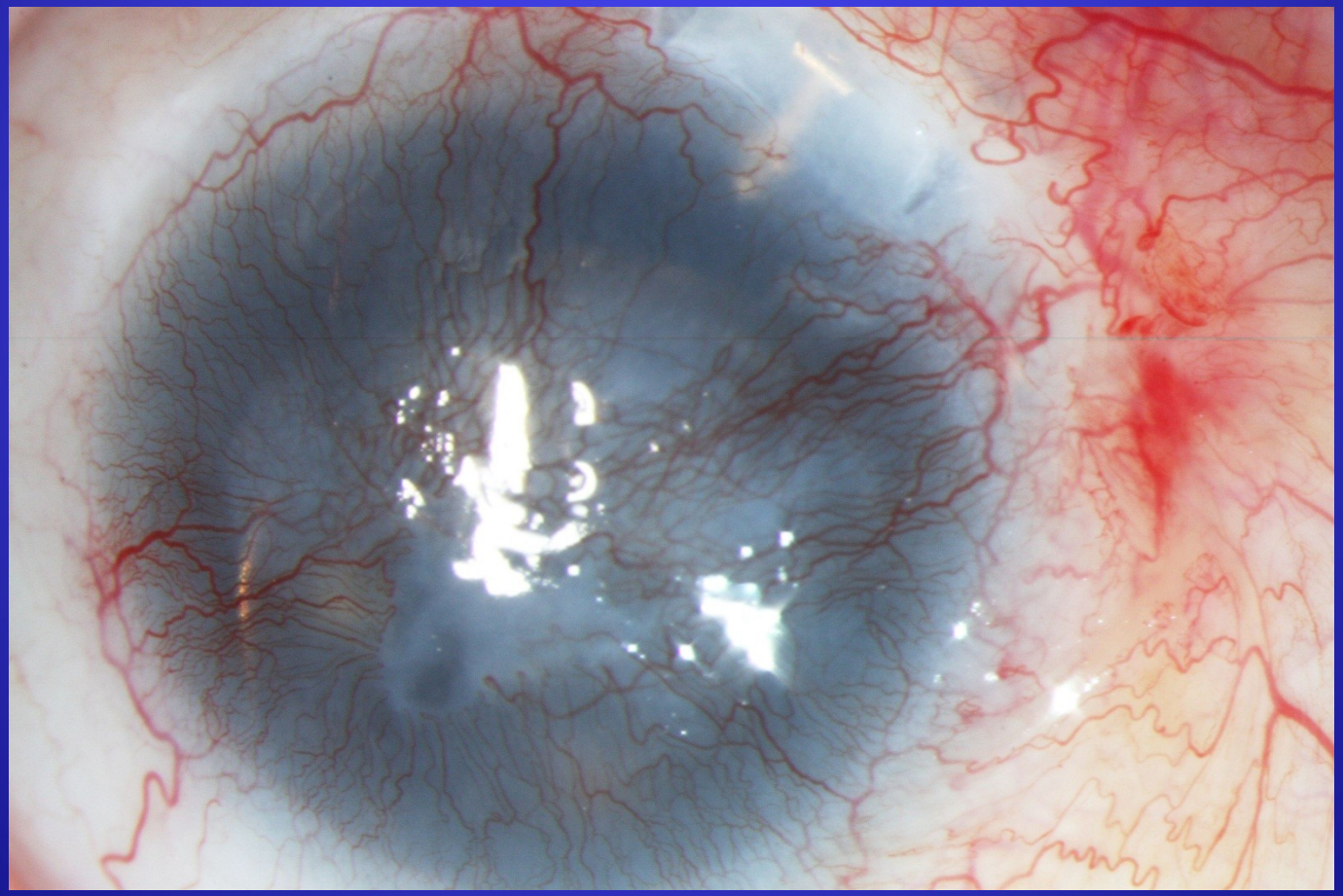
Cornea

Eva Vlková

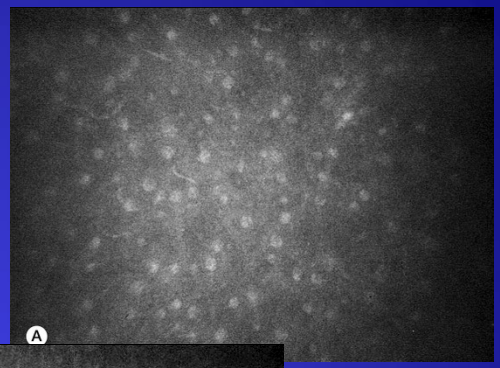


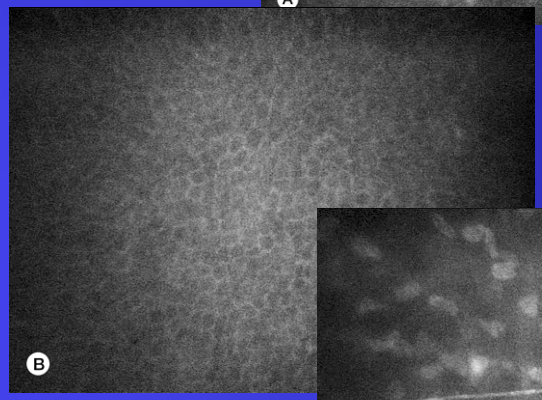
Anatomy of cornea

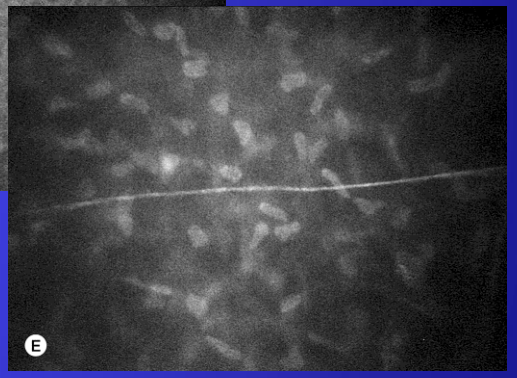
- Transparent optical part of the eyeball - impermeable barrier
- Refractive medium (43 D)
- Diameter 11.5 mm x 12.6 mm
- Central thickness of 560 micron peripheral thickness of 600 - 1000µm endothelial cell density (2600 / mm^2) water content 76-80%

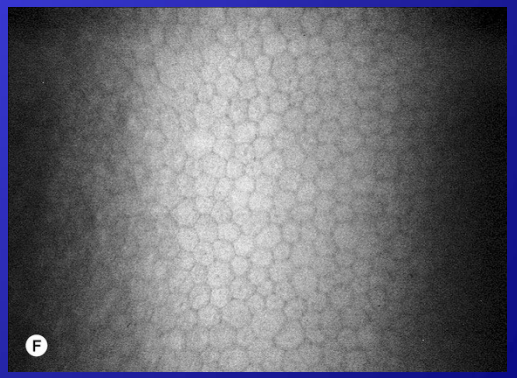
Anatomy of cornea

- Epithelium – squamous, nonkeratinized (4-6 layers), ability of regeneration (A)
- Bowman's membrane - (8-12μm) - 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 endotelial cells
- Endothelium - one layer of hexagonal cells (5000-2000 cells / mm^2), 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 imunosupresive cytokines (apoptosis of lymphocytes)
- The phenomenon ACAID (anterior chamber associated immune deviation)

Function of cornea

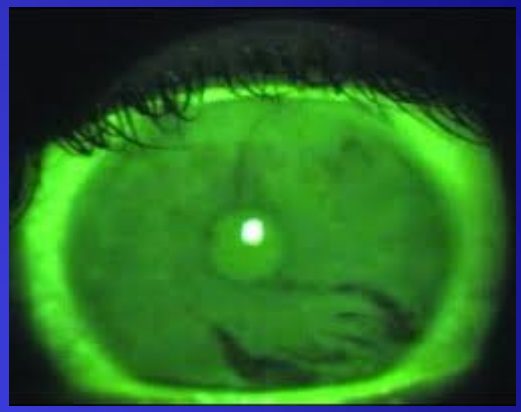
- Most refractive tissue (43D)
- Transparency is defined by the arrangement of fibrils
- Endothelial pump (ability of endothelium actively suck water- Na / K ATP pump)
- Decrease in endothelial cells below 500 / mm^2 leads to irreversible changes

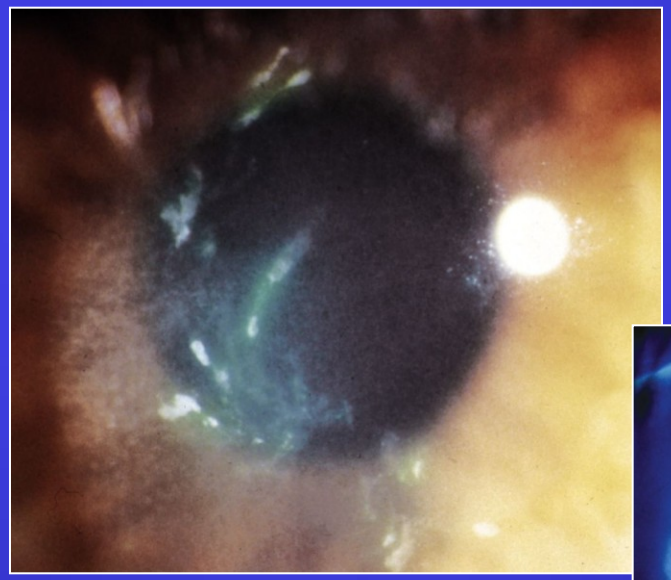
Basic examination methods

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

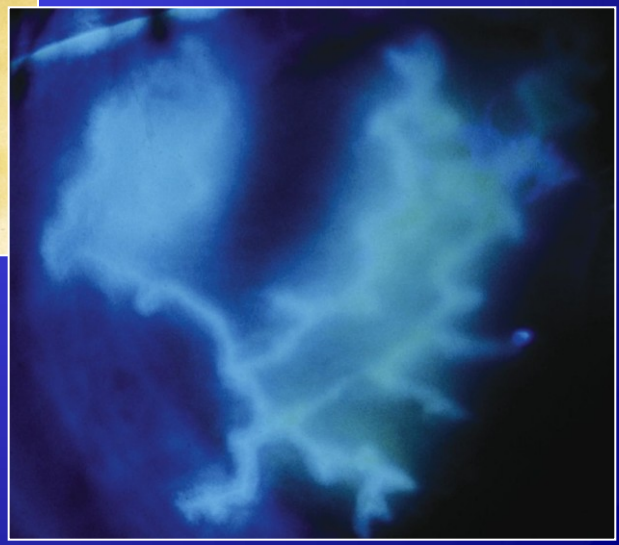
Special examination methods

- BUT
- Schirmer test





- Staining
  - Fluorescein
  - Bengal rose

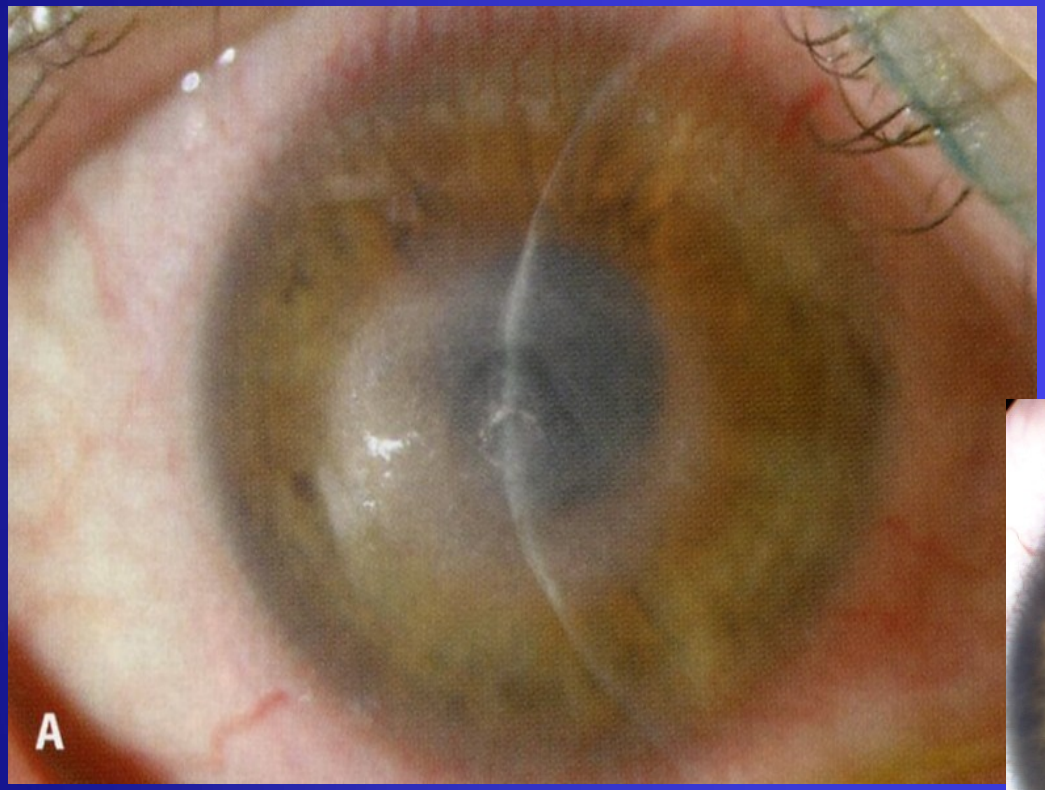


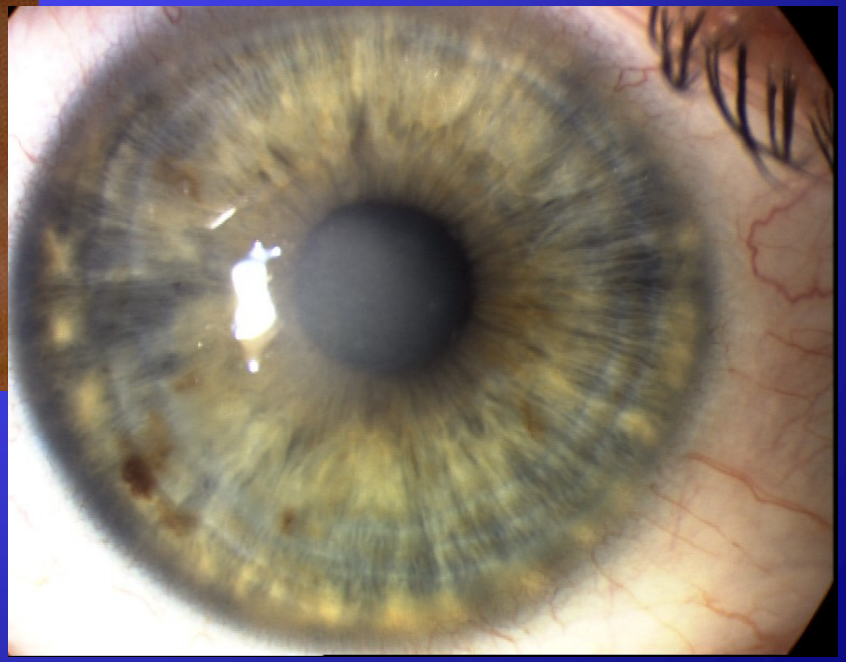
Special examination methods

1. Pachymetry (ultrasound, optic)

2. Esteziometry (cotton buds, estesiometr)

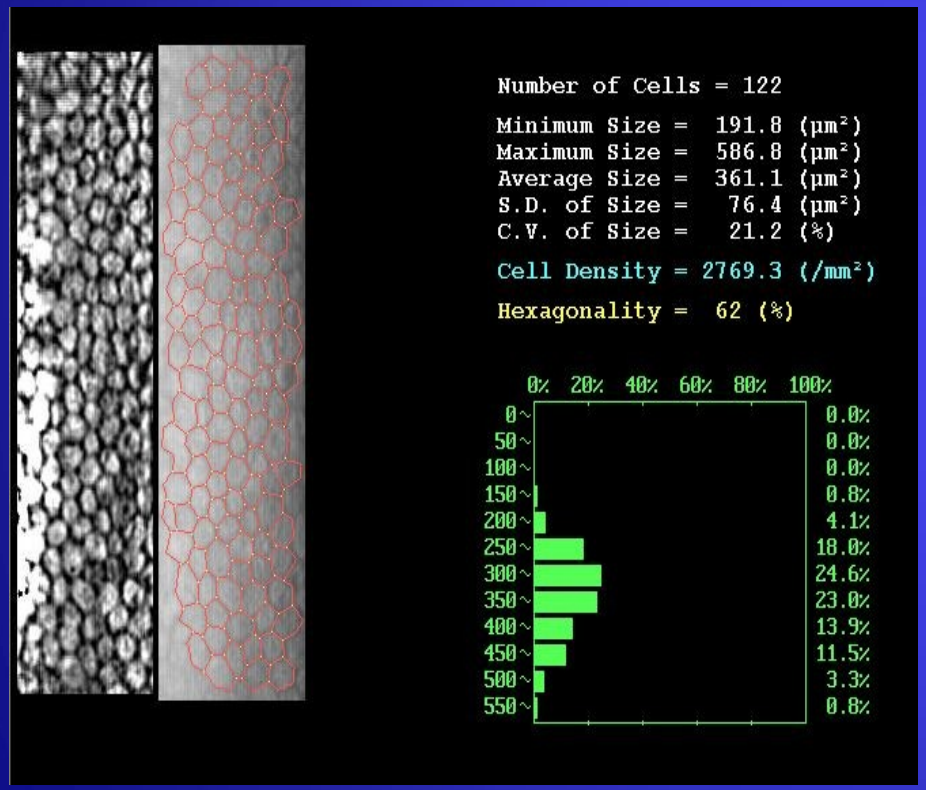
Photodocumentation

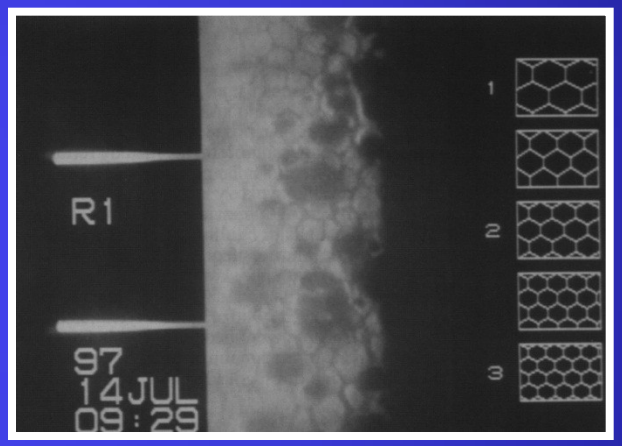


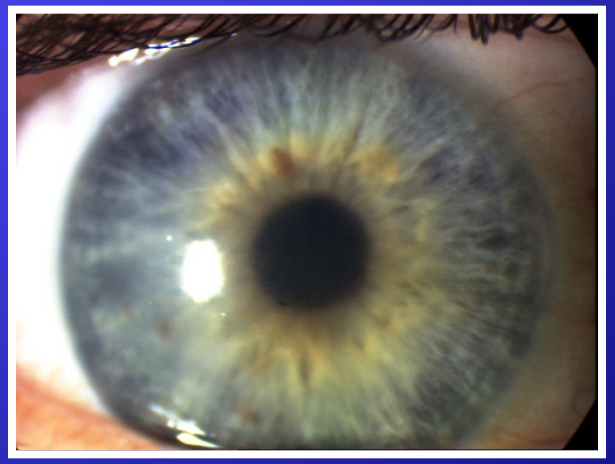


Specular microscopy

- Dytrophia corneae endotheliasis Fuchs

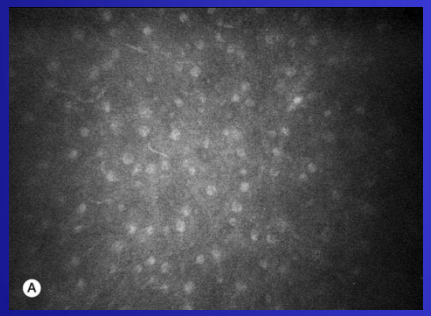


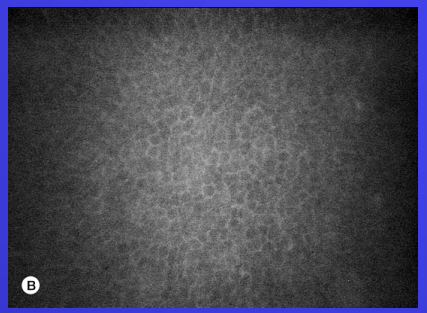


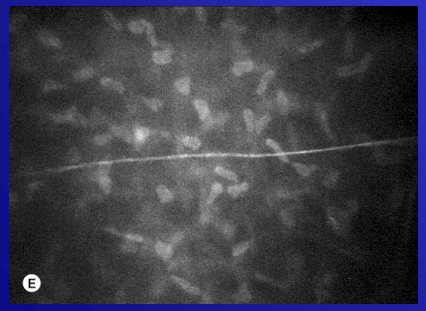


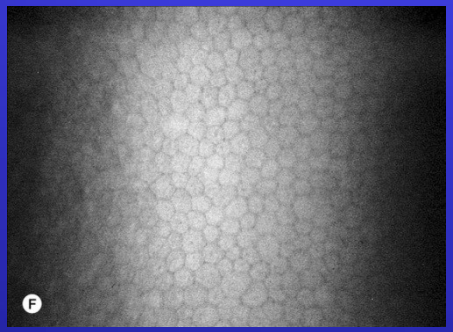
Confocal microscopy

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

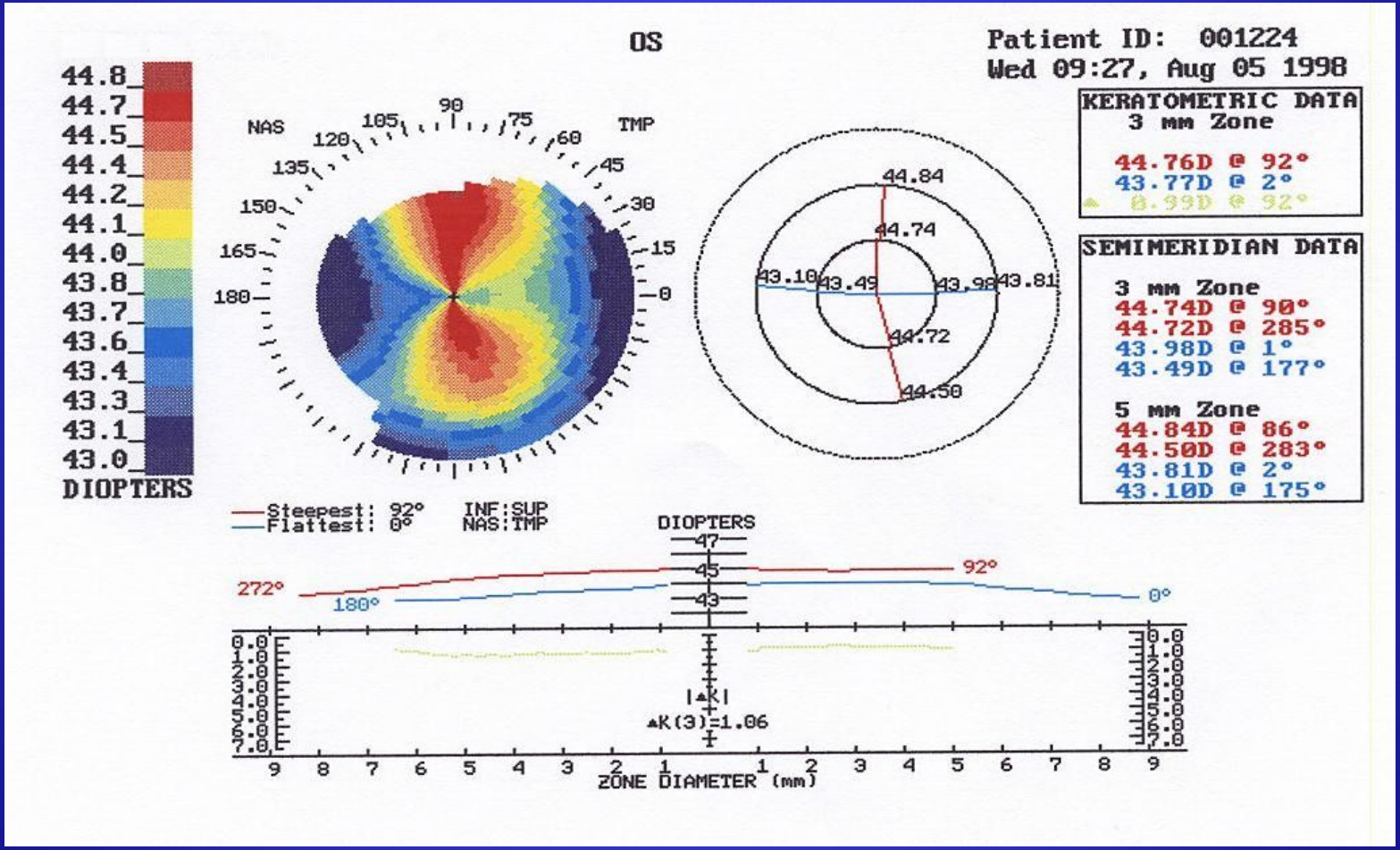








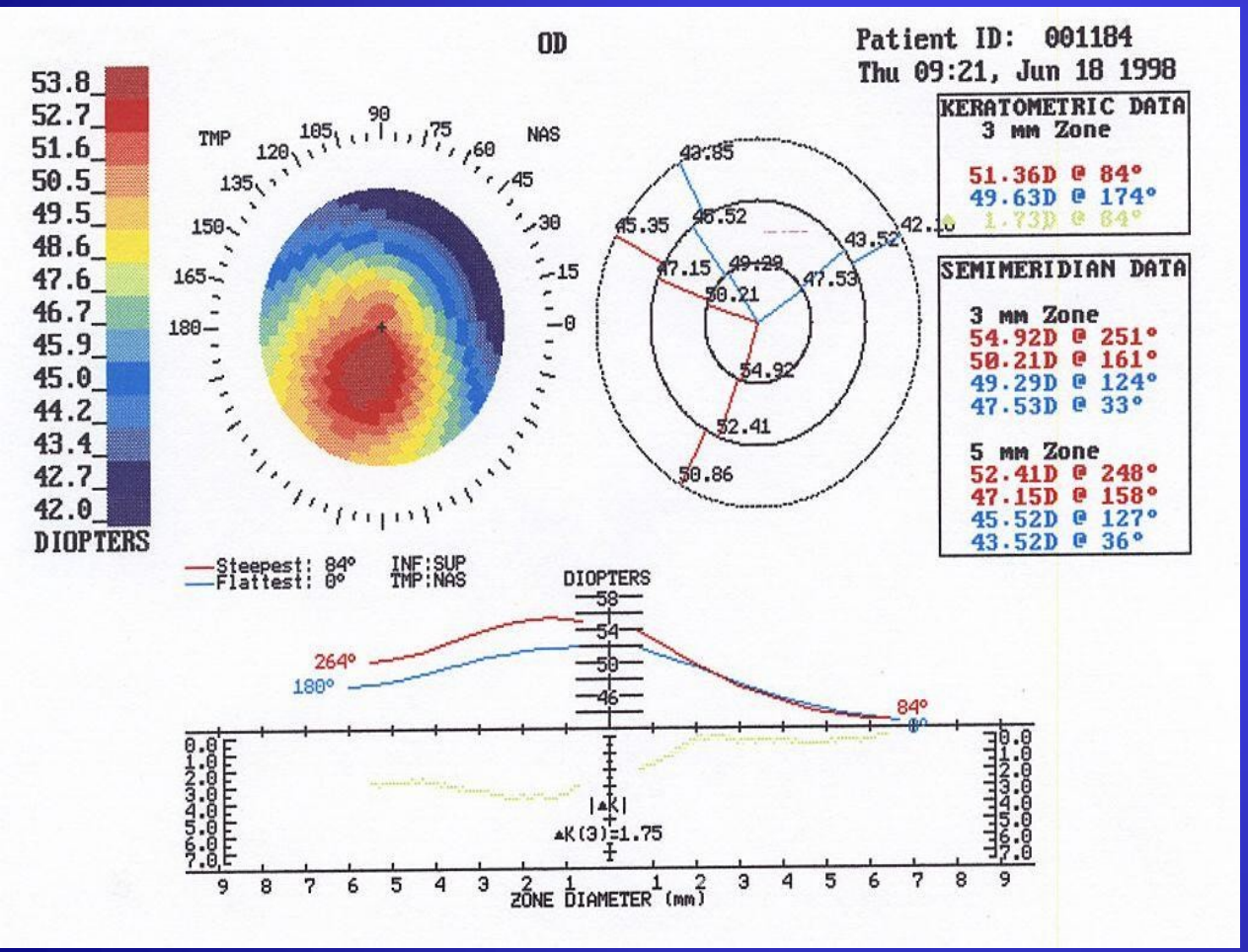
Corneal topography

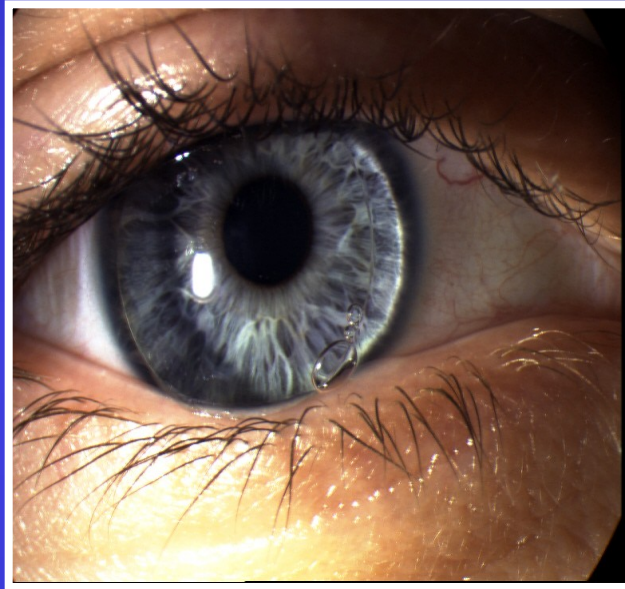


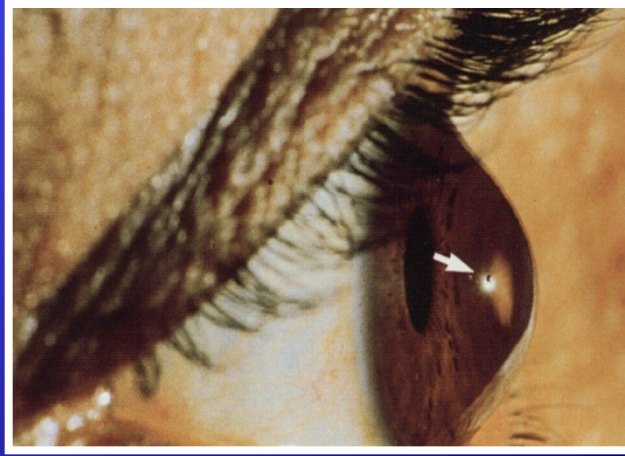
Physiological astigmatism

Corneal topography – keratoconus

(flat curvature = blue, steep = red)







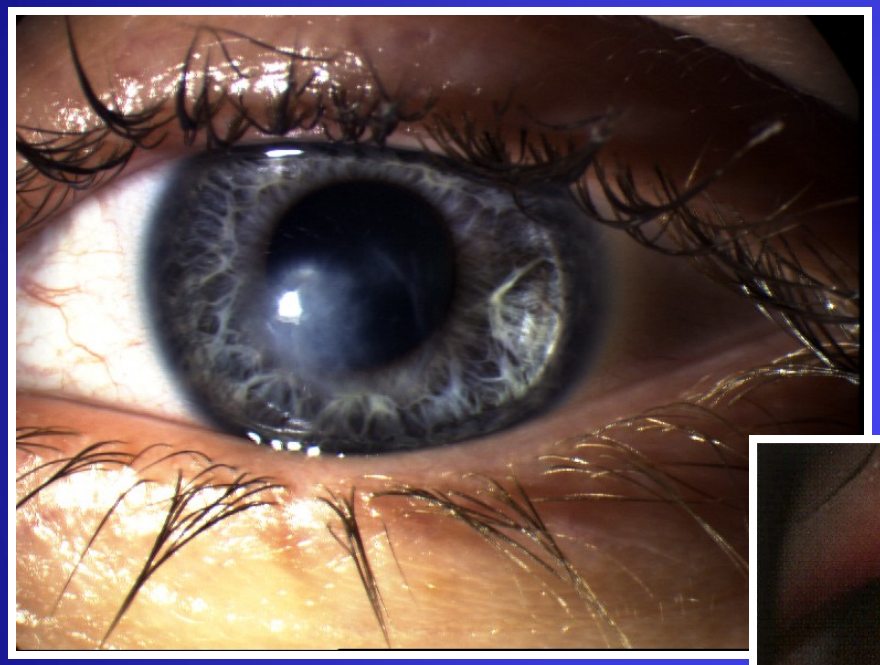
Corneal ectasias

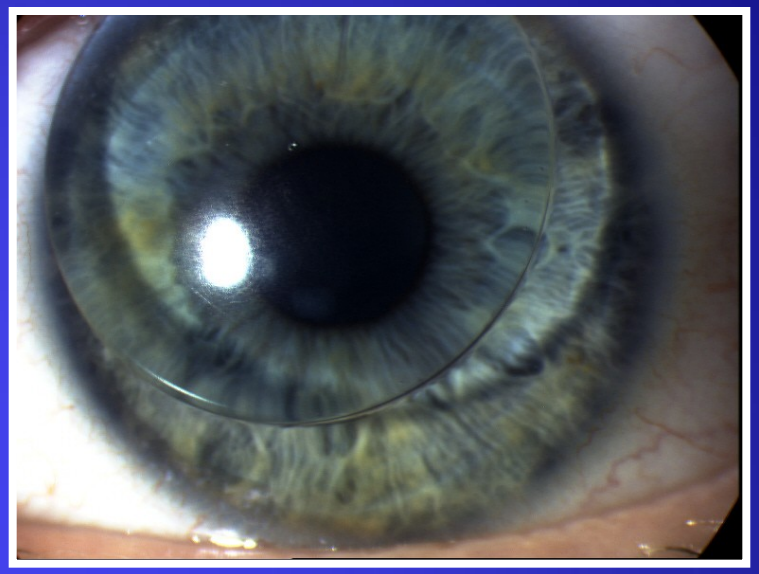
- Keratoconus – progressive, the cornea assume the cone shape
  Treatment: rigid contact lenses, CLX, intrastromal ring, lamellar and penetrating keratoplasty

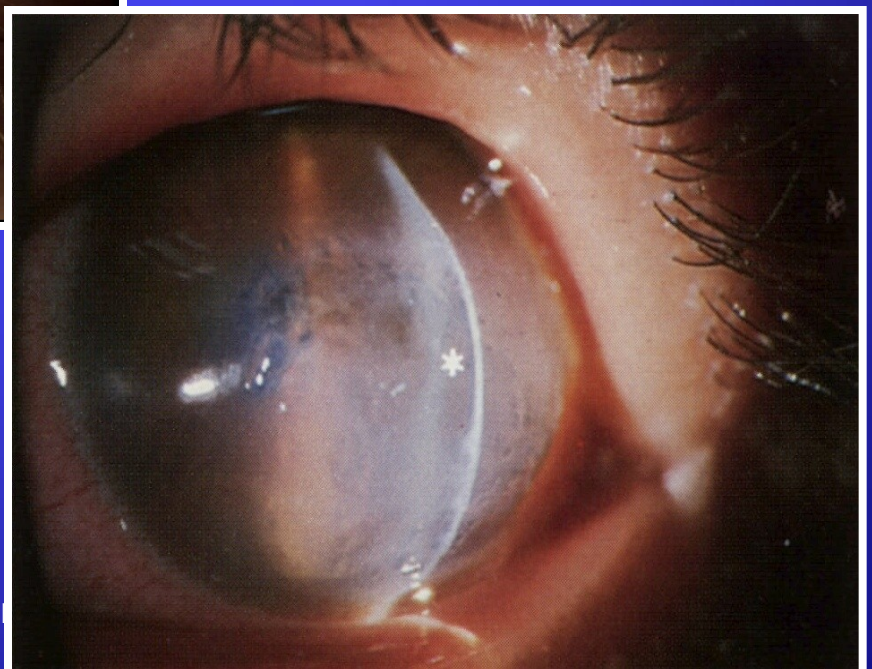
- Keratoglobus - the thinning of entire cornea

- Pellucid marginal degeneration – thinning in the lower periphery of the cornea, perforation sometimes occurs

Keratoconus acutus et subacutus







Corneal dystrophies

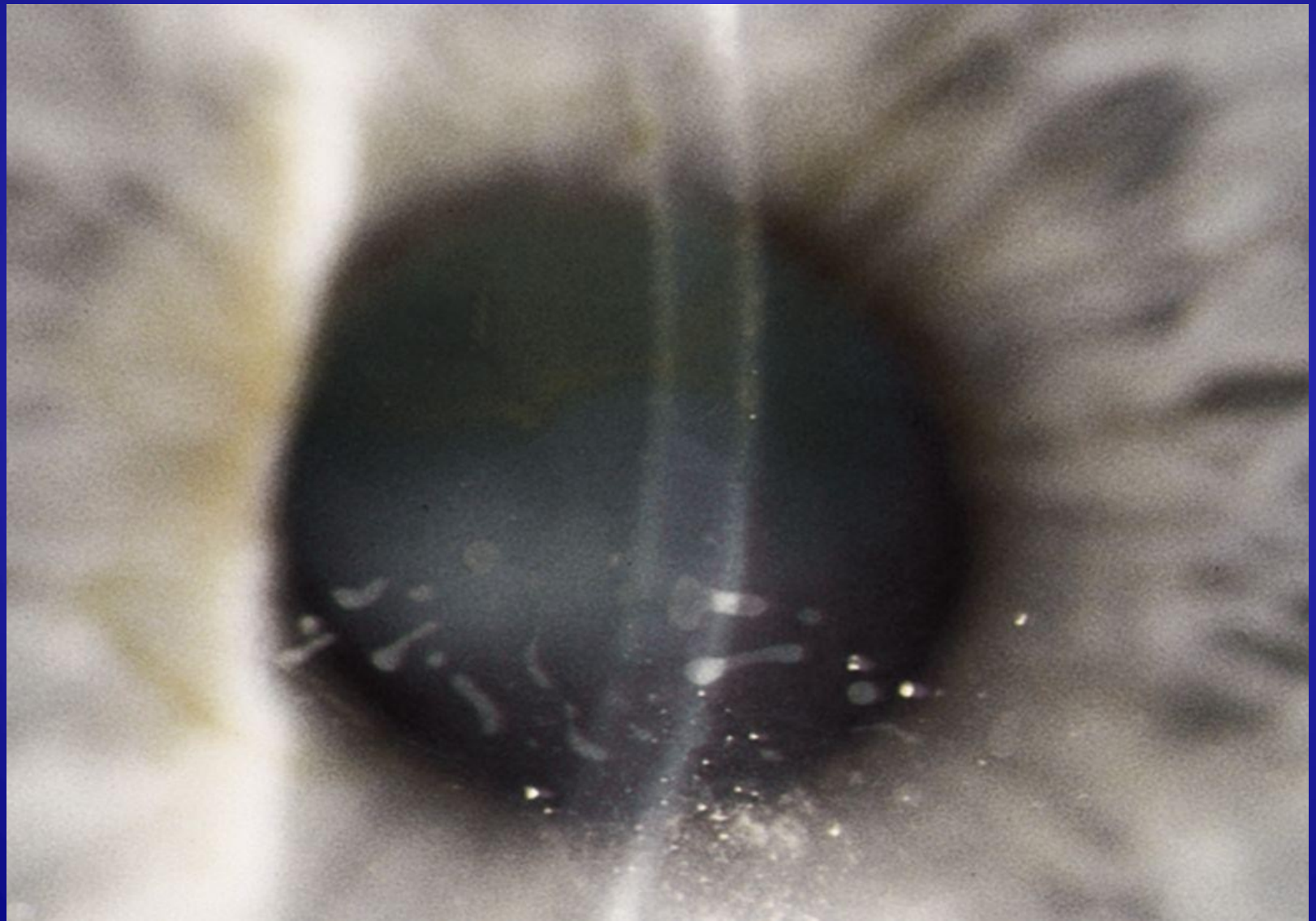
- Progressive, bilateral, non inflammatory, opacifying

- Anterior
- Stromal
- Posterior

Anterior corneal dystrophies

- Cogan dystrophy - epitelial basement membrane
- Messman dystrophy – epitelium
- Reisova – Bücklersova – Bowman layer dystrophy

Cogan dystrophy (map dot finger print)

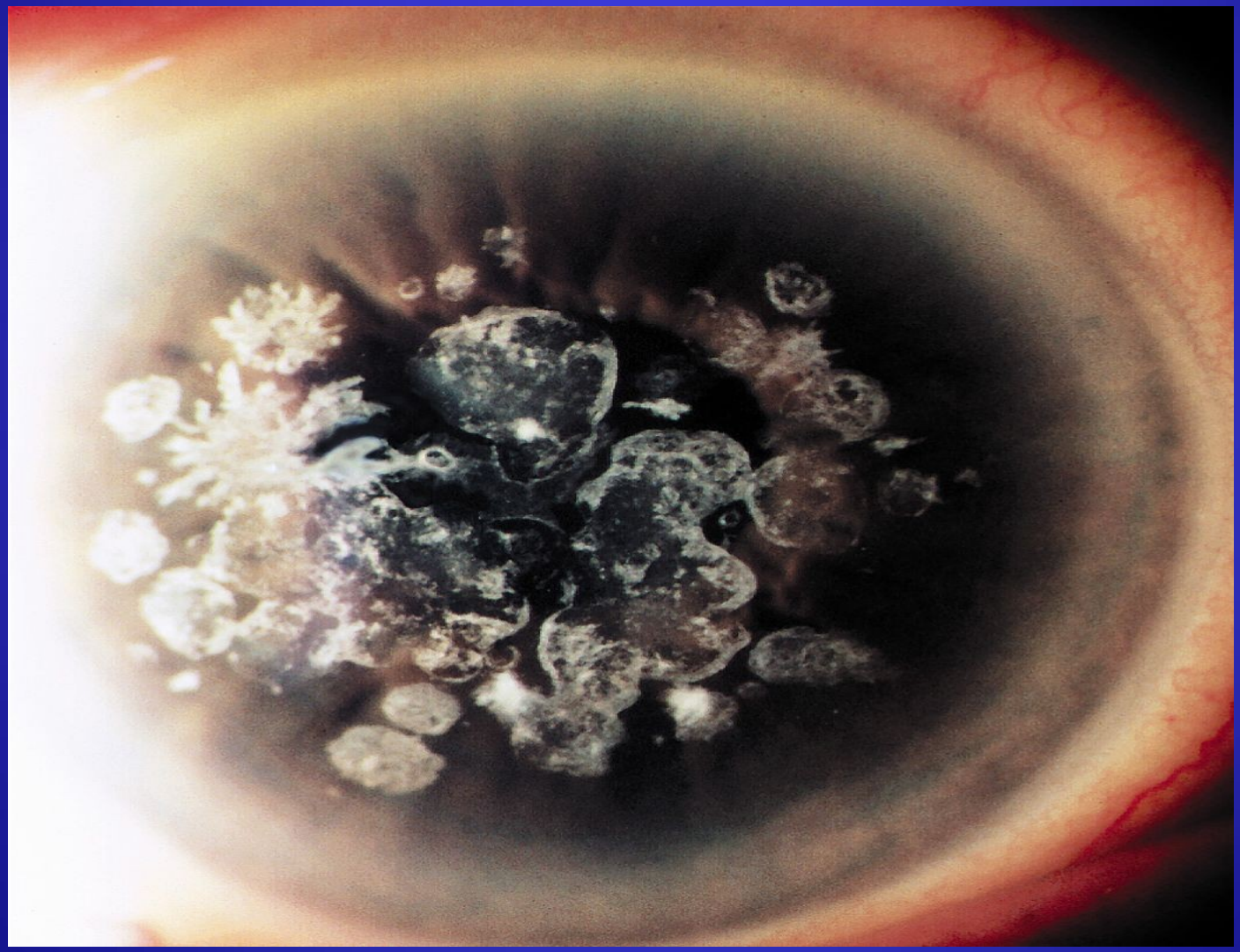


Stromal dystrophies

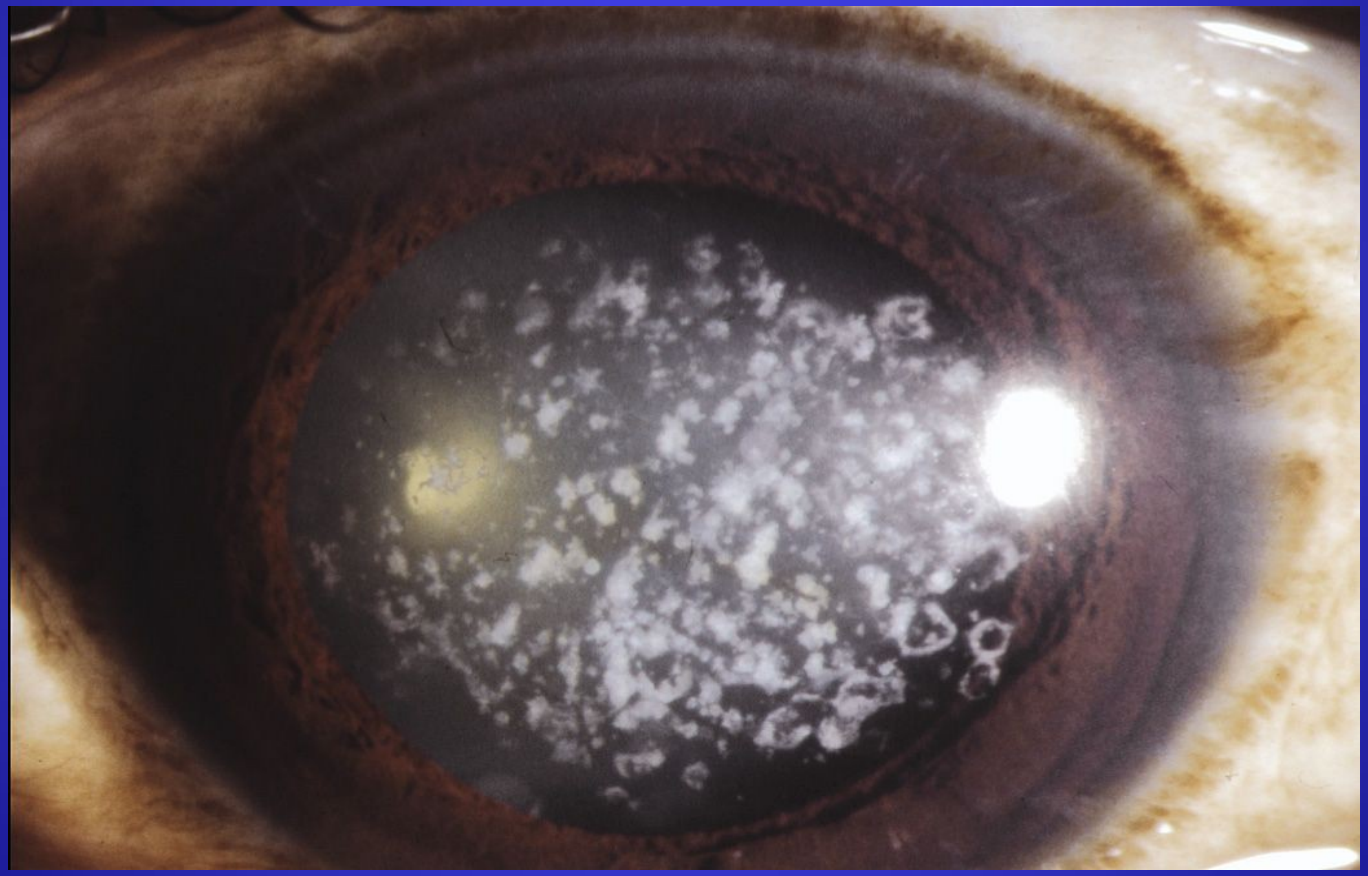
- Early onset, impairment of vision
- T: perforating keratoplasty

- Granular
- Macular (the most severe)
- Lattice (systemic asoc. – sek. Amyloidosis)

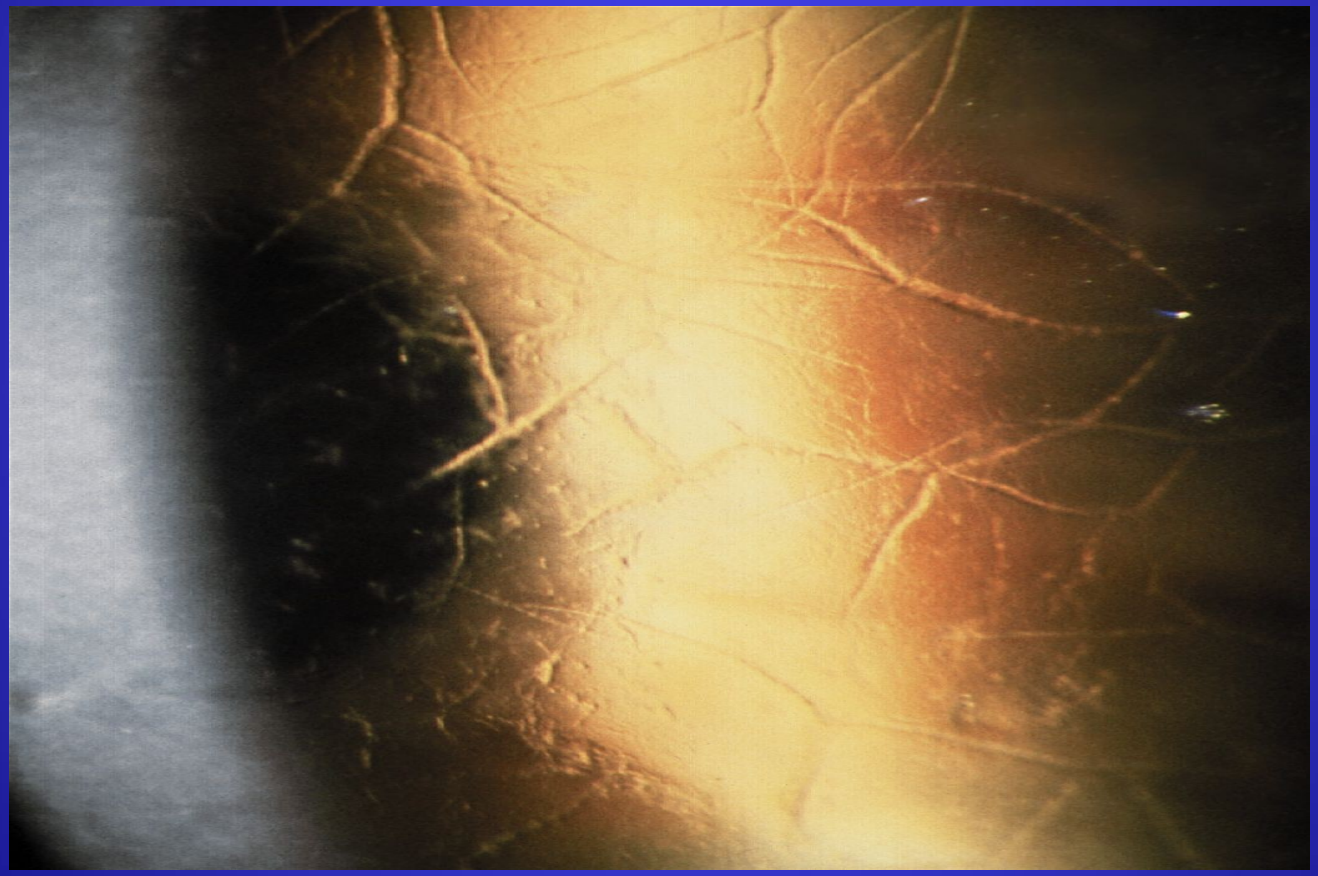
Crystalline dystrophy



Granul dystrophy



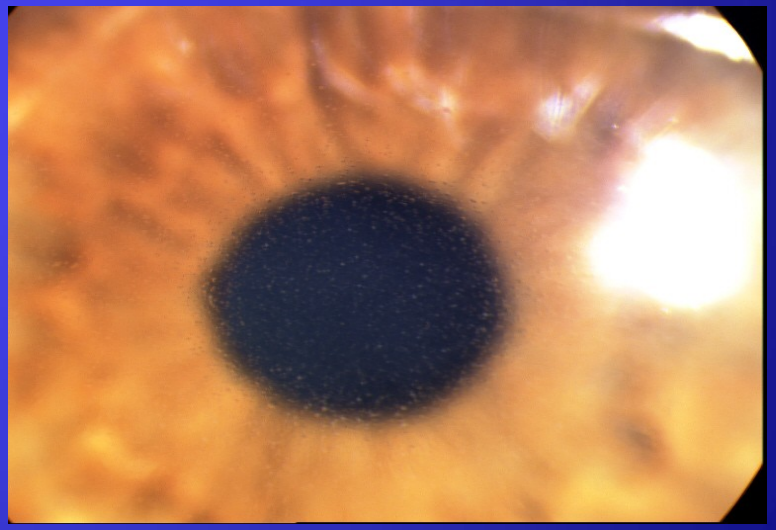
Lattice dystrophy



Fuchs endotelial dystrophy

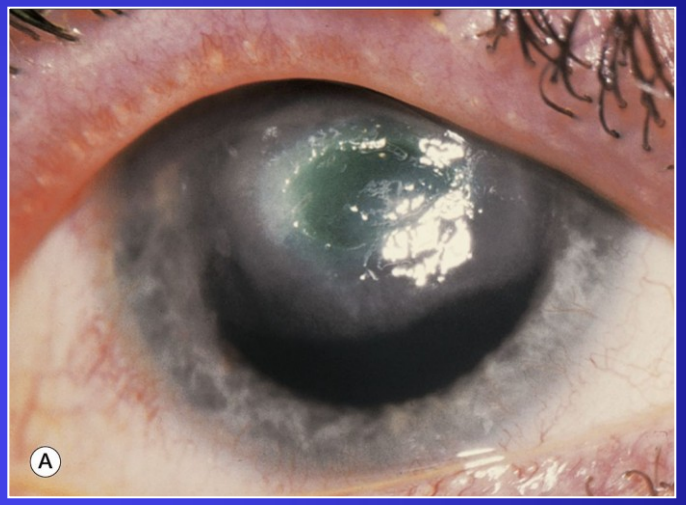
- Bilateral, accelerated corneal endothelium cell loss

- Irregular warts of excrescences of Descemet membrane secreted by ambnormal endotelial cells
- Endotelial decompensation
- Stromal edema, blurred vision, epithelial edema



Corneal infection

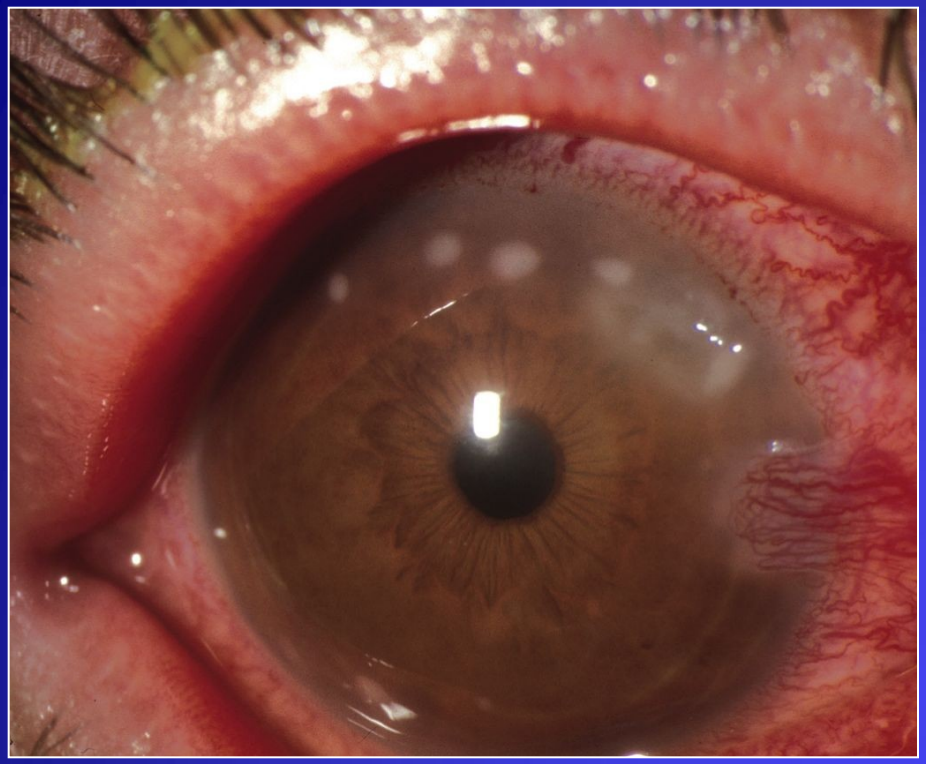
- bacterial
- viral
- fungal
- protozoan



Clinical features of bacterial keratitis

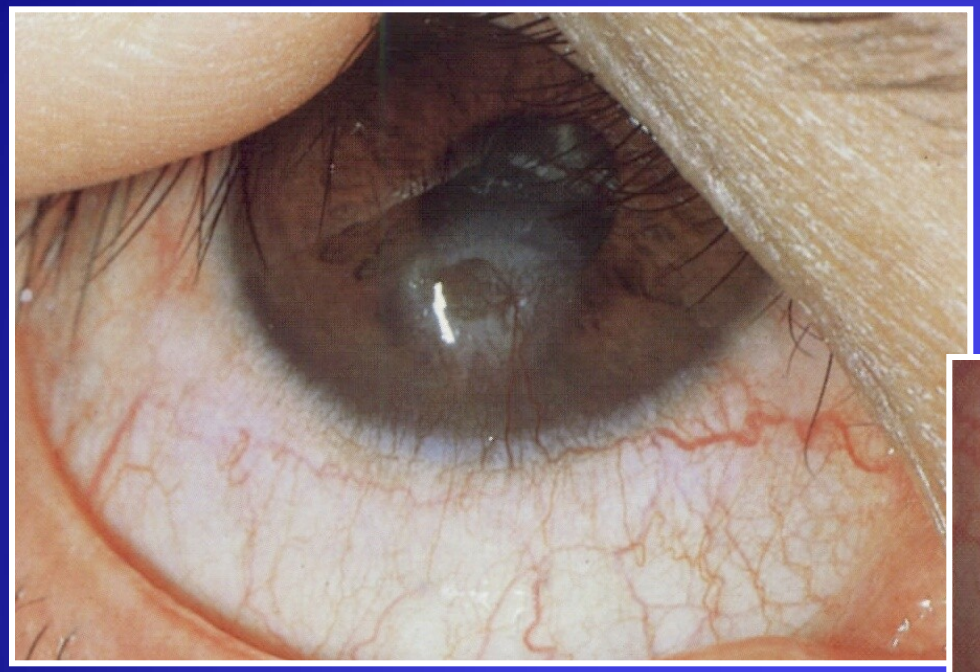
- Blurred vision
  Photophobia
  Pain

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

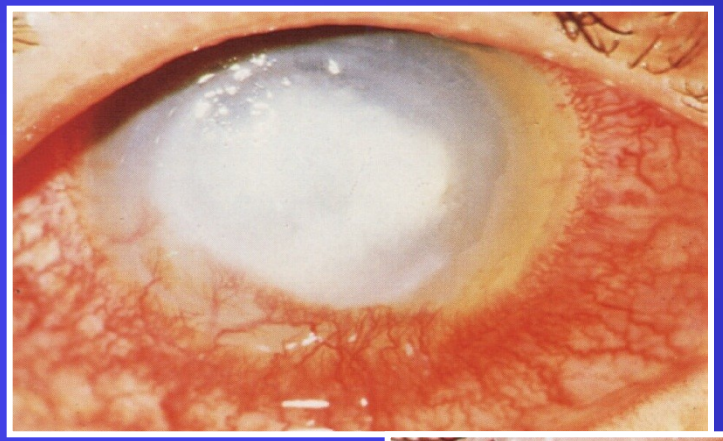


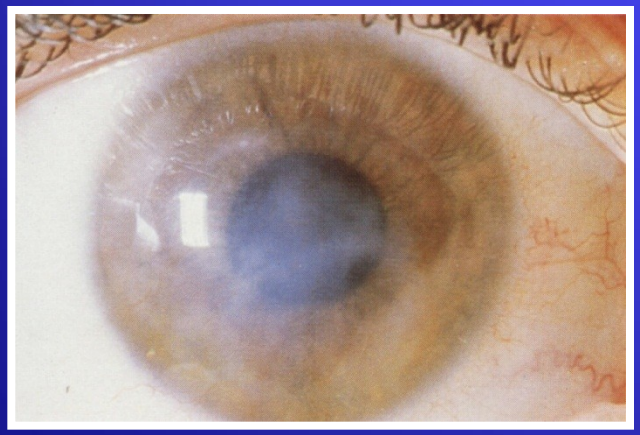
Staphylococcus aureus

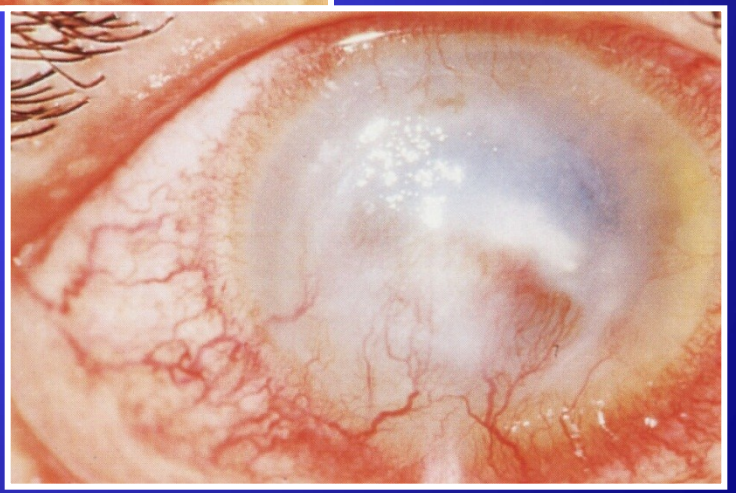
Staphylococcus



Pseudomonas Aeruginosa

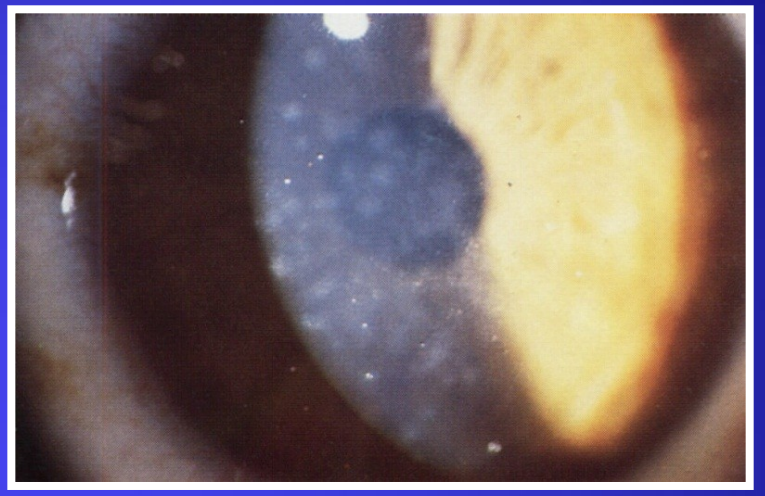






Viral keratitis

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



Viral keratitis

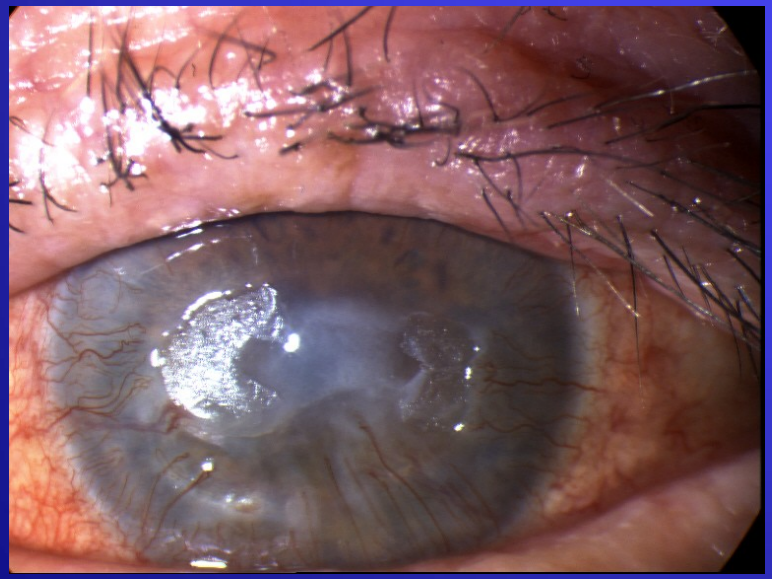
- Primary herpetic infection
- Keratoconjunctivitis
- corneal hypoesthesia

- 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

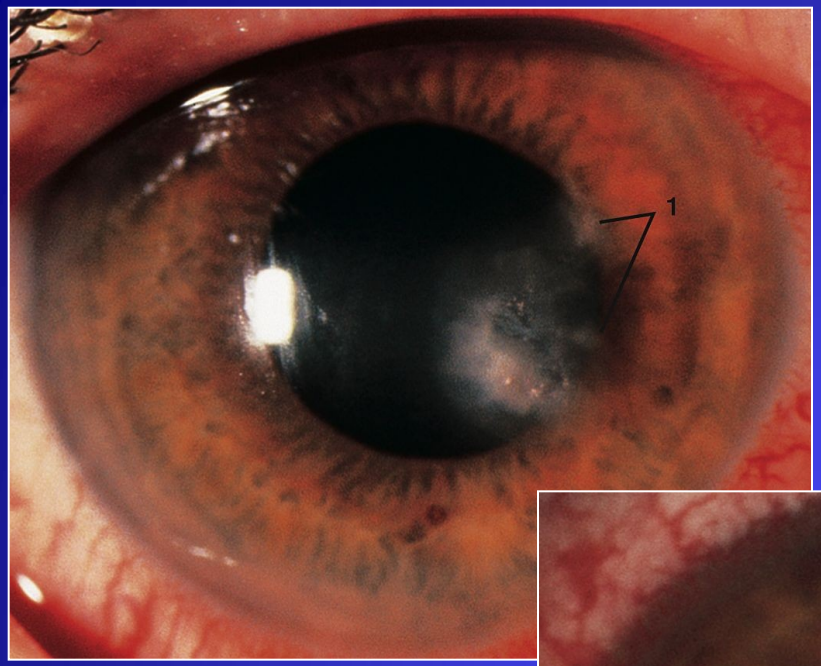
Hypopyon

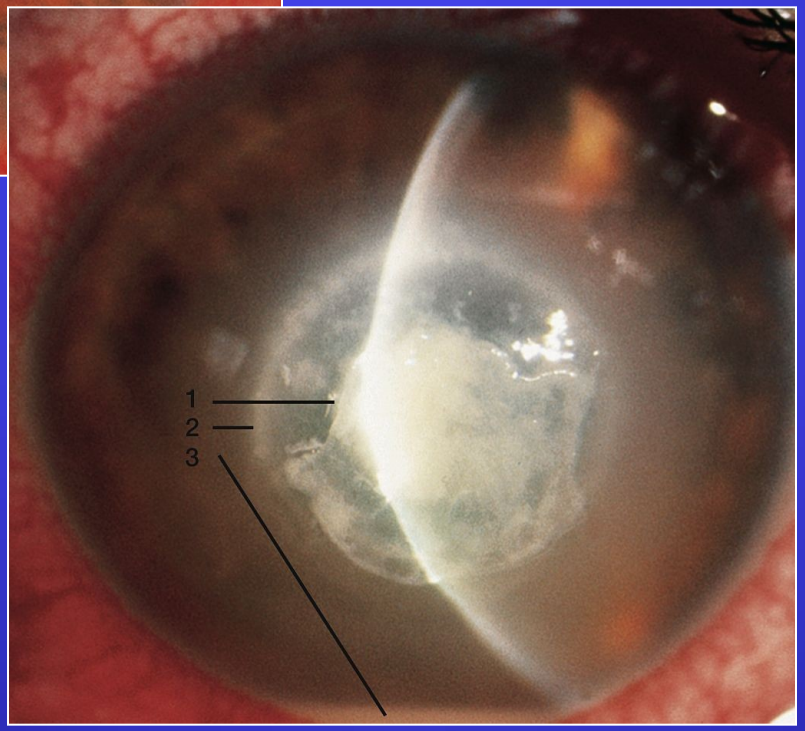
Dg: Cytological examination cultivation - corneal scarification, DNA diagnostics

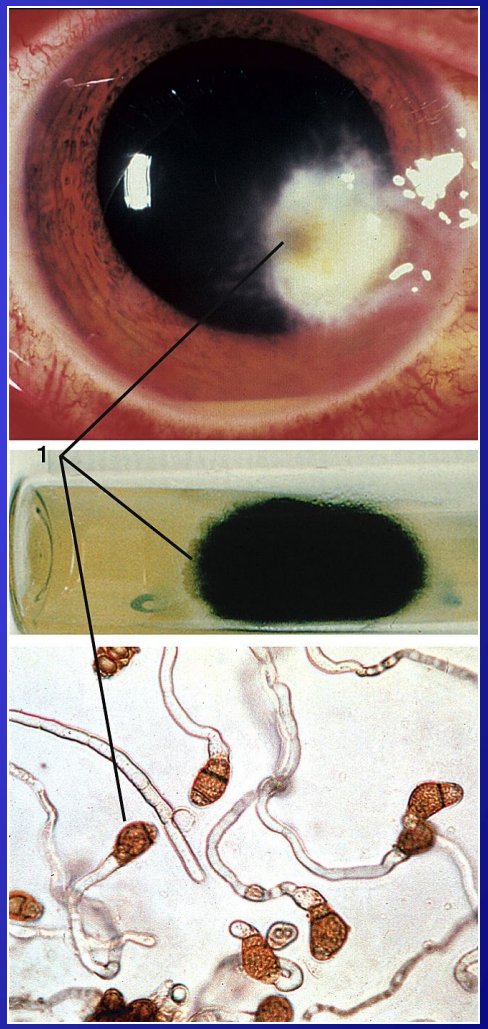
T: removal of the epitelium

topical treatment

systemic anti fungals (intraconazole)

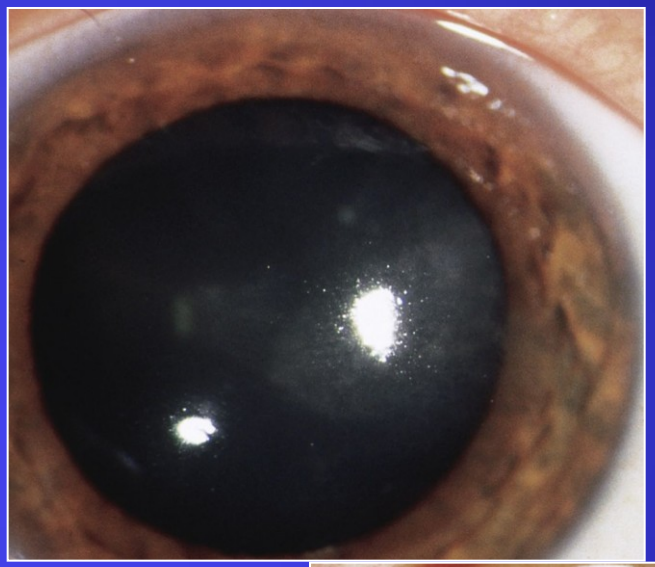




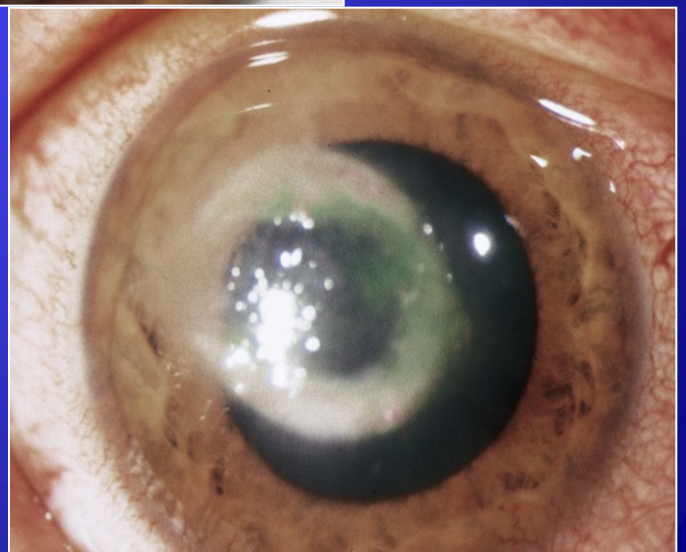


Fungal keratitis
(Candida)

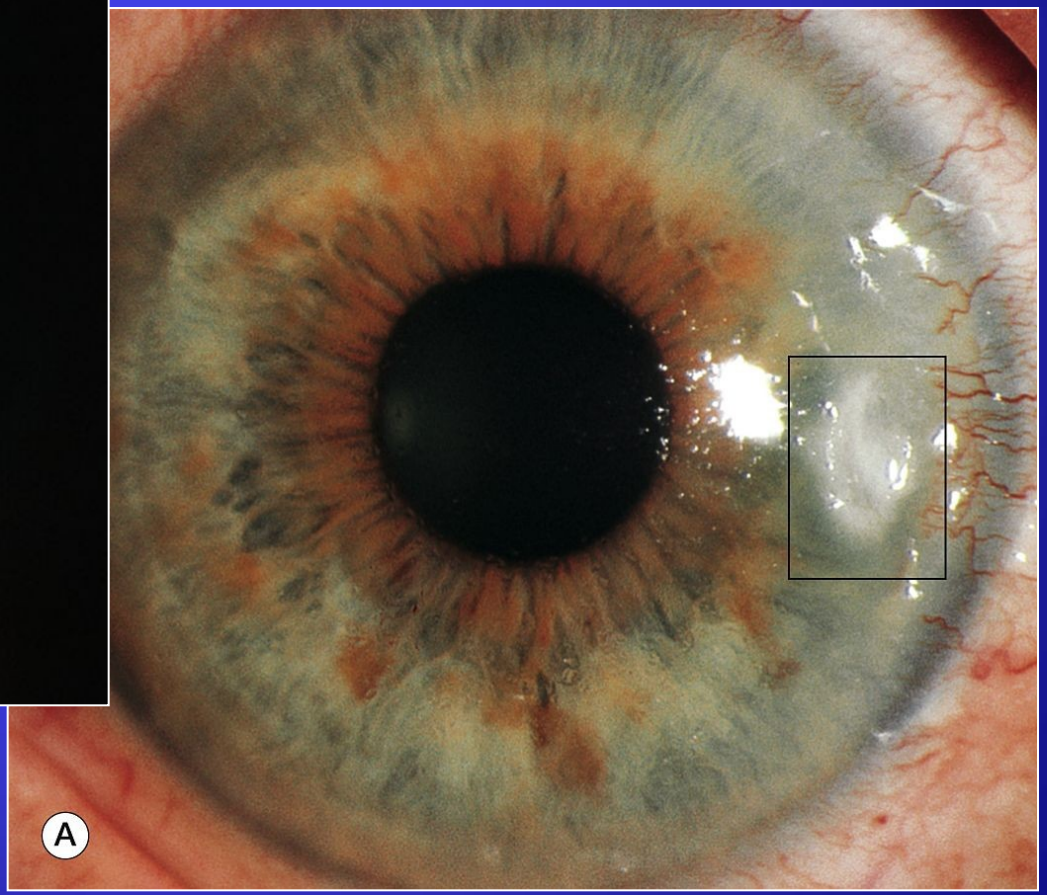
Protozoan keratis - Acanthamoeba



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



Ulcus corneae

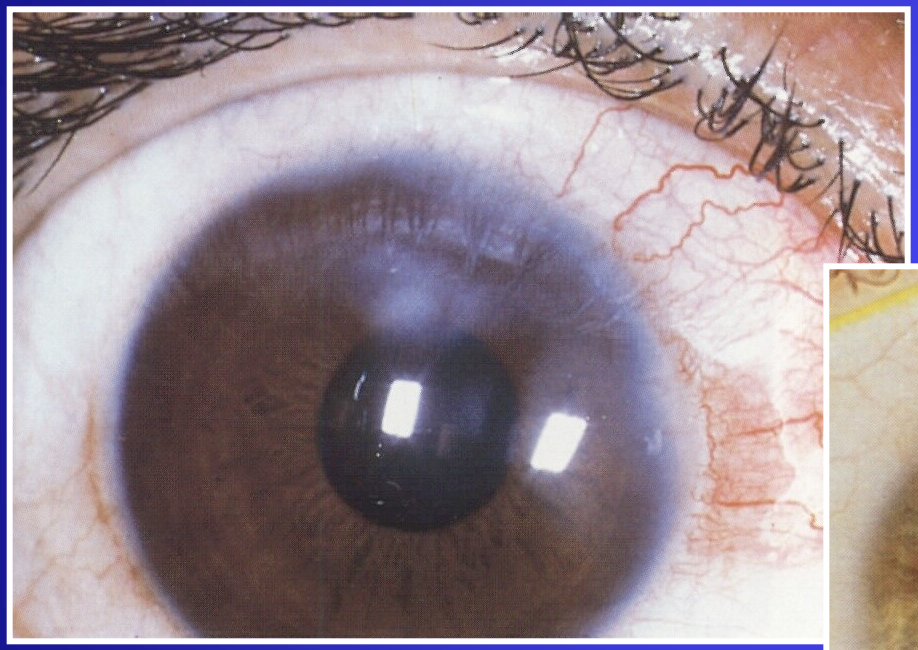


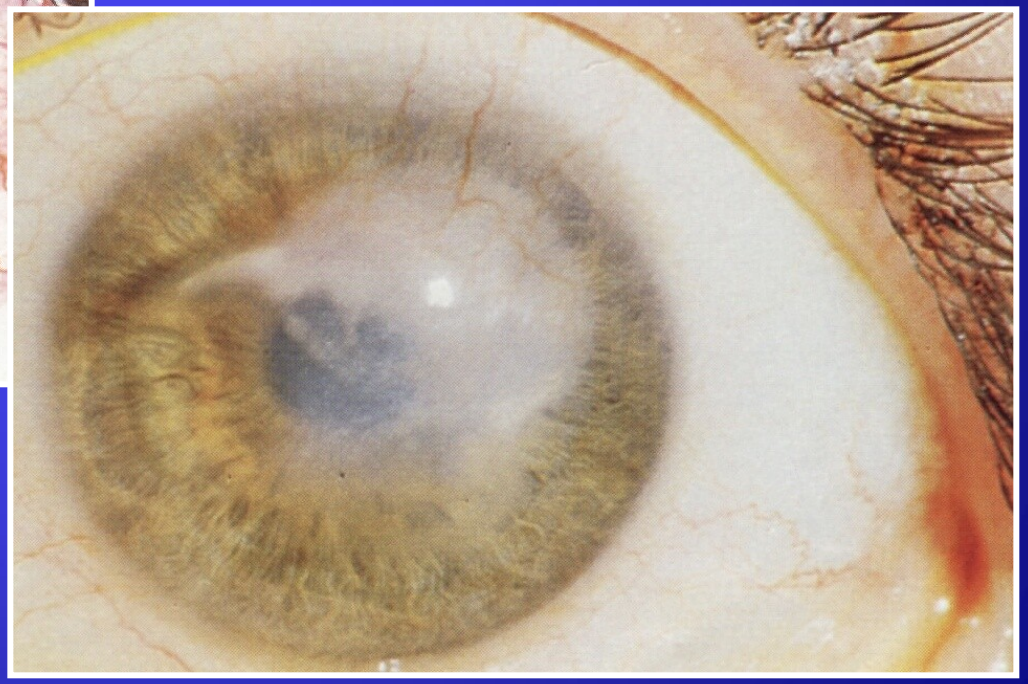
Keratitis interstitialis

- Interstitial keratitis - on the basis of the immune response to live microbe - antigen in the cornea (syphilis, tuberculosis, herpes, monokukleóza, fymfogranulom, 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)

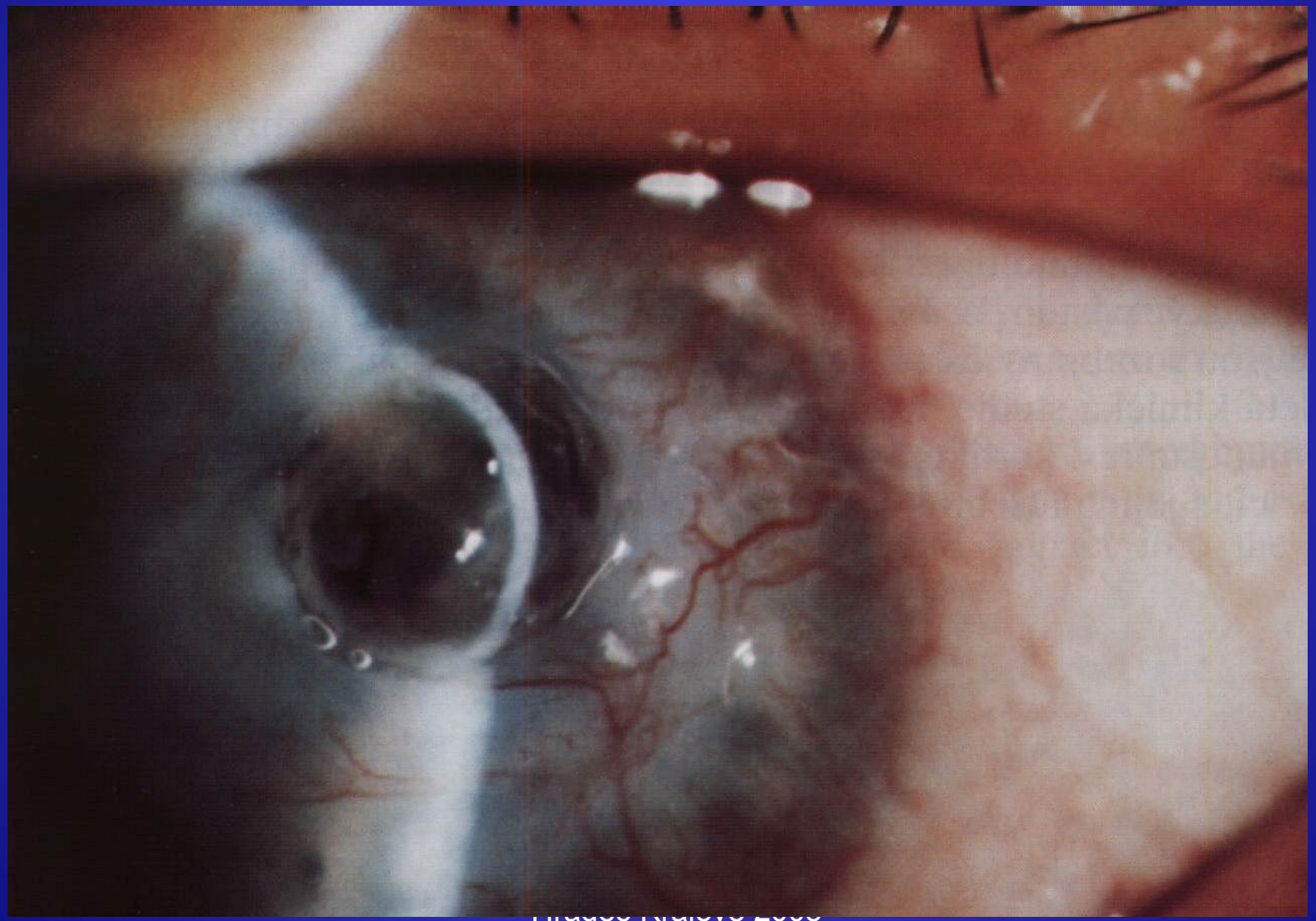
- **Always stromal infiltration with scarring and neovascularization**

Keratitis interstitialis

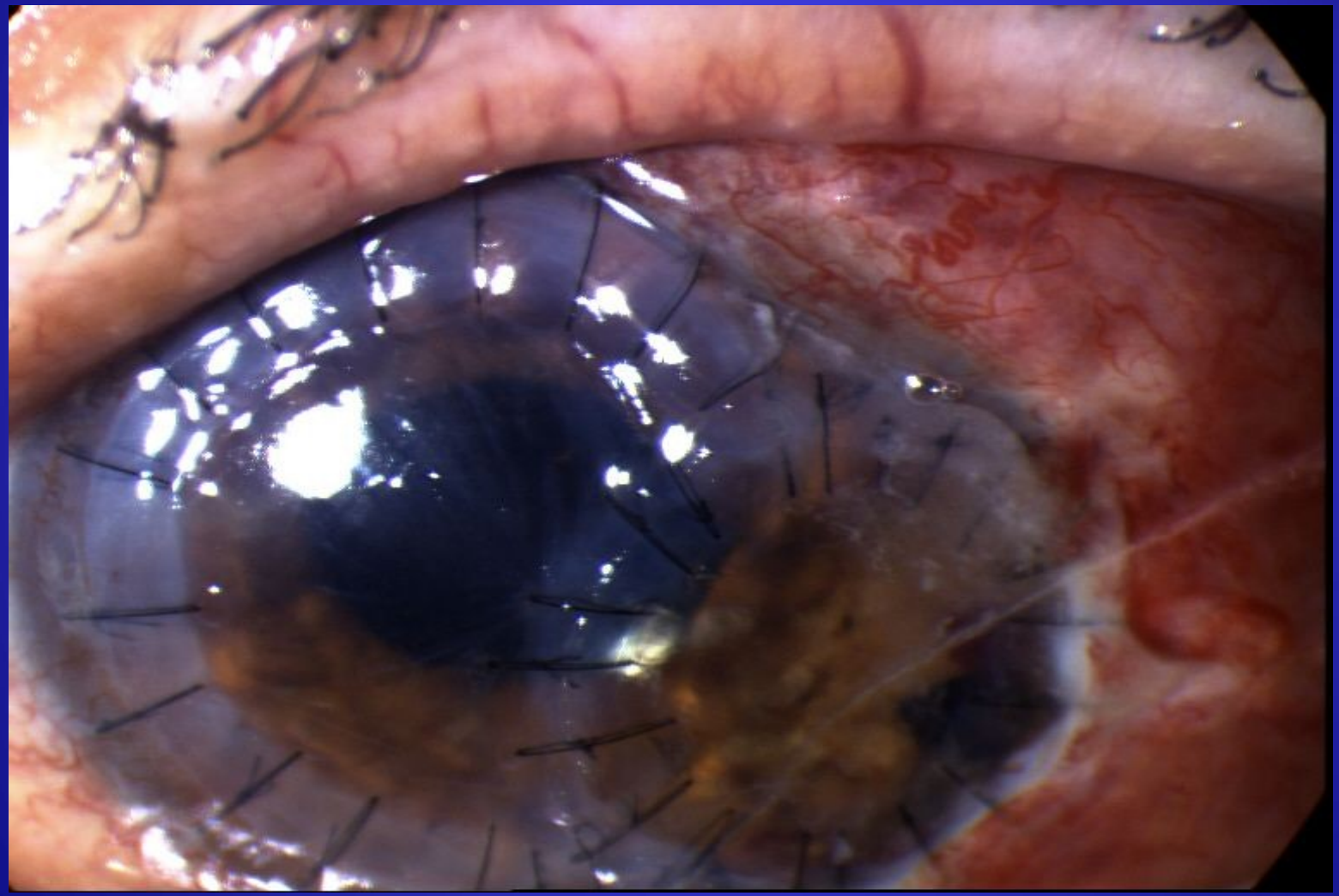




Neurotrofic keratitis - Descemetocela

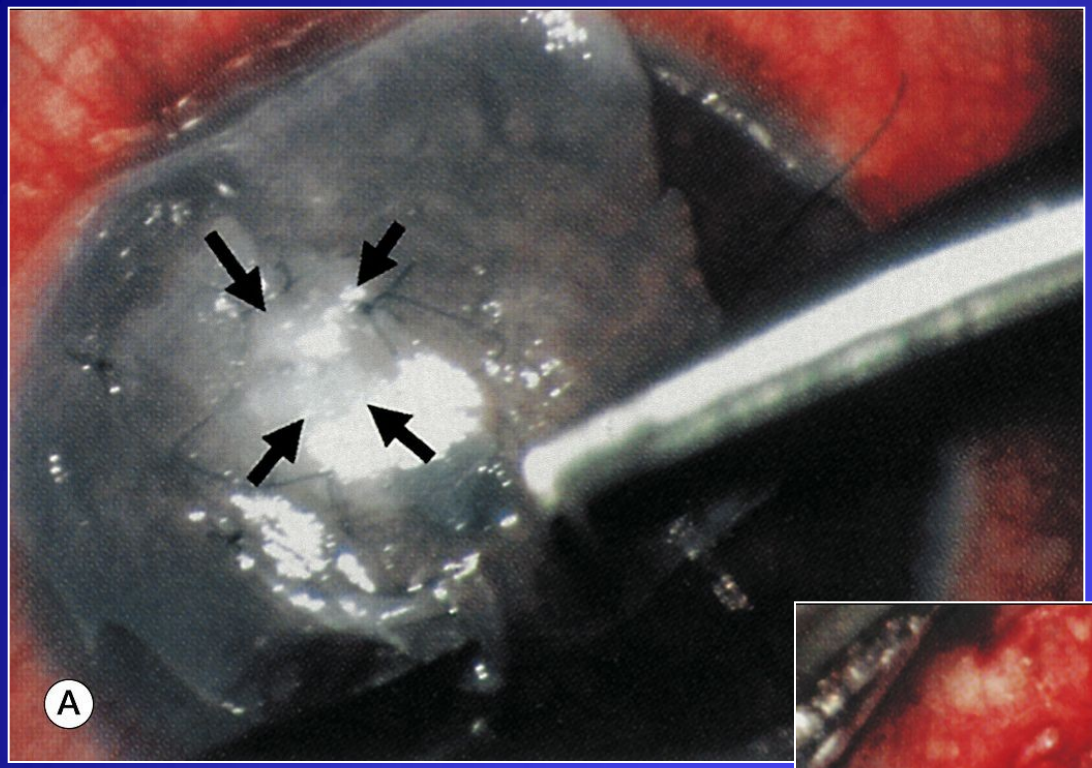


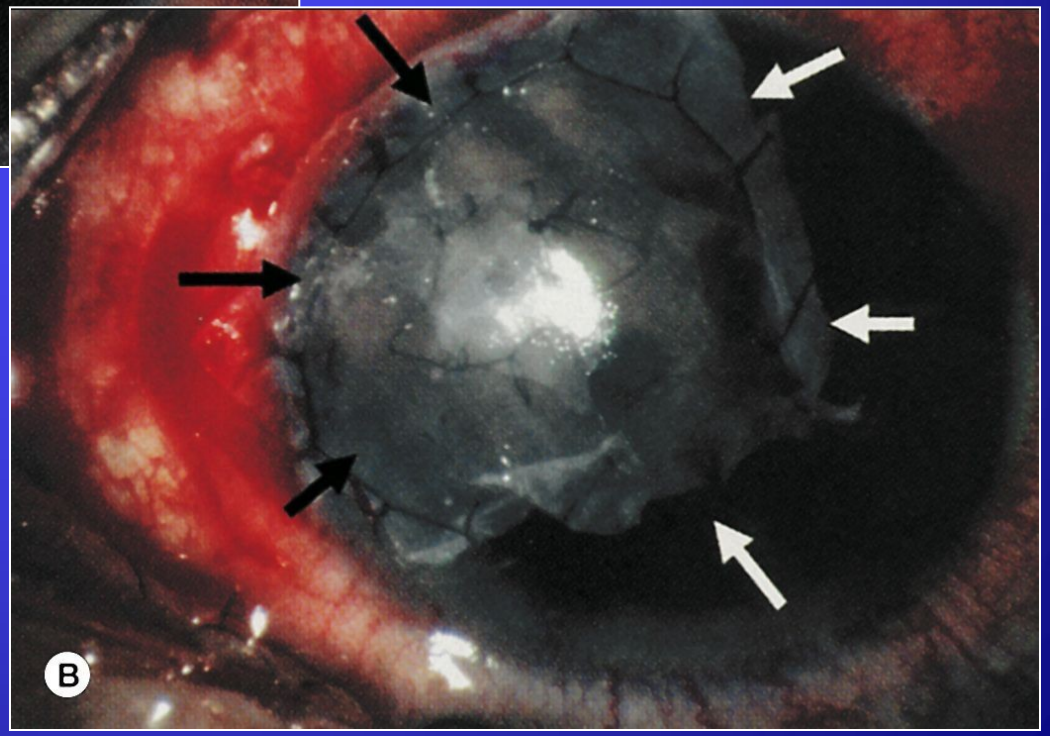
Keratitis neurotrophica



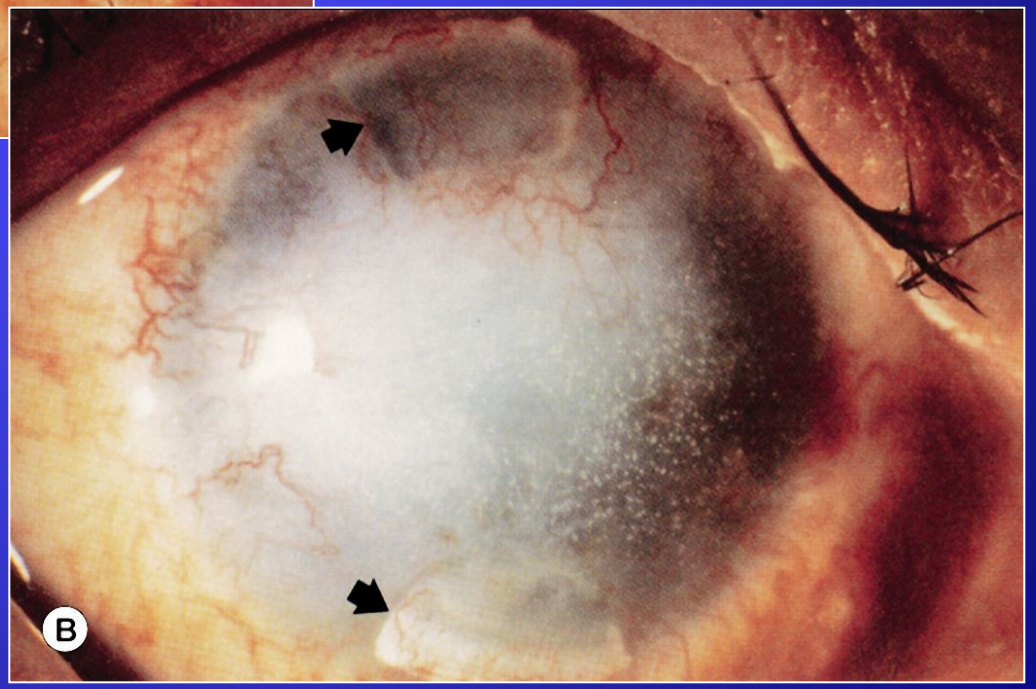
Surgery treatment

- Transplantation of amniotic membrane
- Transplantation of conjunctiva partial
- Lamellar transplantation
- Perforating keratoplasty
- DMEK
- Keratoprostheses (osteo – odonto)
- Arteficial cornea
- Phototherapeutic keratectomy (PTK)





Amniotic membrane



Conjunctiva transplantation

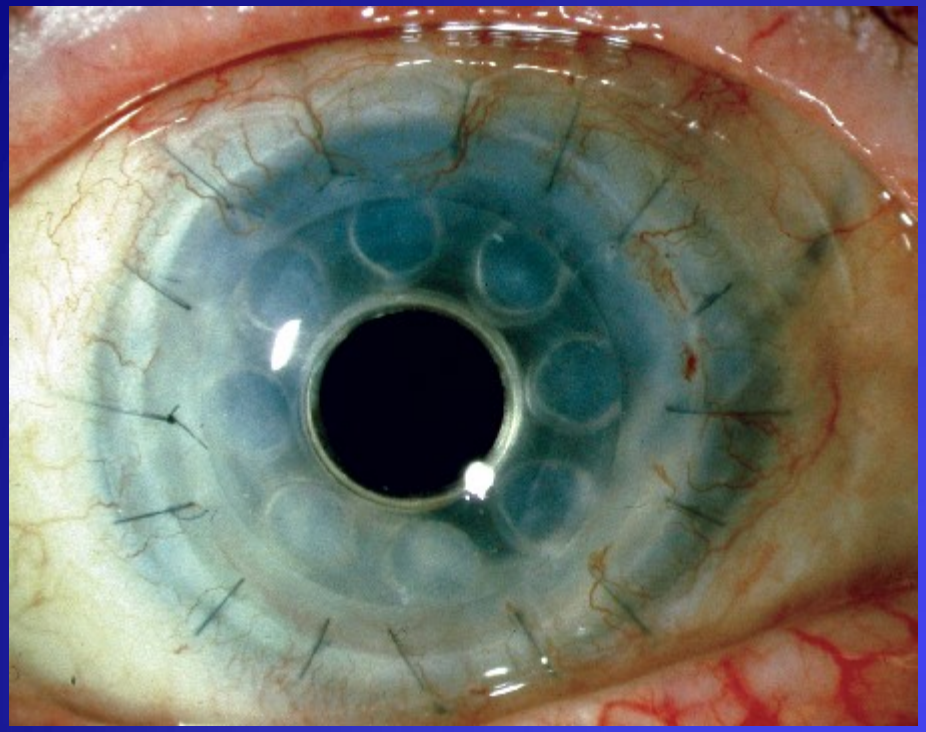
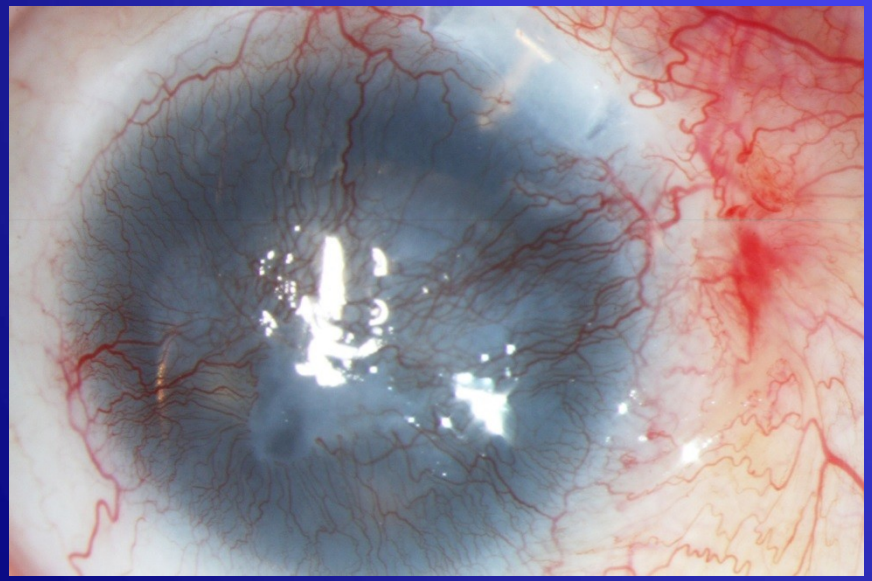
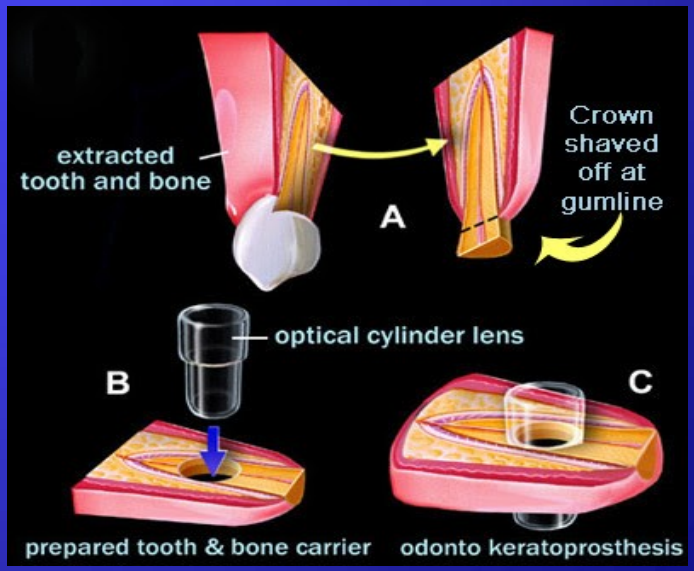


FIGURE 3 Modified Osteo-odonto-keratoprosthesis one year after implantation. *(Photo courtesy of Victor Perez, MD.)*



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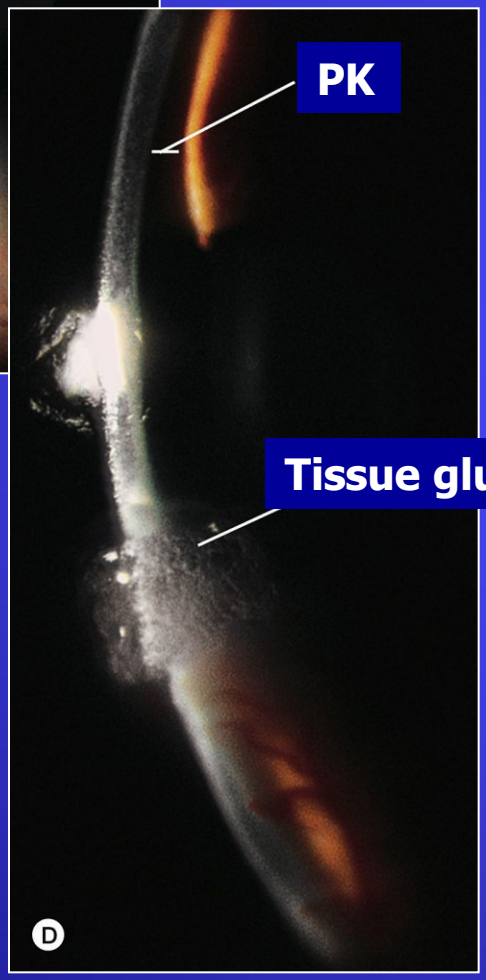
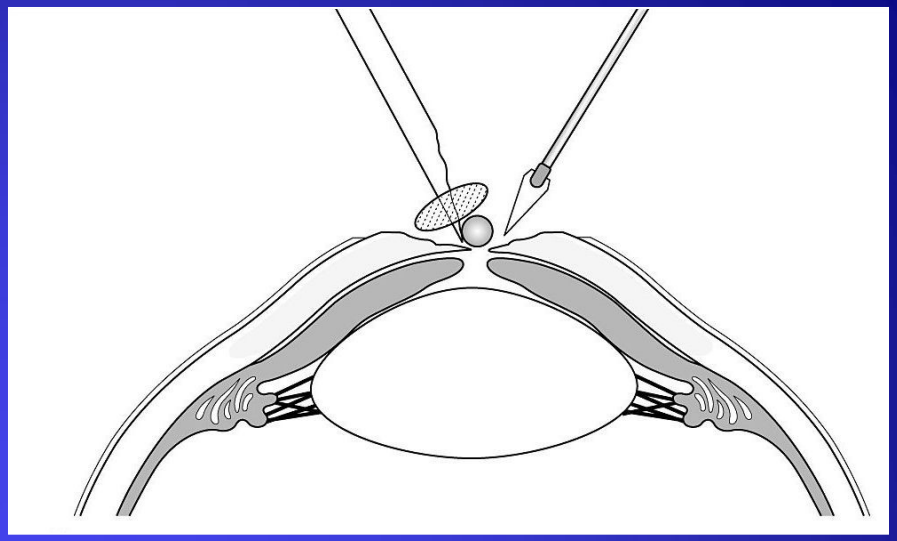
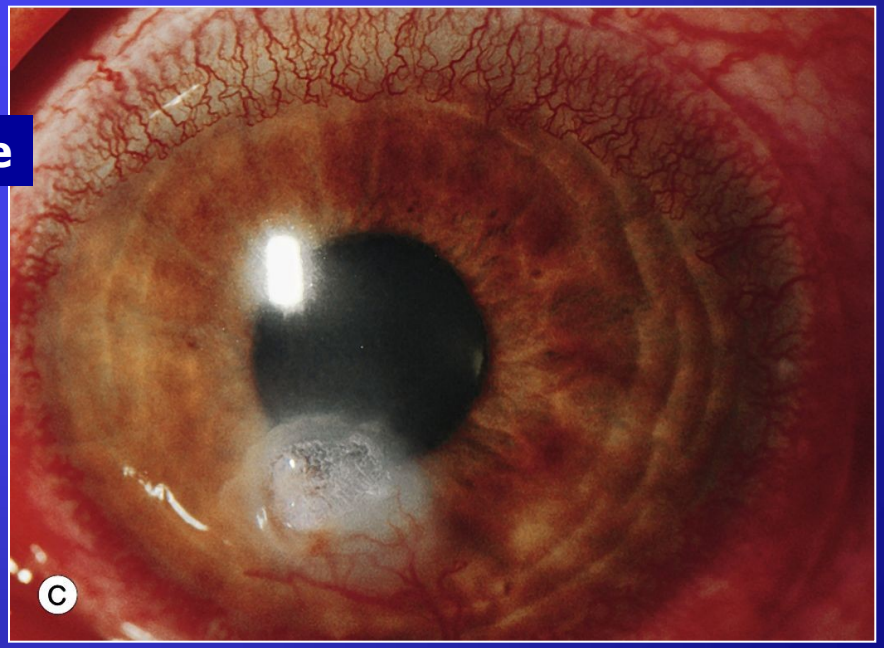
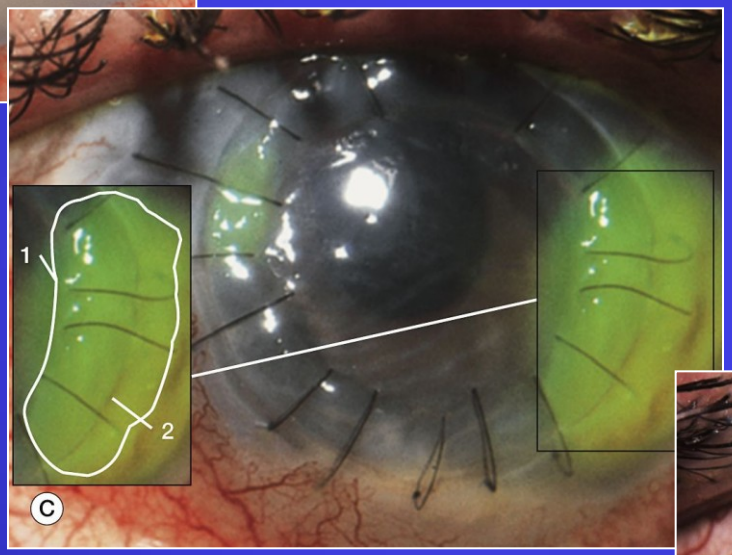

PK
Tissue glue
D

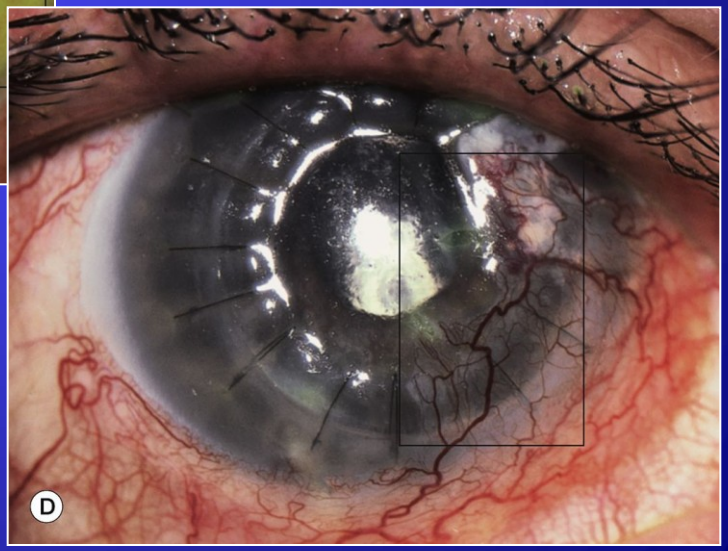



C

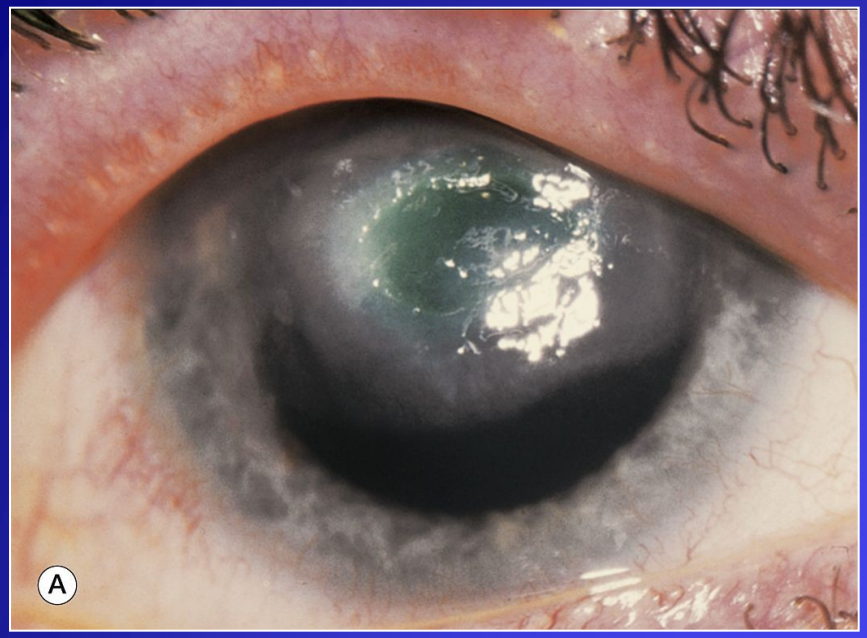
Penetrating keratoplasty

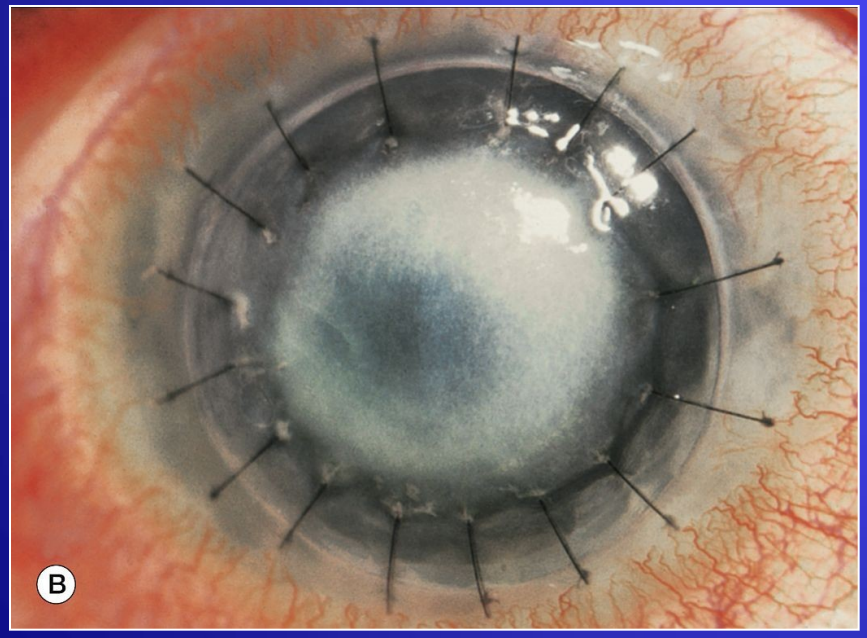


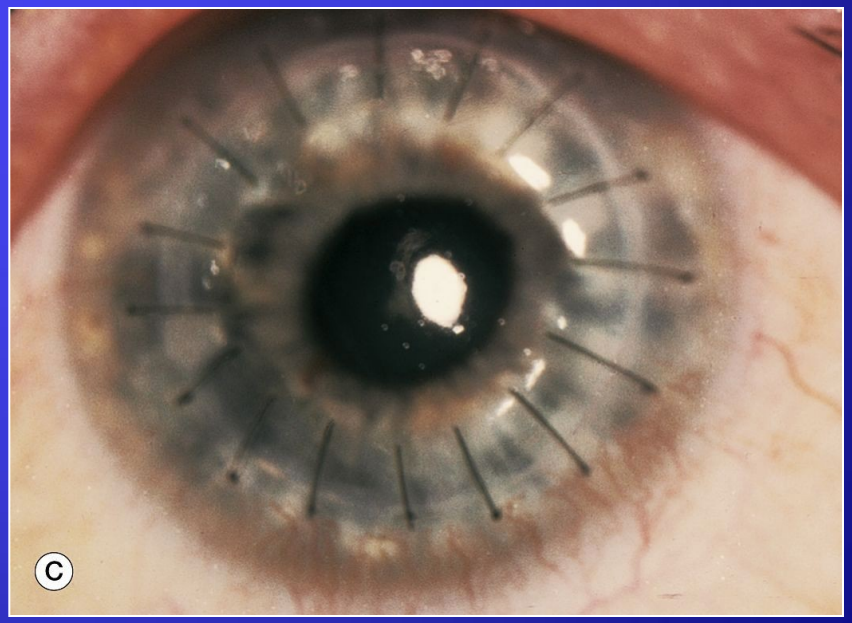
Viral keratitis



Fungal keratitis





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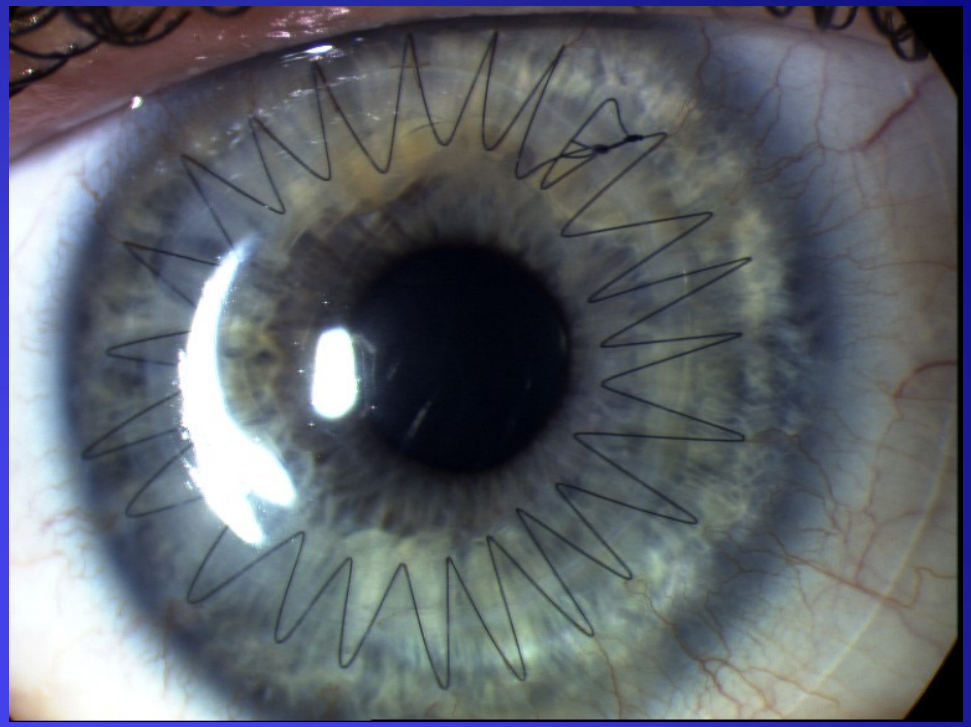

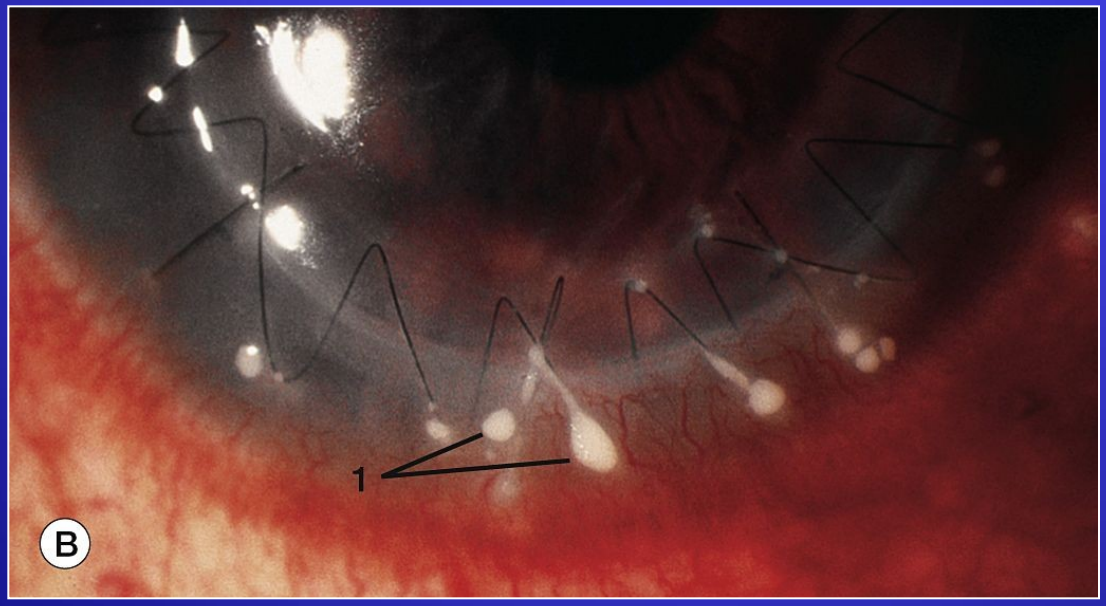
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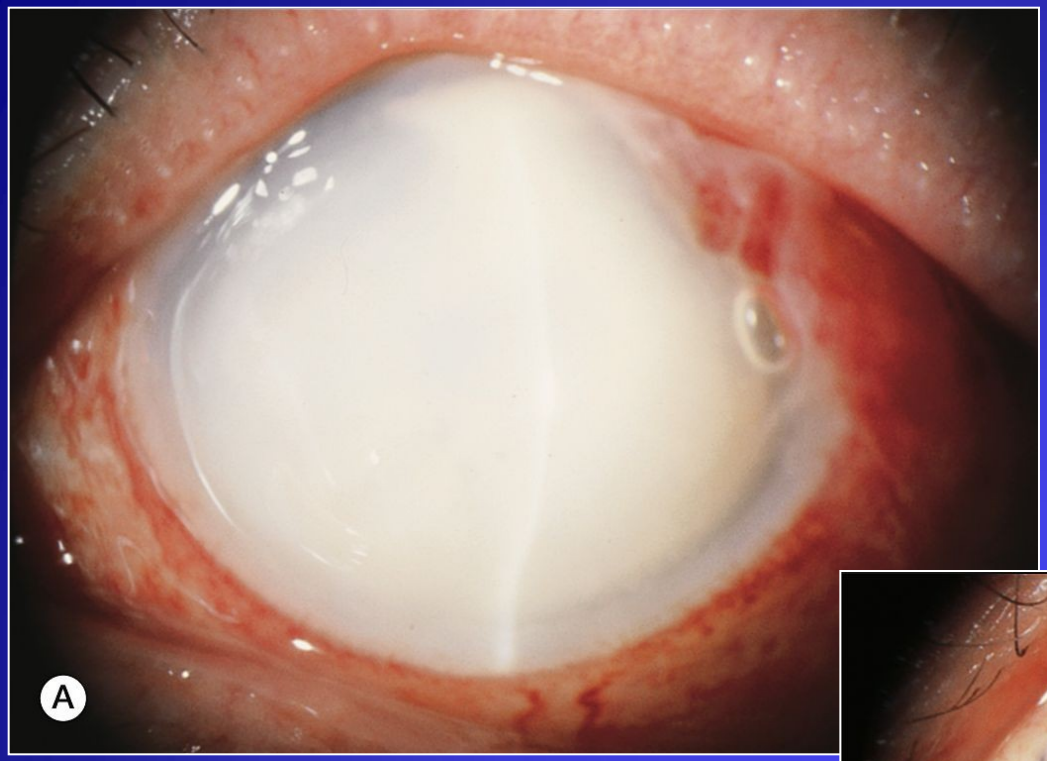
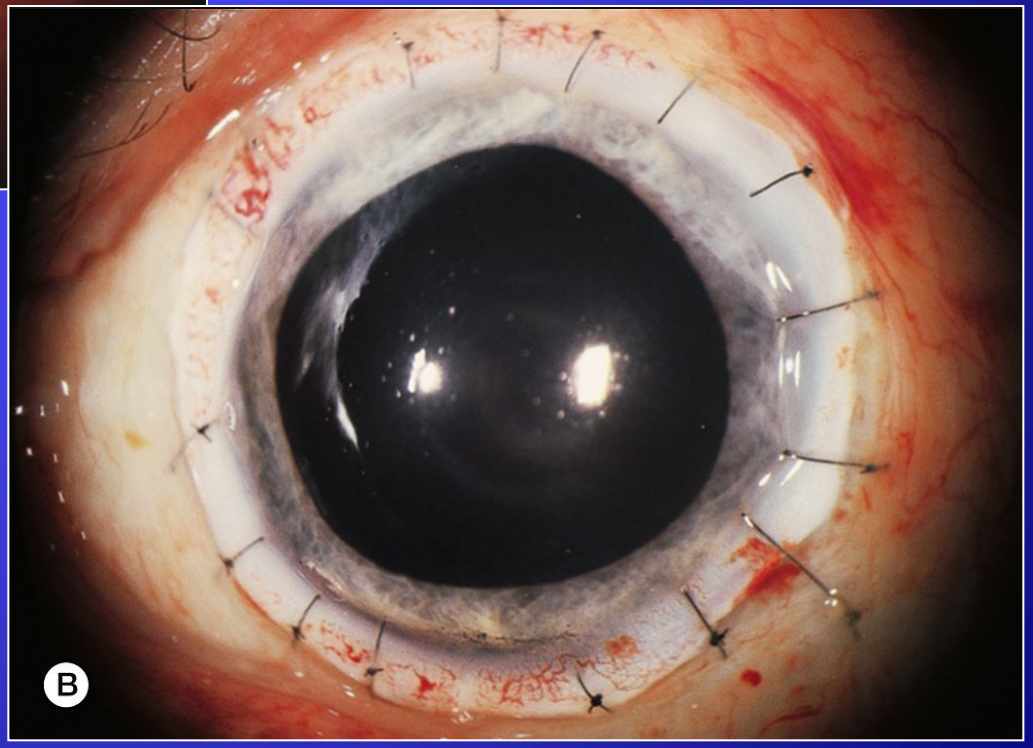
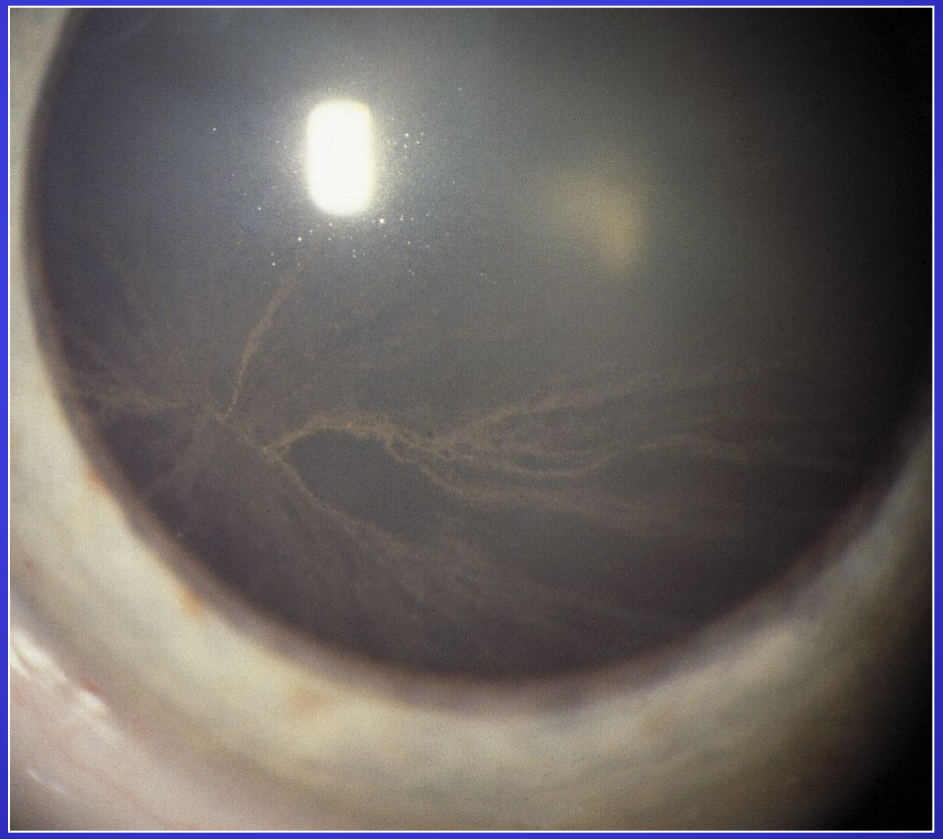
B





Bacterial sklerokeratitis

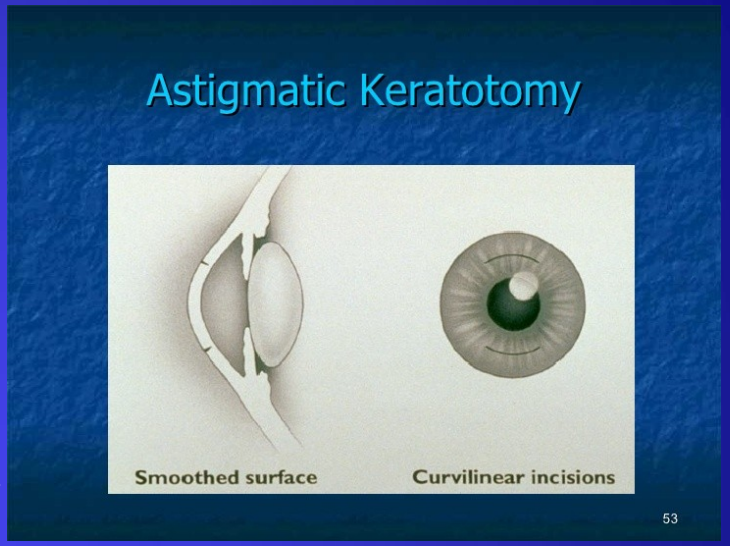
Cornea verticillata



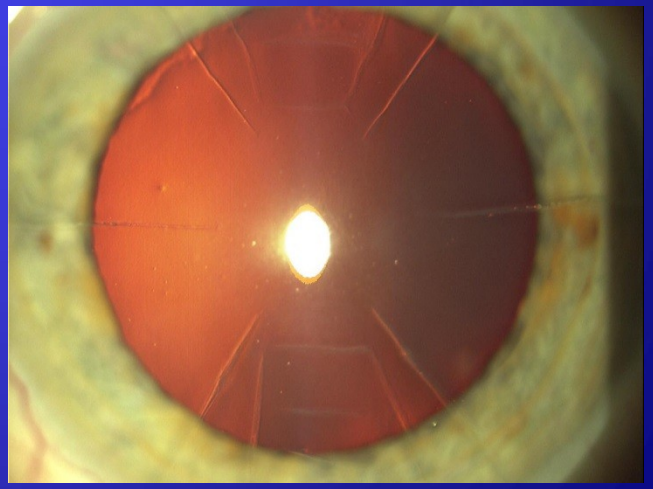
Refractive surgery - cornea

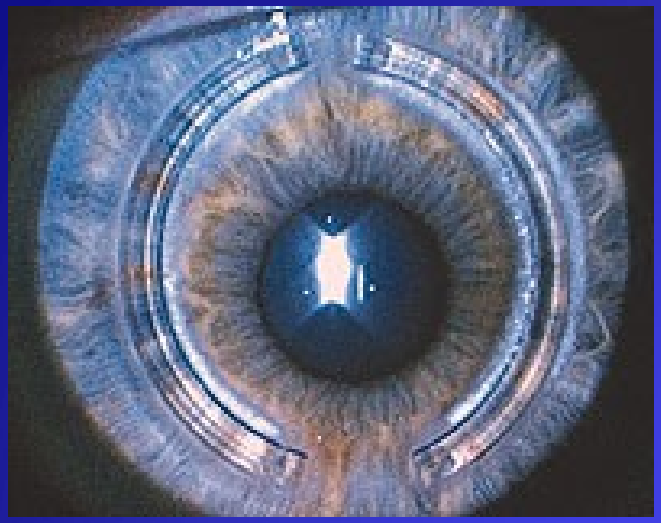
- Keratotomy - radial, hexagonal, arcuate
- Intrastromal rings - myopia, astigmatism
- Intracorneal lens

- PRK - photorefractive keratectomy, LASIK - laser in situ keratomileusis



Photoablation - argon-fluoride laser
Femtosecond laser – intrastromal





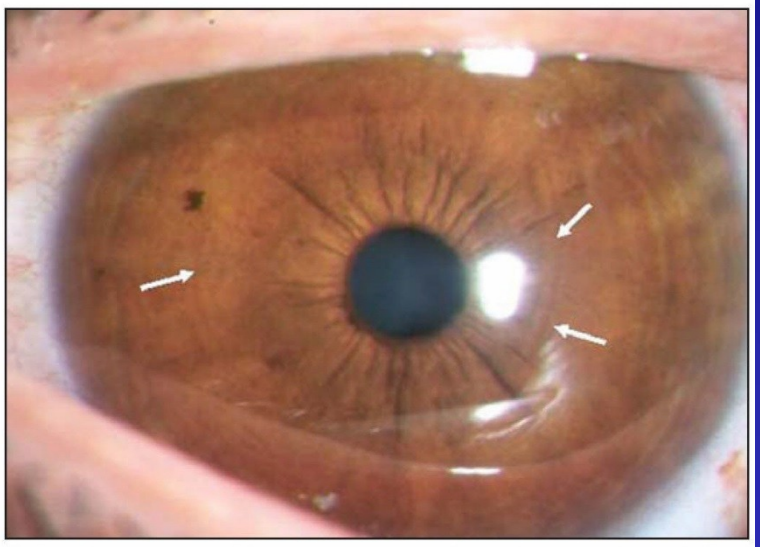
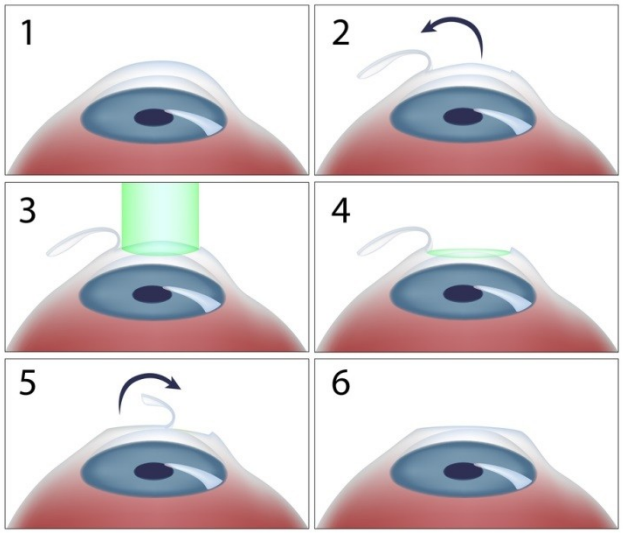
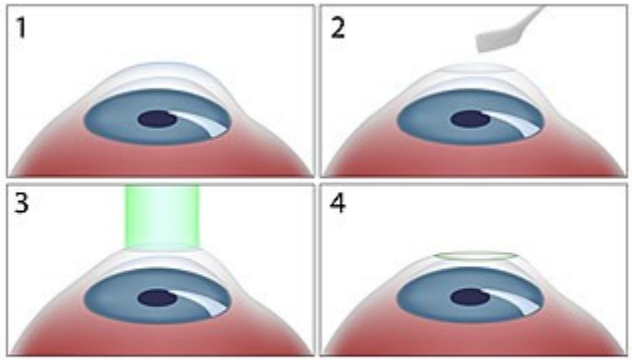


Figure 1. Intracorneal hydrogel lens inlay 6 months after implantation. The arrows indicate the edges of the inlay, showing that they are well centered clinically.



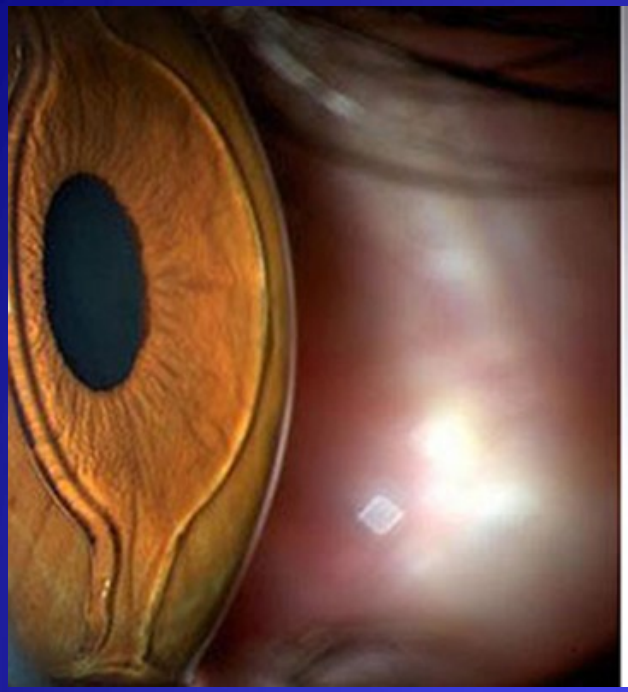
Lasik Eye Surgery

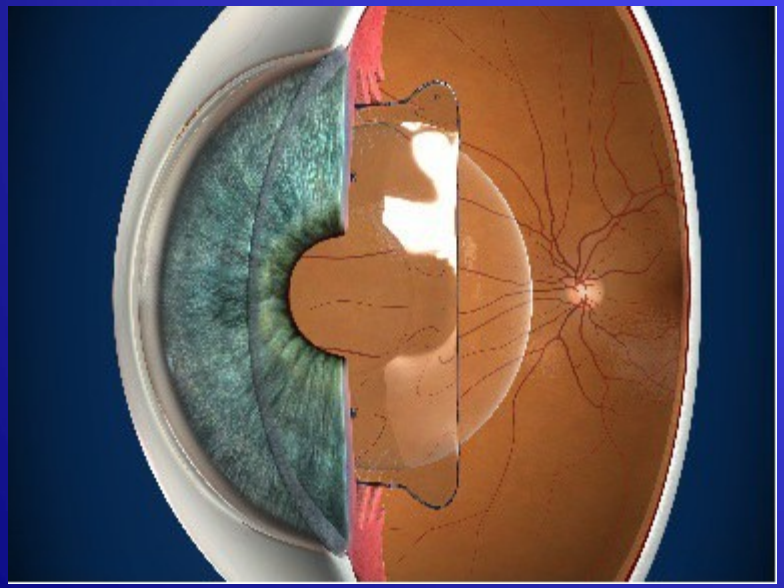


Photorefractive Keratectomy (PRK)

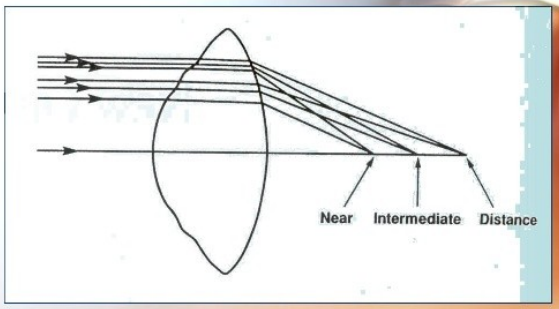
Refractive surgery

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





Principle of a Refractive Multifocal IOL




Děkuji za pozornost