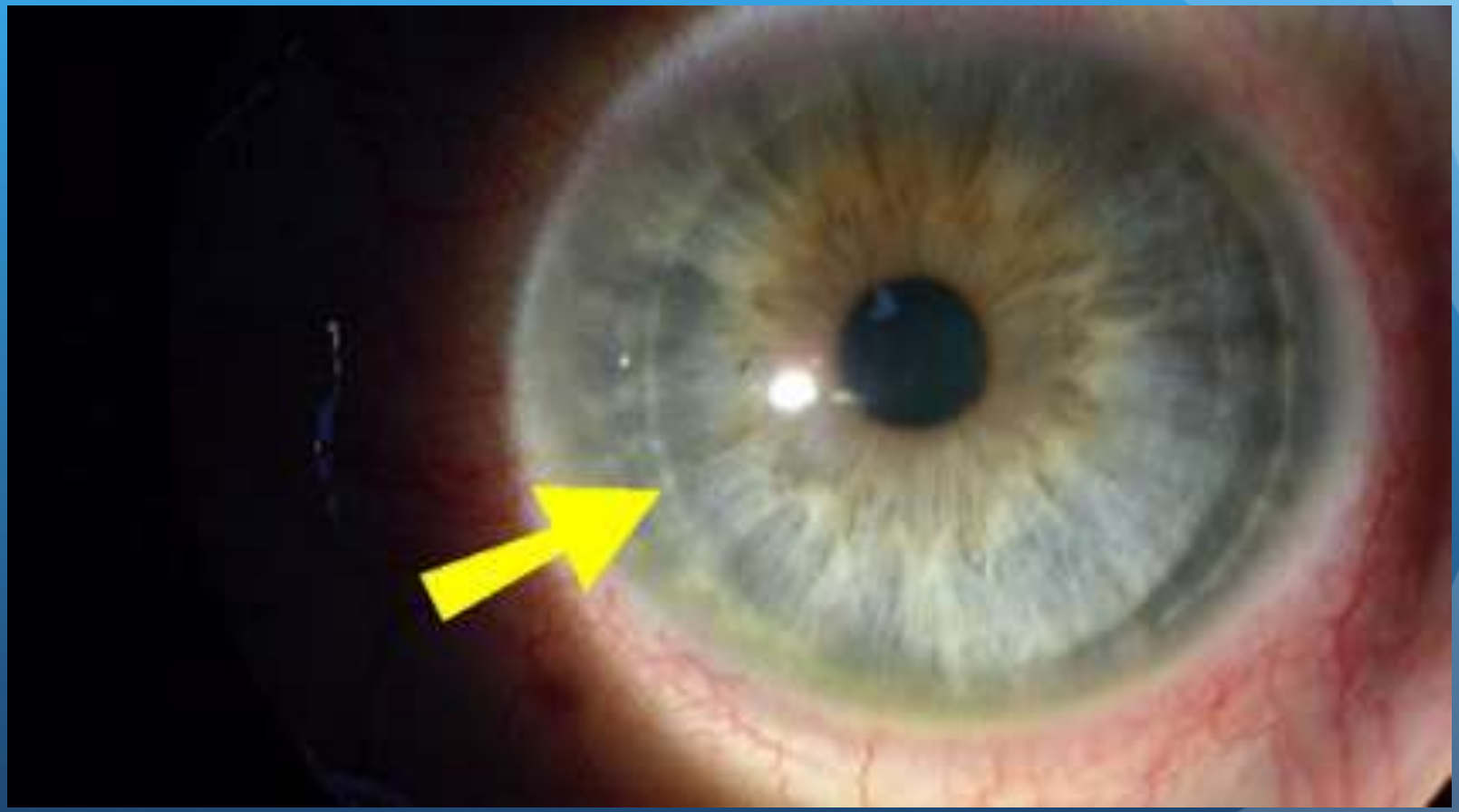


History of Corneal Refractive Surgery

- Radial Keratotomy- 1974- Svyatoslav Fyodorov- Russian Ophthalmologist

History of corneal refractive surgery

- 1987- Theo Seiler- German Ophthalmologist performed the first photorefractive keratectomy



History of corneal refractive surgery

- 1991-Ioannis Pallikaris- Greek Ophthalmologist- First laser assisted in situ keratomileuisis

History of Laser Treatments

- Argon Fluoride- Argon and Fluorine gas react to make an excited dimer molecule (excimer) and radiate energy at 193 nm. Ar-F laser was invented in 1976
- Most wide spread use is to make computer chips. Mercury Xenon was used in 1960s-1980s
- 1981, IBM researcher Rangaswamy Srinivasan brought his Thanksgiving leftovers to the lab and irradiated turkey cartilage with the Argon-Fluoride laser. Noted precise control and no damage to adjacent tissue
- 1983, Srinivasan worked with Stephen Trokel to demonstrate the precise effects on cows' eyes

History of laser treatments

- Charles Munnerlyn created the first working excimer laser for vision correction in 1985
- Created Munnerlyn's formula
  - Ablation depth = Ablation diameter squared/3= microns per diopter ablated
  - Example- 6 mm optical zone is 12 microns ablated per diopter of treatment
  - Does not account for transition zones and astigmatism

History of laser treatments

- Types of lasers
  - Broad beam
  - Flying spot
  - Scanning Slit

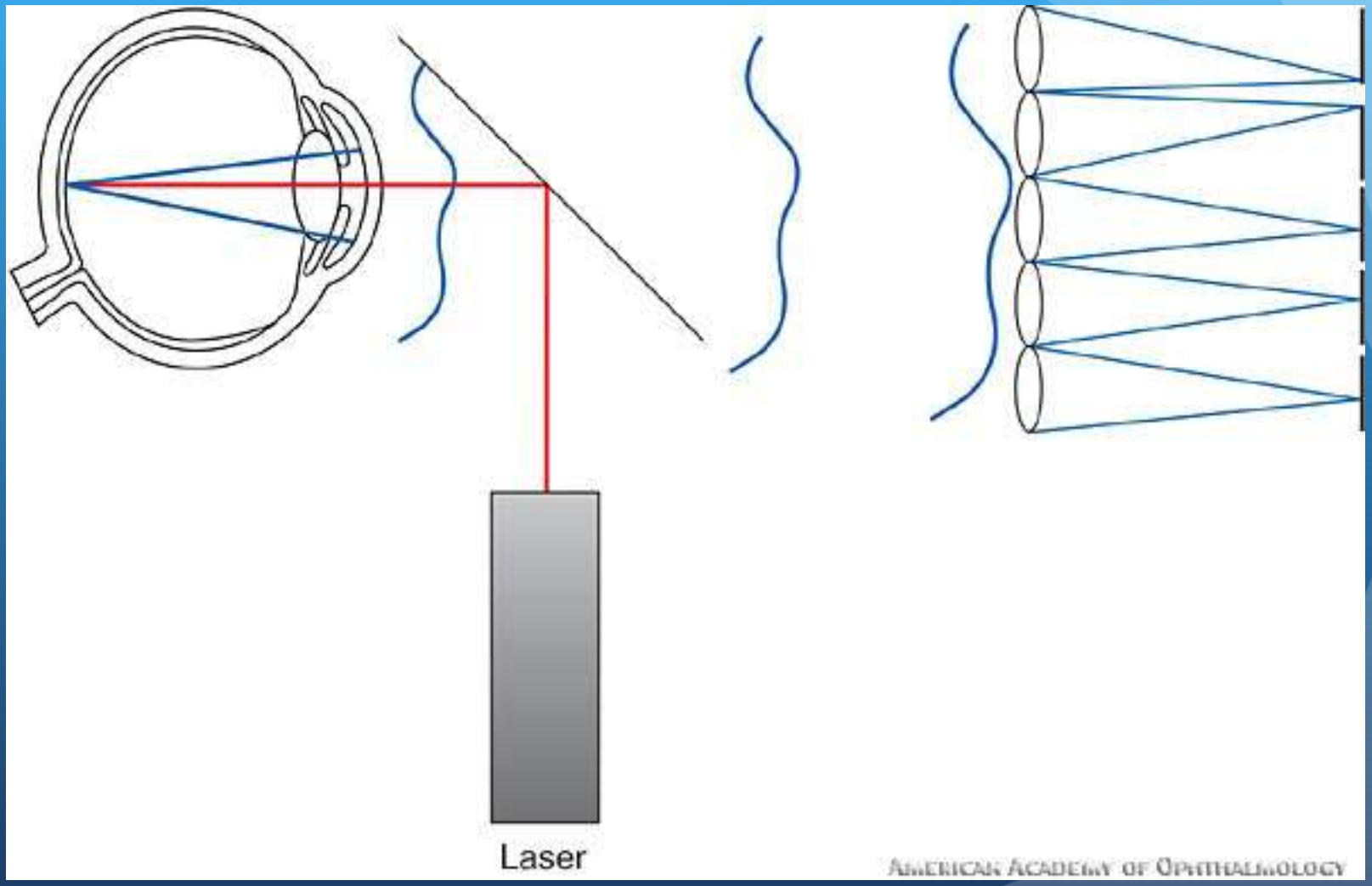
AMO- VISX

Alcon- Wavelight Allegretto

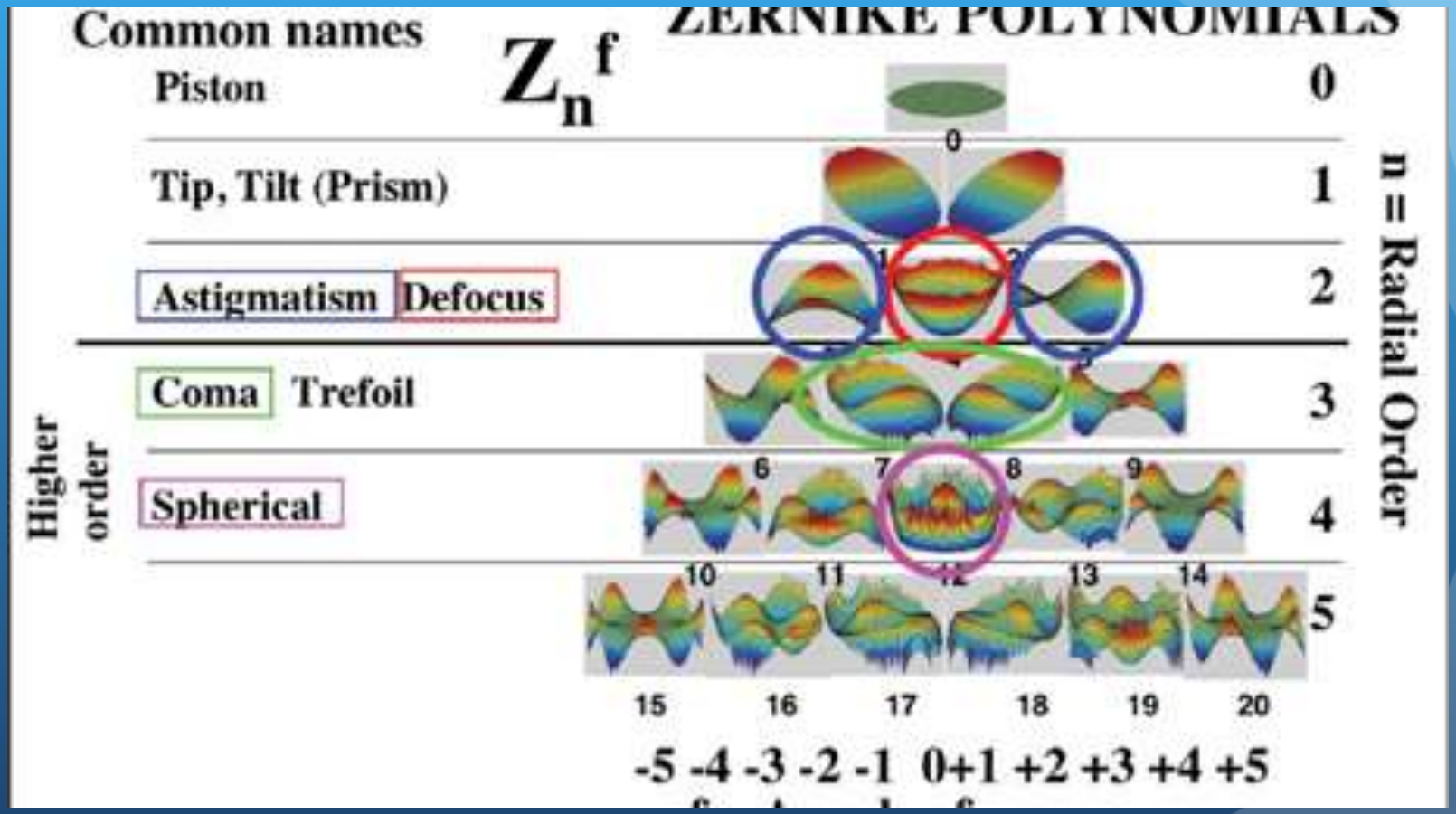
History of laser treatments

- Evolution of laser treatments
  - Zone sizes
  - Transition Zones
  - Wavefront treatments
  - Aberrations
    - Correct Lower order- sphere, cylinder- up to 95% aberrations treated
    - Correct Lower and Higher order- coma, spherical aberration- up to 99% of aberrations
  - Types of treatments
    - Wavefront-guided
    - Wavefront-optimized
  - Topography-guided treatments

Hartmann-Shack Wavefront Sensor

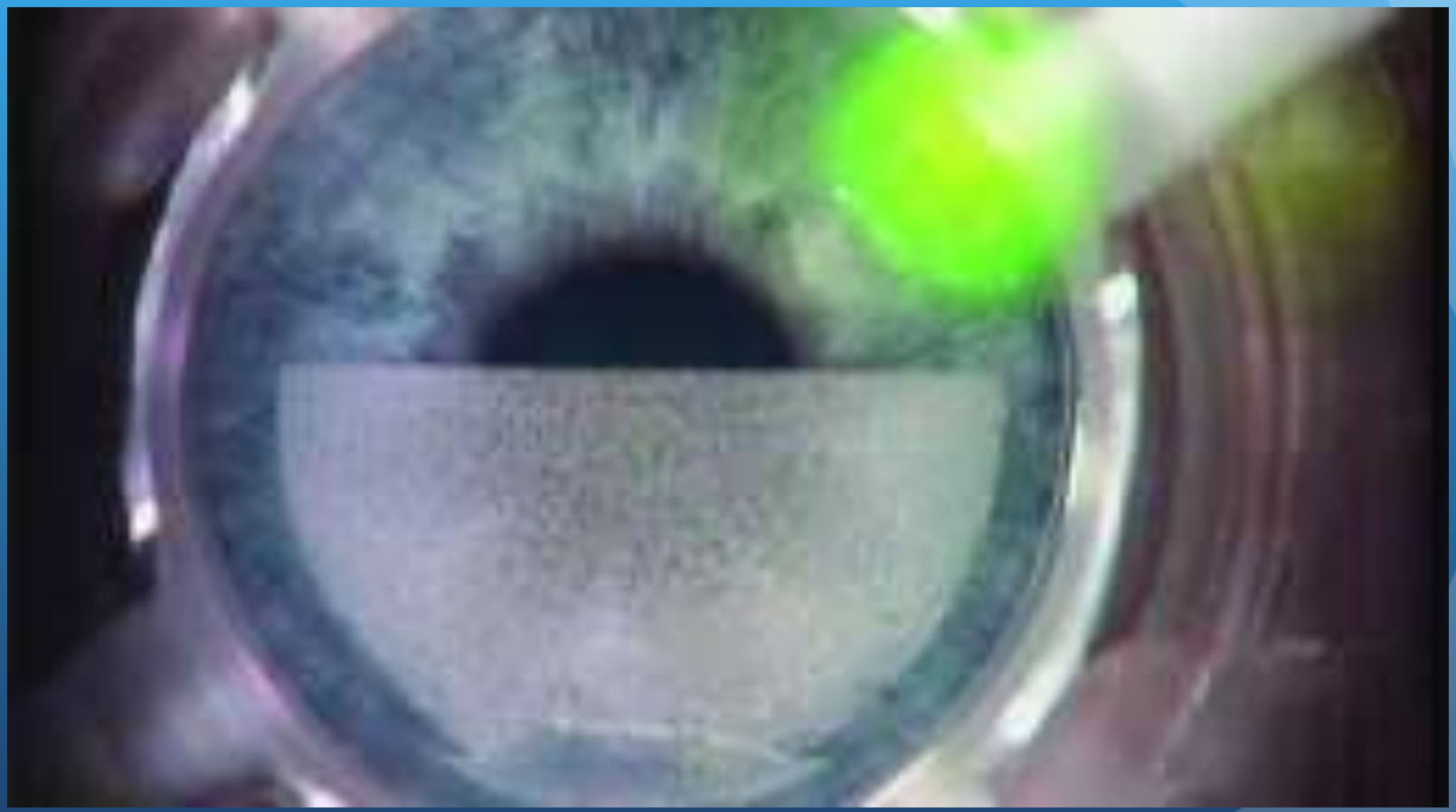


Zernike Polynomials



History of LASIK Flaps

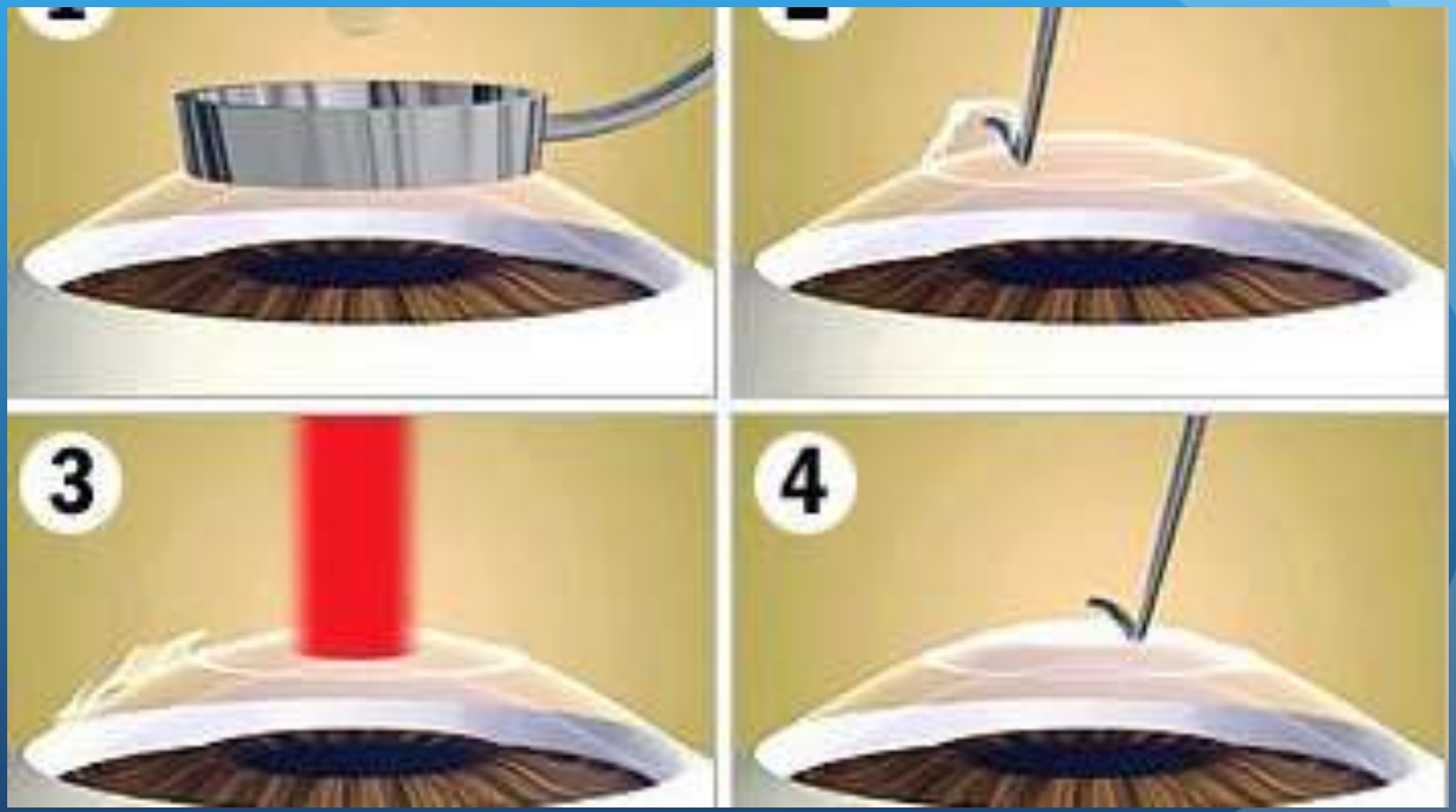
- Microkeratomes
  - Variable depth
  - Fixed depth
  - Hinge location
    - Nasal hinge
    - Superior hinge
- Femtosecond lasers



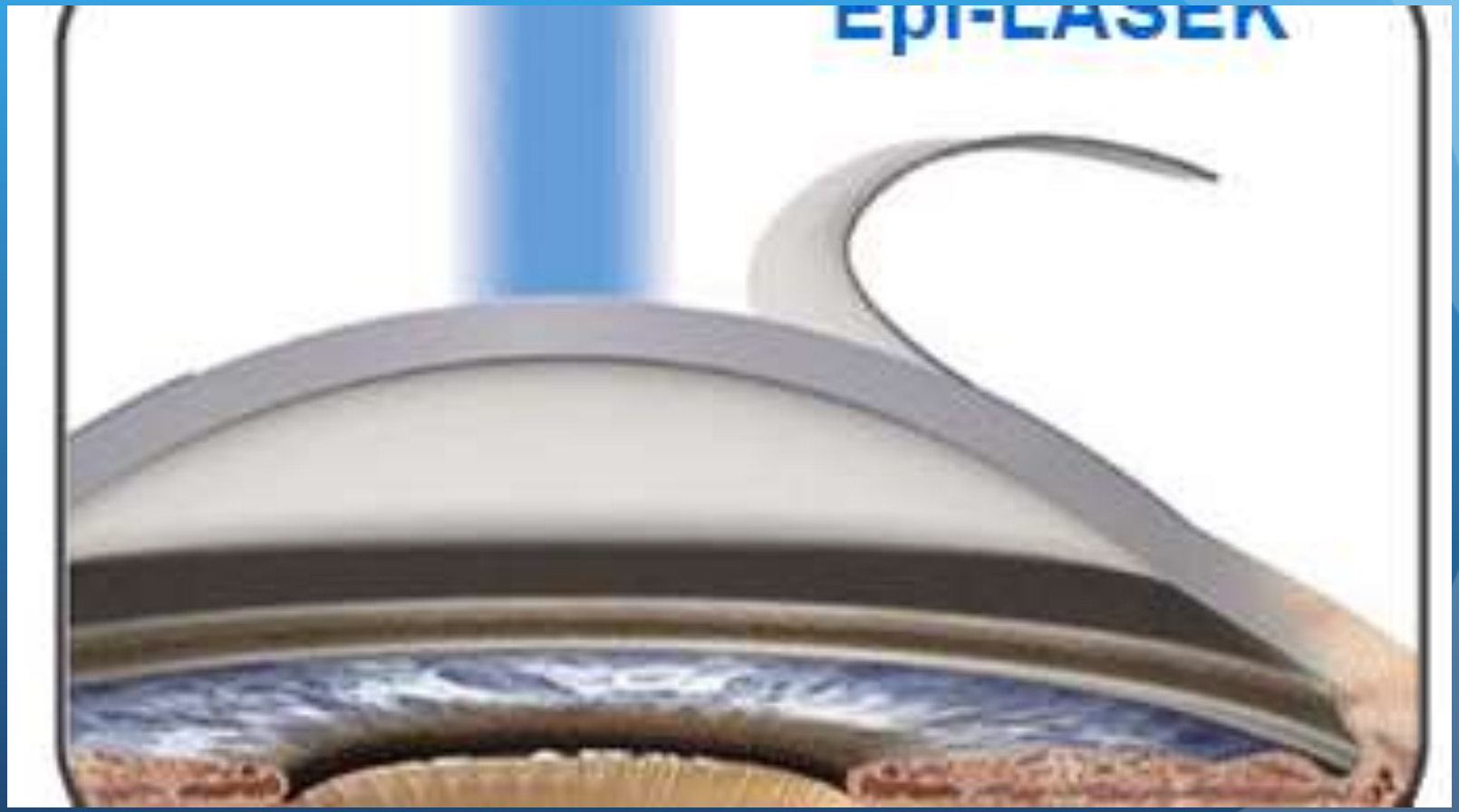
History of surface ablation techniques

- Photorefractive keratectomy (PRK)
- Advanced surface ablation
  - PRK with mitomycin C
  - LASEK
  - Epi-LASIK

PRK vs. LASEK



Epi-LASIK



Pre-operative assessment for laser vision correction

- Randleman's criteria for keratoectasia risk
  - Age
  - Topography
  - Pachymetry
  - Residual stromal bed
  - Prescription

Ectasia risk factor score system

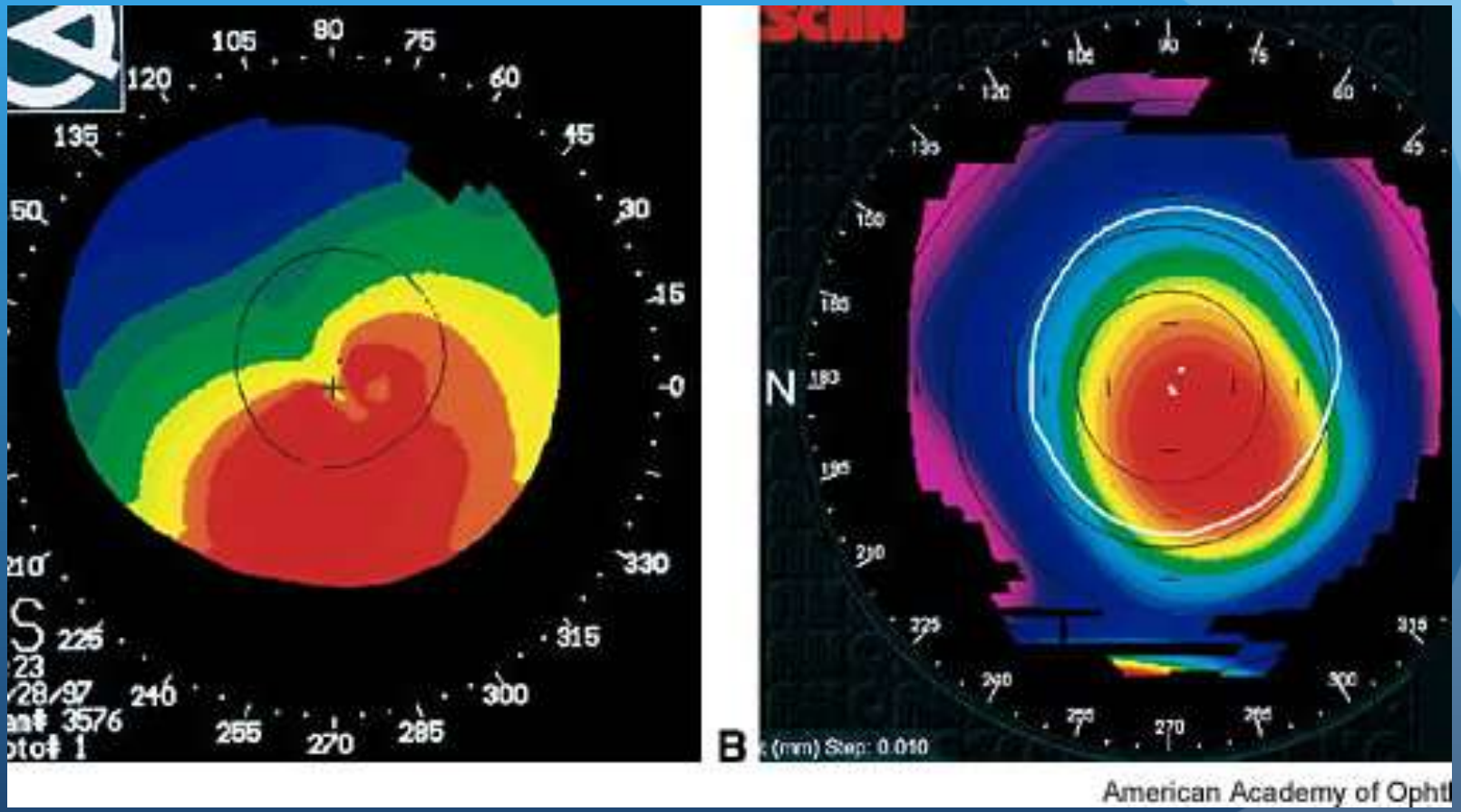
Parameter	Points				
	4	3	2	1	0
Topography pattern	FFKC	Inferior steepening/SRA		ABT	Normal/SBT
RSB thickness (μm)	<240	240–259	260–279	280–299	>300
Age (yrs)		18–21	22–25	26–29	>30
CT (μm)	<450	451–480	481–510		>510
MRSE (D)	>−14	>−12 to −14	>−10 to −12	>−8 to −10	−8 or less

Via this method, any potential refractive surgery candidate could be given a cumulative score for ectasia risk. Based on that score, patients could be assigned a risk category, and surgeons advised whether or not to proceed with refractive surgery in the following way (courtesy of *Ophthalmology*).

Cumulative Risk Scale Score	Risk Category	Recommendations	Comments
0 to 2	Low risk	Proceed with LASIK or surface ablation	
3	Moderate risk	Proceed with caution, consider special informed consent; safety of surface ablation has not been established	Consider MRSE stability, degree of astigmatism, between-eye topographic asymmetry, and family history
4 or more	High risk	Do not perform LASIK; safety of surface ablation has not been established	

Pre-operative assessment for laser vision correction

- Systemic diseases- Diabetes Mellitus, Autoimmune diseases.
- Ocular diseases- Keratoconus, Cataract, Uncontrolled glaucoma, Herpes Simplex Keratitis, Significant dry eye
- Medications- Accutane, Amiodarone, Imitrex
- Spectacle Prescription- Sweet Spot -8 D to +3 D, with less than 3 D of cylinder
  - Treatment Range- Approved from -14 D to +6 D, up to 6 D of cylinder
  - Stability of prescription, change in sphere or cylinder of less than 0.5 D in the past 12 months


105
80
75
120
60
135
15
50
30
15
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210
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240
300
255
270
285
B
N
(mm) Step: 0.010
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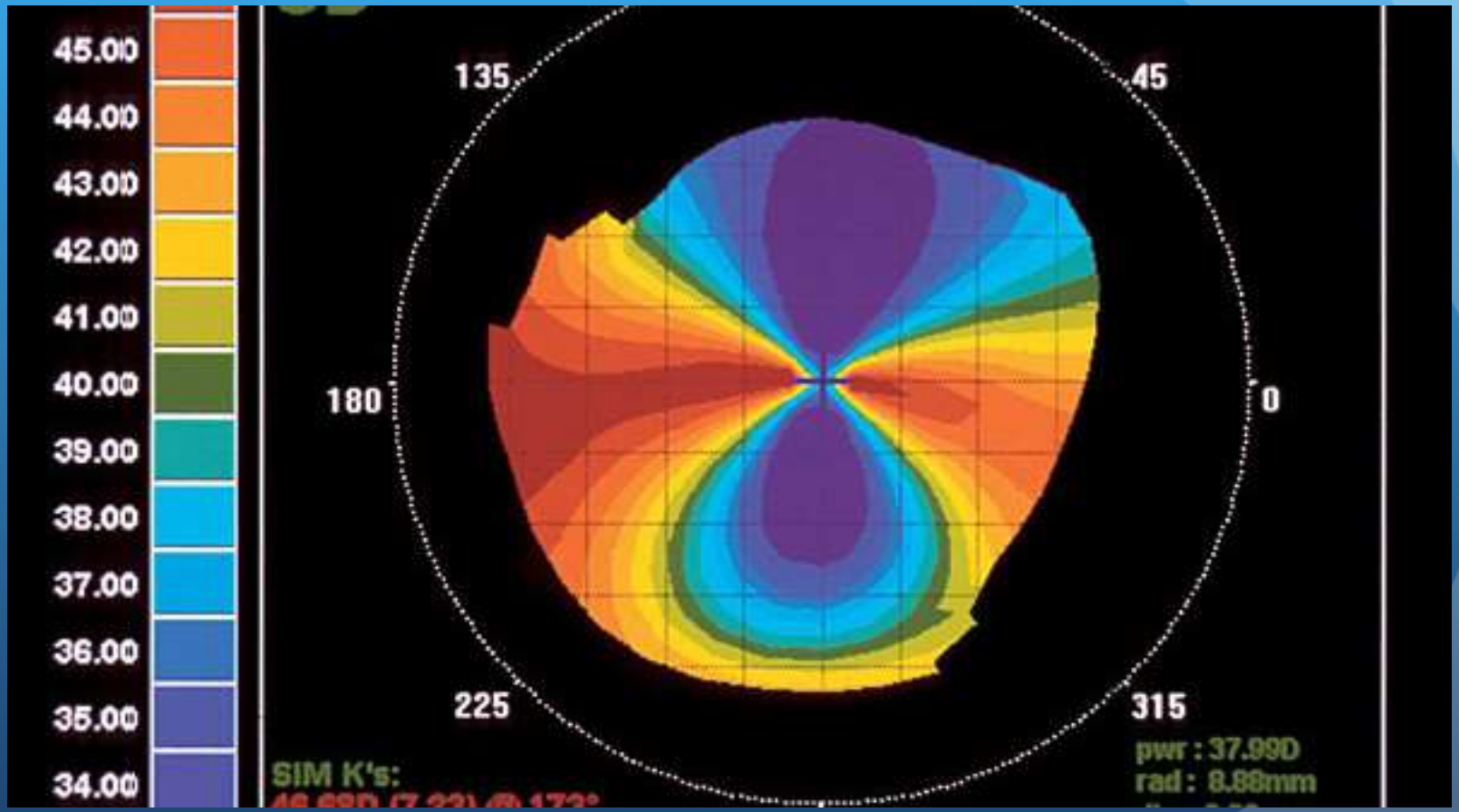
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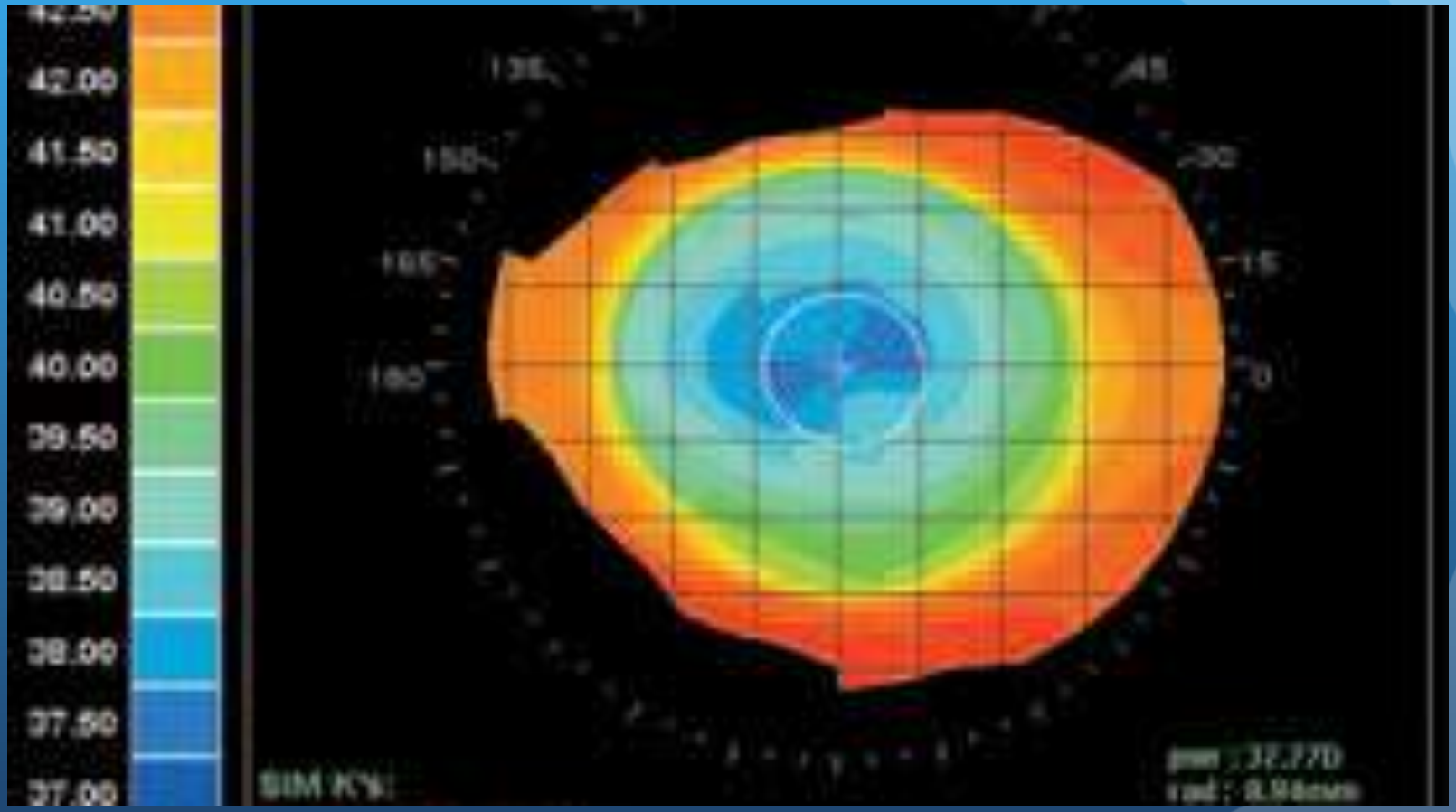
37.00
36.00
35.00
34.00
135
45
180
0
225
315
SIM K's:
pwr : 37.99D
rad : 8.88mm

Pre-operative assessment for laser vision correction

- Monovision option
- Dominant eye
- Pupil size

Surgical results- Custom LVC

- Myopia- 90% 20/20
- Hyperopia- 60% 20/20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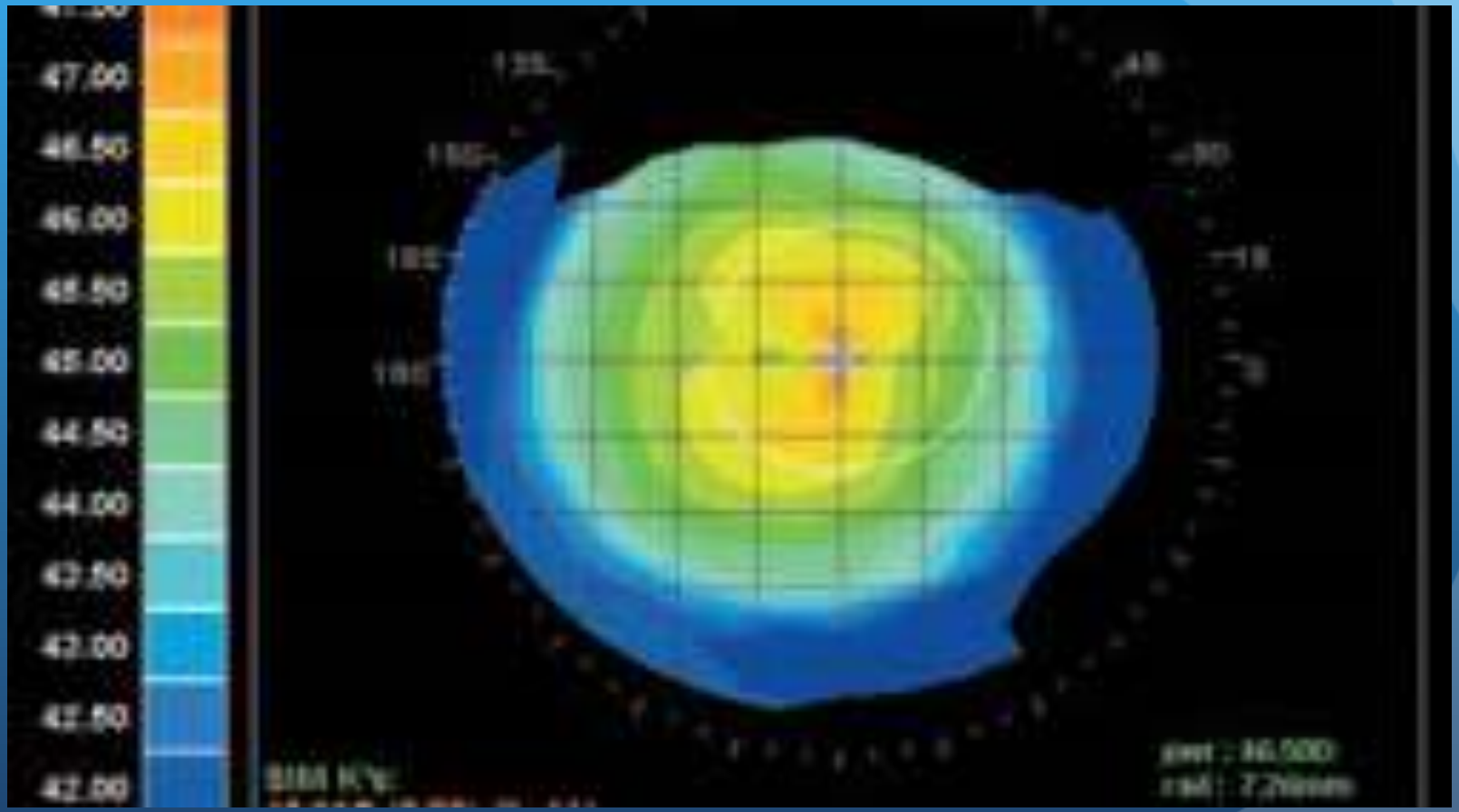
SIM K's: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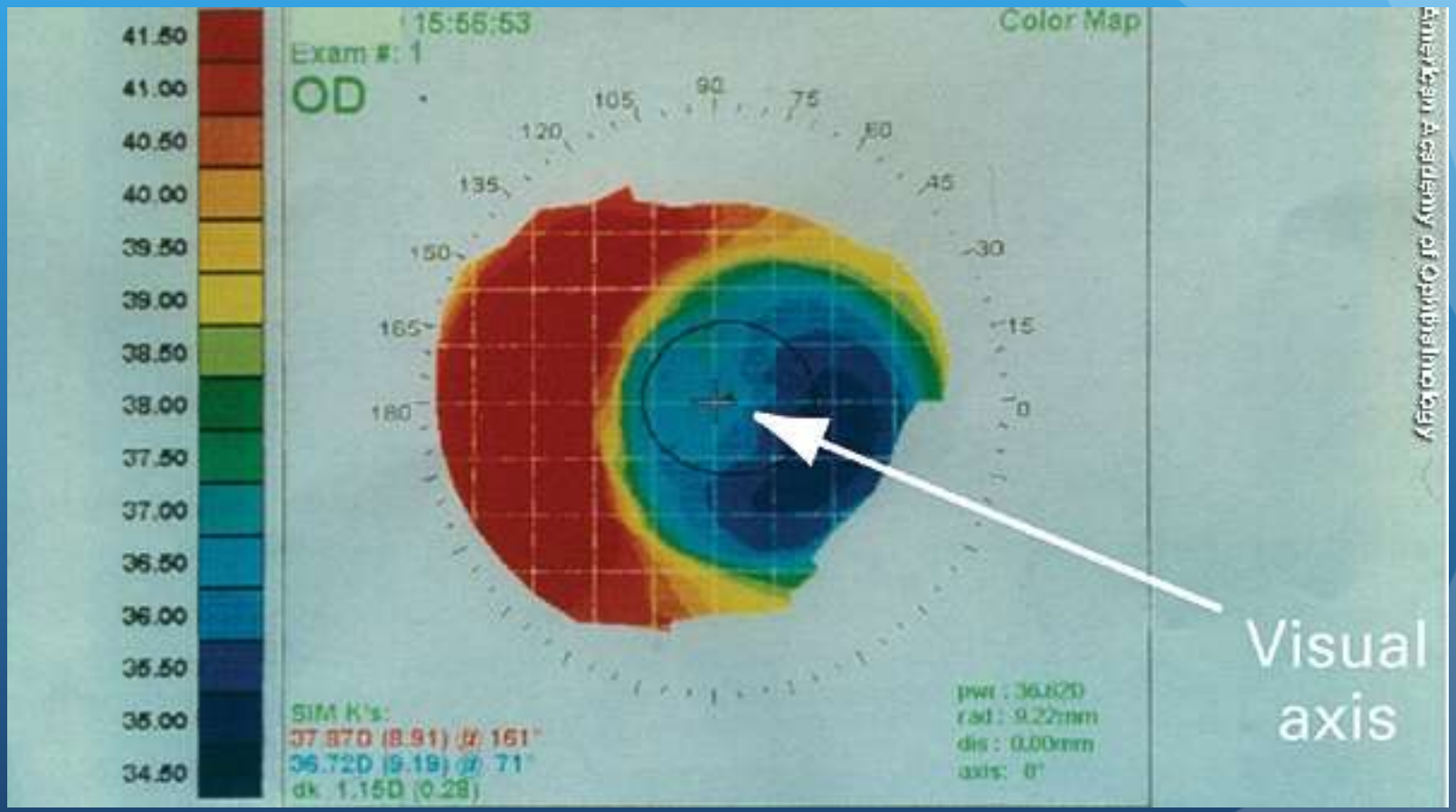
15:55:53
Color Map
Exam #: 1
OD
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36.00
35.50
35.00
34.50
105
90
75
120
60
135
45
150
30
165
15
180
0
SIM K's:
37.87D (8.91) @ 161°
36.72D (9.19) @ 71°
dk 1.15D (0.28)
pwr : 36.82D
rad : 9.22mm
dis : 0.00mm
axis: 0°
Visual axis
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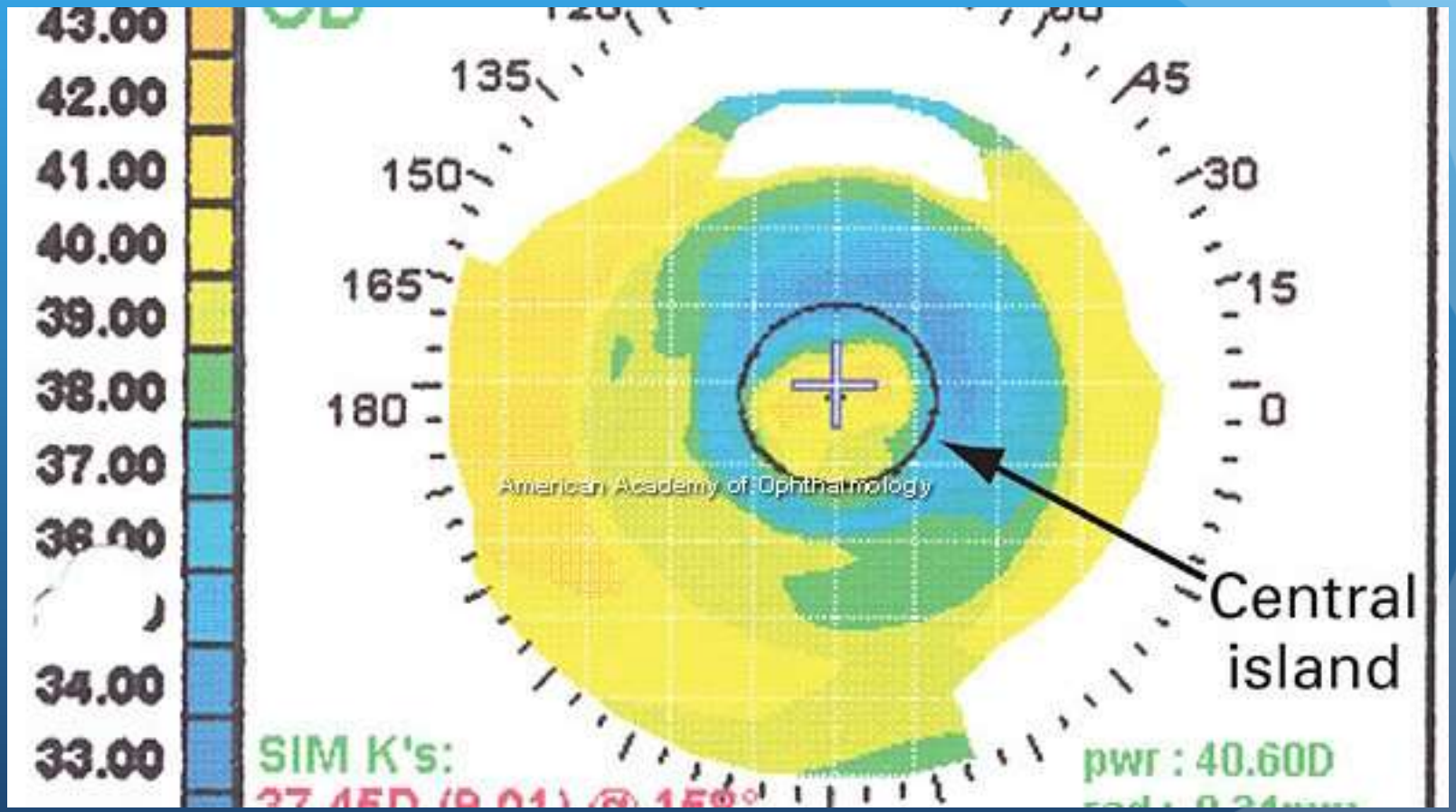
43.00
42.00
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45
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0
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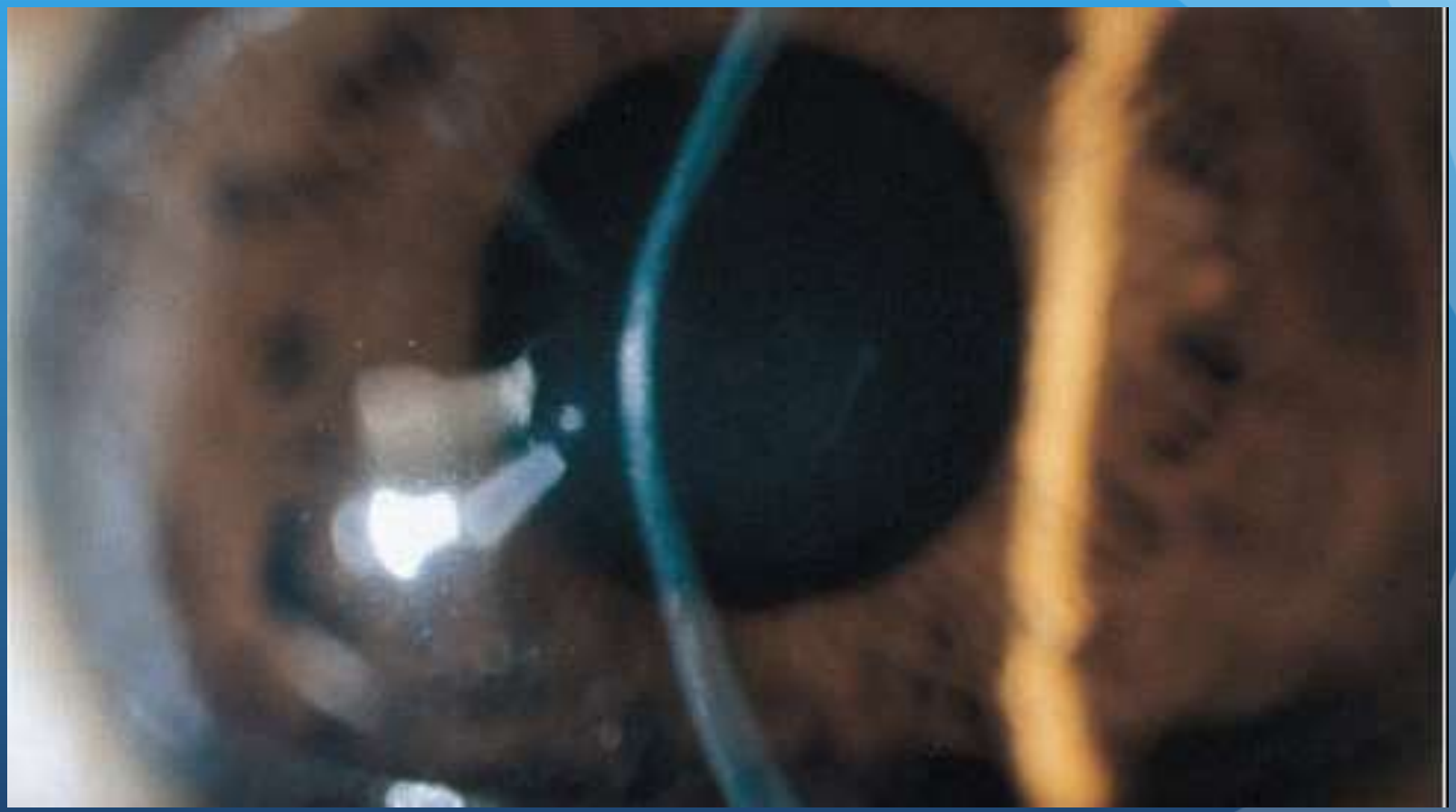
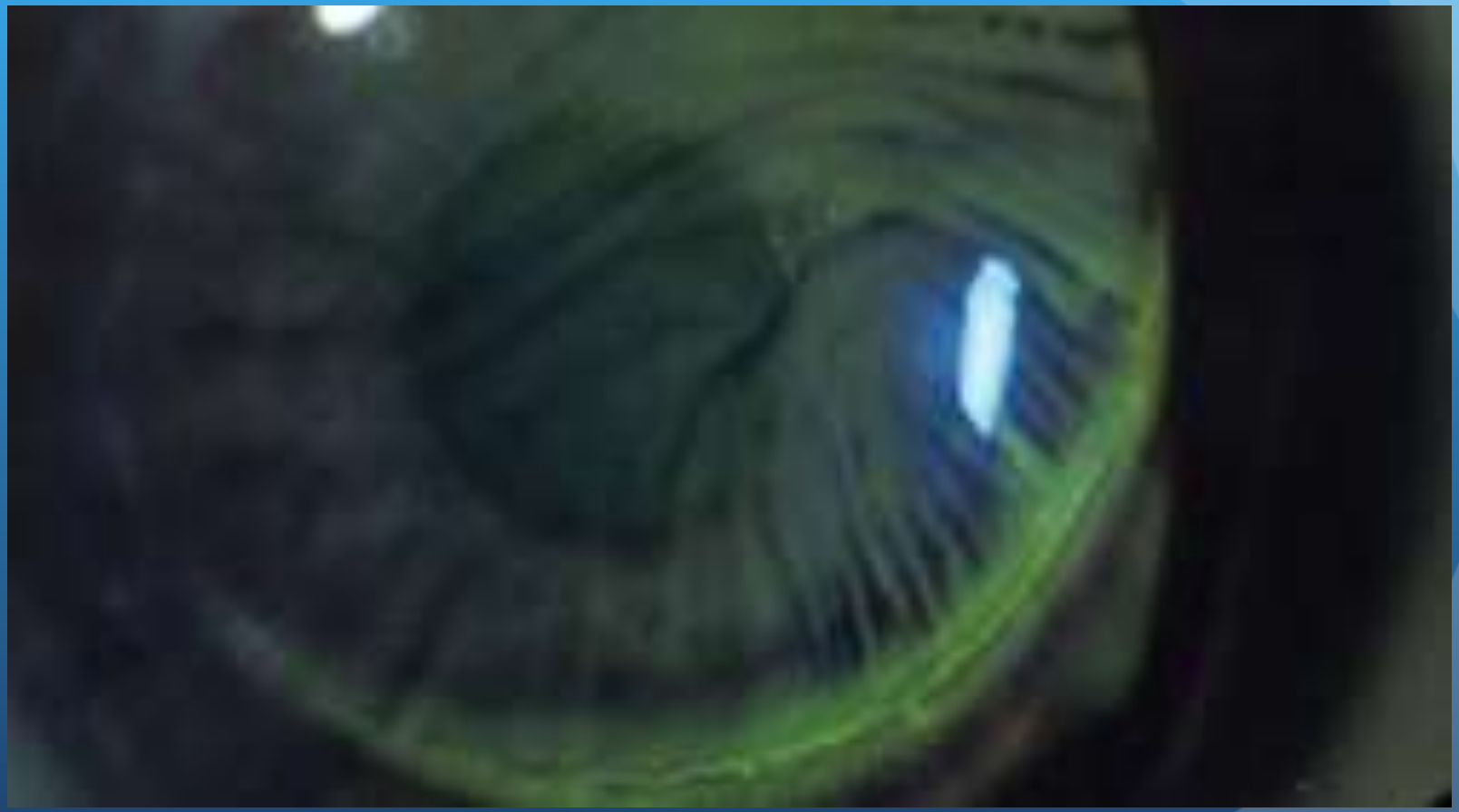
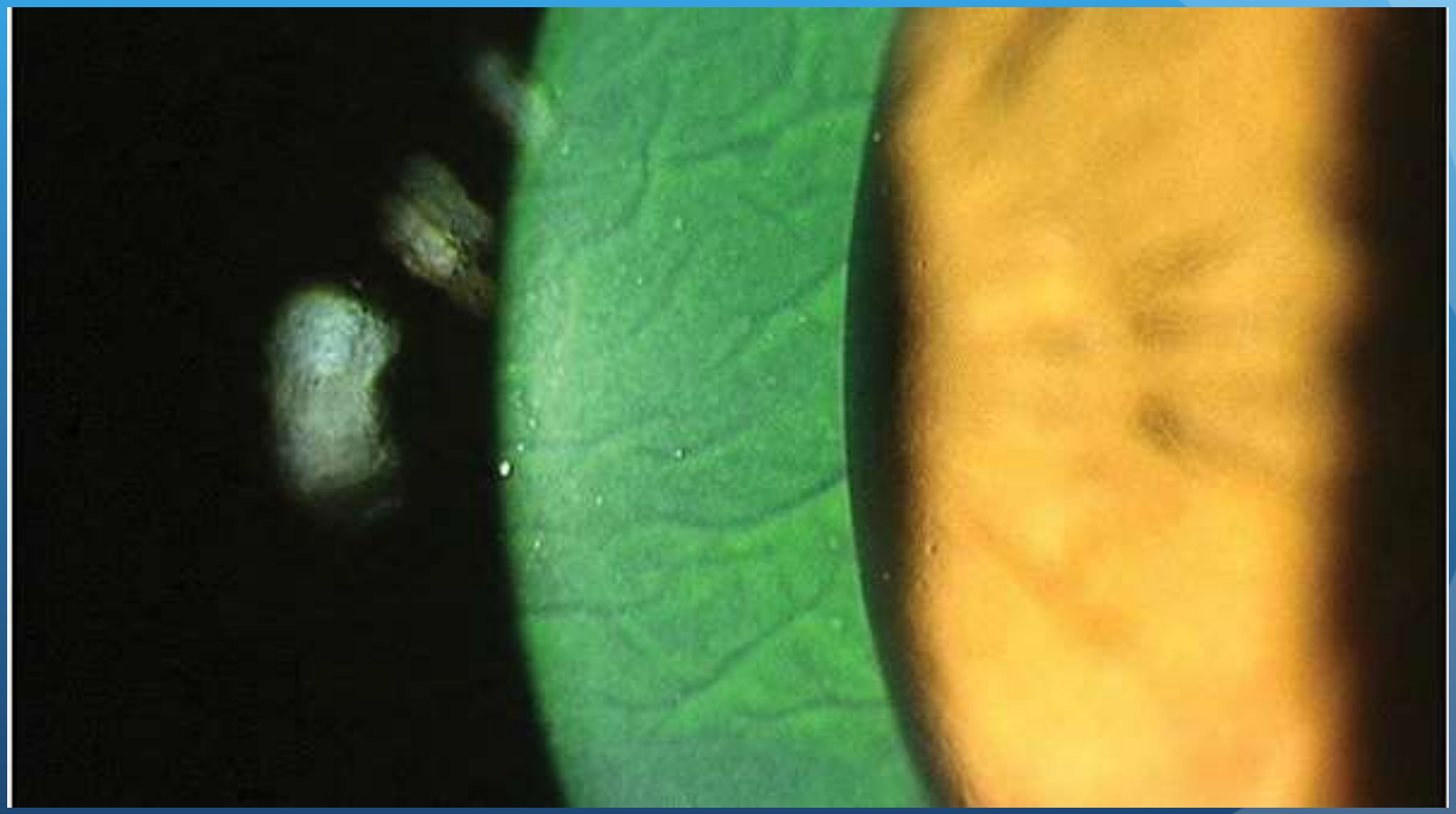
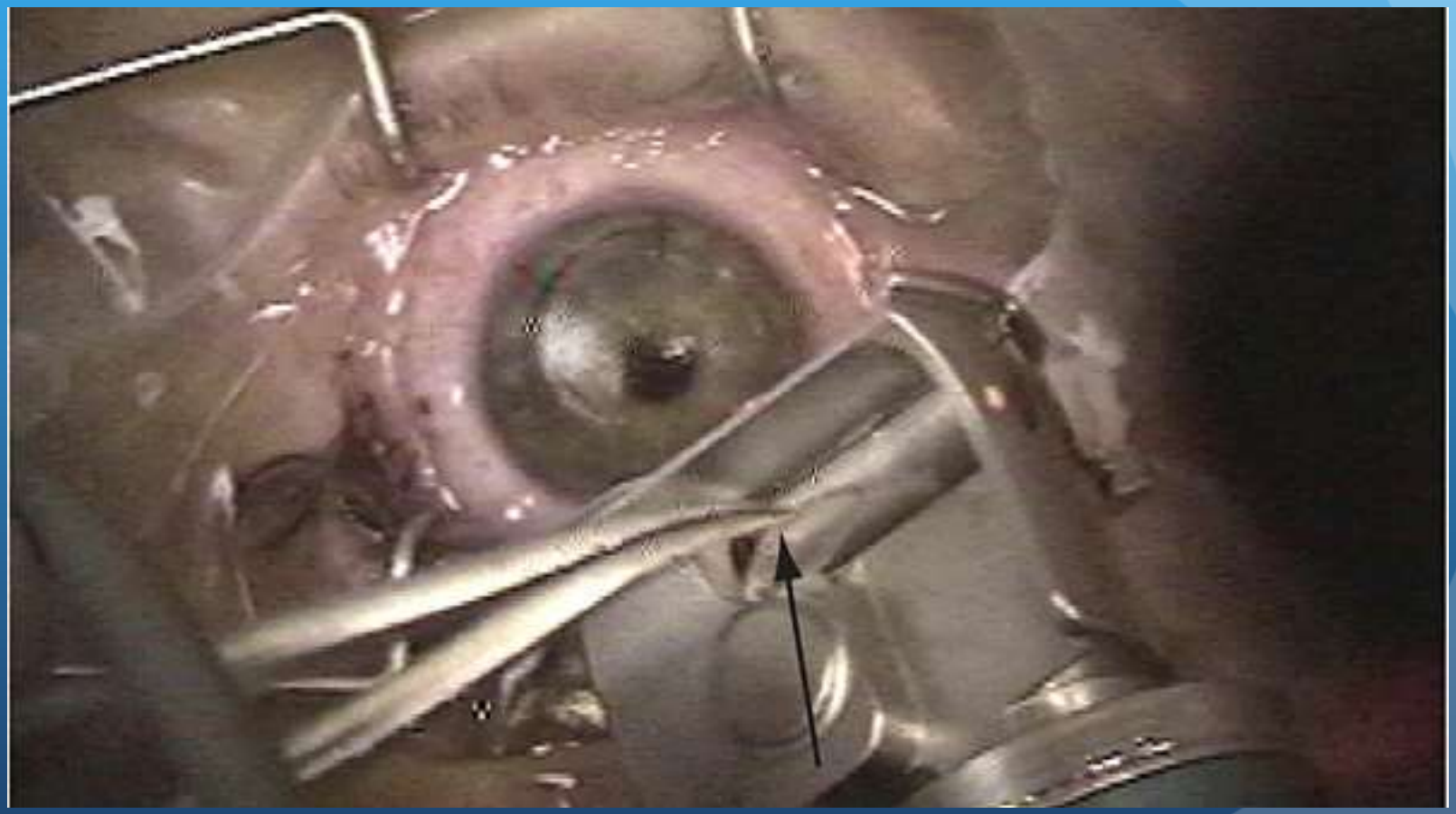
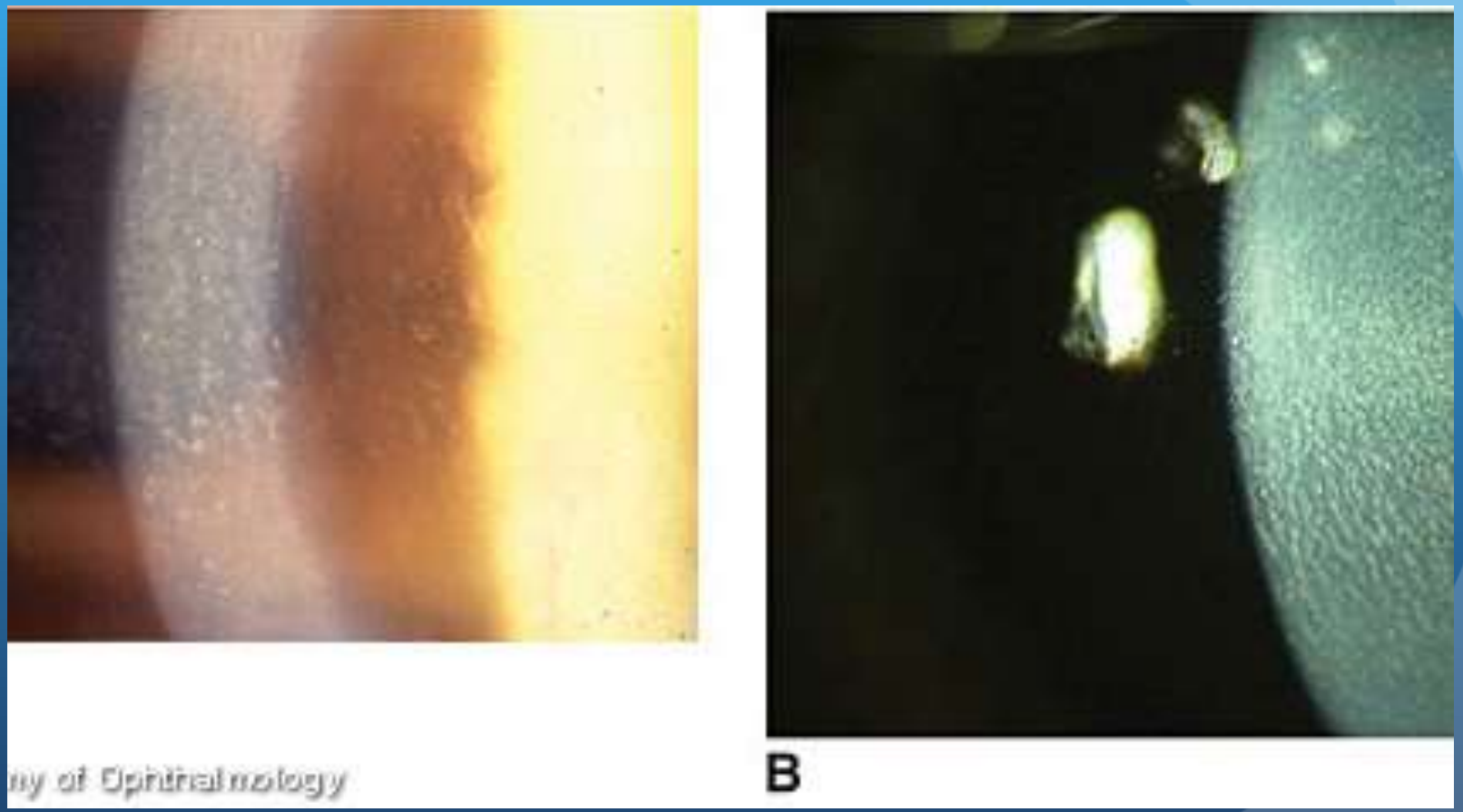
Central island
SIM K's:
pwr : 40.60D







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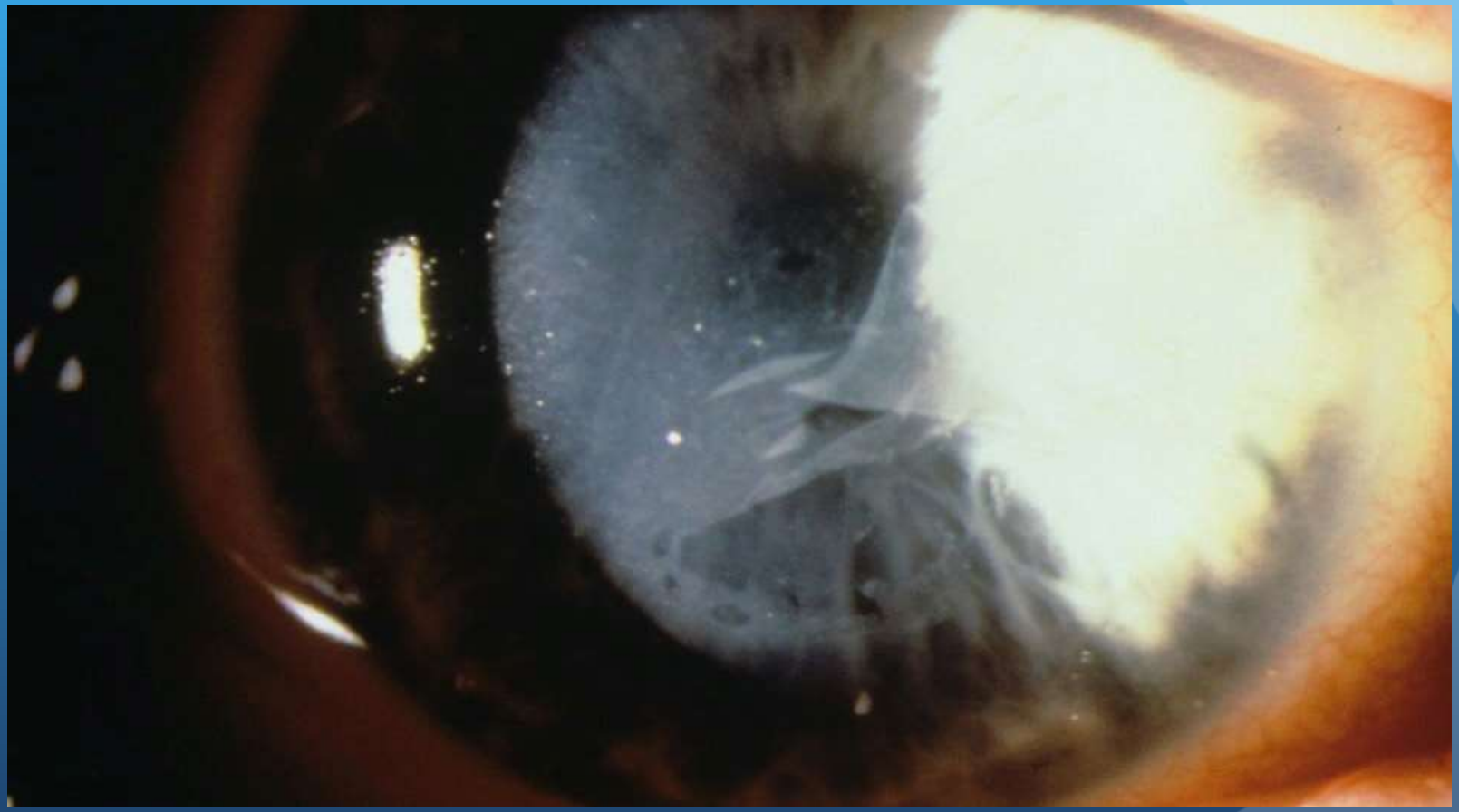
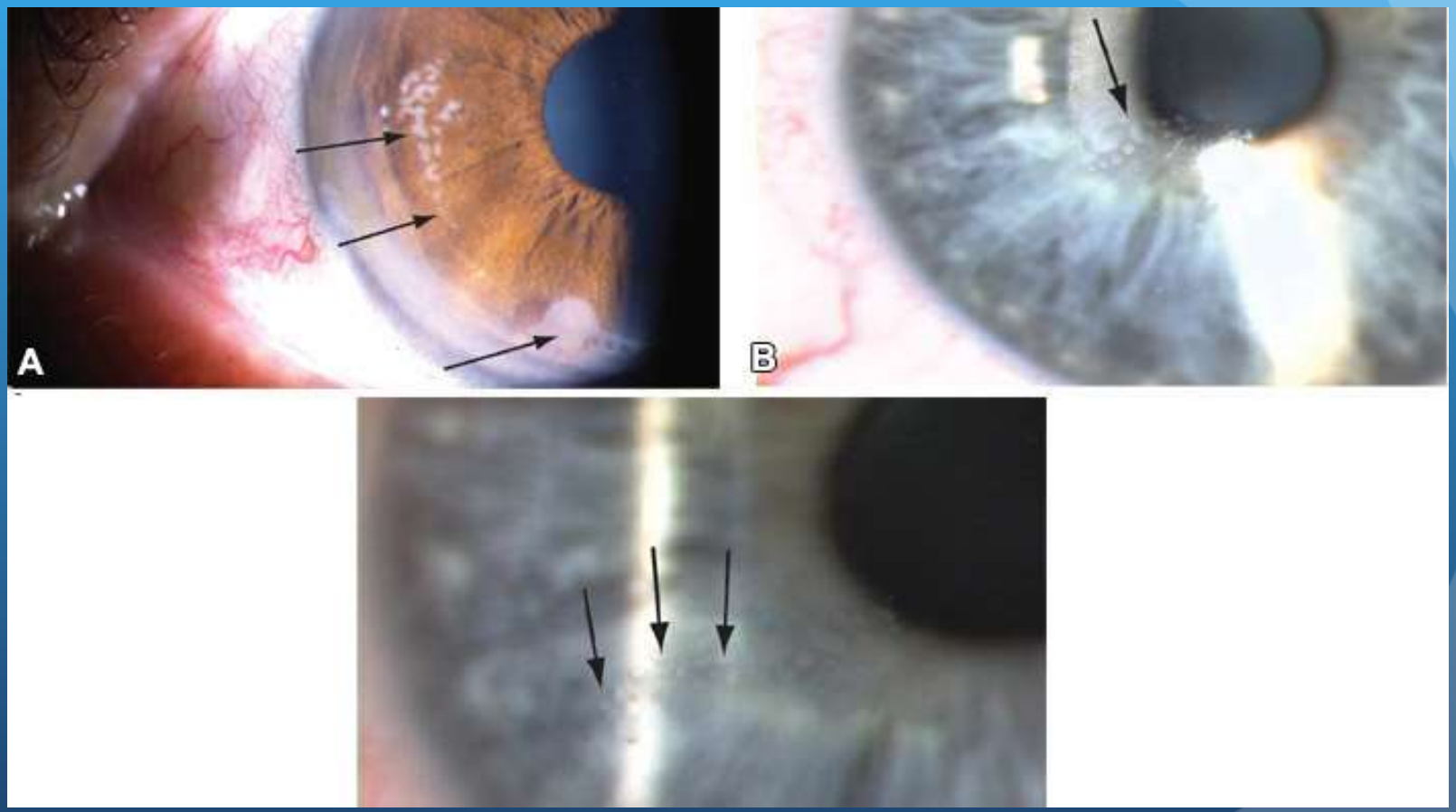
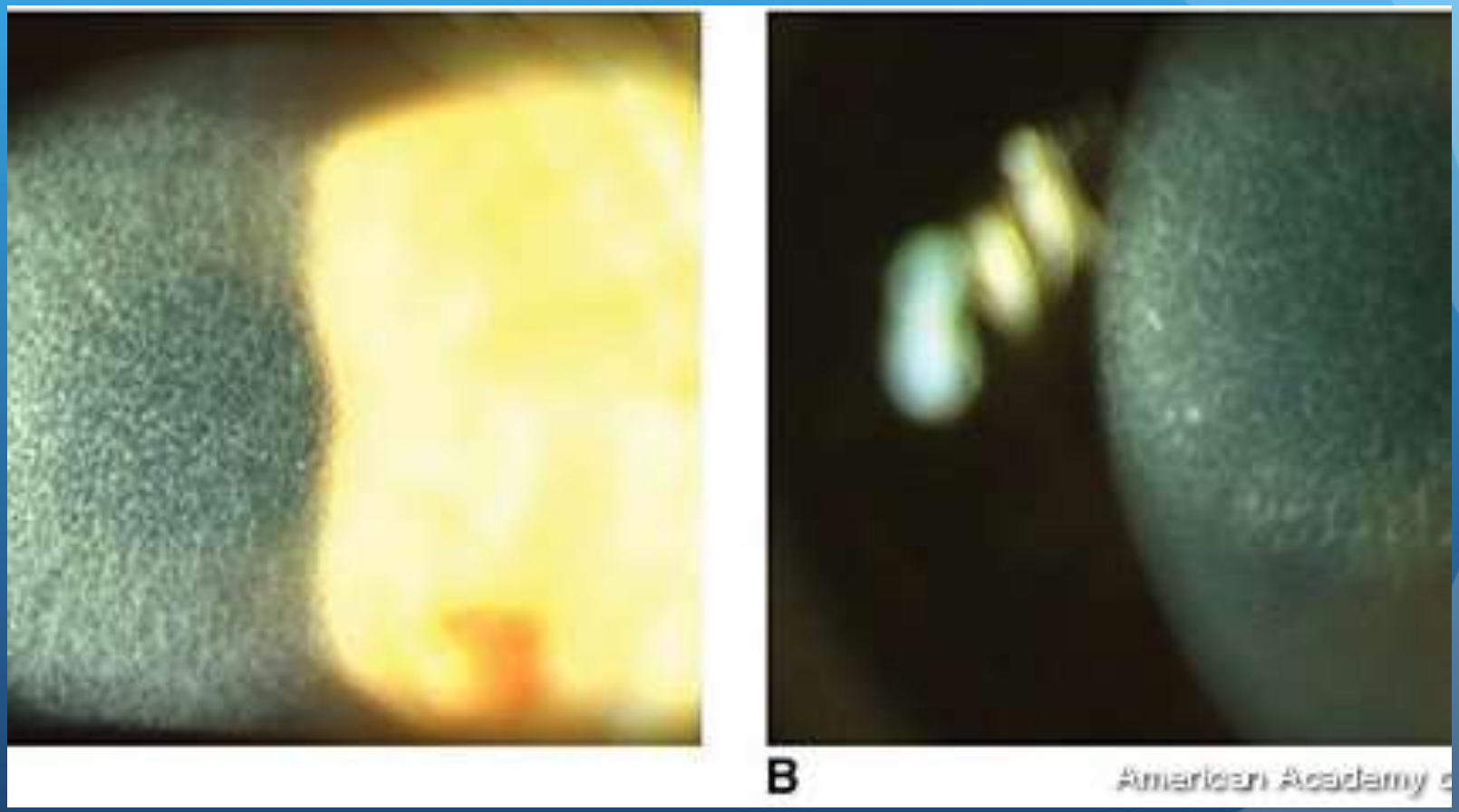
B




A
B


B
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Post-operative management

- LASIK
  - Flap evaluation
  - Medications- topical, oral
- PRK/ Advanced surface ablation
  - Epithelial defect
  - Haze evaluation
  - Medications- topical, oral

Post-operative management

- Dry eye
  - Regeneration of corneal nerves
  - Treatments
    - Aqueous trearments
      - Artificial tears
      - Punctal plugs
      - Cyclosporine
      - Humidifier
      - Fan/ ventilation modifications
      - Sunglasses
      - Goggles

Post-operative management

- Meibomian gland treatments
  - Warm compresses
  - Eyelid hygiene
  - Medications
    - Topical- Azasite, Tobradex
    - Oral- Doxycycline

Post-operative management

- Visual fluctuation
- Post-operative appointments