

Cornea and Sclera



Muawyah Al Bdour

The University of Jordan

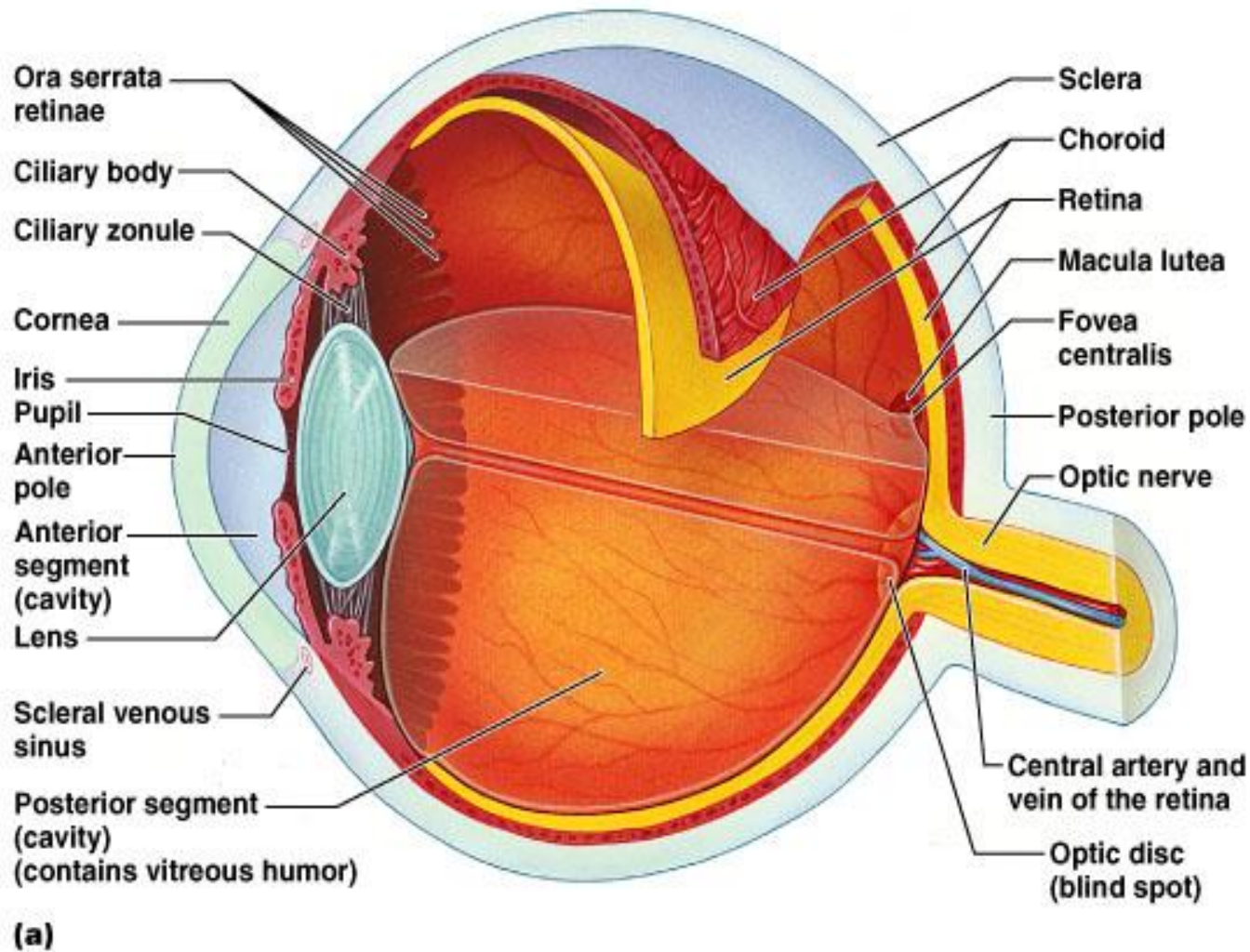
2023/2024



Objectives

- Know the basic anatomy, histology, physiology
- Highlight some common diseases
- Special focus on Keratoconus being relatively common in the region
- Brief notes on corneal graft

Cornea and sclera: tough outer coat



0.5 mm thick
11-12 mm in diameter

5 Layers:

Epithelium: Non-keratinized stratified squamous. **Regenerates** from stem cells found in the limbus

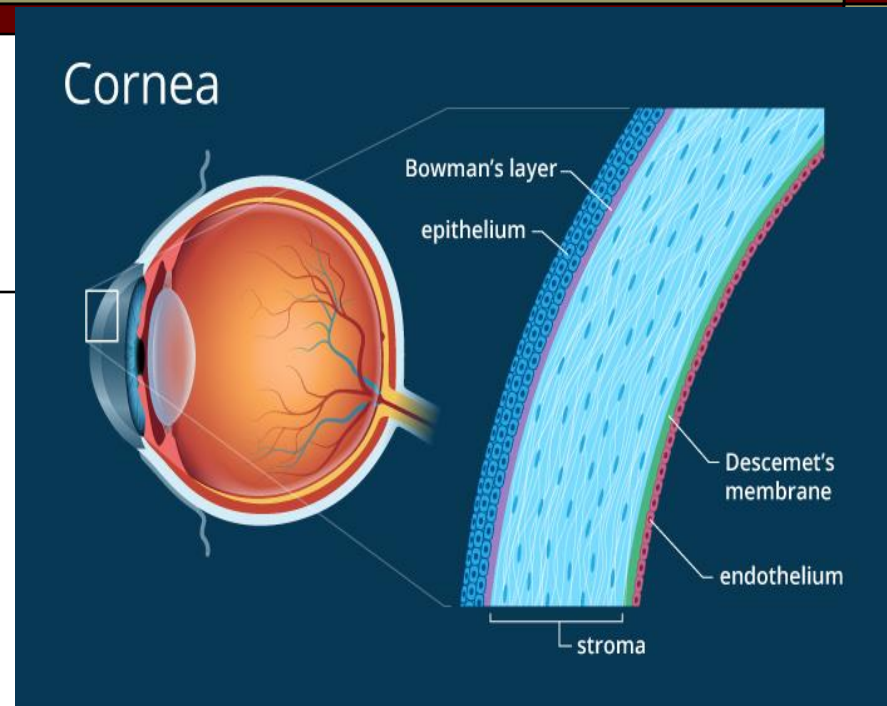
Bowman membrane

Stroma: 90 % of corneal thickness; parallel collagen fibrils

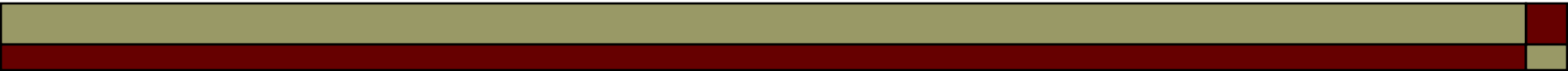
Descemet membrane: tough

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



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- ❑ 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

Infective corneal lesions

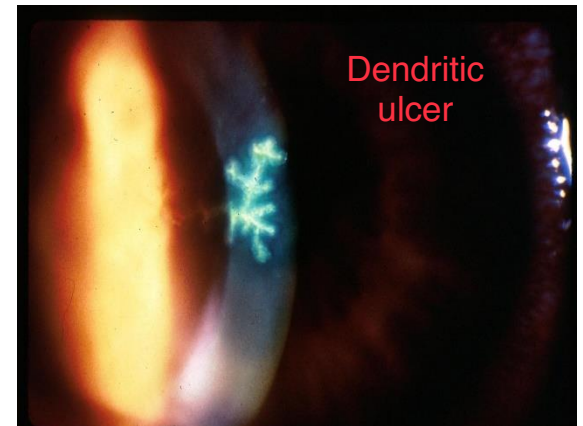
Herpes Simplex and Zoster Keratitis

Can occur with intact epithelium (latency / reactivation)

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



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- 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



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- If the stroma is involved (disciform keratitis which is immunogenic reaction to herpes antigen) > corneal edema > permanent scarring > 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

Infective corneal lesions

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

As in patients with allergies who use topical steroids beyond prescribed

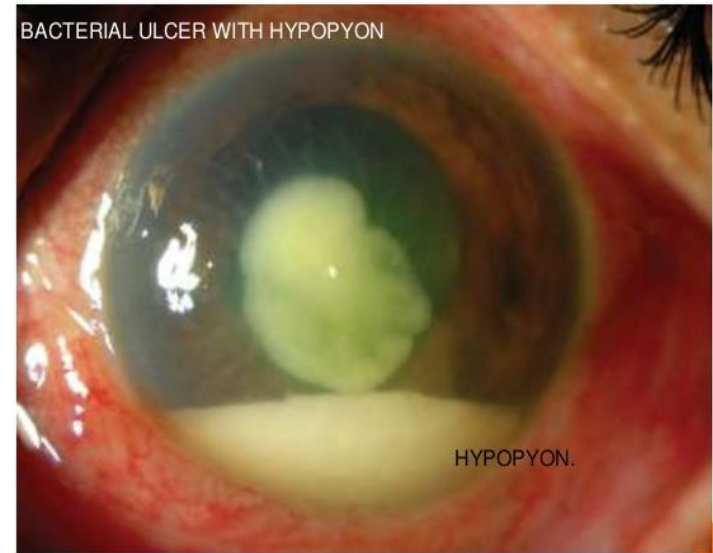
Symptoms:

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

Even following the resolution of infection the patient will most likely have a corneal scar and will probably need a corneal graft

Treatment:

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



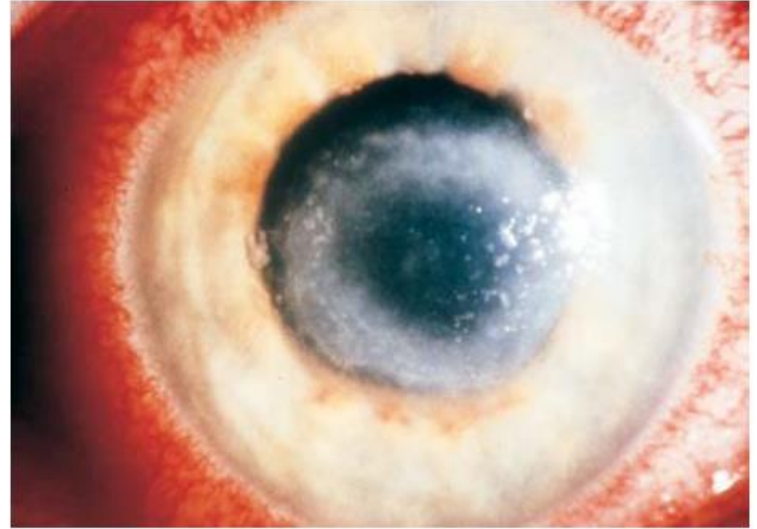
Infective corneal lesions

Acanthameba Keratitis

Caused by a protozoa

Very resistant/ treatment duration: 6-12 months

- 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

Infective corneal lesions

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

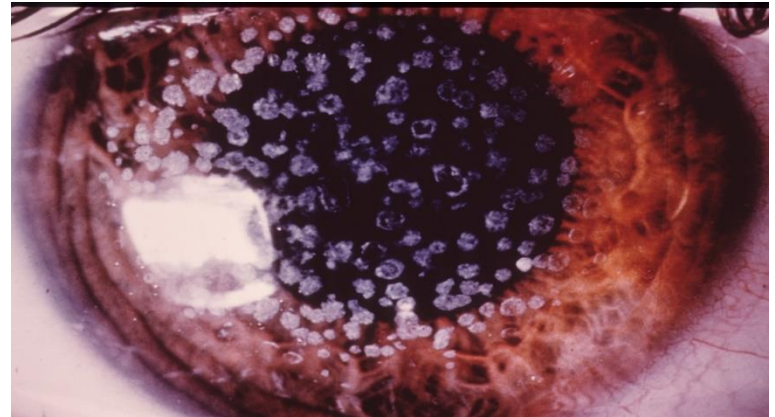
Cornea

Non- Infective corneal lesions

Most: autosomal dominant / Few: autosomal recessive

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



Management : corneal graft

Disorders of Shape

Keratoconus (KC)

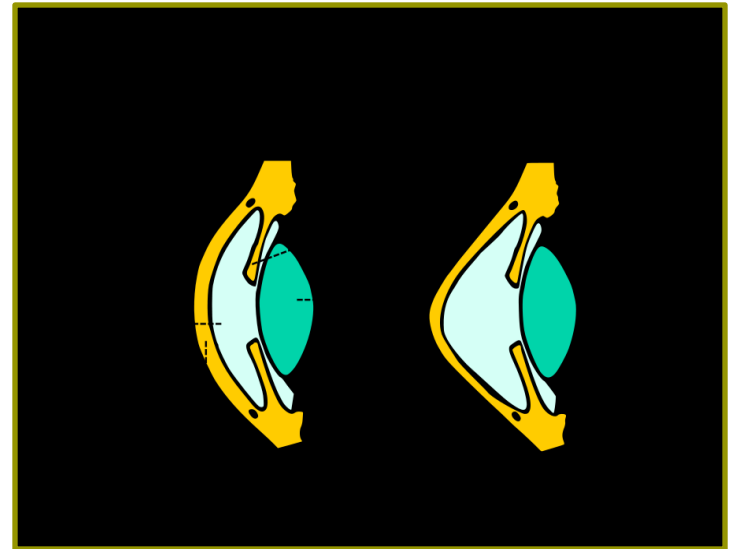
By default a bilateral disease (might vary in severity between the two eyes)

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

Vision is affected without pain

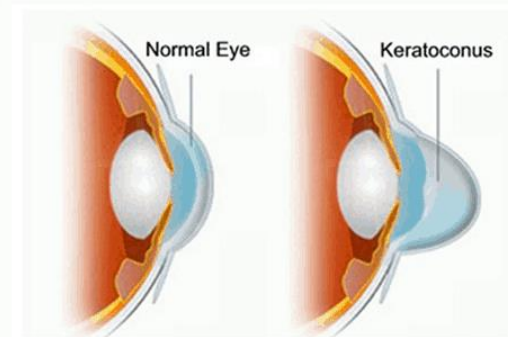
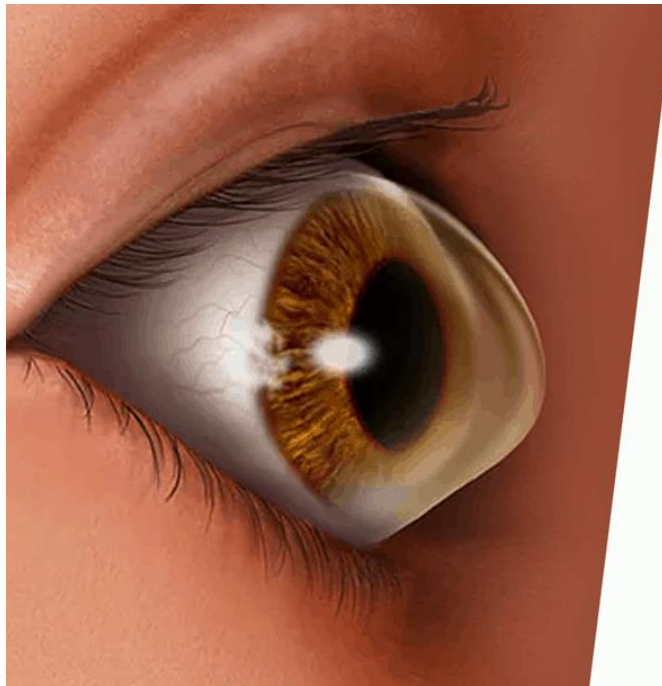
2 major defects :

1. Corneal morphology (bulging)
2. Corneal thinning (due to bulging)



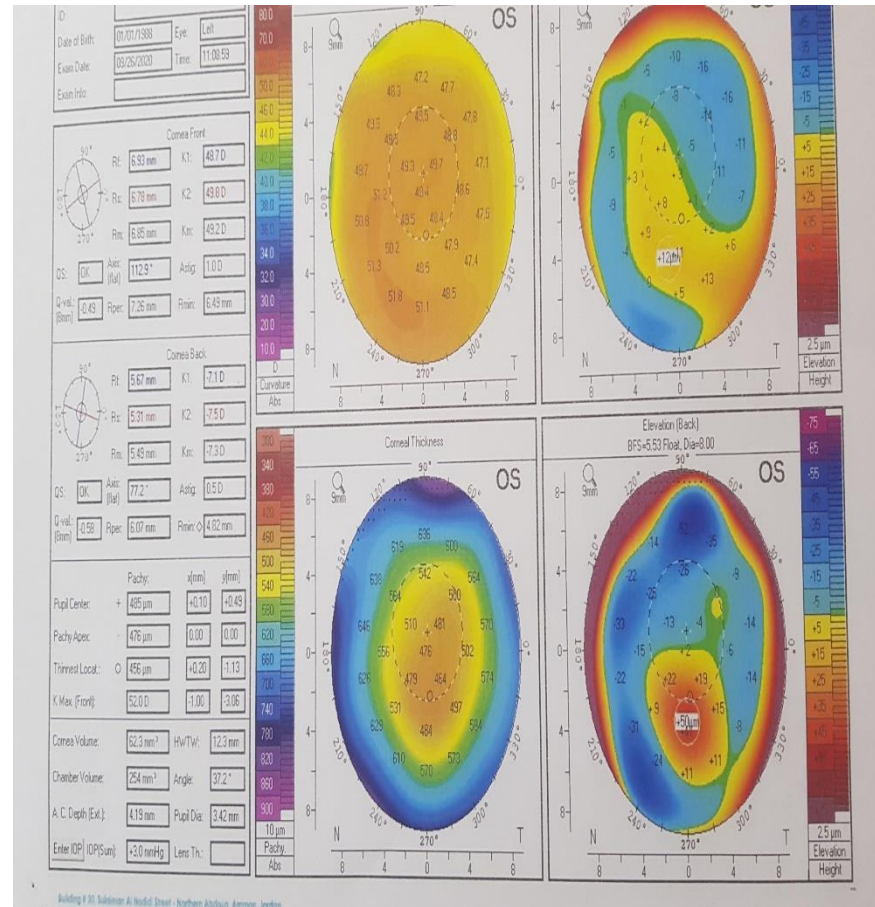
Protrusion of the cornea cause myopia and astigmatism

The earlier the onset of keratoconus (the younger the patient (early adolescence)) >> the higher the risk & rate of progression >> early cross-linking (we are fully aware of the course of the disease and how rapidly and severely it will progress)



Late onset (beyond 20 y.o) >> not as progressive as when it presents early (minimal progression) >> we can delay cross-linking (the keratoconus will improve to some extent due to auto cross-linking that occurs as a part of the normal aging process)

Sometimes mild or sublinical, Dx by corneal topography



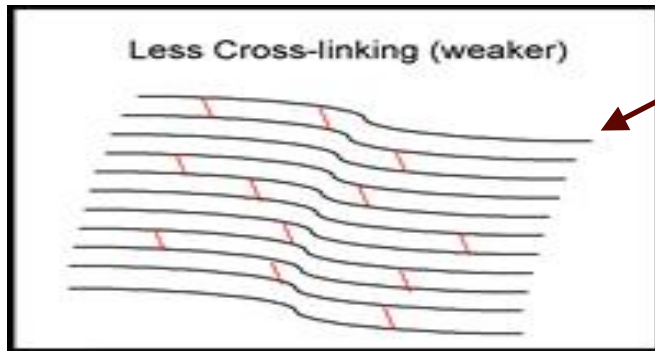


Modalities of treatment for KC

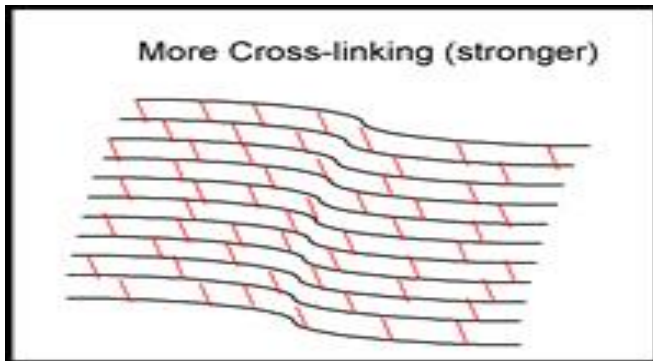
- Spectacles
- Contact lenses
- Corneal cross linking
- Intra stromal corneal rings
- Corneal graft

Induced by oxygen free radicals

Cross linking: stops progression of KC



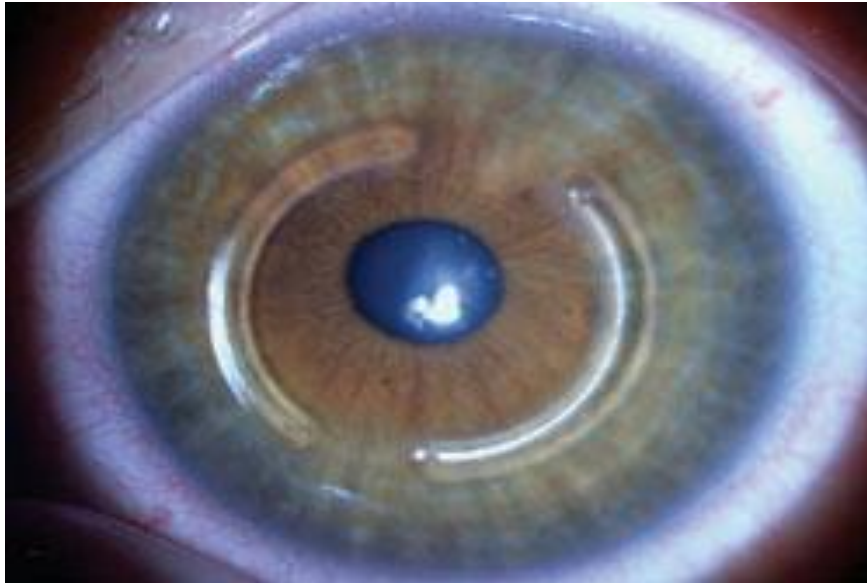
Collagen fibers



Vitamin B2 + UV light

KC will stop progressing in ~ 80% of the patients following cross-linking

Rings reshape cornea and reduce astigmatism



We create a tunnel in the cornea then we insert the ring in the corneal stroma (80% in the depth of the stroma) >> this will flatten the cornea

Corneal Grafting

Disadvantage: poor slow healing

- 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 since 1979

Taken within 24 hrs of death given the fact that the cadaver was kept in the fridge

Cornea can be grafted within 2 weeks from extraction

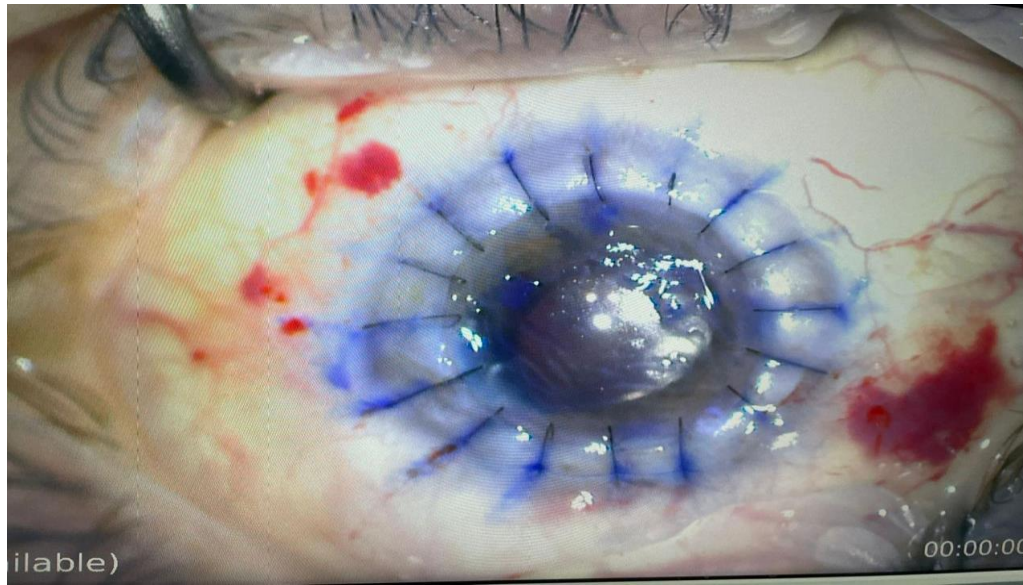
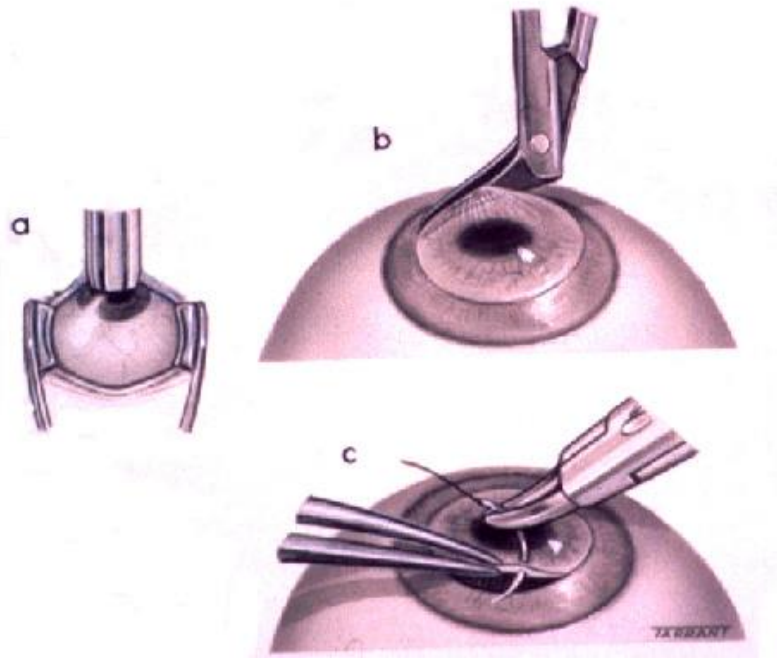


Corneal graft diameter: 7.5-8 mm (no contact with the limbus / central)

If larger >> greater risk of rejection (one possible cause is corneal neovascularization)

[[ADDITIONAL]]

Corneal neovascularization (NV) is a pathologic condition of the cornea, characterized by the formation and extension of new vascular capillaries within and into the previously avascular corneal regions, extending from the limbus into the superficial or deep areas of the cornea (caused by an imbalance between angiogenic and antiangiogenic factors that preserve corneal transparency as a result of various ocular insults and hypoxic injuries).



Non absorbable sutures for 1 year





Corneal refractive surgery

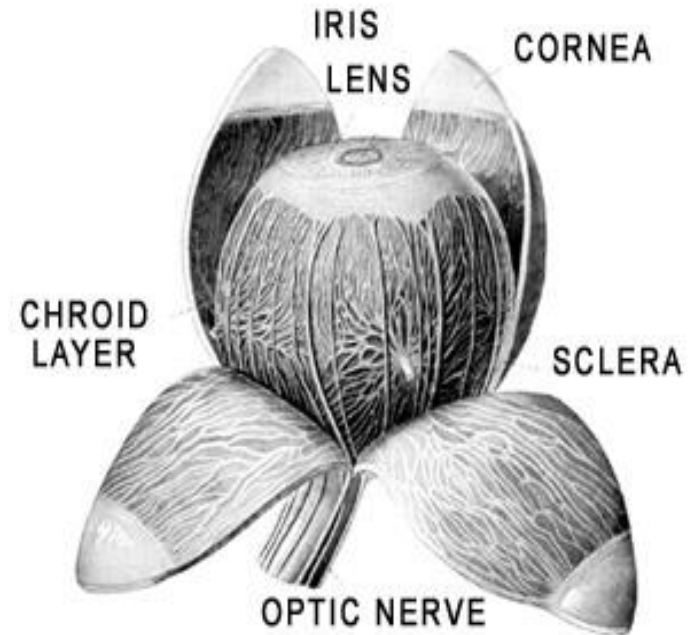
- Principles
- Rate of success
- Contraindications

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 **Localized area of hyperemia**

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 Site of EOM insertion
Characterized by swelling of the sclera



Complications

- Scleromalacia (scleral thinning) sometimes with perforation *Visible uveal tissue*
- 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 Unlike episcleritis



Thank you