Cornea and Sclera

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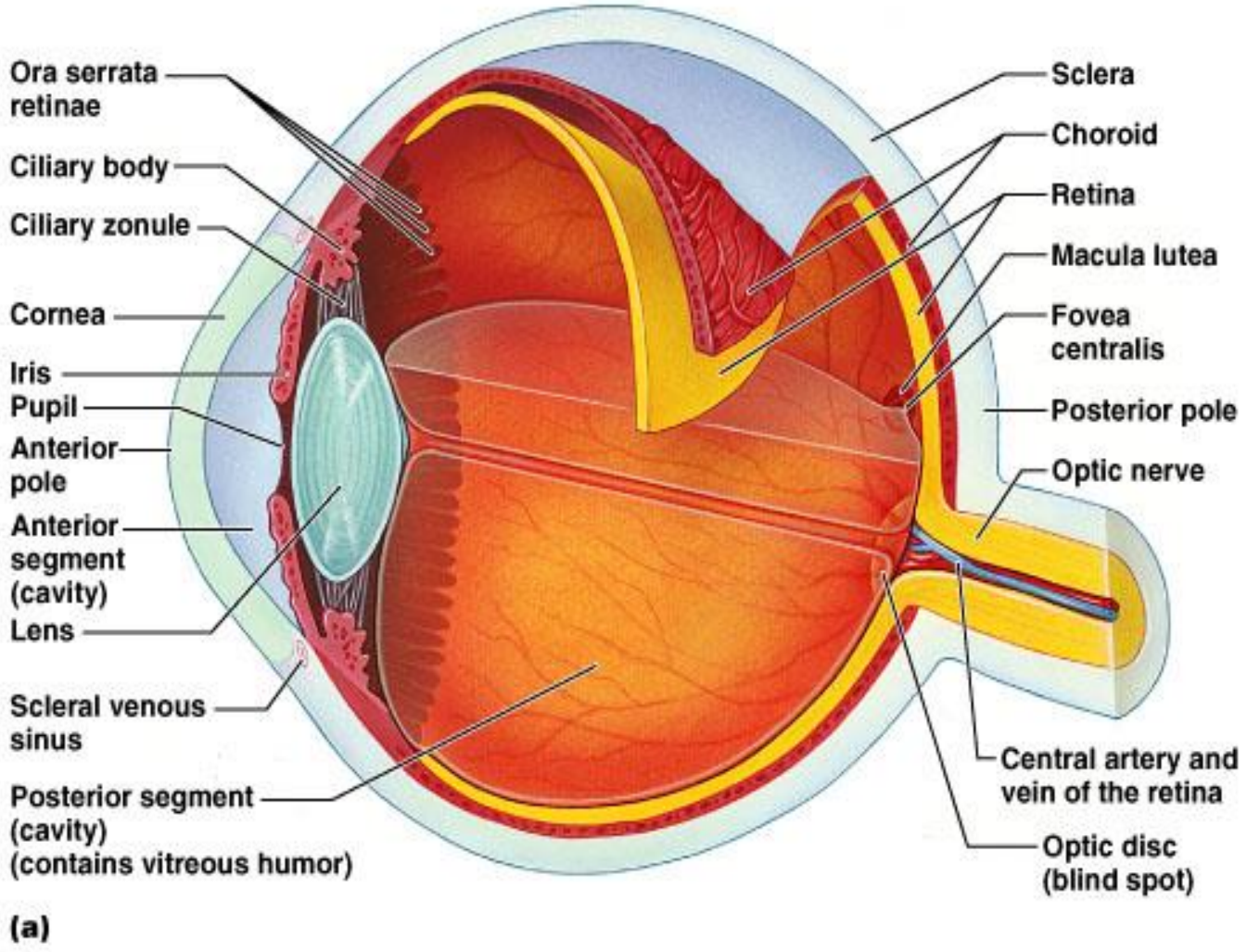
Outline

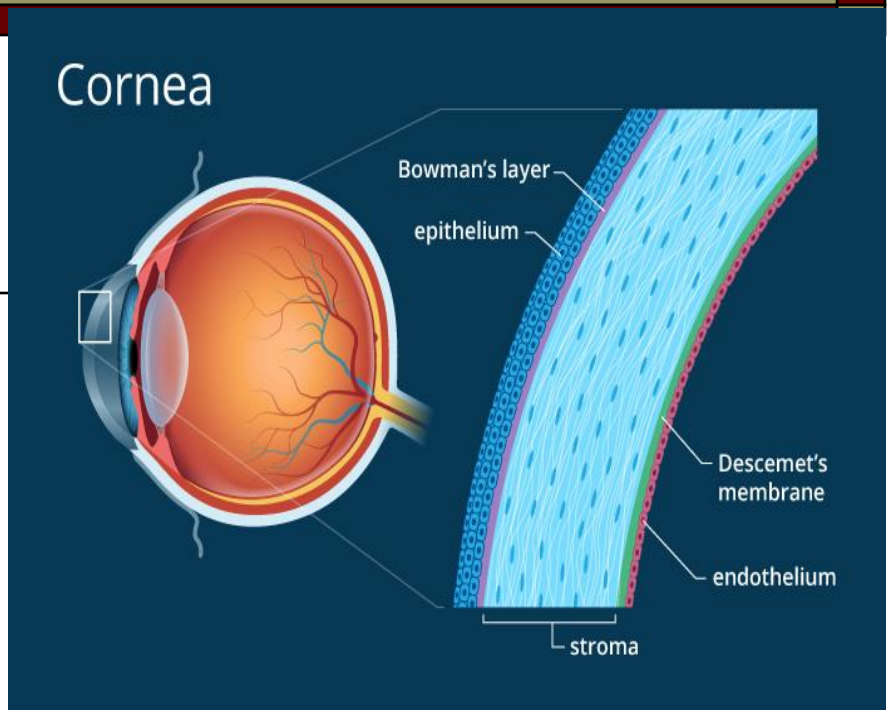
- Know the basic corneal anatomy, histology, physiology
- Highlight some common diseases
- Special focus on Keratoconus
- Brief notes on corneal graft and refractive surgery
- Some scleral diseases

Cornea and sclera: tough outer coat



0.5 mm thick
11-12 mm in diameter

5 Layers:



Epithelium: Stratified squamous. Regenerates from stem cells found in the limbus

Bowman membrane

Stroma: 90 % of corneal thickness; parallel collagen fibrils

Descemet membrane: tough

Endothelium: a monolayer of non-regenerating cells that actively pump water from the stroma to control hydration of the cornea. When damaged, by disease or surgery, cells spread

Loss of barrier and pumping functions lead to edema and corneal clouding

- The cornea derives its nutrition almost entirely from aqueous humour which supplies O_2 to the endothelium & post. stroma. While the ant. stroma & epithelium receive O_2 from ambient air and tear film
- Avascular
- Rich in sensory nerve endings originating from the nasociliary branch of trigeminal nerve

The focus must be adjustable to allow clear vision for both distant and near objects (with accommodation).

Function of the cornea:

- Protection of internal ocular structures
- Refraction

Refractive components of the eye or the focusing power is :

** 2/3 cornea, fixed power
** 1/3 lens, power increases with accommodation

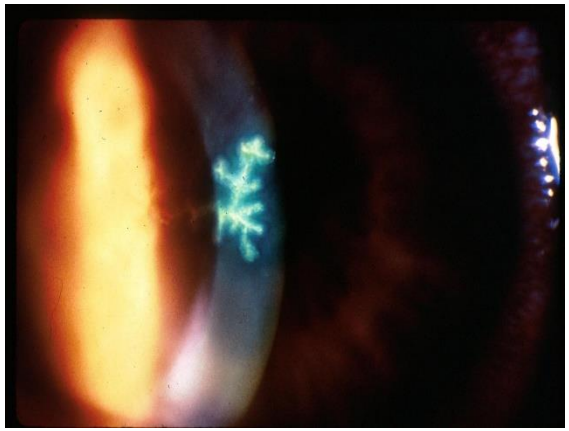
Cornea

Infective corneal lesions

Herpes Simplex and Zoster Keratitis

Latency of the virus in the trigeminal ganglion

- Recurrent infection involve reactivation of the latent virus
- The risk of reactivation increases in debilitated patients and with stress



- HSV type (1) & (2), HZV (Varicella Zoster)
- Primary infection
- Recurrent infection results from reactivation
- Characterized by the appearance of dendritic ulcers on the cornea, which usually heal without scar

- HSV type 1 is the most common cause
- Usually acquired in early life due close contact and what we see in clinic is reactivation

- Symptoms and signs:
  - Very painful and associated with photophobia, watery discharge and swelling of the eyelids
  - Pathognomonic appearance is *dendritic ulcer*

HZV

- Dendritic ulcers
- Skin lesions: start as vesicle at ophthalmic division of Trig
- Pain and headache
- Also need medical & derma care
- Ocular problems are more likely if the nasociliary branch is involved Hutchinson's sign

- If the stroma is involved (disciform keratitis which is immunogenic reaction to herpes antigen) > corneal edema > permanent scaring > coneal graft may be required

- ***Rx:***
  - Topical antiviral for dendritic ulcer (acyclovir)
  - Topical steroids must be avoided in patients with dendritic ulcer since they may cause more extensive ulceration
  - Oral antiviral in HZV with skin involvement , will reduce post herpetic neuralgia

The cornea is protected against infection by:

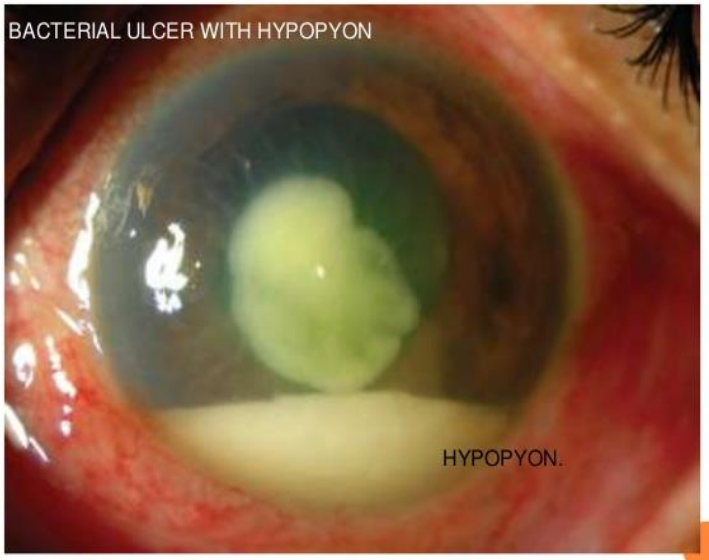
1- Blinking
2- Washing of debris by the flow of tears
3- Entrapment of foreign particles by mucus
4- Anti-microbial properties of tear
5- The barrier function of the corneal epithelium

Loss of balance may predispose to infection

Bacterial Keratitis

- Over 90% of corneal infections are caused by bacteria
- Prime pathogens are staphylococcus and streptococcus
- Most bacteria are unable to penetrate the cornea if the epithelium is intact. (*Neisseria gonorrhoeae* is the only organism that can penetrate the intact epithelium)

- Predisposing factors:
  - a- Keratoconjunctivitis sicca (dry eye)
  - b- A breach in the corneal epithelium
  - c- Contact lens use
  - d- Prolonged use of topical steroids



Symptoms:

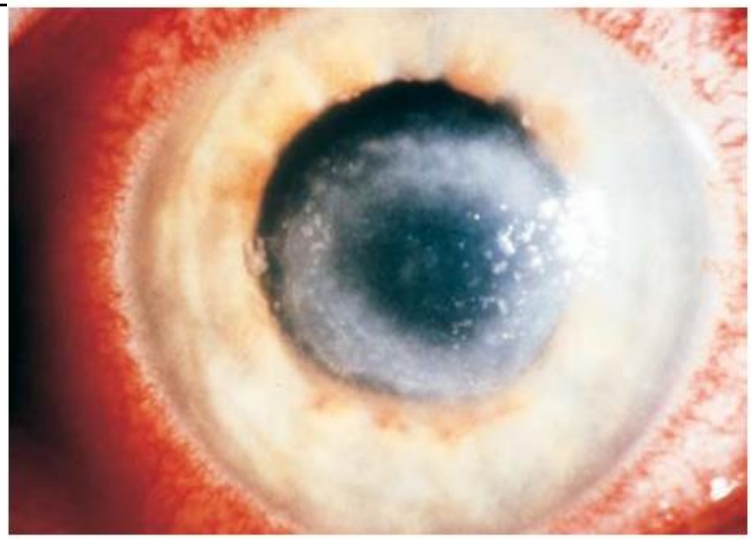
- Pain
- Purulent discharge
- Ciliary injection
- Visual loss
- Hypopyon (white cells collected in the anterior chamber)

Treatment:

- combined topical antibiotics to cover G+ve and G-ve
- Fluorquinolones can be used as monotherapy

Acanthameba Keratitis

Caused by a protozoa



- Common in contact lenses users

- Cause painful keratitis and ring shaped abscess

- Treated with chlorhexidene and propamidine for months and may end by corneal graft

Fungal Keratitis

- Common in warmer areas

- Should be considered in:
    1- Lack of response to antibacterial therapy
    2- Cases associated with prolong use of steroids
    3- History of trauma by plants

-Cause corneal opacity that appear fluffy.

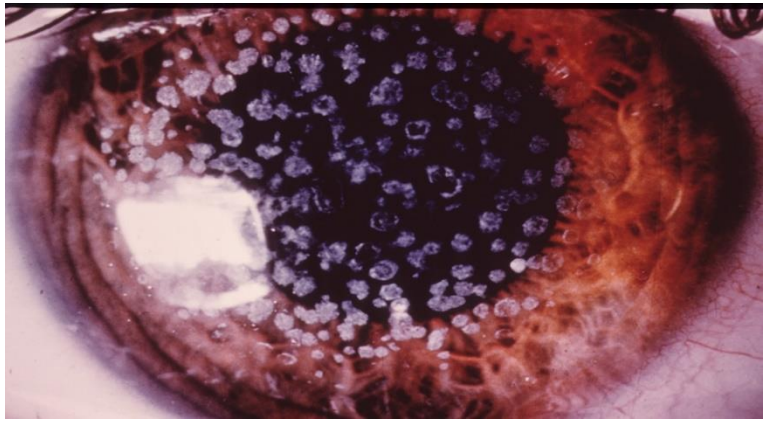
- Treated with topical and systemic antifungals

Cornea

Non- Infective corneal lesions

Corneal Dystrophies

- Rare inherited disorders, but relatively common in Jordan due to high consanguinity rates



- Affect corneal transparency

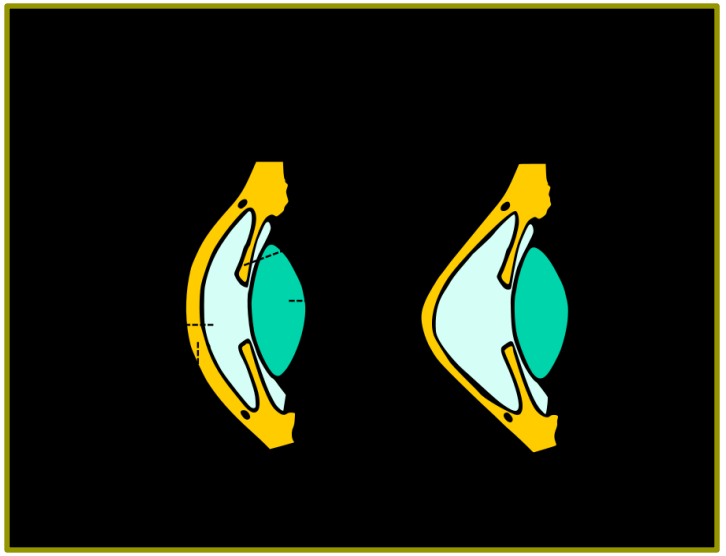
- Divided into:
  1. **Anterior Dystrophies** : present with recurrent corneal erosion
  2. **Stromal Dystrophies**: present with visual loss
  3. **Posterior Dystrophies** : gradual visual loss

Disorders of Shape

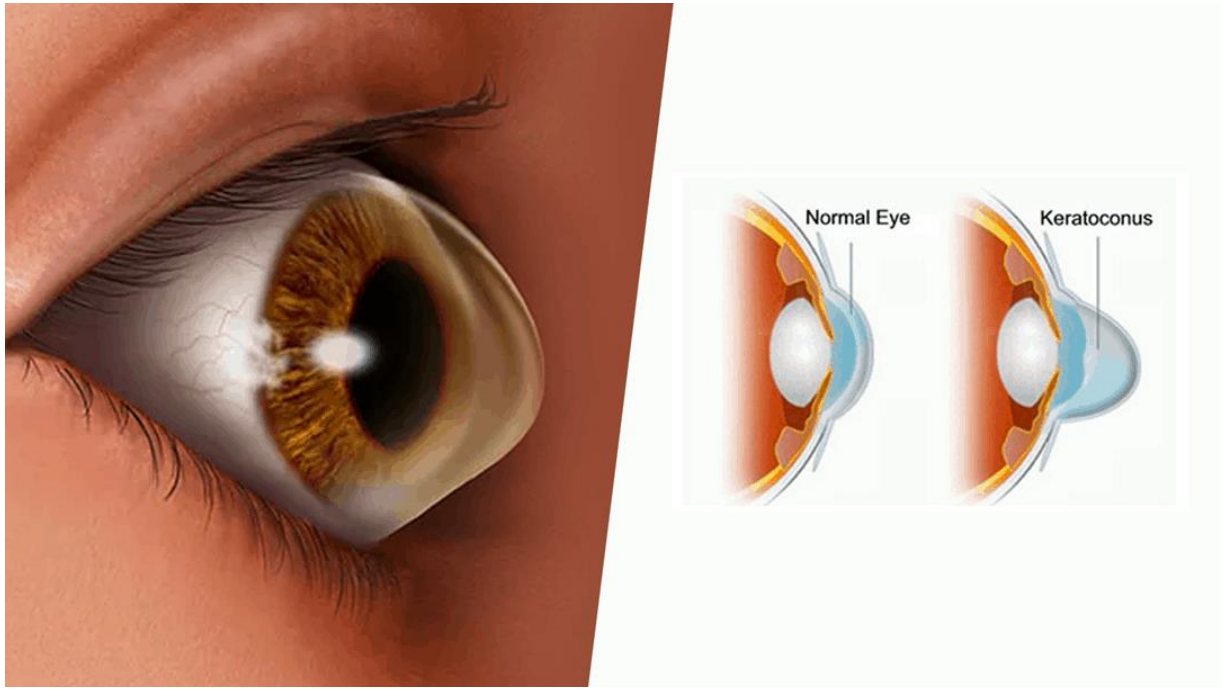
Keratoconus (KC)

Sporadic disorder associated with thinning of the centre of the cornea leads to ectasia and cone shaped cornea

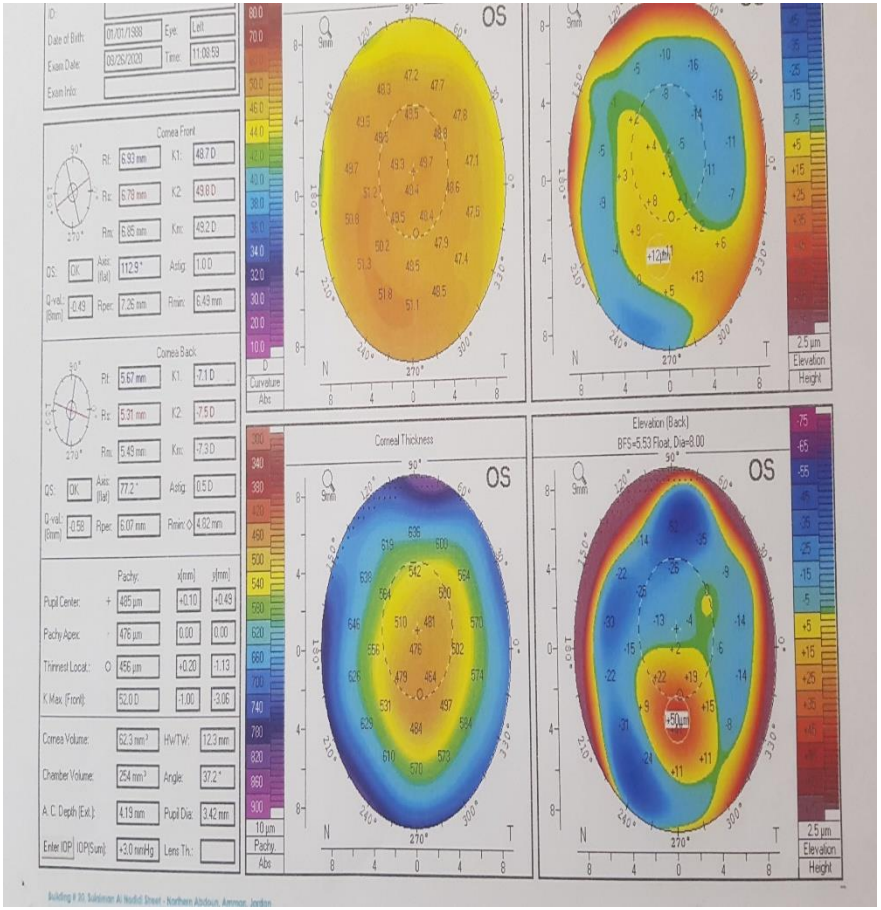
Vision is affected without pain



Protrusion of the cornea cause myopia and astigmatism


Normal Eye
Keratoconus

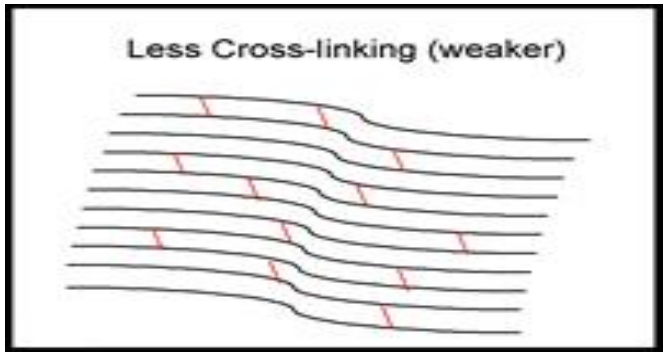
Sometimes mild or sublincal, Dx by corneal topography

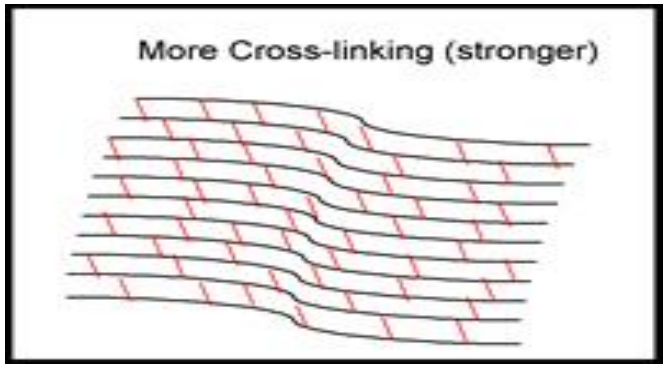


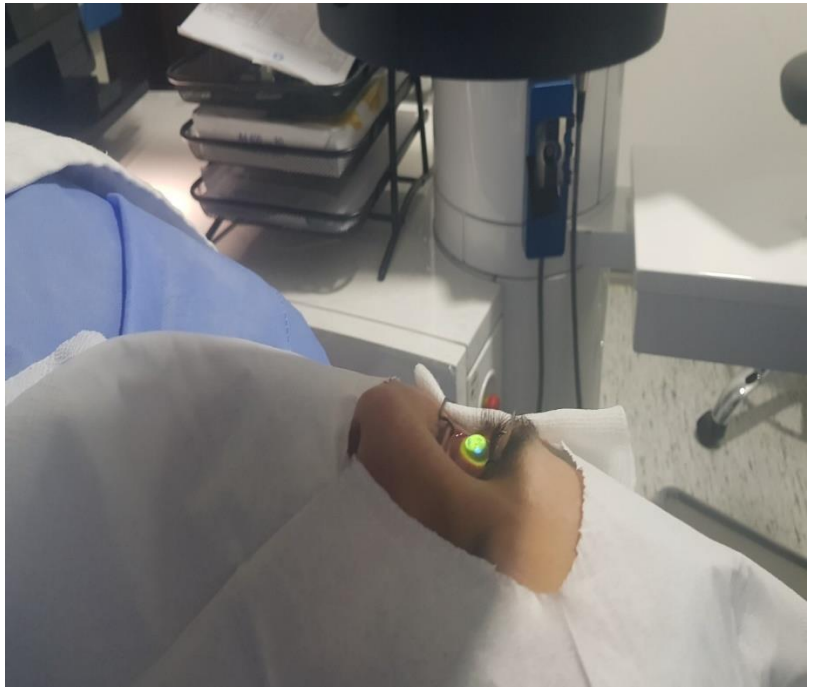
Modalities of treatment for KC

- Spectacles
- Contact lenses
- Corneal cross linking
- Combination
- Corneal graft

Cross linking: stops progression of KC



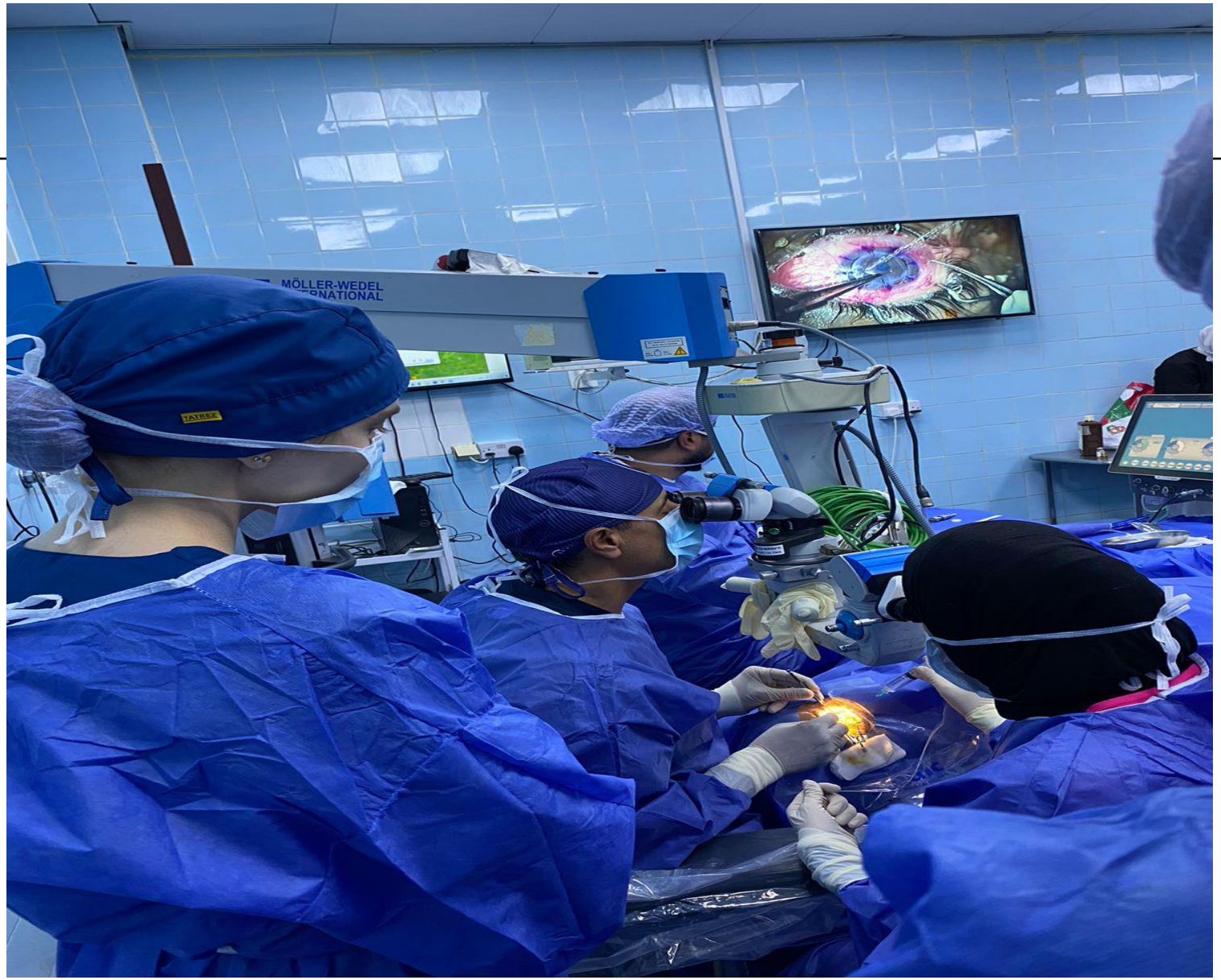




Corneal Grafting

- Donor corneal tissue can be grafted into a host cornea to restore corneal clarity or repair a perforation
- Avascular host cornea provides an immune-privileged site for grafting, with high success rate (80%)
- No need for HLA matching
- Extracted within 24 hours of death
- Topical steroids eye drops are used after operation to prevent graft rejection
- In Jordan, 50% of need is covered by local donation. JEB is based at JUH since1979

Cornea can be grafted within 2 weeks from extraction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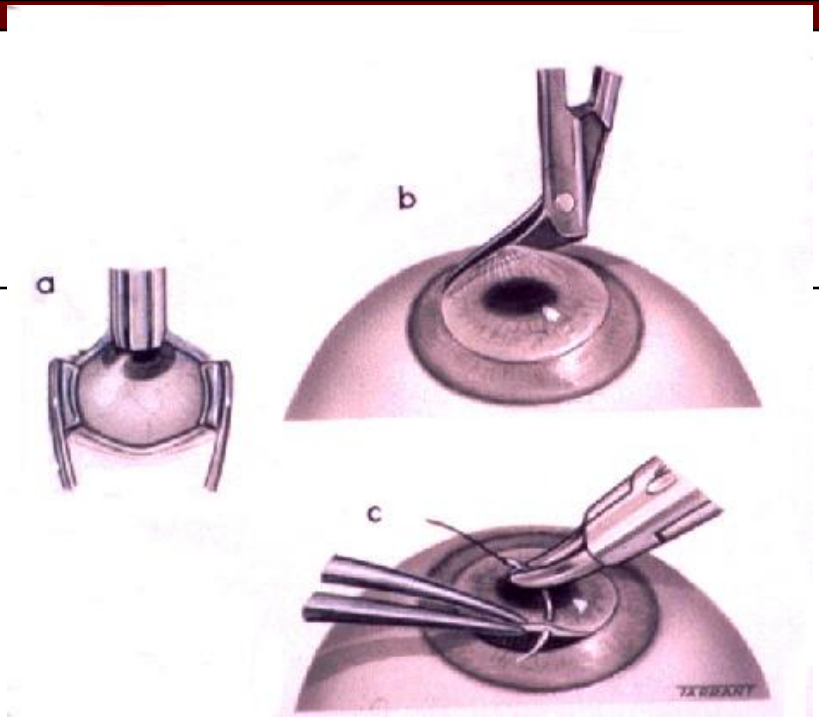
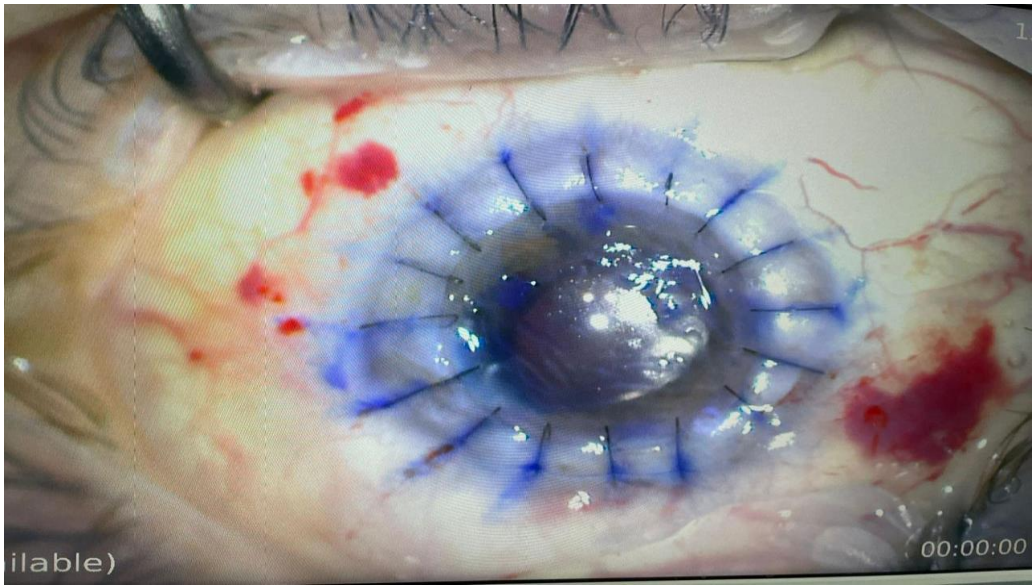

a
b
c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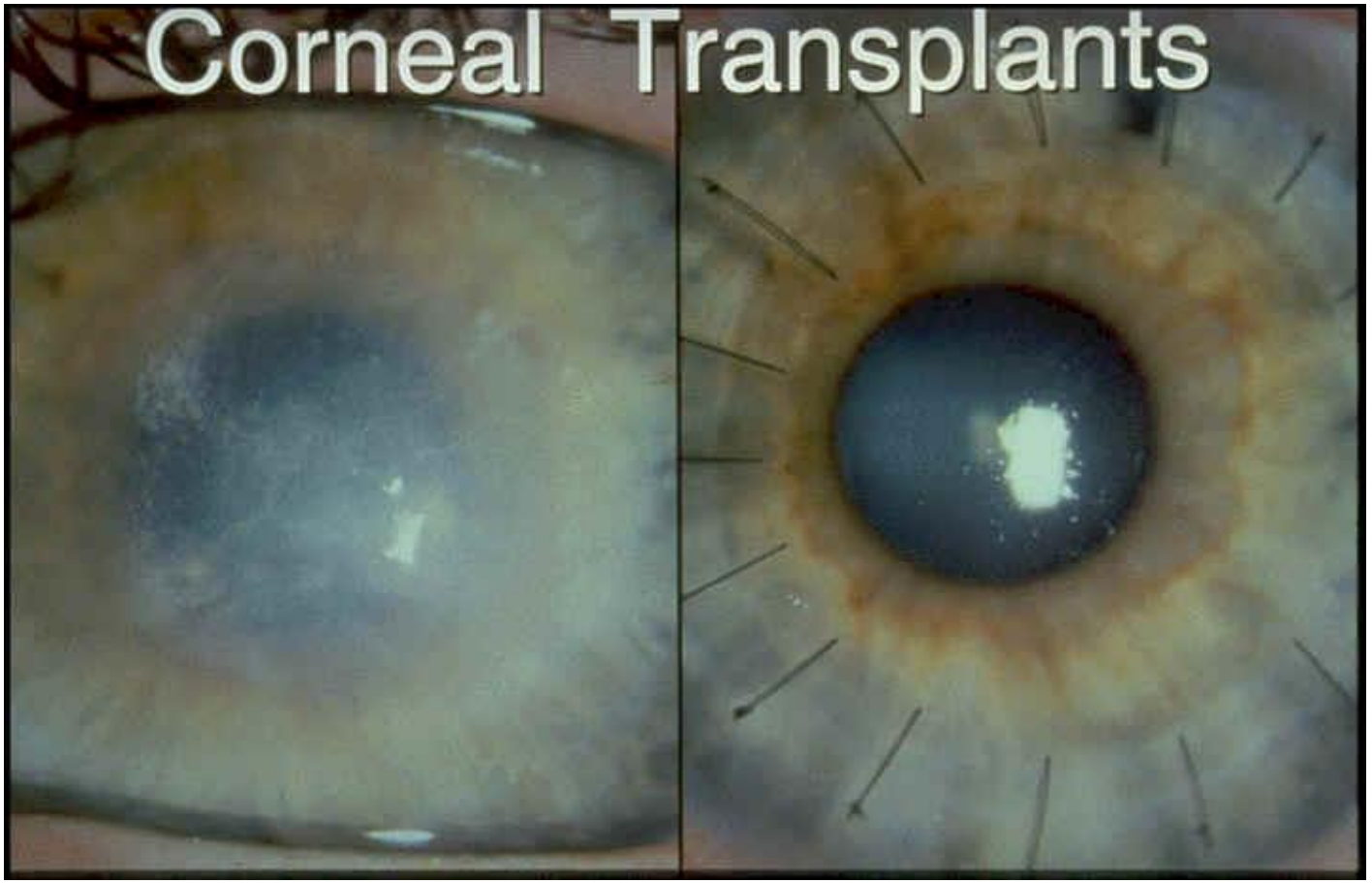
Non absorbable sutures for 1year



Refractive surgery

- Corneal surgery

(90-95% are treated by laser)

  - PRK - photorefractive keratectomy
  - LASIK - laser assissted in-situ keratomileusis
  - LASEK - laser subepithelial keratomileusis
  - Trans PRK: transepithelial
- Cross linking, rings, graft
- Lens surgery

Corneal refractive surgery

- Principles
- Rate of success
- Contraindications: Keratoconus

Excimer laser :

Excited dimers, is a cool laser beam, because it causes little thermal damage to adjacent tissues.

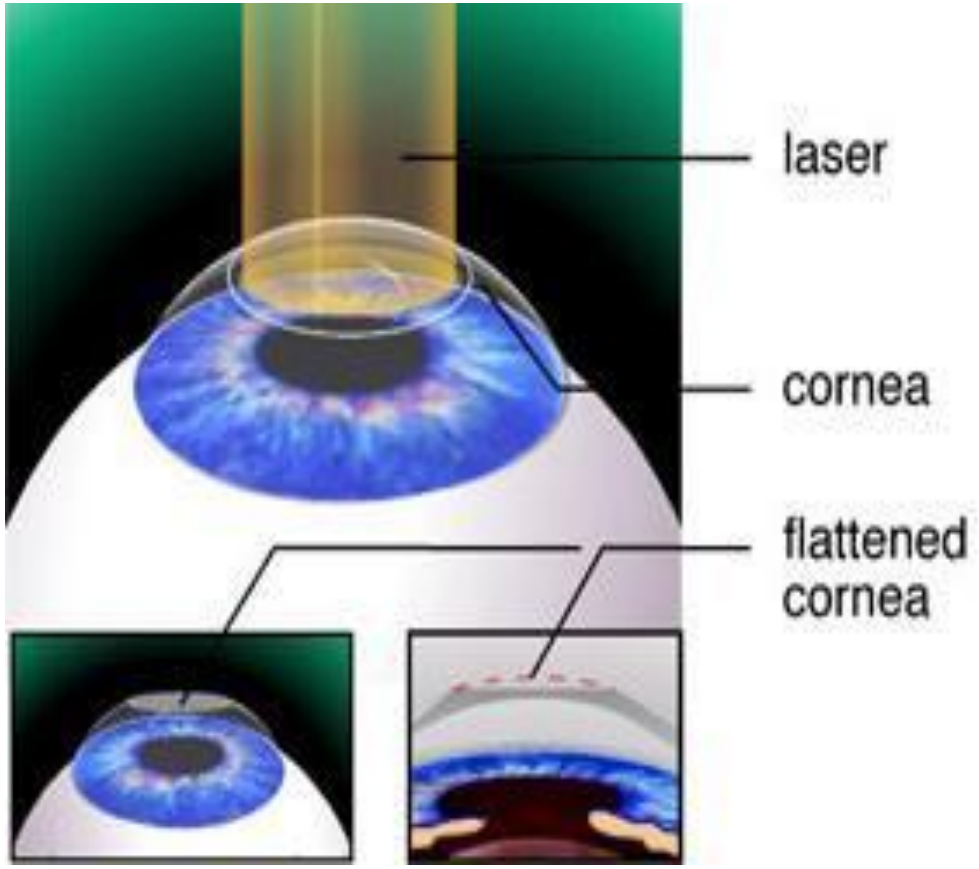
UV laser (193 nm)that works by photoablative decomposition of the corneal stroma laser energy destroys intermolecular bonds in cornea to alter its shape.

In myopia it flattens the cornea while in hypermetropia it steepens it.

In astigmatism it flattens the steepest meridian .

PRK

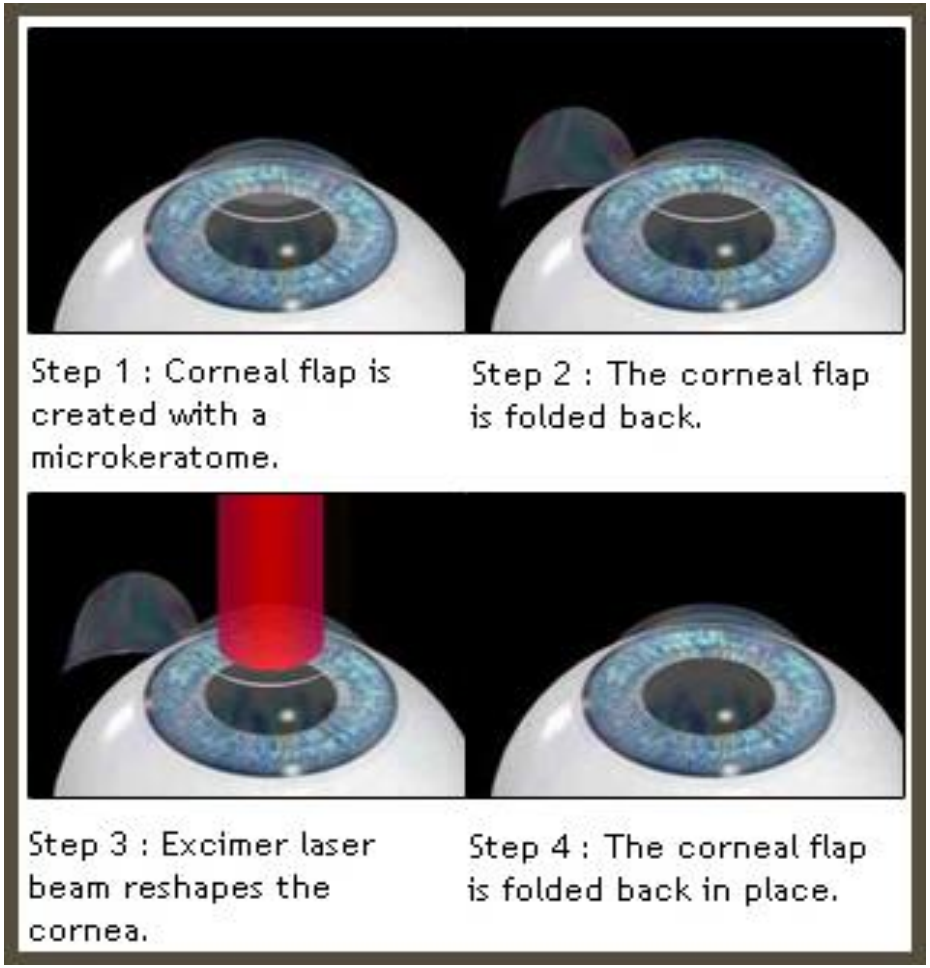
Laser is applied to the corneal surface after removing the epithelium , the cornea is resurfaced later.



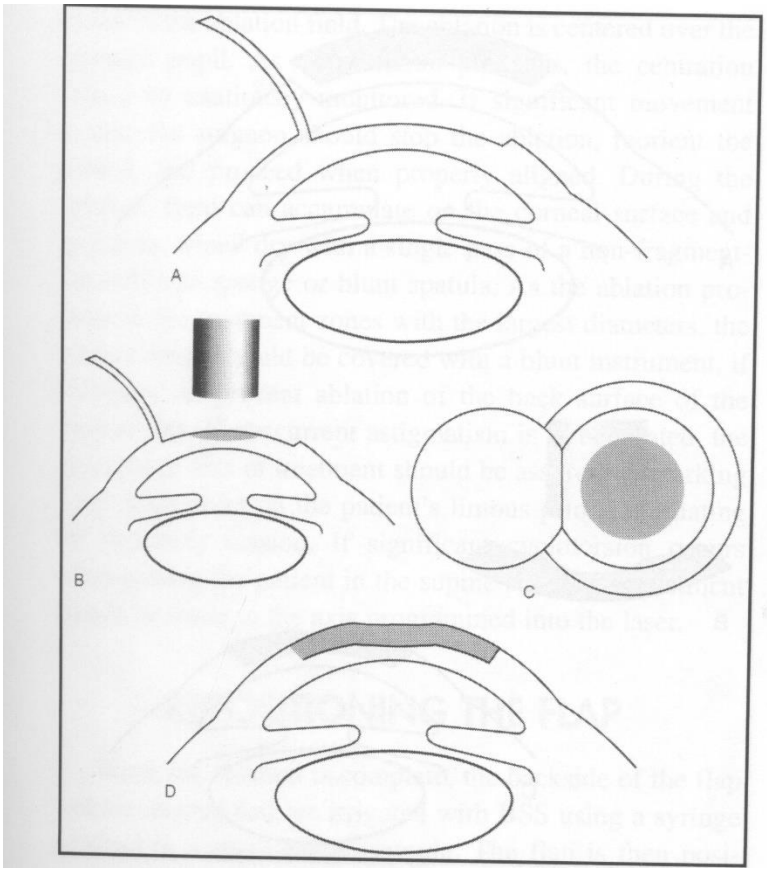
LASIK

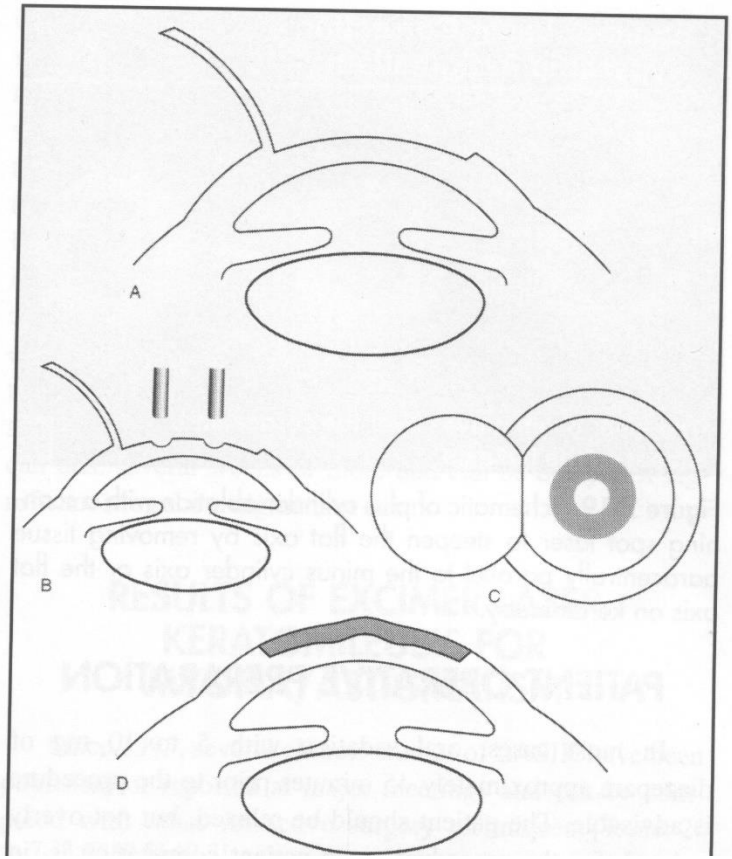
laser assisted in situ keratomileusis

* corneal flap (in situ)
* reshape the cornea (keratomileusis)



Lasik





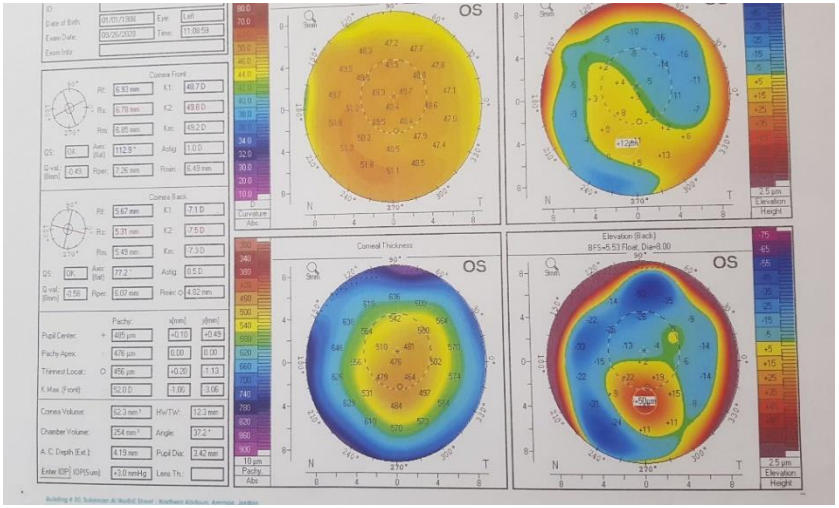
Topical anesthesia

Contraindications

- Age below 19
- Unstable refractive error
- Poor vision due to other causes
- Unhealthy cornea
- Severe dryness or inflammation
- Keratitis
- keratoconus

Before laser

- Corneal thickness and topography are a must



- When laser is not a proper choice we have the other options to do surgery on cornea and / or lens

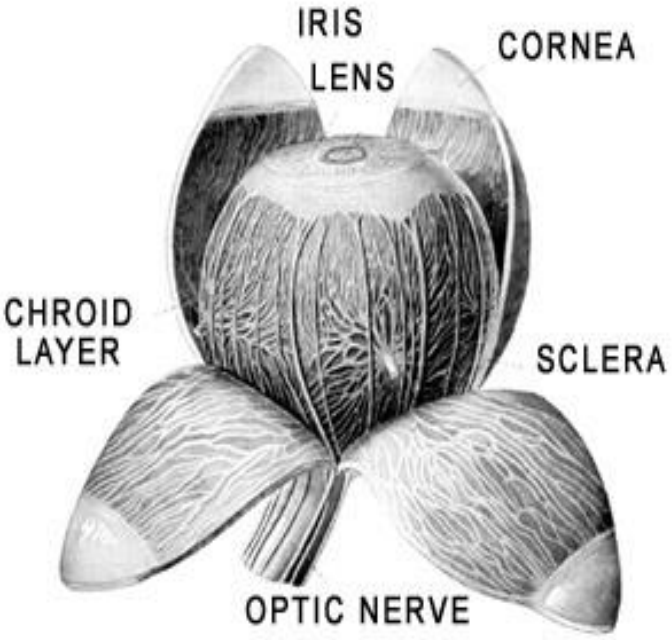
Results

- Success rate approaches 99% nowadays provided you
- select your patients properly and make sure there are no contraindications
- Do proper refraction
- Enter proper data

Sclera (white of the eye)

Composed of interwoven collagen fibrils of different widths

Variable in thickness, 1mm around optic nerve head and 0.3 mm posterior to muscle insertion



All six extraocular muscles are inserted on the sclera

Diseases of the Sclera

1- Episcleritis: Inflammation of the superficial layer of the sclera

Causes mild discomfort with segmental redness of the eye

Usually self-limiting

If symptoms persist, topical anti-inflammatory treatment can be given

Rarely associated with systemic disease

2- Scleritis:

Usually associated with collagen vascular disease most commonly RA

Cause severe ocular pain with generalized redness of the eye

Characterized by swelling of the sclera

Complications

- Sclermalacia (scleral thinning) sometimes with perforation

-Keratitis

- Uveitis

- Cataract formation

- Glaucoma

Management

- Mild cases: topical steroids and oral NSAIDs
- Moderate and severe cases

Usually treated by high doses of systemic steroids or Cytotoxics

Medical condition that requires investigations for underlying cause

Thank You