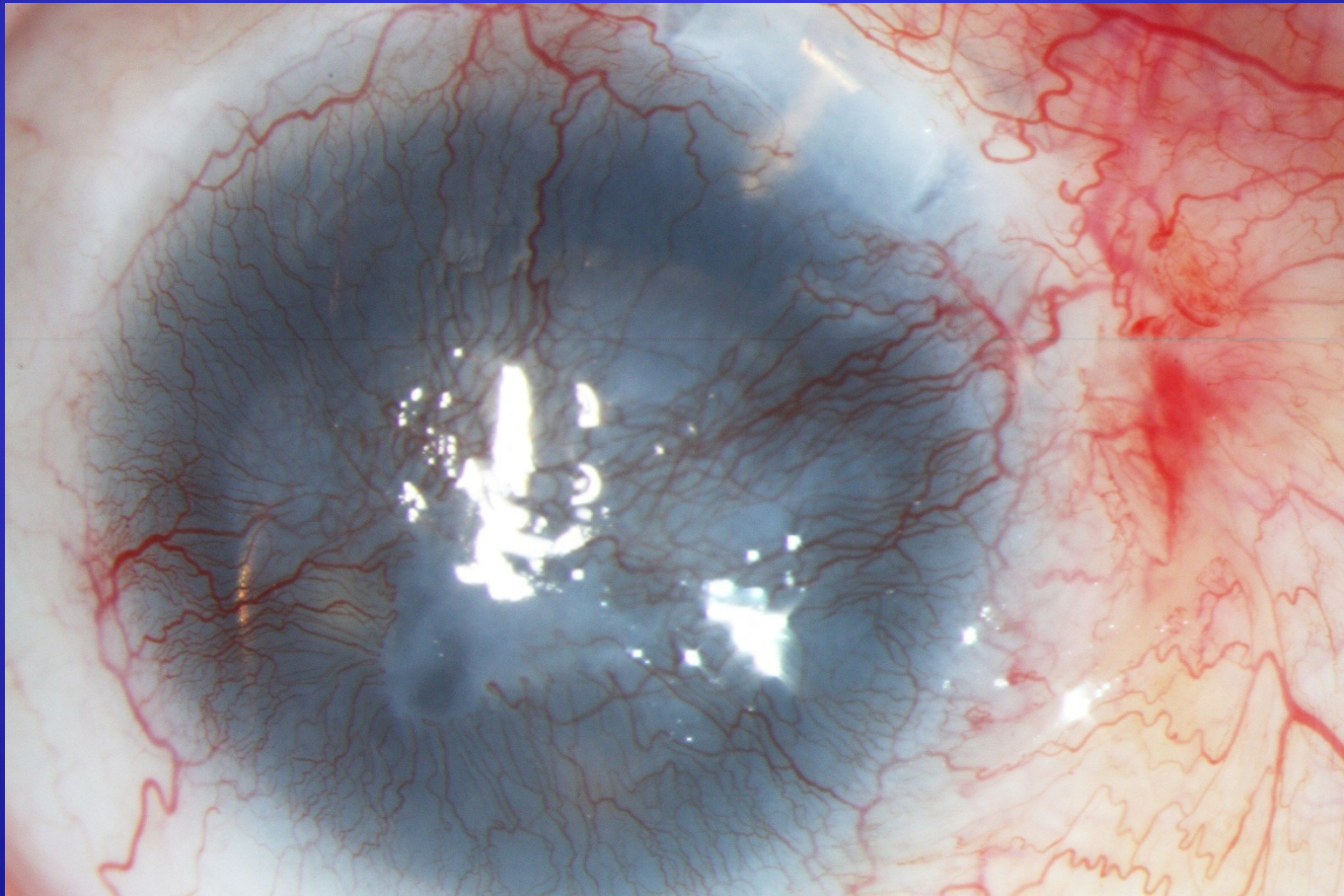


# Cornea

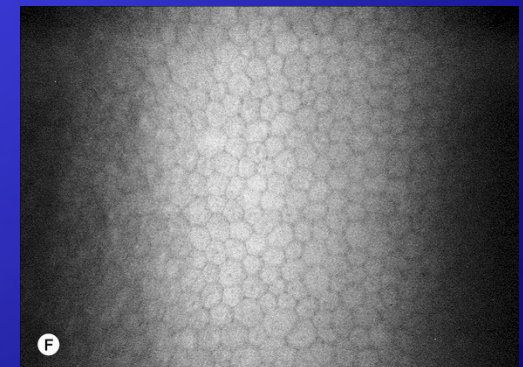
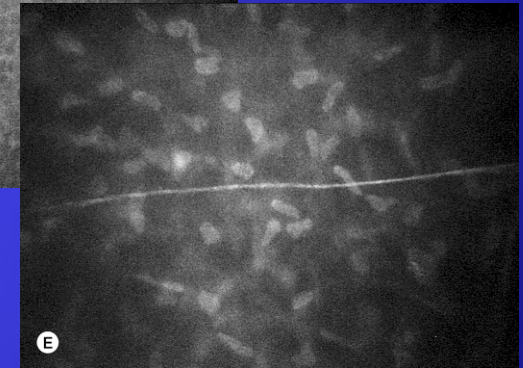
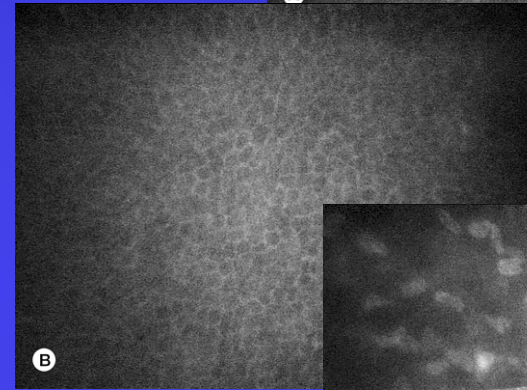
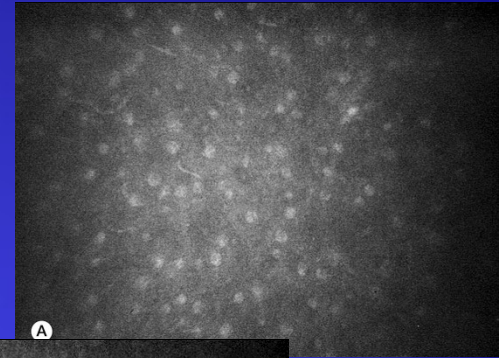


# Anatomy of cornea

- Transparent optical part of the eyeball - impermeable barrier
- Refractive medium (43 D)
- Diameter 11.5 mm x 12.6 mm
- Central thickness of 560 micron  
peripheral thickness of 600 - 1000 $\mu$ m  
endothelial cell density (2600 / mm<sup>2</sup>)  
water content 76-80%

# Anatomy of cornea

- Epithelium – squamous, nonkeratinized (4-6 layers), ability of regeneration (A)
- Bowman's membrane - (8-12 $\mu$ m) - acellular, separates the epithelium and stroma, without regeneration (B)
- Stroma - (90% of thickness) 300-500 lamellae of collagen fibrils in the extracellular matrix (keratinocytes) (E)
- Descemet membrane - product of endothelial cells
- Endothelium - one layer of hexagonal cells (5000-2000 cells / mm<sup>2</sup>), decreases with age (F)



# Anatomy of cornea

- Innervation – n. nasociliaris (nn. ciliares longi) V. cranial nerve
- Immunology - privileged status is due to avascularity, the lack of lymphatic drainage, a small proportion of antigen presenting cells and the secretion of immunosuppressive cytokines (apoptosis of lymphocytes)
- The phenomenon ACAID (anterior chamber associated immune deviation)



# Function of cornea

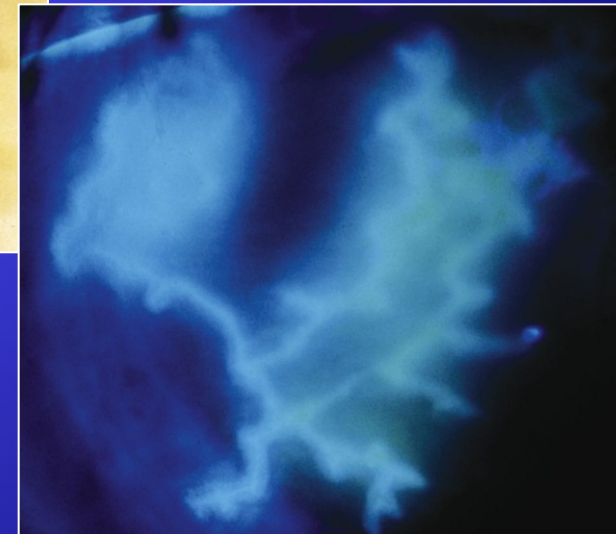
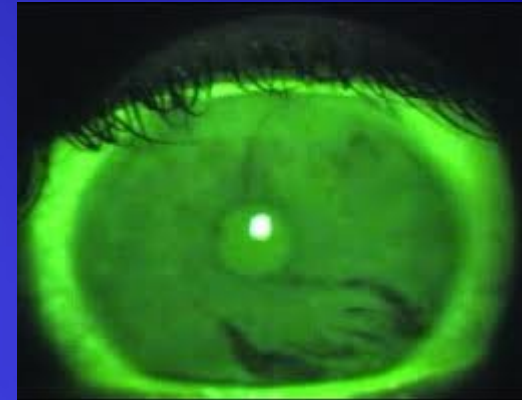
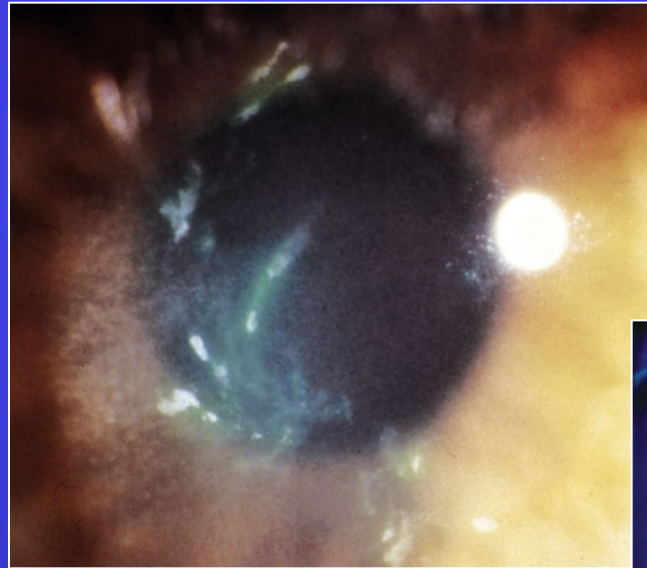
- Most refractive tissue (43D)
- Transparency is defined by the arrangement of fibrils
- Endothelial pump (ability of endothelium actively suck water- Na / K ATP pump)
- Decrease in endothelial cells below 500 / mm<sup>2</sup> leads to irreversible changes

# Basic examination methods

1. Anamnesis
2. Slit lamp biomicroscopy
3. Visual acuity
4. Laboratory test ( microbiology, cytology, serology, PCR)

# Special examination methods

- BUT
- Schirmer test
- Staining
  - Fluorescein
  - Bengal rose



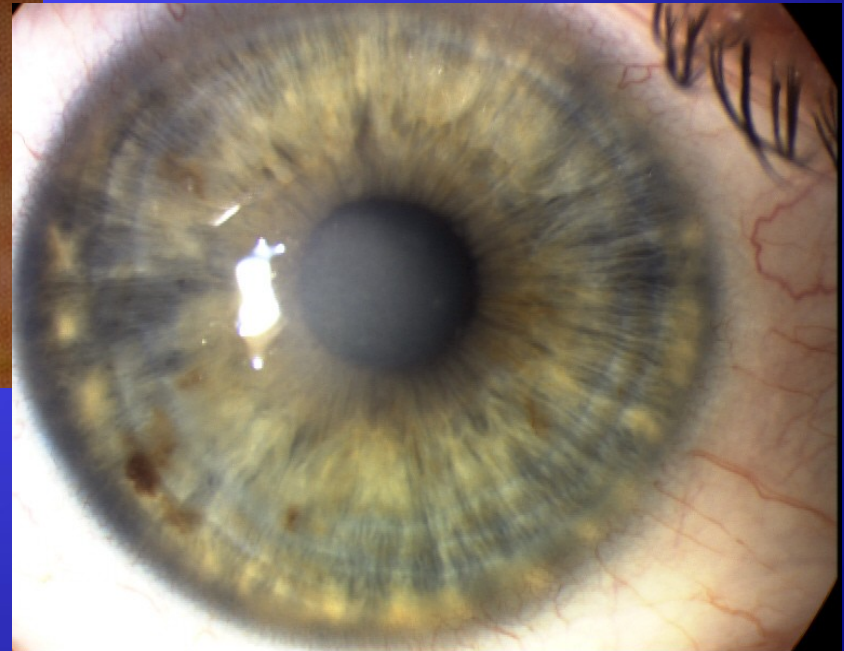
# Special examination methods

1. Pachymetry ( ultrasound, optic)

2. Esteziometry ( cotton buds,  
estesimetr)

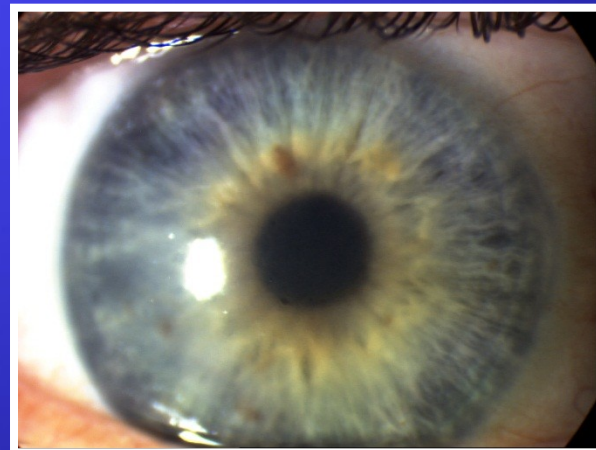
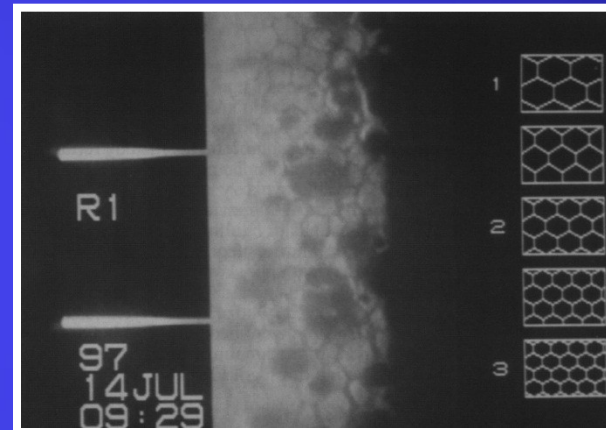
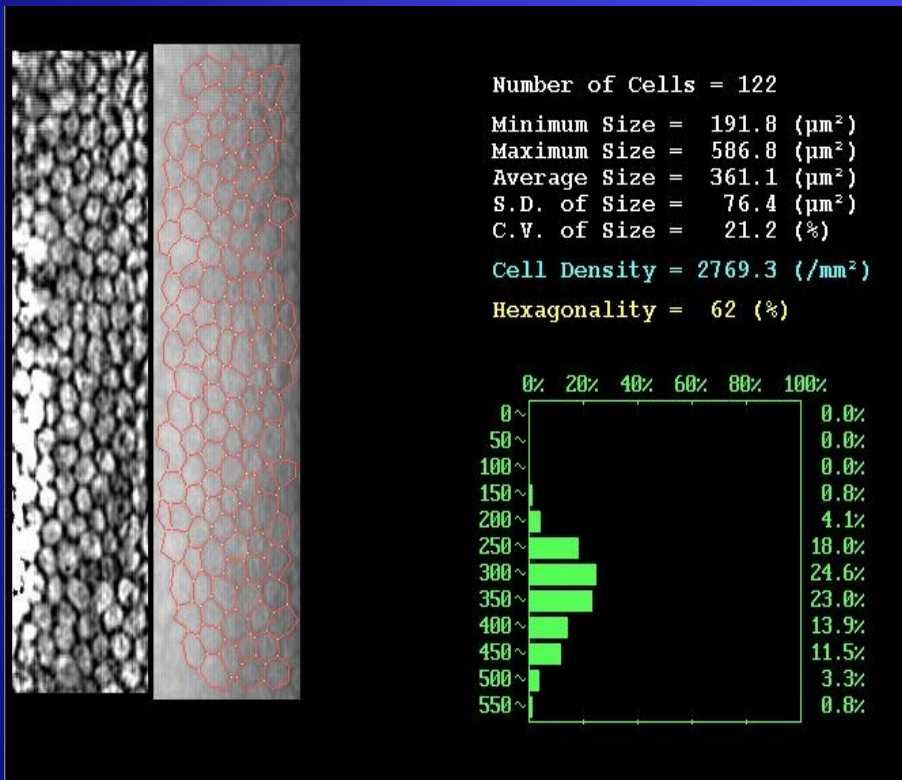


# Photodocumentation



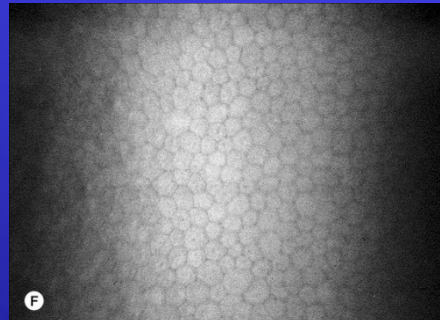
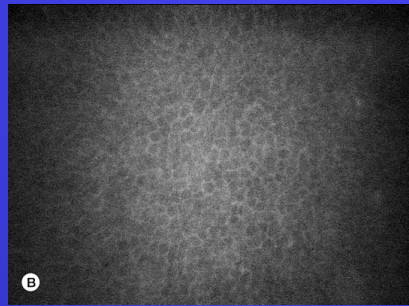
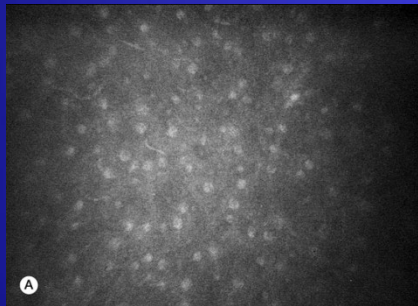
# Specular microscopy

- Dytrophia corneae endotheliasis Fuchs



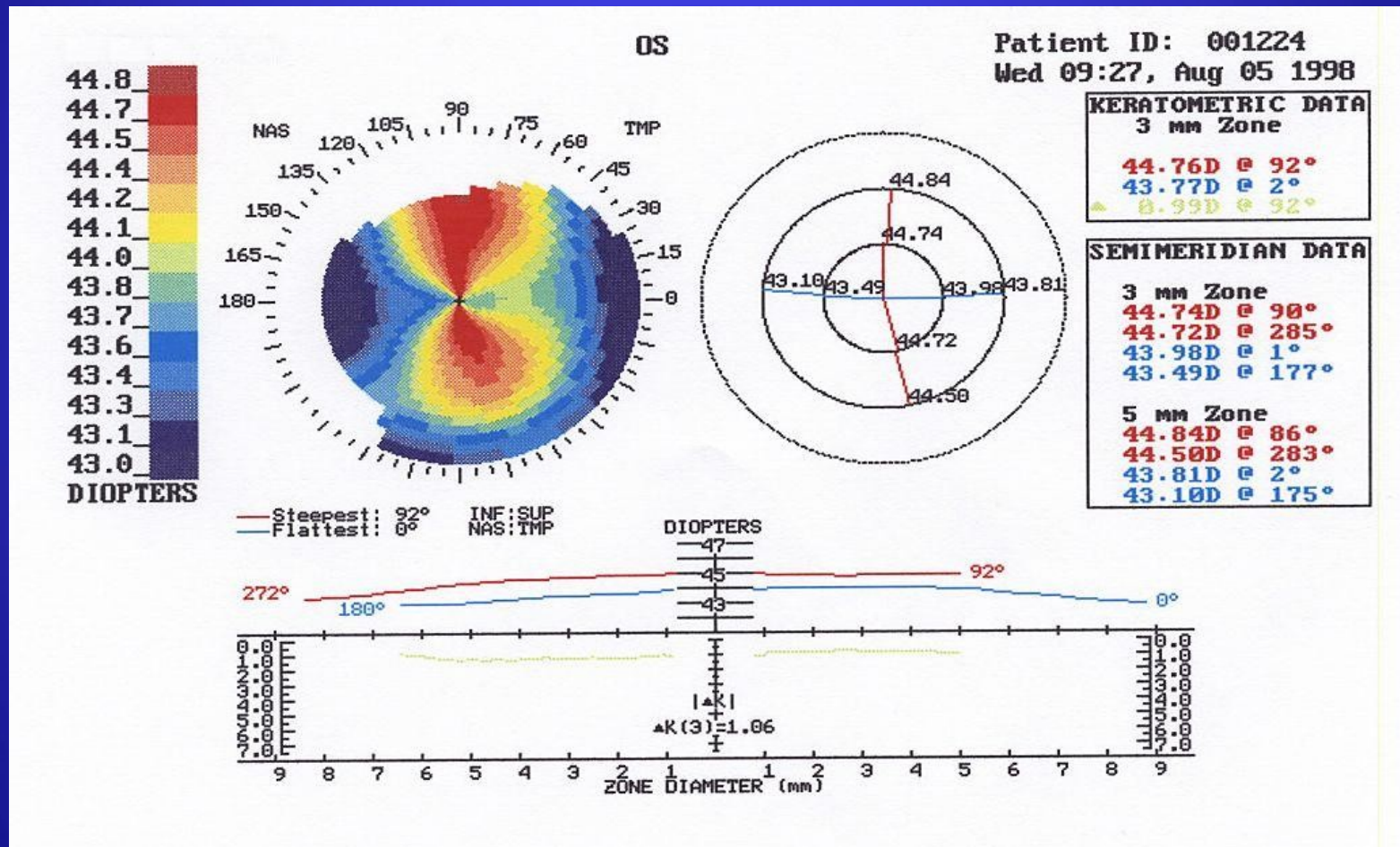
# Confocal microscopy

- in vivo „histology“ examination
- Non invasive, non contact





# Corneal topography

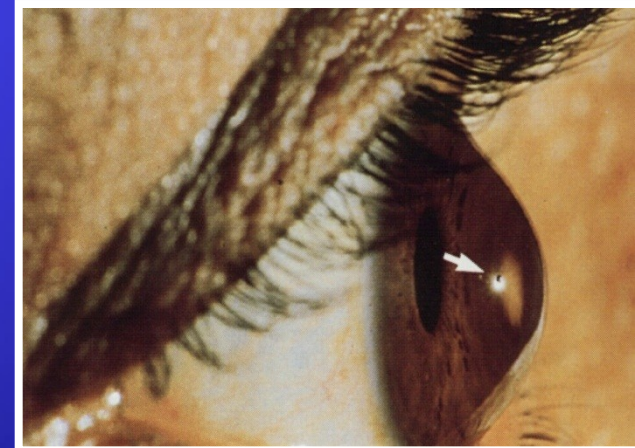
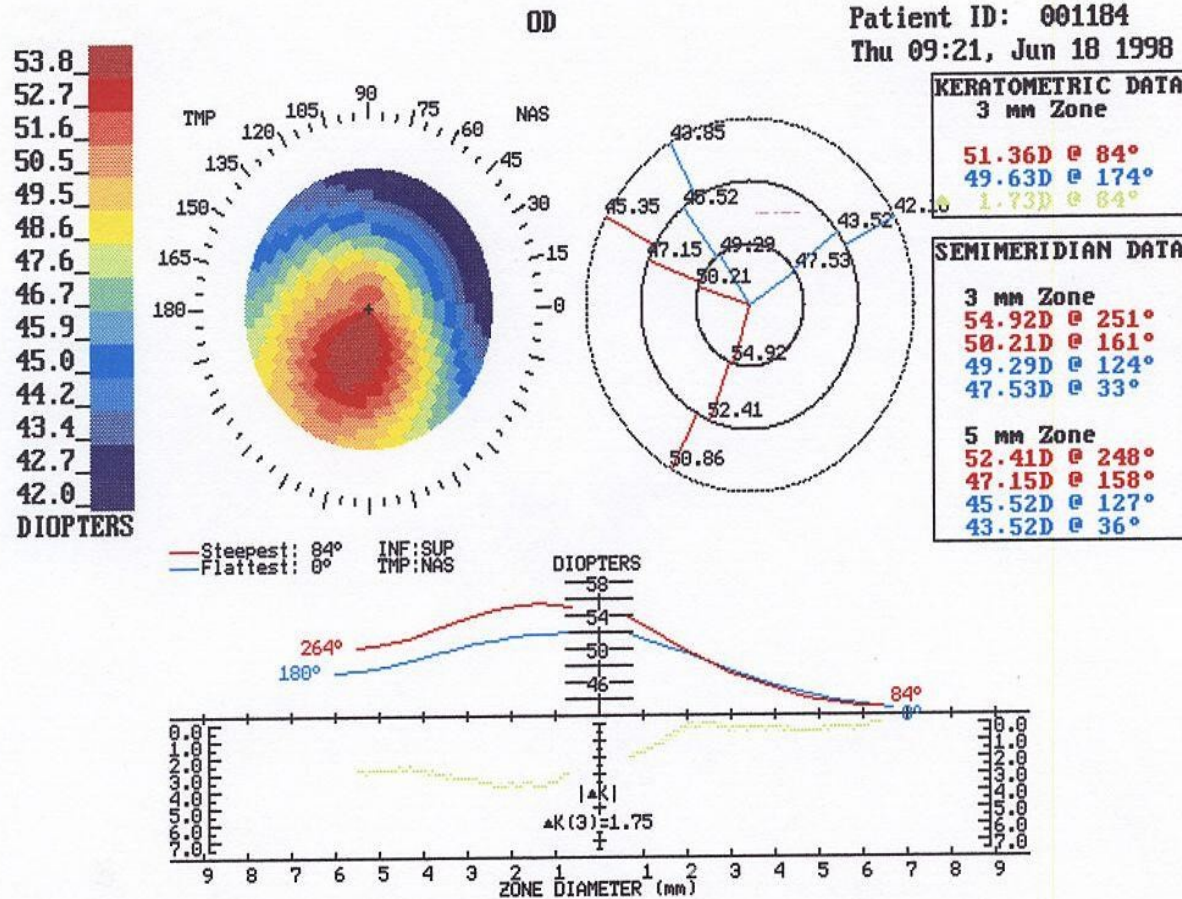


Physiological astigmatism



# Corneal topography – keratoconus

(flat curvature = blue, steep = red)



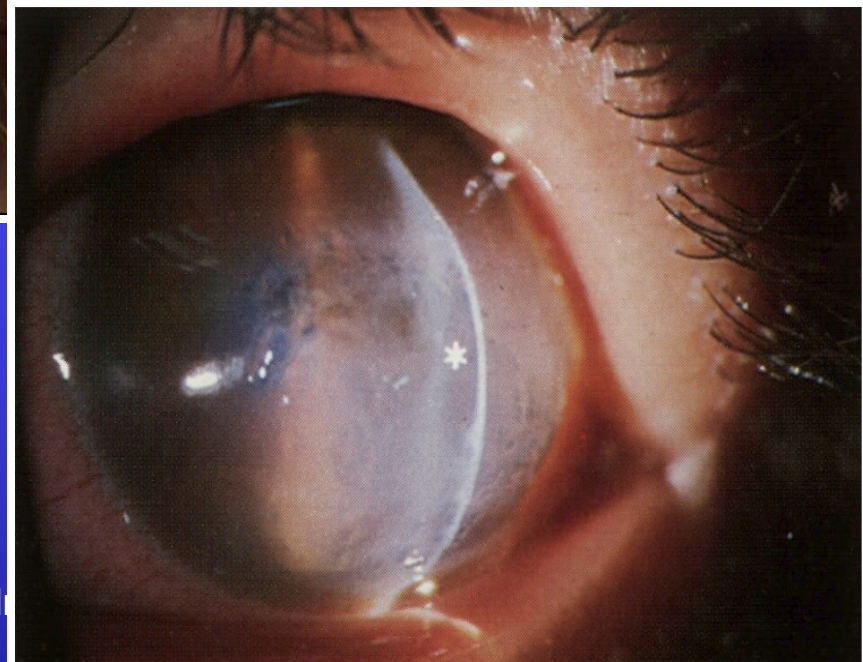
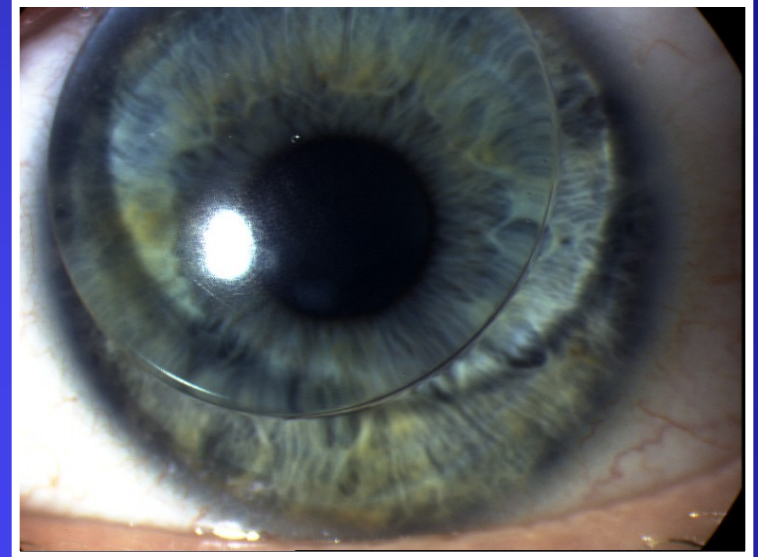
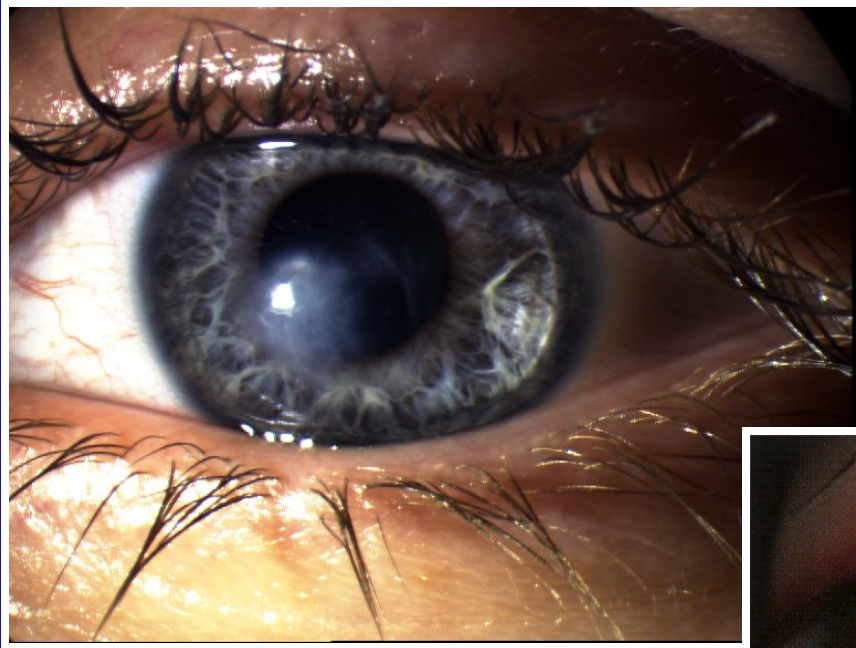
# Corneal ectasias

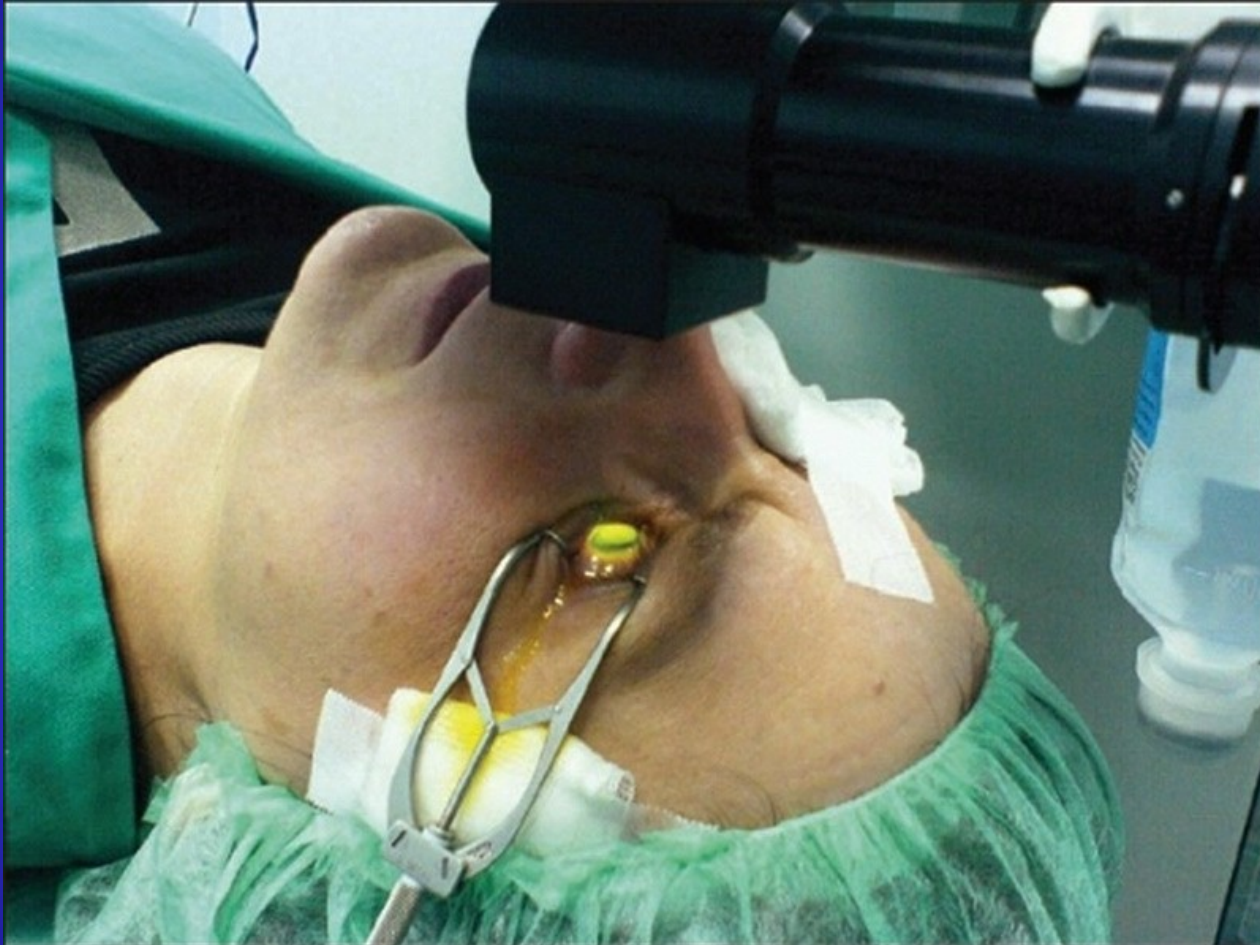
- **Keratoconus** – progressive, the cornea assume the cone shape  
Treatment: rigid contact lenses, CLX, intrastromal ring, lamellar and penetrating keratoplasty
- **Keratoglobus** - the thinning of entire cornea
- **Pellucid marginal degeneration** – thinning in the lower periphery of the cornea, perforation sometimes occurs





# Keratoconus acutus et subacutus

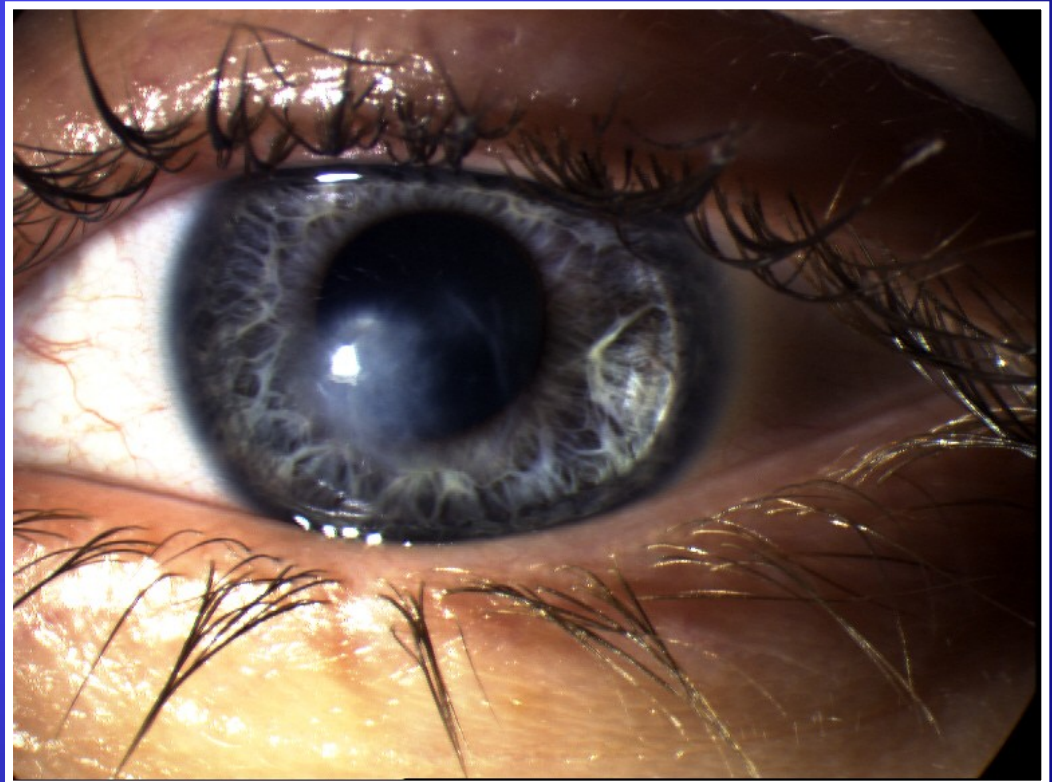






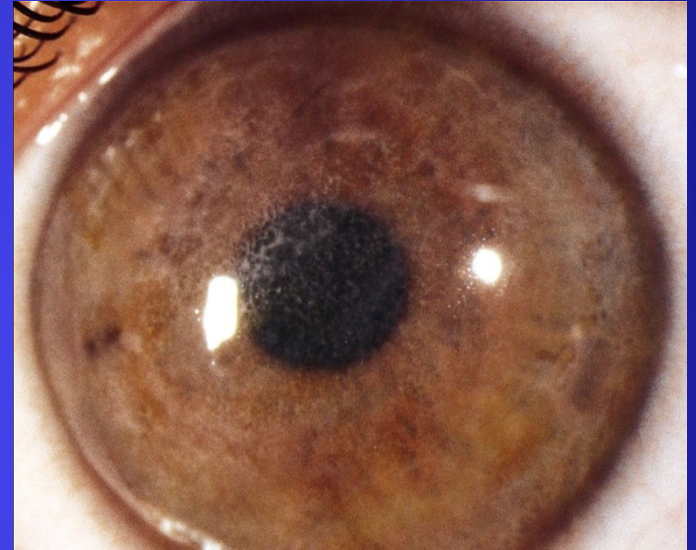
# Corneal dystrophies

- Progressive, bilateral, non inflammatory, opacifying
- Anterior
- Stromal
- Posterior

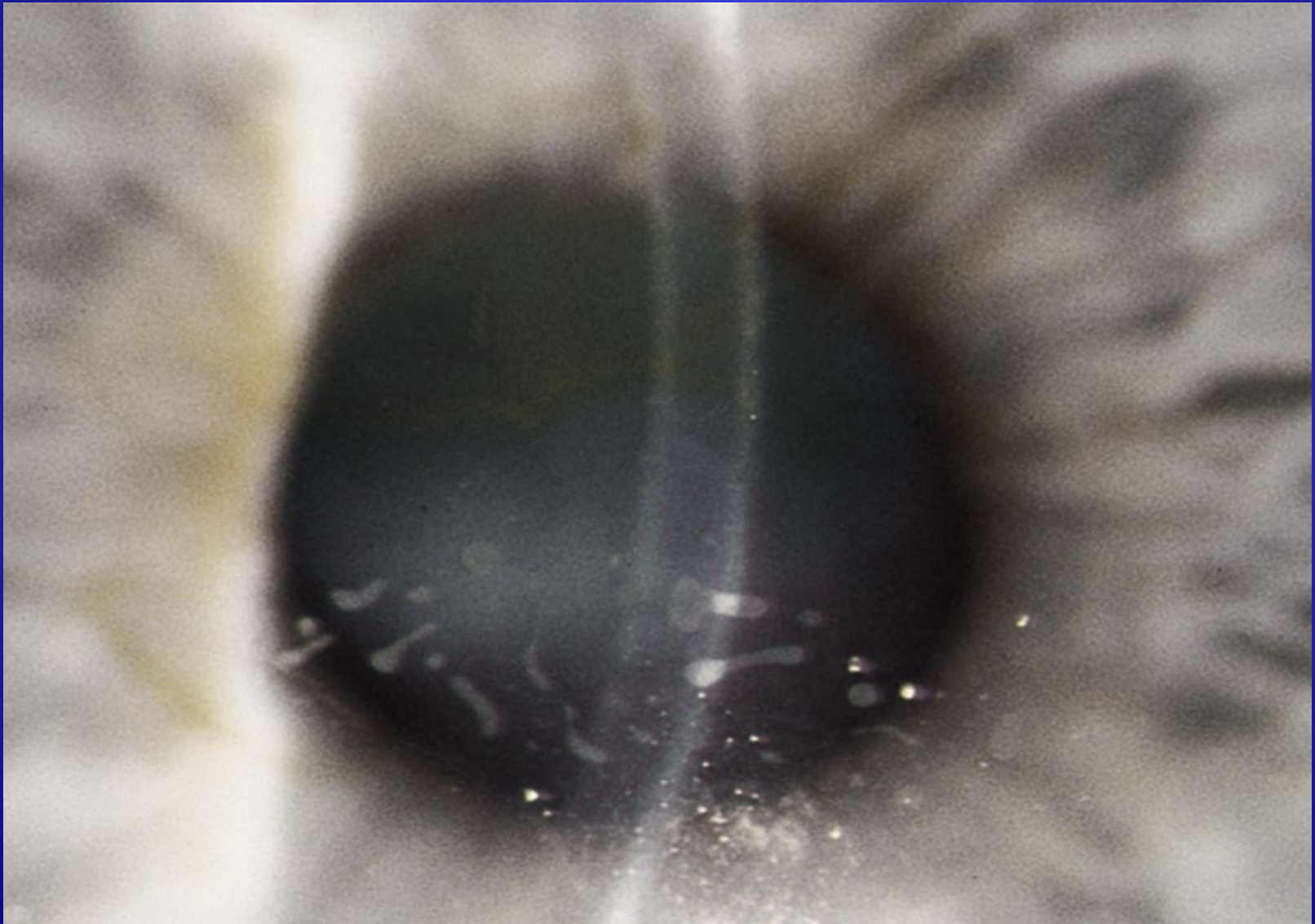


# Anterior corneal dystrophies

- Cogan dystrophy - epithelial basement membrane
- Messman dystrophy – epithelium
- Reisoa – Bücklersova – Bowman layer dystrophy



# Cogan dystrophy (map dot finger print)





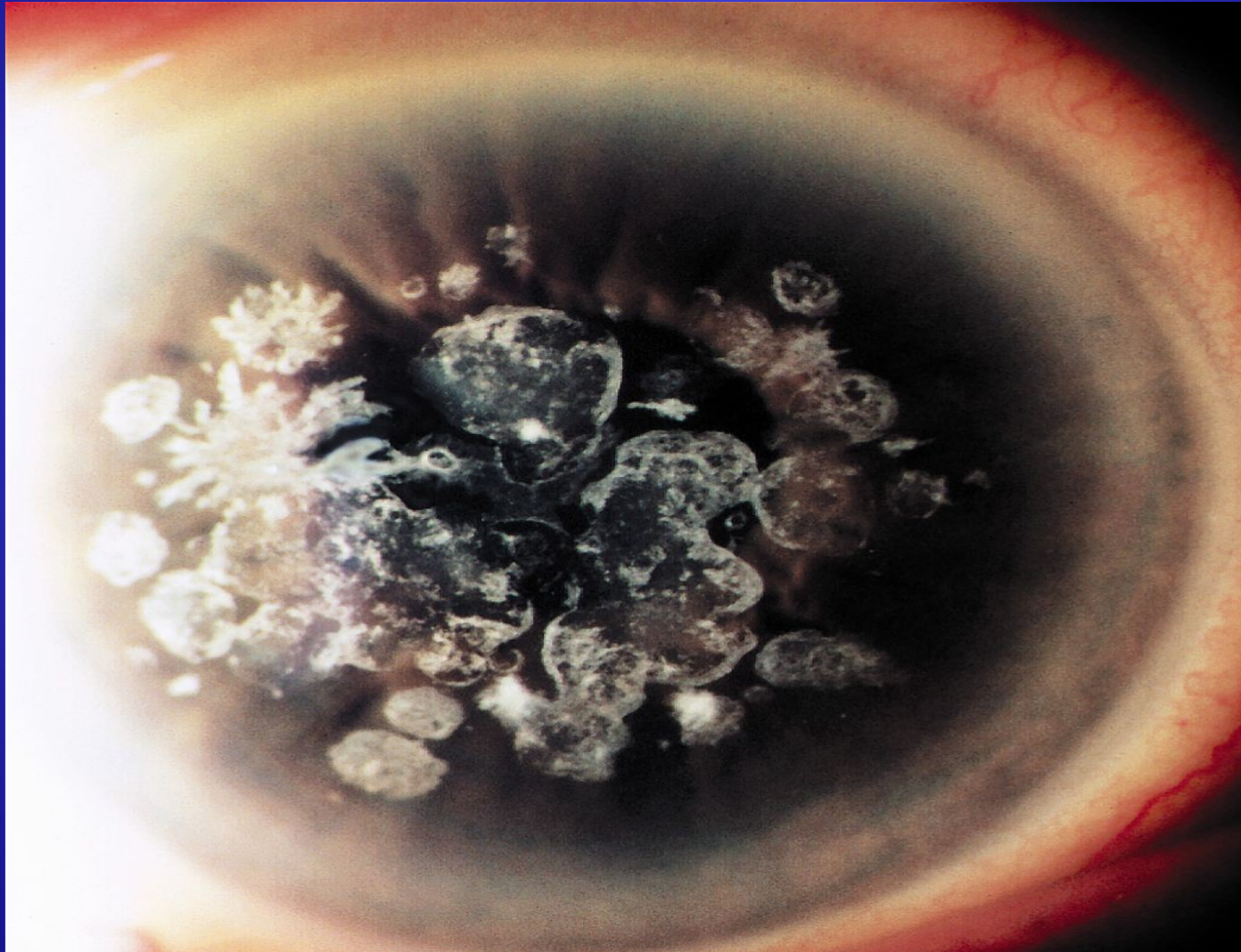
# Stromal dystrophies

- Early onset, impairment of vision
- T: perforating keratoplasty
- Granular
- Macular ( the most severe)
- Lattice ( systemic asoc. – sek. Amyloidosis)

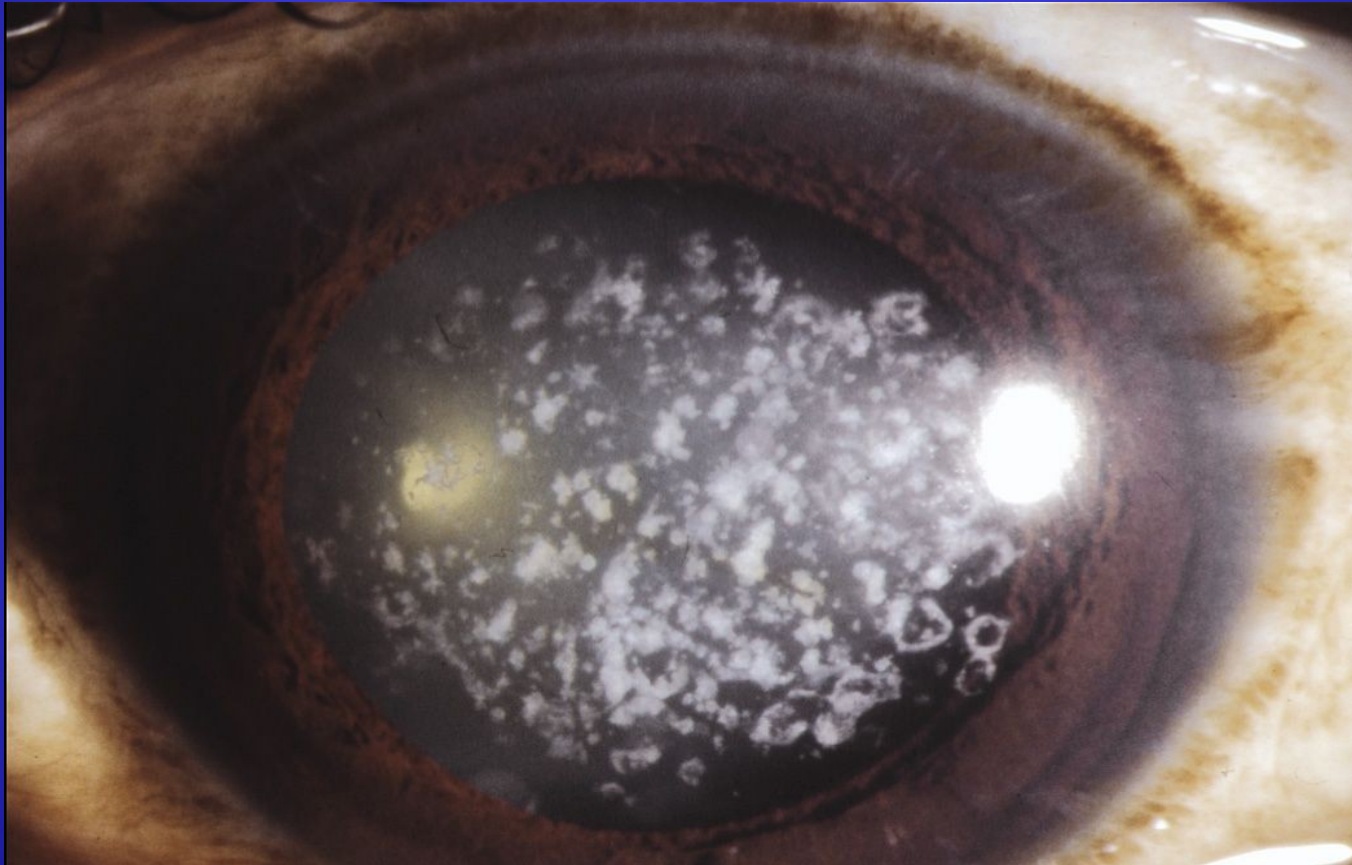




# Crystalline dystrophy

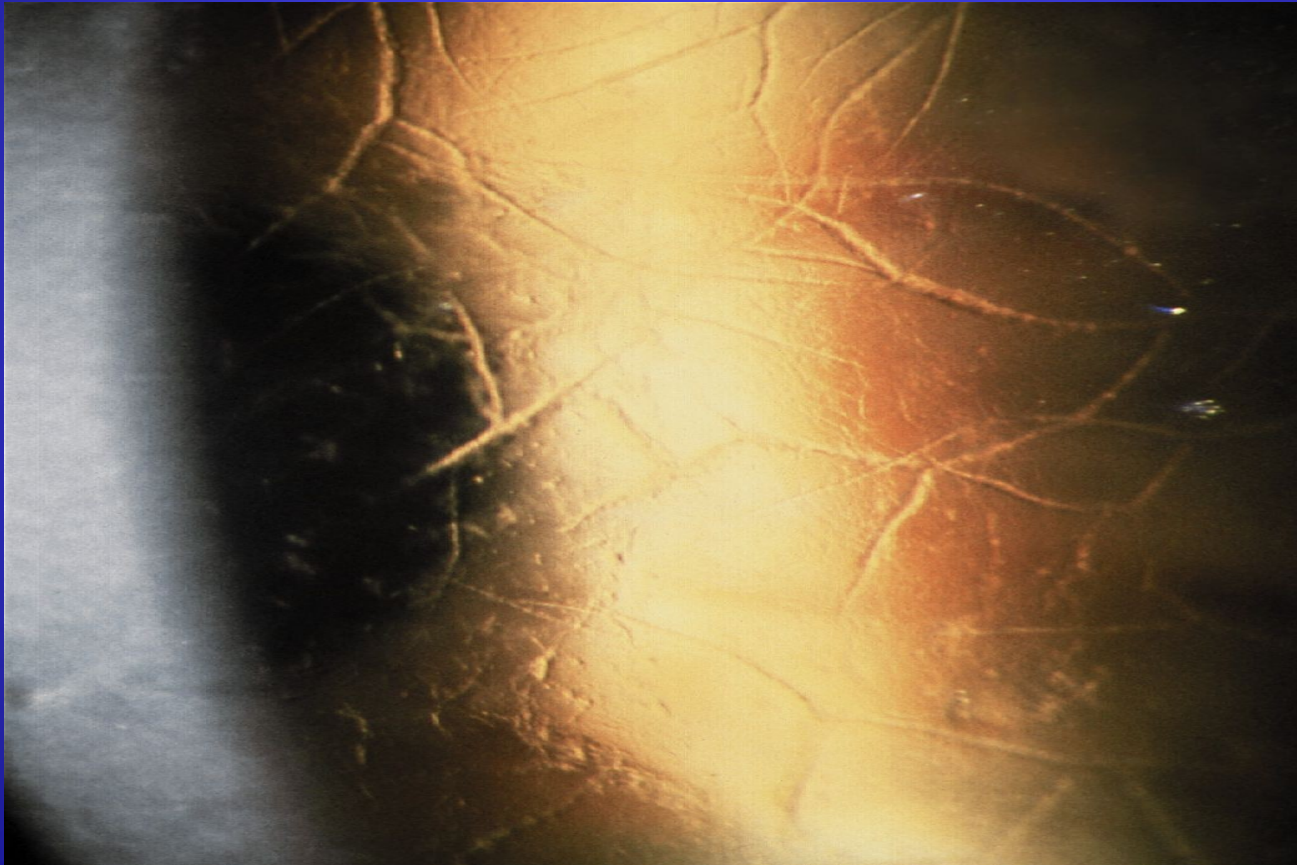


# Granul dystrophy





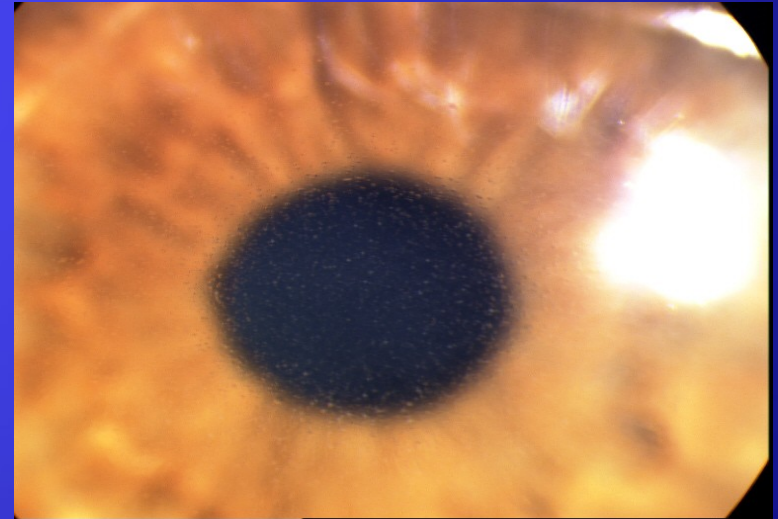
# Lattice dystrophy





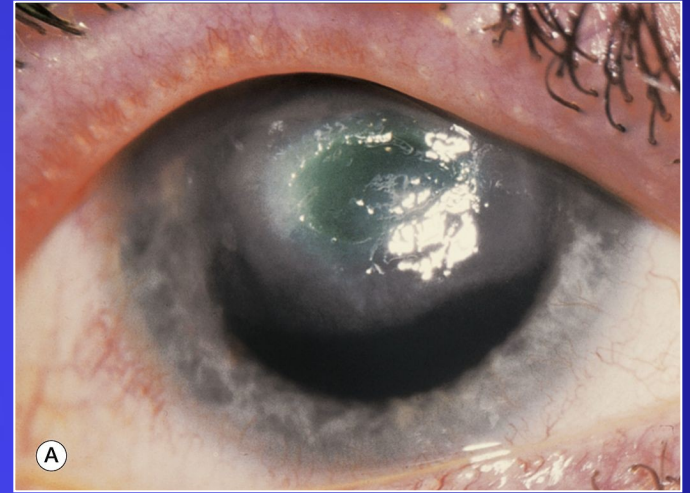
# Fuchs endothelial dystrophy

- Bilateral, accelerated corneal endothelium cell loss
- Irregular warts of excrescences of Descemet membrane secreted by abnormal endothelial cells
- Endothelial decompensation
- Stromal edema, blurred vision, epithelial edema



# Corneal infection

- bacterial
- viral
- fungal
- protozoan

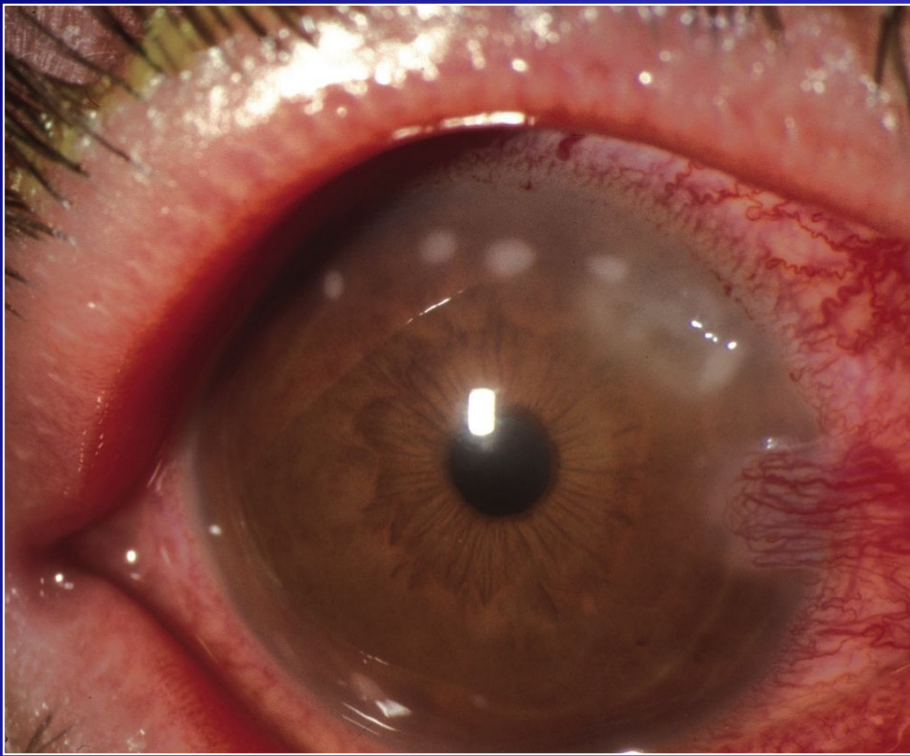


# Clinical features of bacterial keratitis

- Blurred vision
  - Photophobia
  - Pain
- Edema of the eyelids
  - Deep injection
  - Mucopurulent secretion
  - Corneal defects  
(damaged epithelium,  
stromal infiltration)
  - Hypopyon



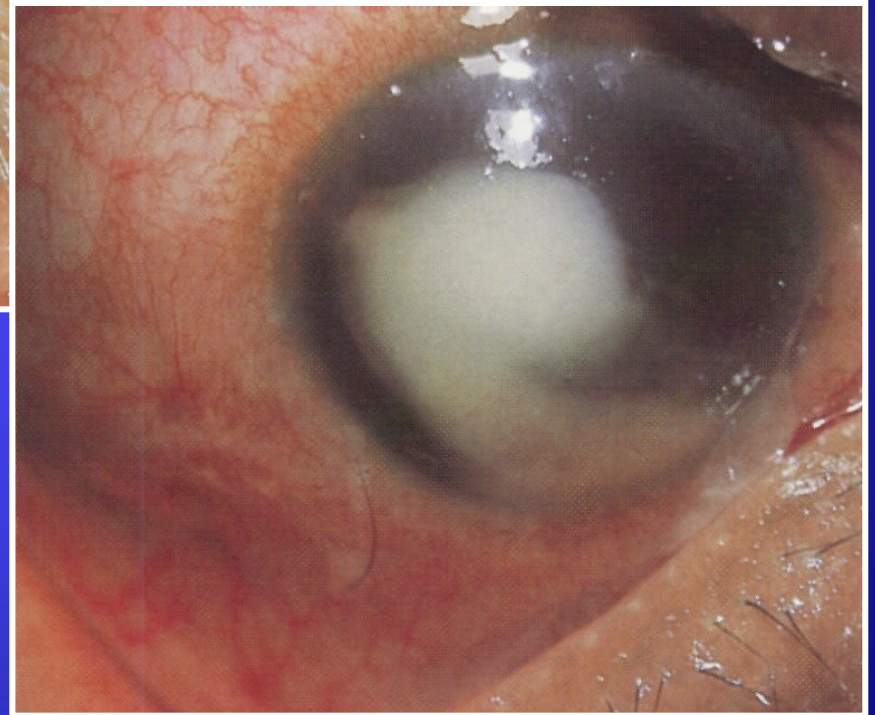
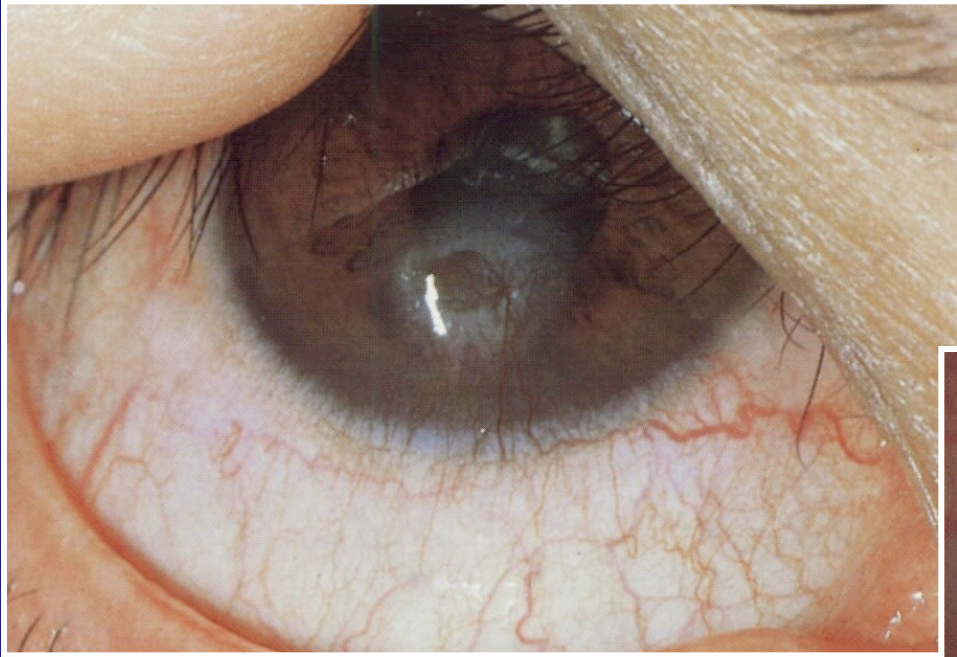




**Staphylococcus aureus**

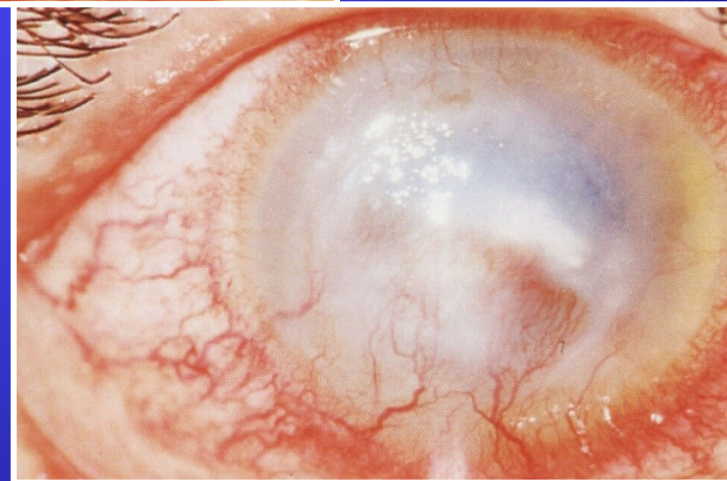
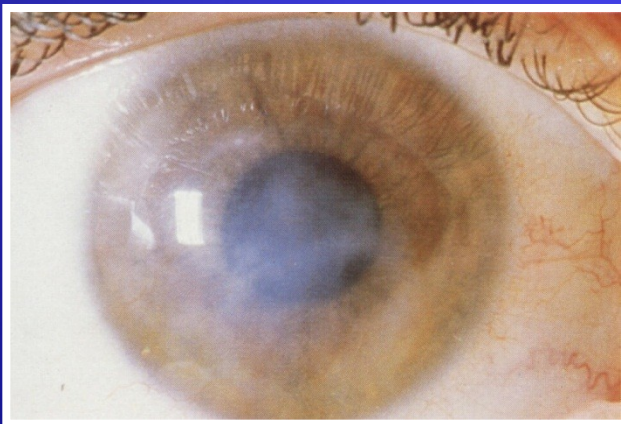
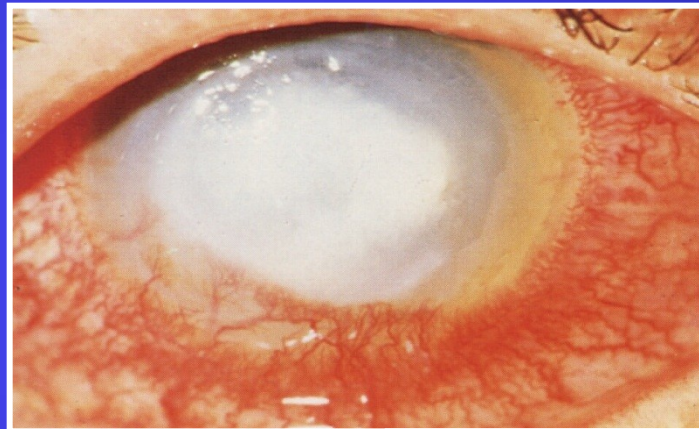
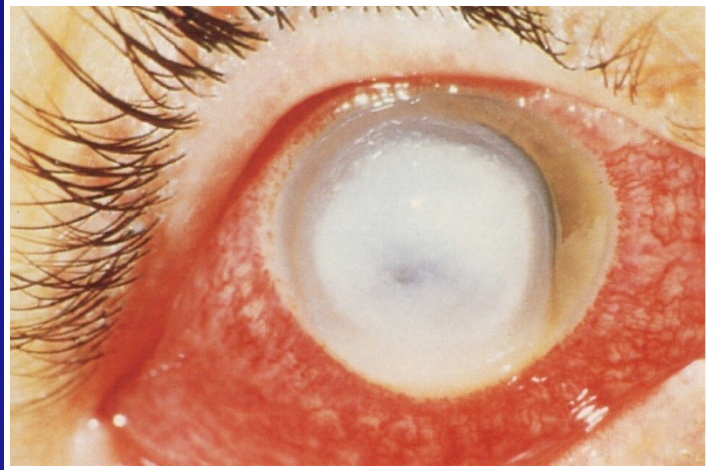


# Staphylococcus





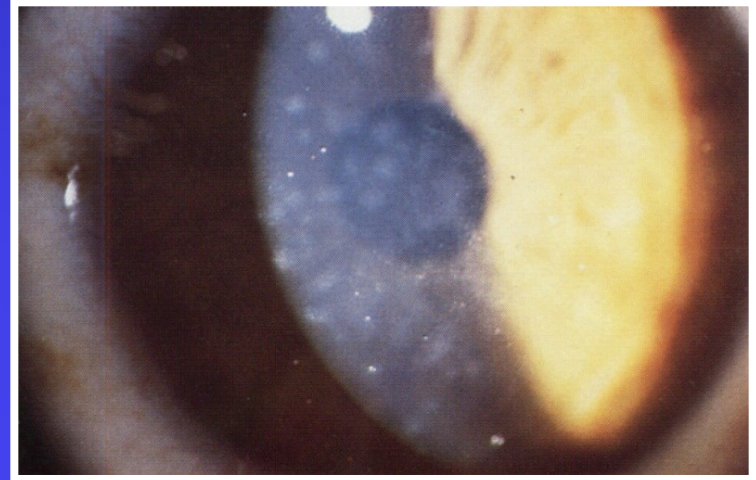
# Pseudomonas Aeruginosa





# Viral keratitis

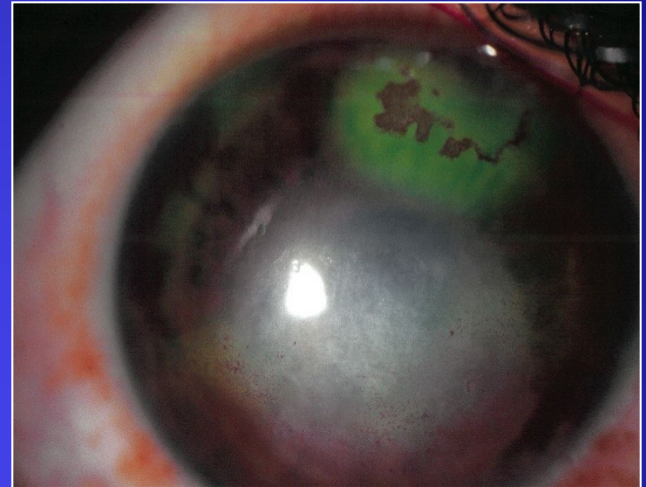
- **Adenoviridae**
  - adenovirus  
(keratokonjunktivitis)
- **Herpesviridae**
- **Herpes simplex** virus  
(keratitis)
  - Varicella zoster virus  
(keratitida)
  - Epstein Barrové virus  
(keratitida)
- **Poxviridae**
  - Molluscum contagiosum  
(keratitis)



# Viral keratitis

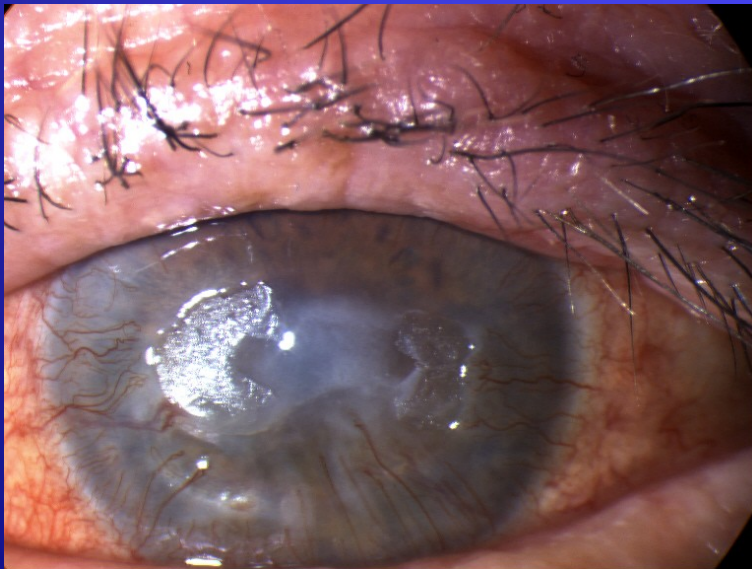
- Primary herpetic infection
- Keratoconjunctivitis
- corneal hypoesthesia
  
- Treatment:  
Mydriatics, antiviral  
agents, lubricants

CAVE steroids



# Keratitis disciformis herpetica

- Hypersensitivity reaction to viral antigen in cornea
- Treatment:  
Mydriatics, corticosteroids





# Fungal keratitis

- Clinical features:

The white stromal infiltrate with indistinct margins

Wessly ring

Satellite lesions

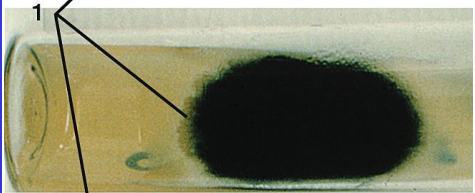
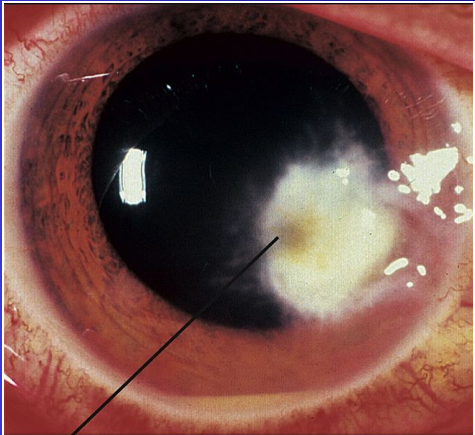
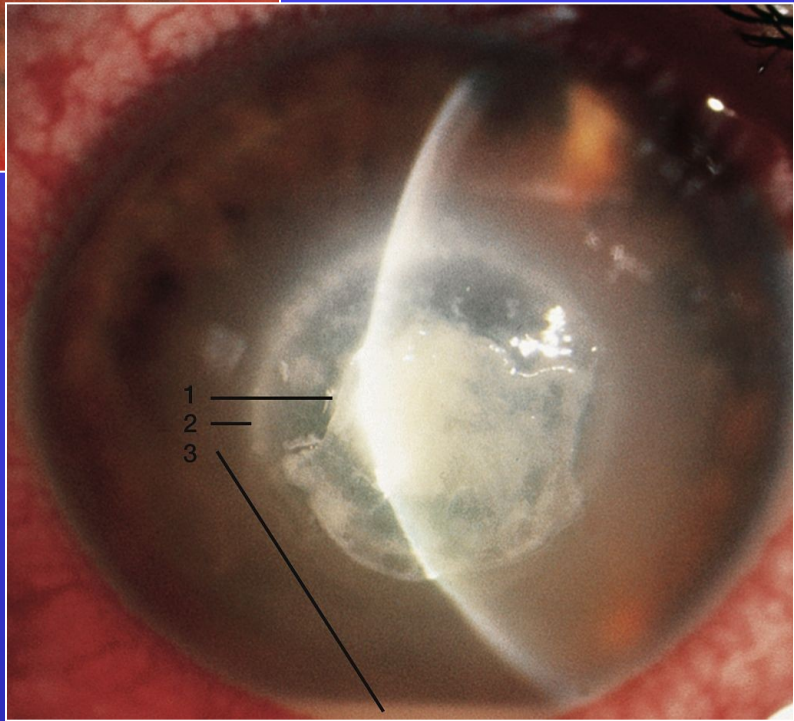
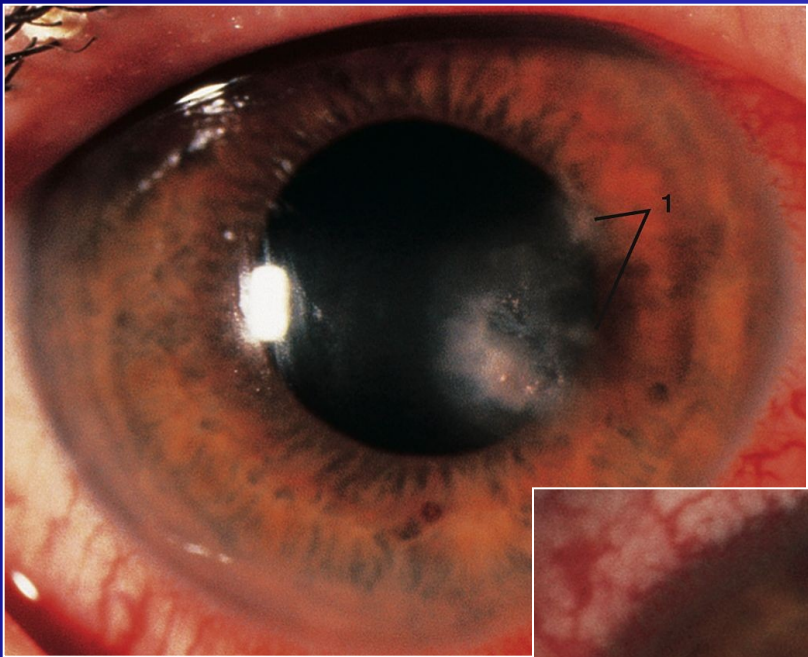
Hyphy in the corneal stroma and anterior chamber

Hypopyon

Dg: Cytological examination  
cultivation - corneal scarification,  
DNA diagnostics

T: removal of the epithelium  
topical treatment  
systemic anti fungals  
(intraconazole)



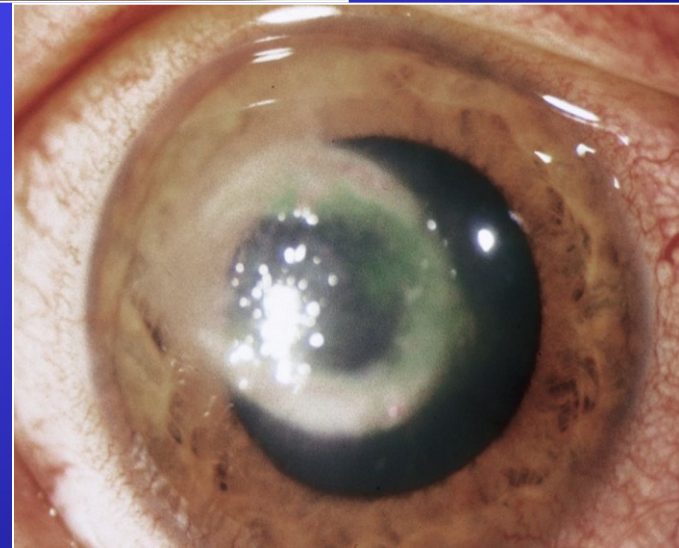
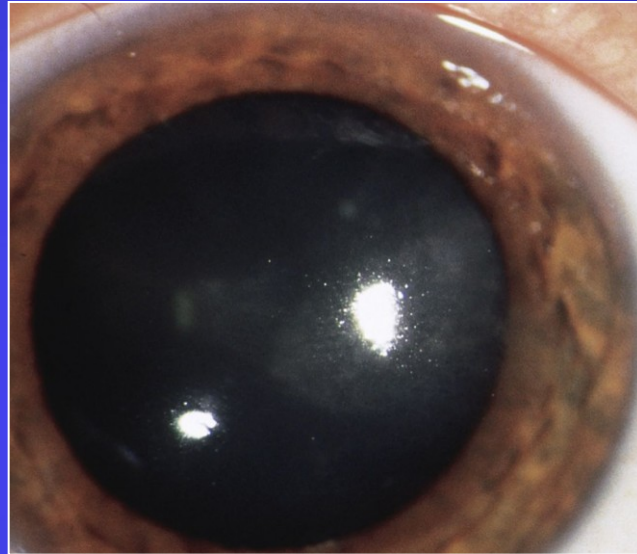


**Fungal keratitis  
( Candida )**



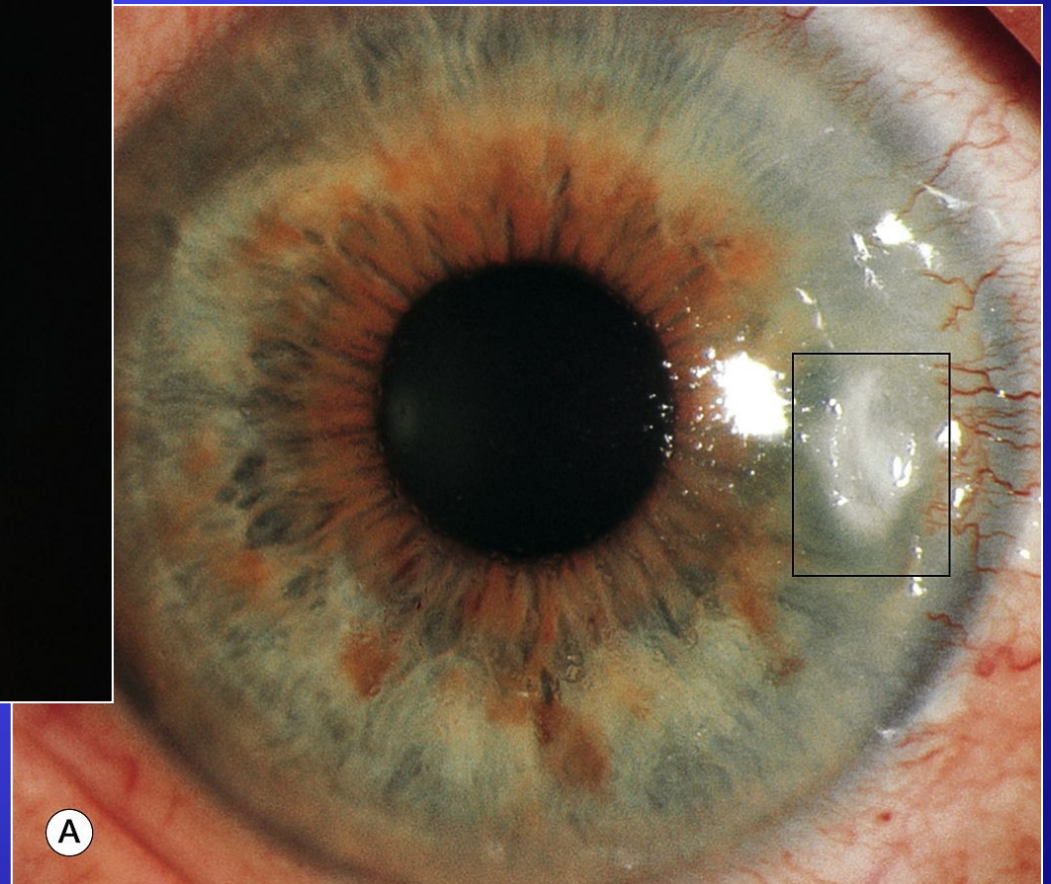
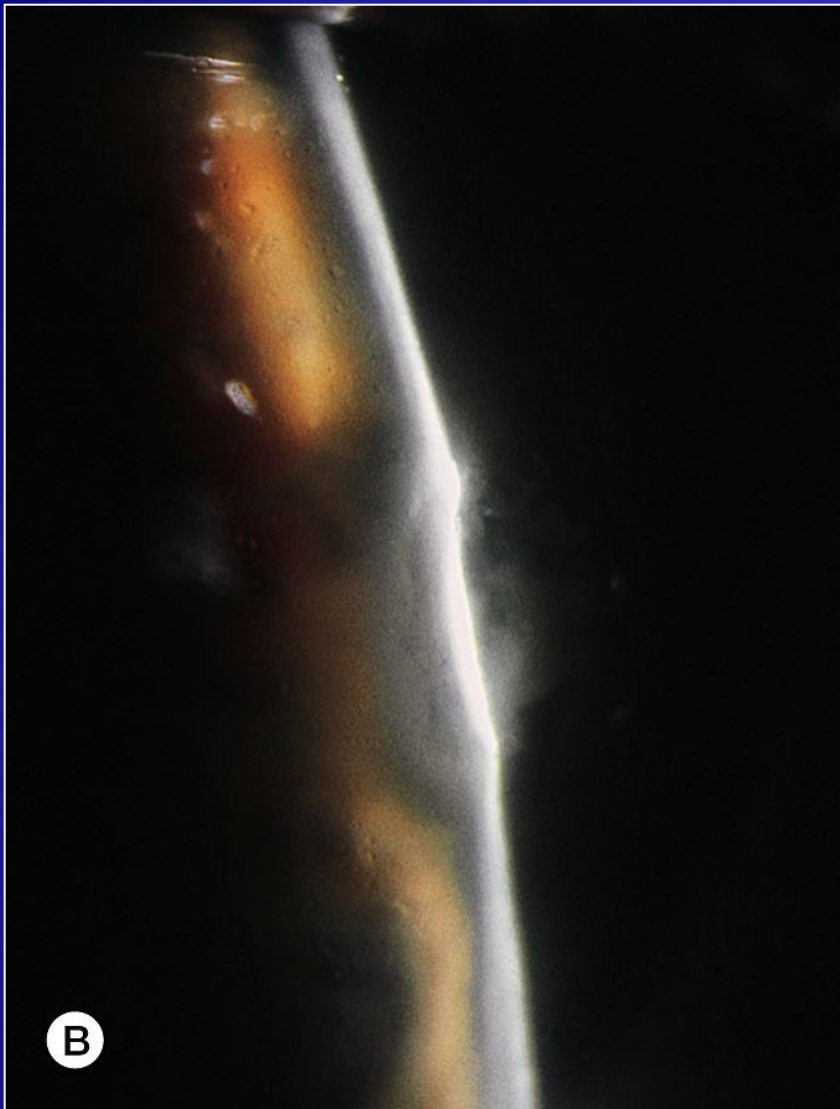
# Protozoan keratitis - Acanthamoeba

- Associated with contact lens wear (microerosion)
- Blurred vision, **pain !!**
- T: promanidin (Brolen), Polyhexamethylenm chlorhexidin





# Ulcus corneae

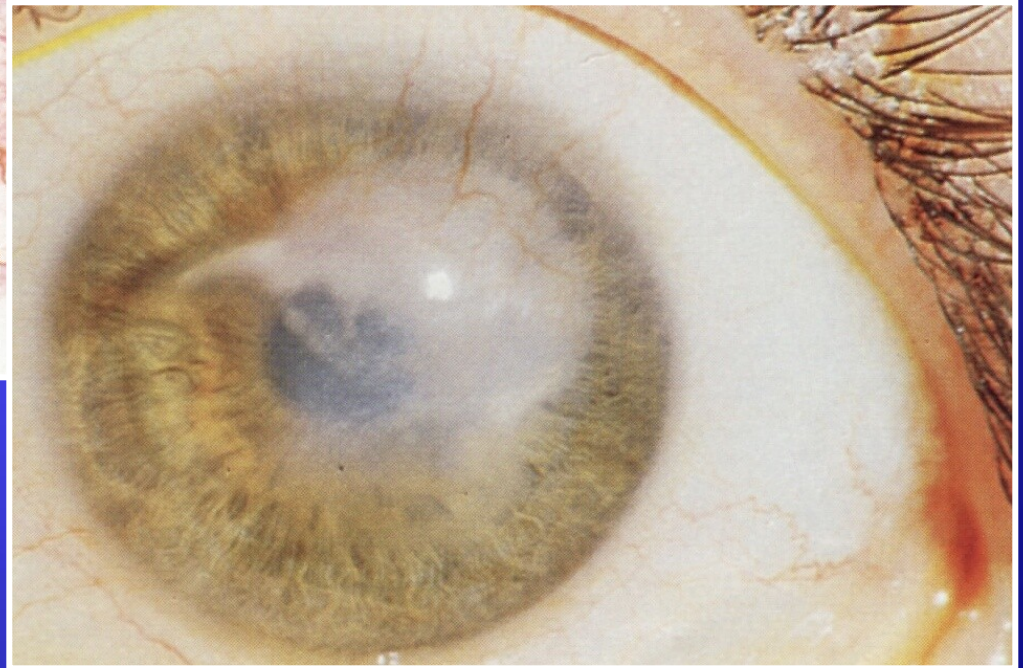
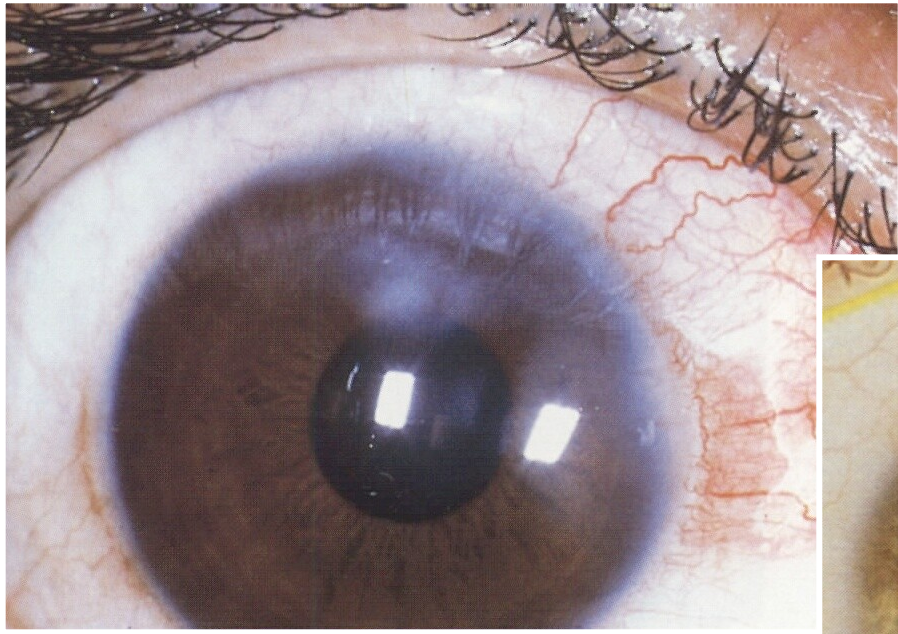


# Keratitis interstitialis

- **Interstitial keratitis** - on the basis of the immune response to live microbe - antigen in the cornea (syphilis, tuberculosis, herpes, monokukleóza, fymfognulom, Lyme disease, rubella, leprosy, mumps, etc.).
- **Mooren's ulcer** – III.type of hypersensitivity,
- **Exposure keratitis** – due to paresis n. facialis
- **Peripheral ulcerative keratitis (PUK)** - infectious involvement in systemic diseases (rheumatoid arthritis, lupus, scleroderma, polyarteritis, arcoidosis...
- **Neurotrophic keratitis** – loss of corneal innervation of n. trigeminus (trauma, tumors, RS, cerebrovascular lesions)
- **Always stromal infiltration with scarring and neovascularization**

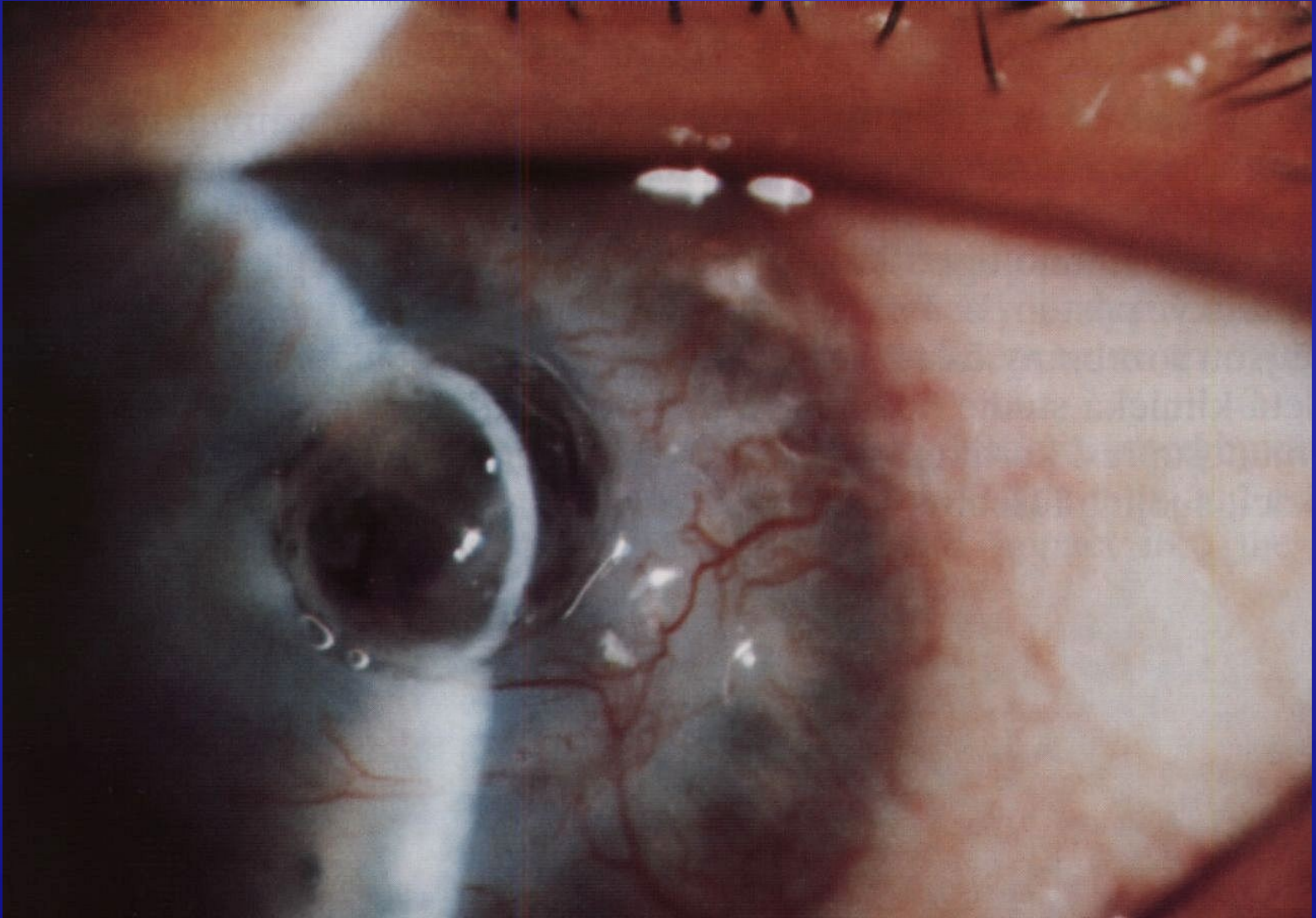


# Keratitis interstitialis

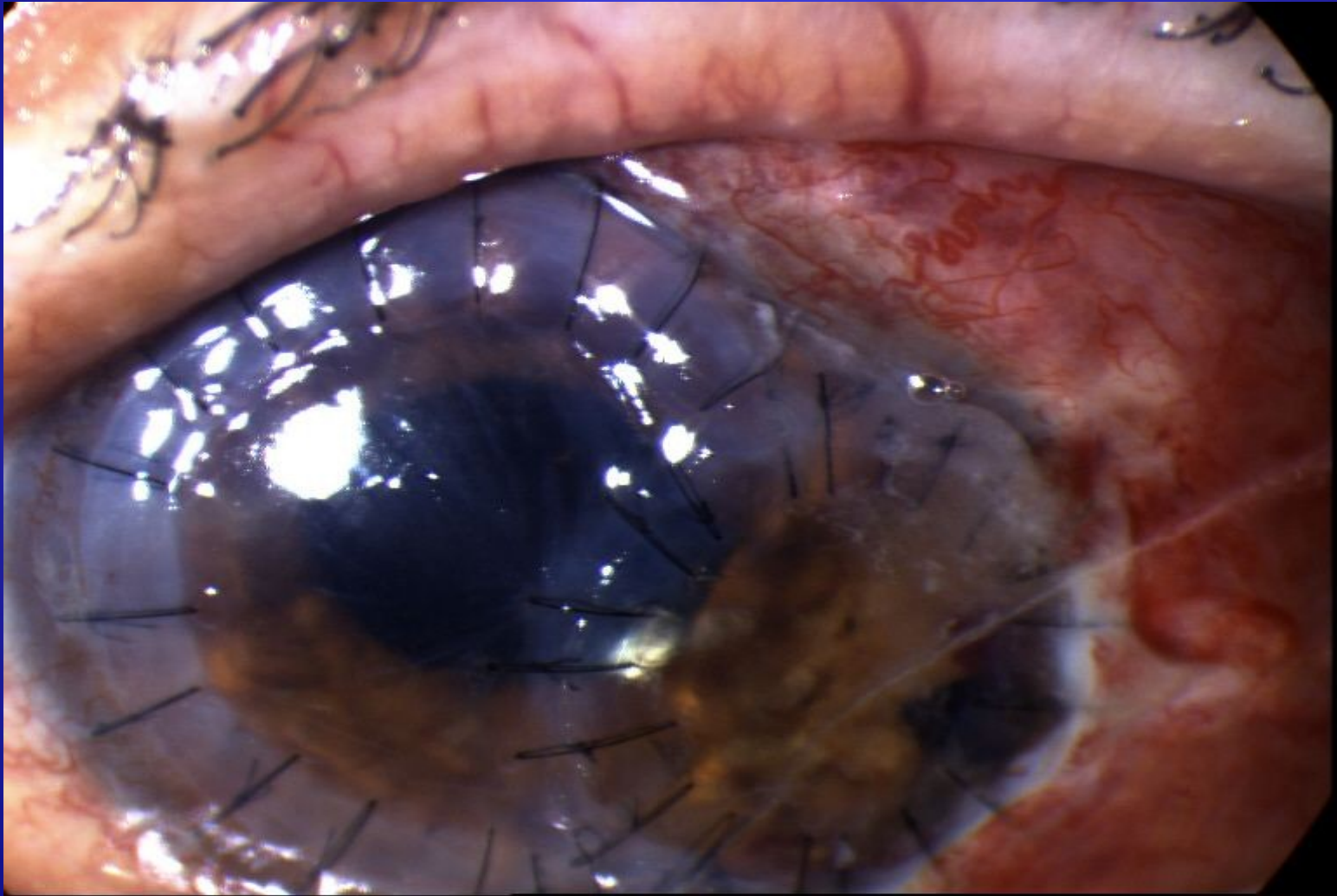




# Neurotrophic keratitis - Descemetocelata



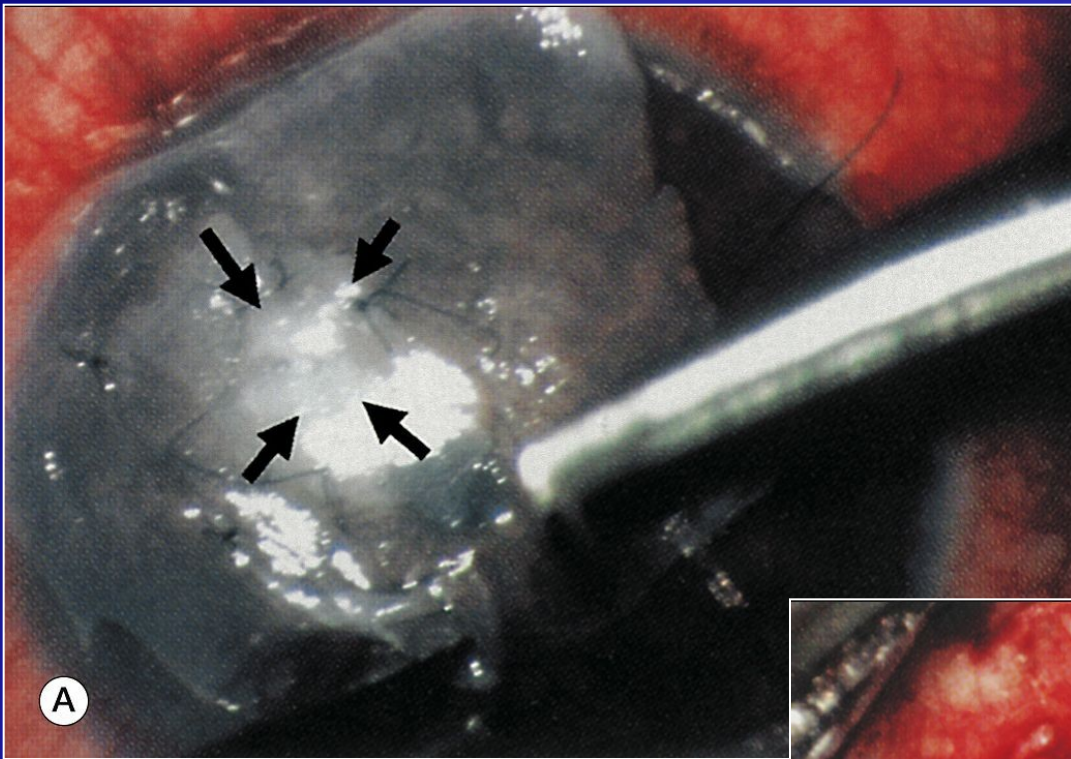
# Keratitis neurotrophica



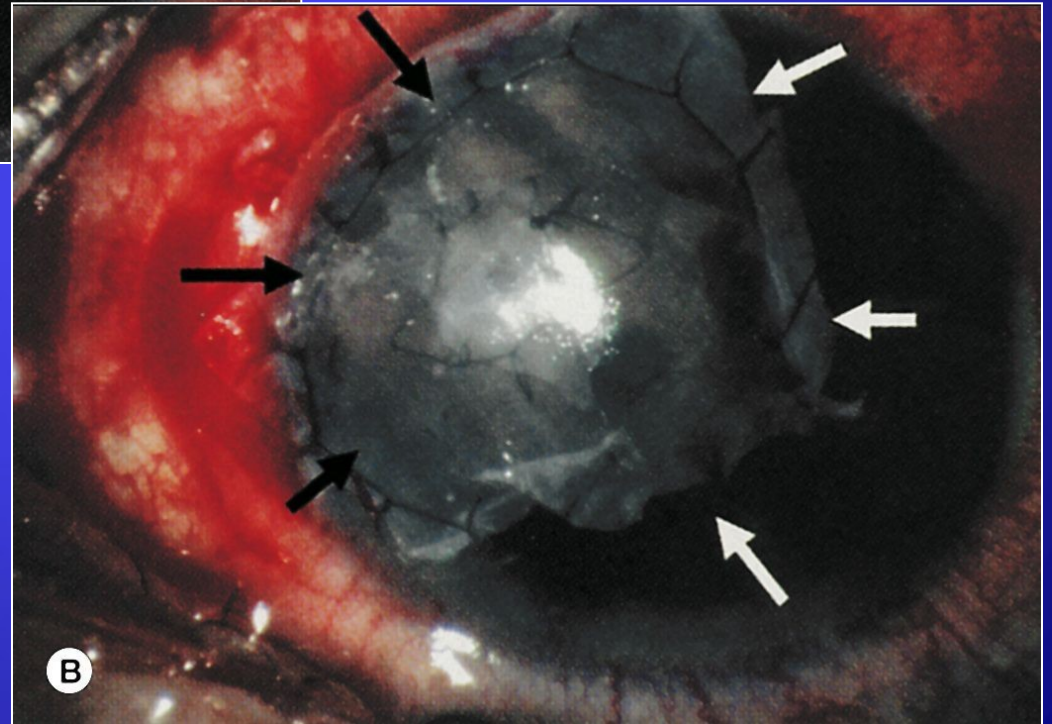
# Surgery treatment

- Transplantation of amniotic membrane
- Perforating keratoplasty
- DMEK

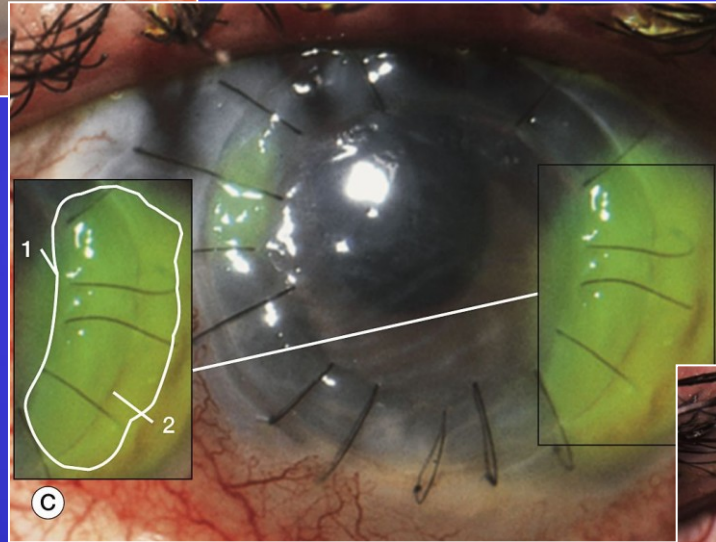
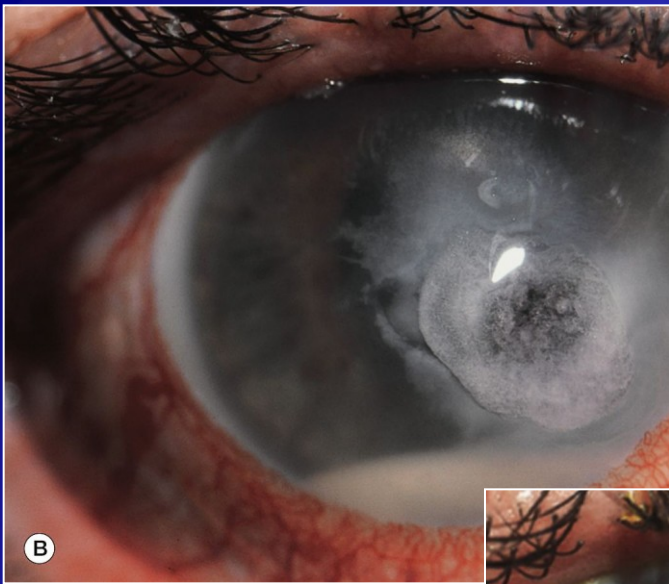




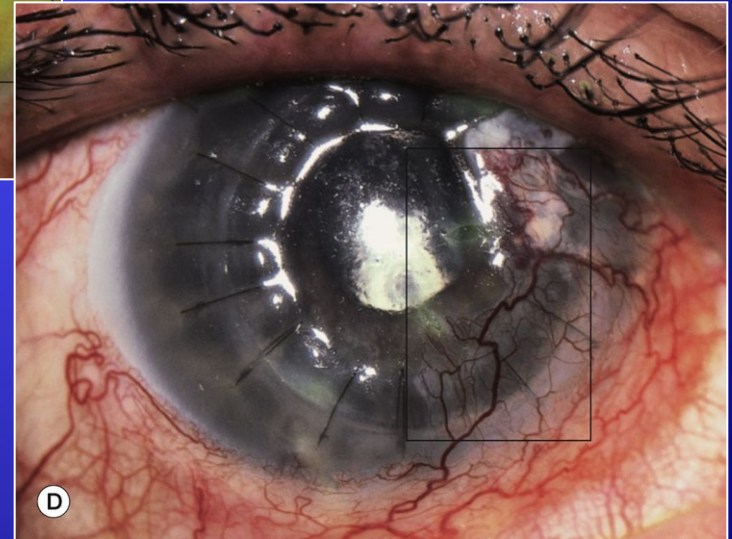
## Amniotic membrane



# Penetrating keratoplasty

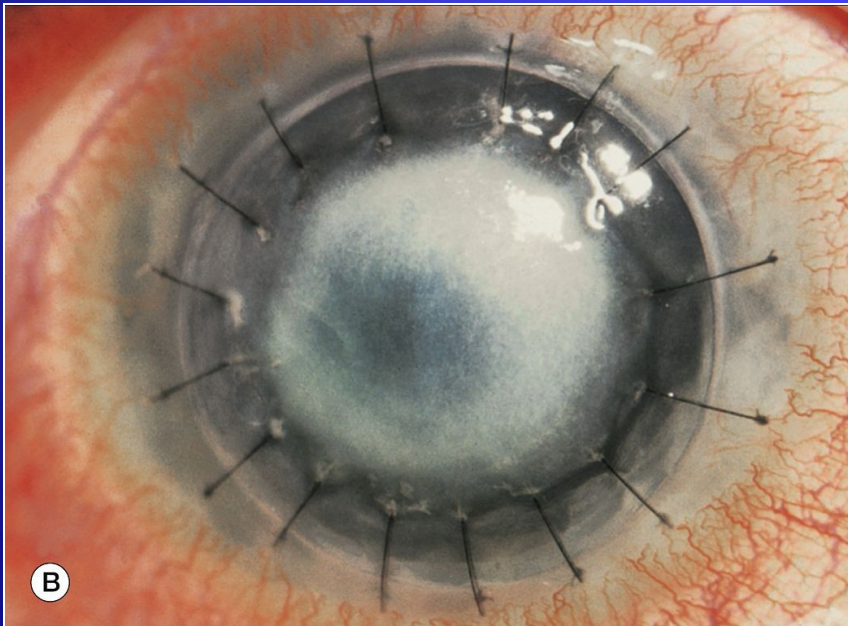
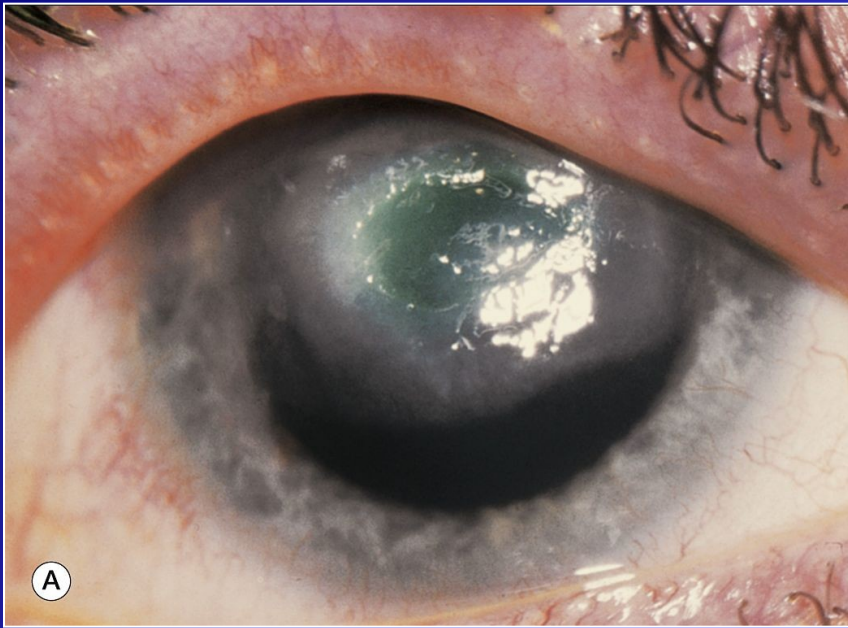


# Viral keratitis

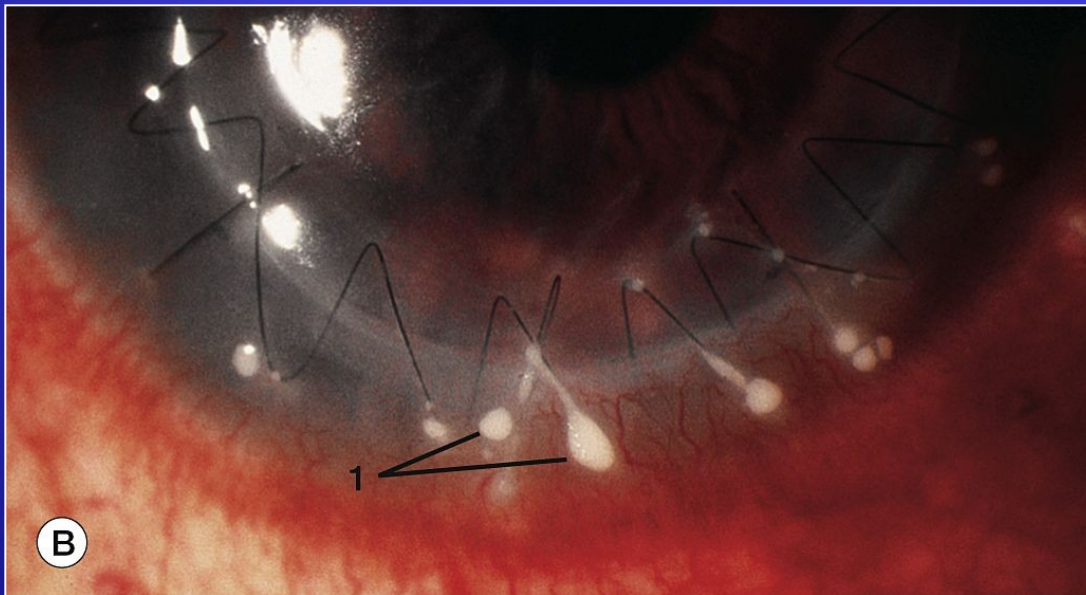
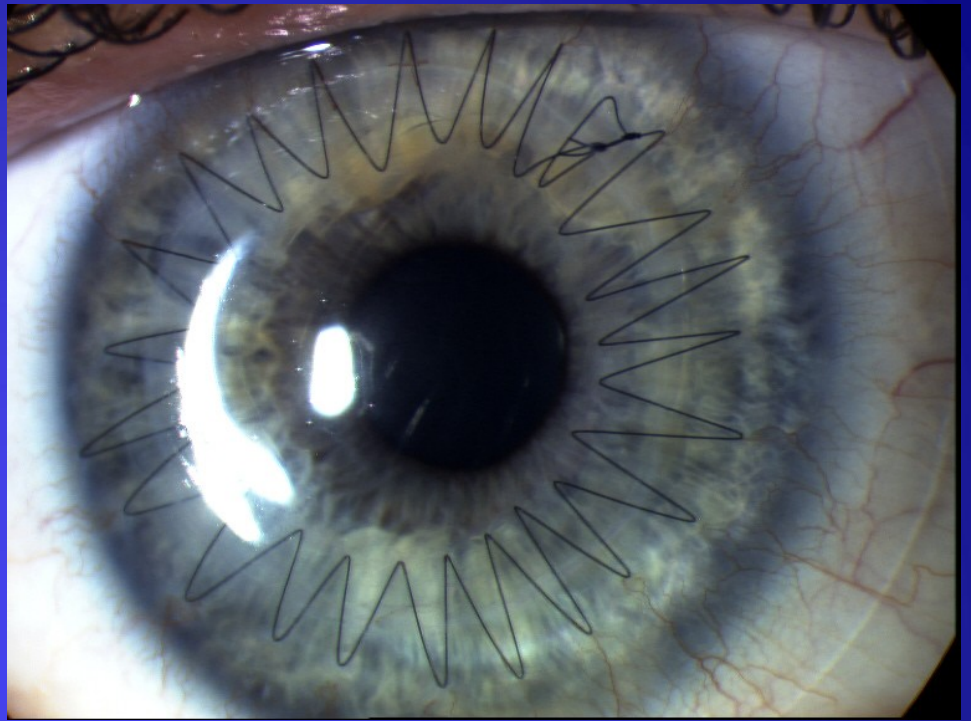
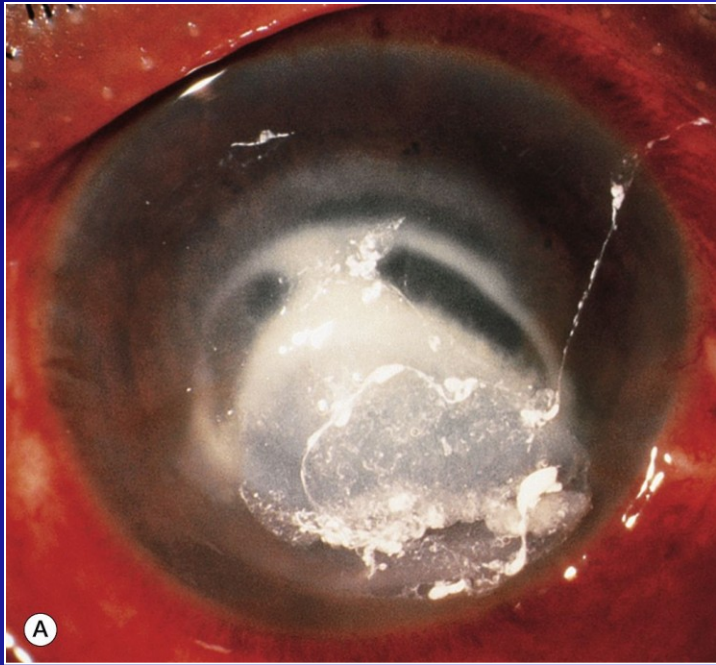


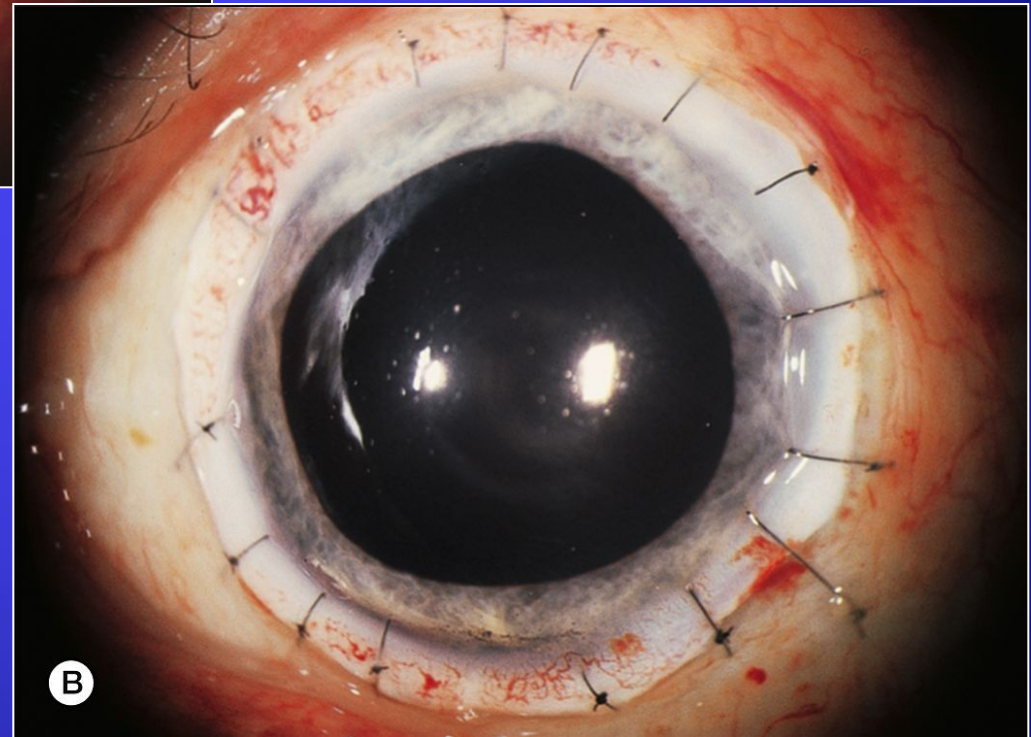


# Fungal keratitis





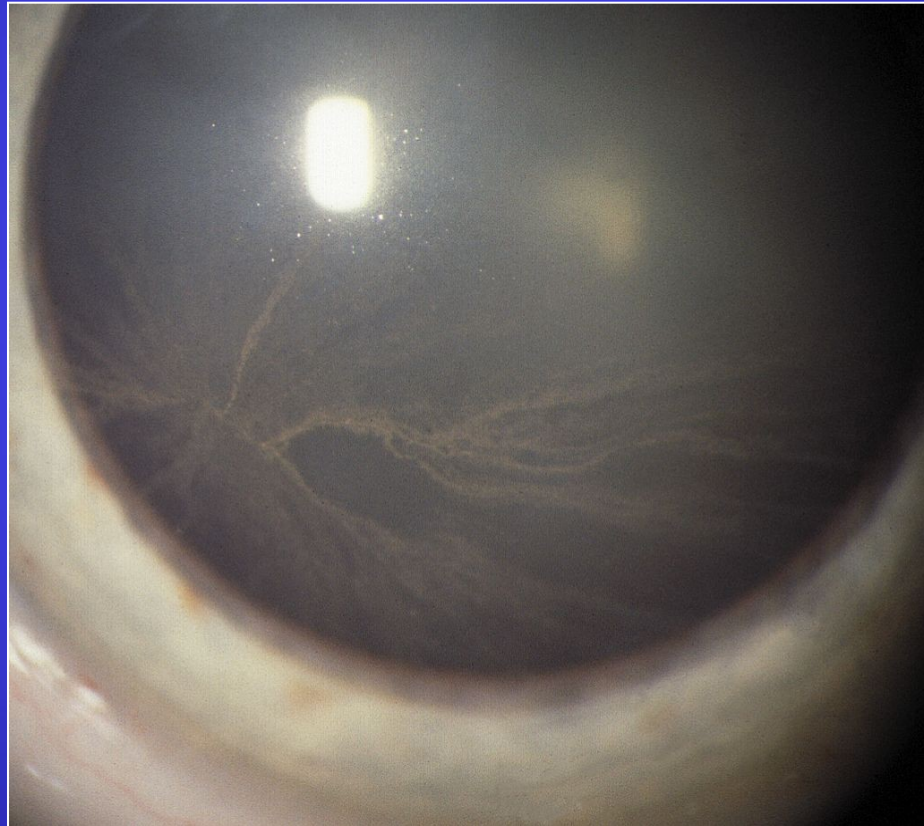




**Bacterial  
sklerokeratitis**



# Cornea verticillata

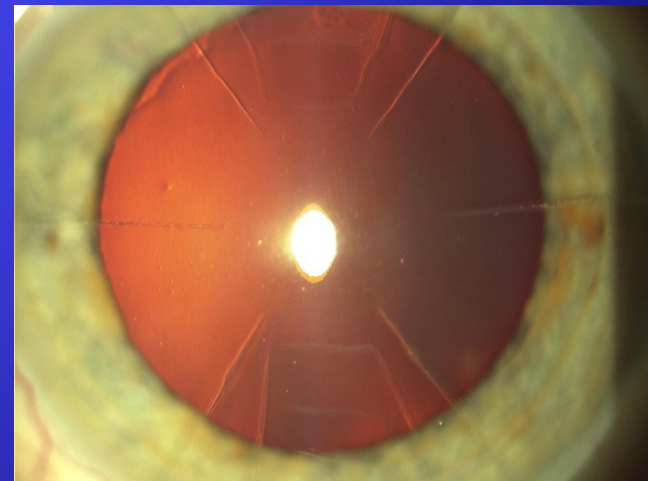
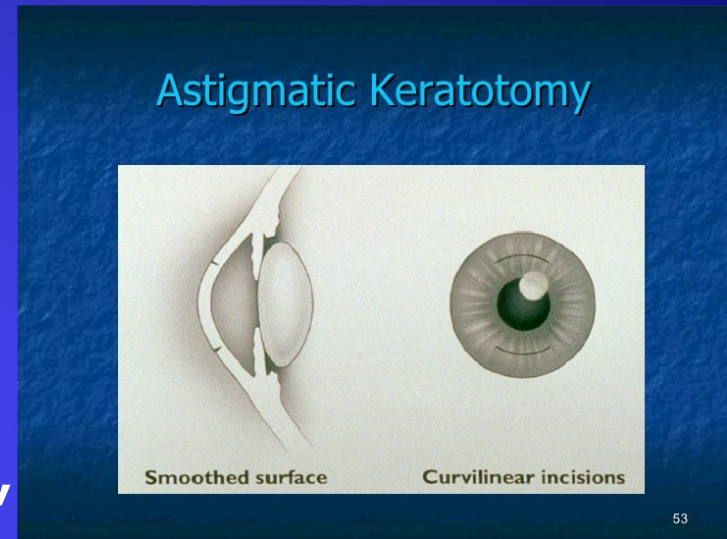


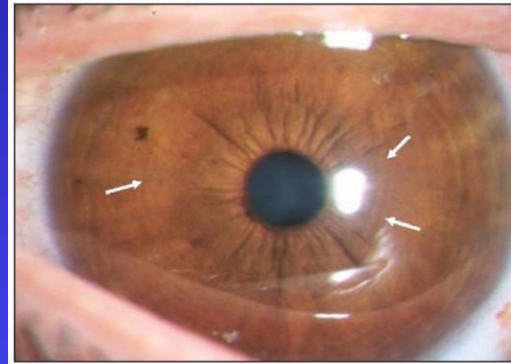
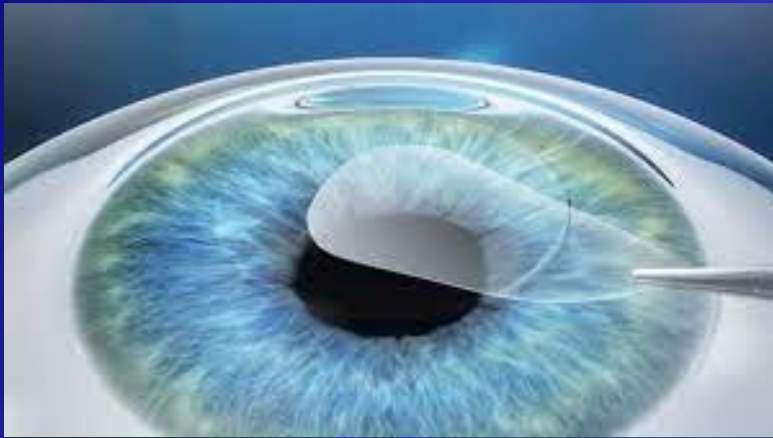


# Refractive surgery - cornea

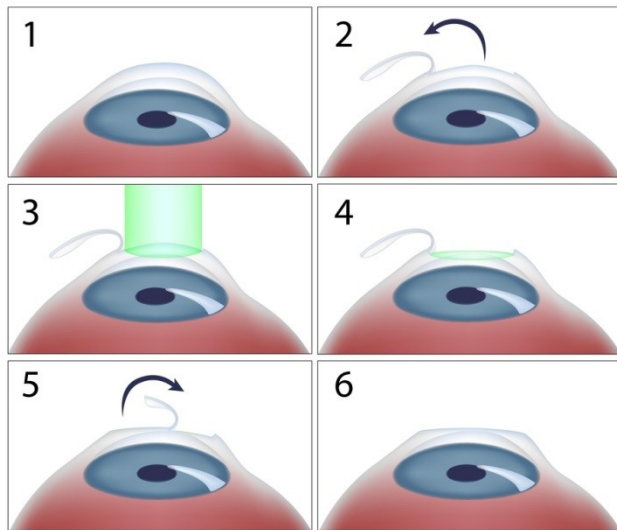
- Keratotomy - radial, hexagonal, arcuate
- Intrastromal rings - myopia, astigmatism
- 
- PRK - photorefractive keratectomy, LASIK - laser in situ keratomileusis
- SMILE

Photoablation - argon-fluoride laser  
Femtosecond laser – intrastromal

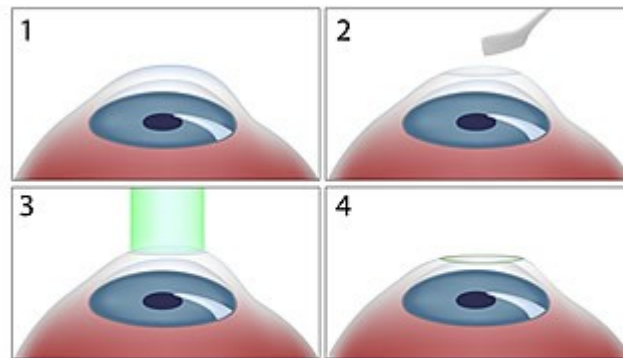




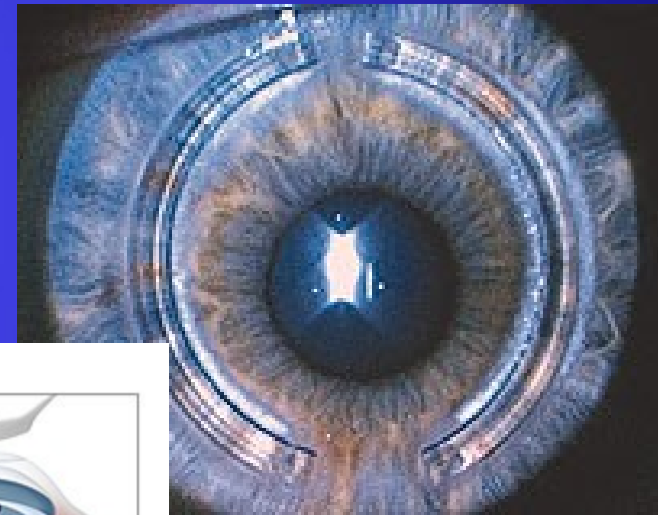
**Figure 1.** Intracorneal hydrogel lens inlay 6 months after implantation. The arrows indicate the edges of the inlay, showing that they are well centered clinically.



Lasik Eye Surgery



Photorefractive Keratectomy (PRK)



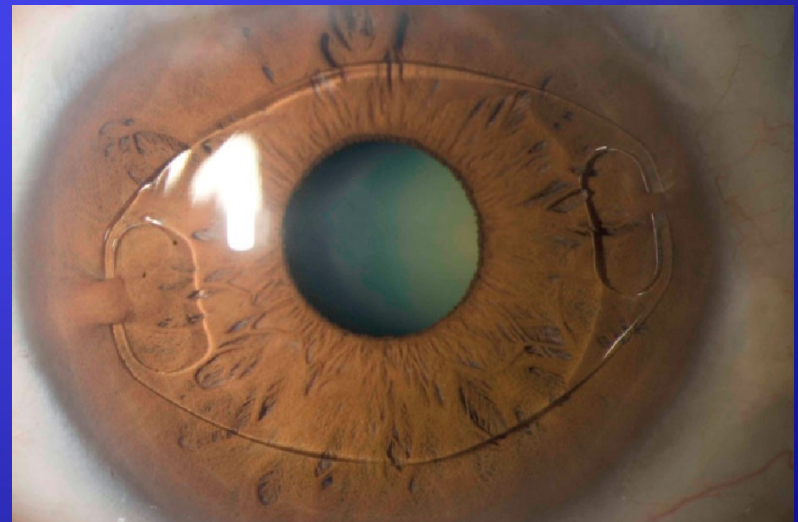
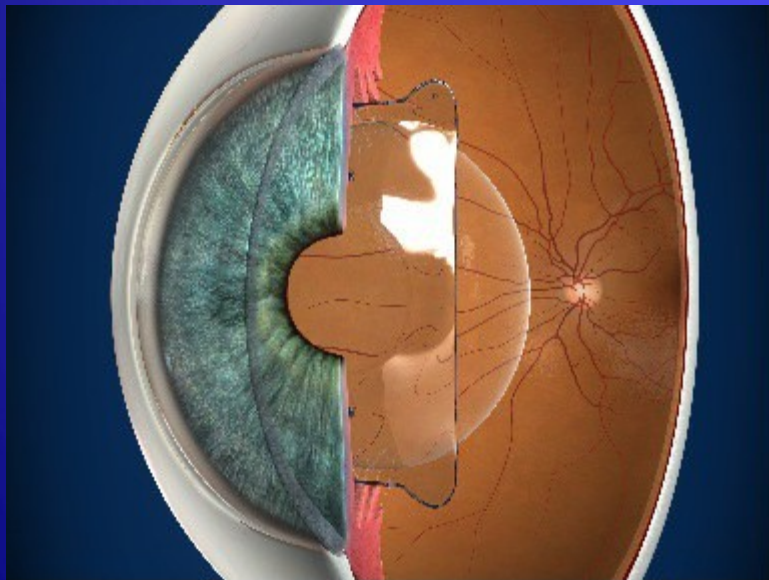
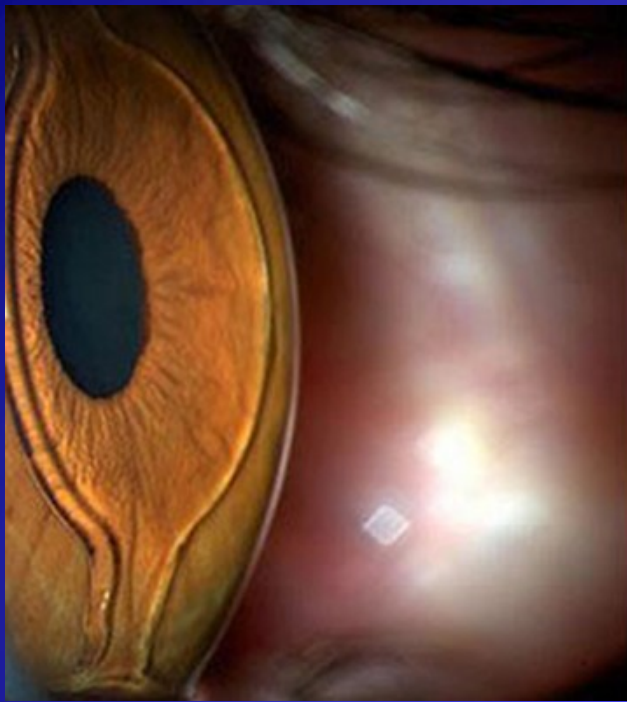
# Refractive surgery

Tissue	Type of surgery	Name	Refractive error
Cornea	Surgery	Keratotomy	<b>Astigmatismus</b>
	Laser	PRK LASIK ReLEX SMILE	<b>Myopie</b>
<b>Intraocular - lens</b>	Surgery – phacic intraocular lens	Anterior chamber fakic lens Posterior chamber lens (ICL)	<b>High myopia</b>
	<b>Surgery – intraocular lens (removinf of the lens)</b>	Multifocal arteficial lens	<b>Hypermetropia Presbyopia</b>



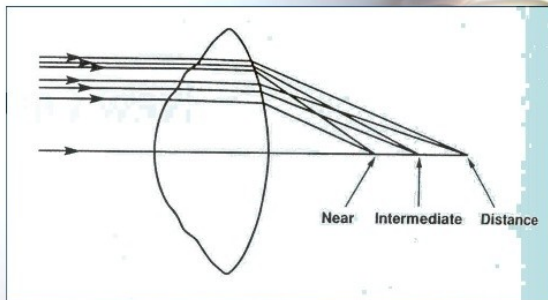
# Refractive surgery

- Non corneal procedure
- Intraocular lens – phakic - AC IOL  
- ICL
- Clear lens extraction – multifocal IOL





## Principle of a Refractive Multifocal IOL







**Děkuji za pozornost**