Corneal Pathologies

Dr. Pradeep Bastola
MD, Ophthalmologist
Assistant Professor
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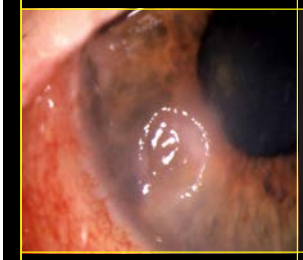
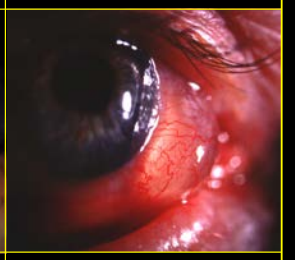
PERIPHERAL CORNEAL THINNING AND ULCERATION

1. **Without systemic disease**
   - Dellen
   - Terrien marginal degeneration
   - Mooren ulcer
2. **With systemic disease**
   - Rheumatoid arthritis
   - Wegener granulomatosis
   - Polyarteritis nodosa

Dellen

- Common and unilateral
- Innocuous

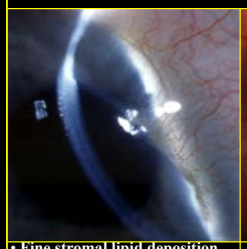
Signs	Causes
	
• Saucer-like thinning with intact epithelium • Fluorescein pooling but no staining	Causes - chemosis, raised limbal lesions, abnormal blinking

Treatment - lubricants and elimination of cause

Terrien marginal degeneration

- Uncommon, bilateral but asymmetrical
- Initially asymptomatic

Progression




- Fine stromal lipid deposition separated by clear zone
- Mild thinning and vascularization

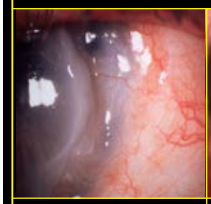
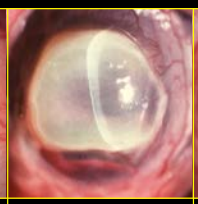
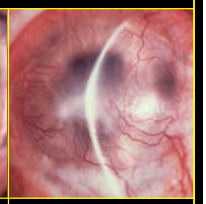
- Circumferential thinning and increasing astigmatism
- Formation of pseudo-pterygia if longstanding

Treatment of severe astigmatism - crescent-shaped excision of gutter

Mooren ulcer

- Limited form - usually unilateral, affects elderly
- Progressive form - bilateral, affects younger patients

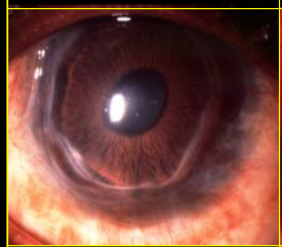
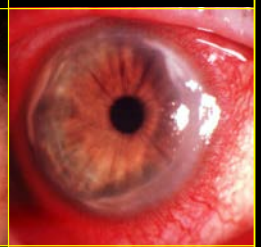
Progression

Peripheral ulcerative keratitis | Circumferential and central spread | End-stage scarring and vascularization

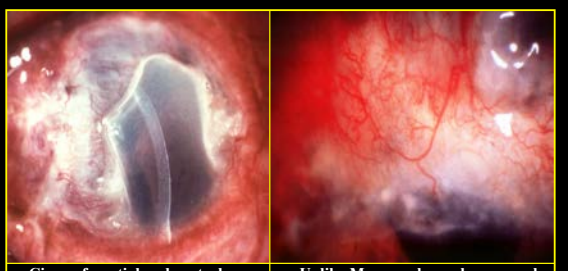
Treatment - systemic steroids and/or cytotoxic drugs

Peripheral corneal involvement in rheumatoid arthritis

Without inflammation	With inflammation
	
• Chronic and asymptomatic • Circumferential thinning with intact epithelium ('contact lens cornea')	• Acute and painful • Circumferential ulceration and infiltration

Treatment - systemic steroids and/or cytotoxic drugs

Peripheral corneal involvement in Wegener granulomatosis and polyarteritis nodosa



Circumferential and central ulceration similar to Mooren ulcer

Unlike Mooren ulcer sclera may also become involved

Treatment - systemic steroids and cyclophosphamide

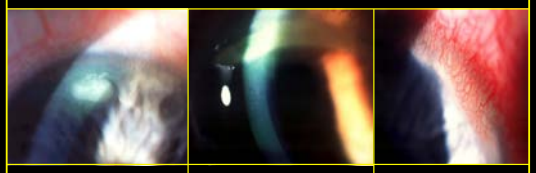
PERIPHERAL CORNEAL INFLAMMATION

1. Marginal keratitis
2. Rosacea keratitis
3. Phlyctenulosis
4. Acute stromal keratitis

Marginal keratitis

- Hypersensitivity reaction to *Staph.* exotoxins
- May be associated with *Staph.* blepharitis
- Unilateral, transient but recurrent

Progression



Subepithelial infiltrate separated by clear zone

Circumferential spread

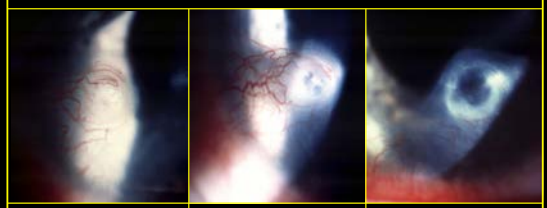
Bridging vascularization followed by resolution

Treatment - short course of topical steroids

Rosacea keratitis

- Affects 5% of patients with acne rosaeca
- Bilateral and chronic

Progression



Peripheral inferior vascularization

Subepithelial infiltration

Thinning and perforation if severe

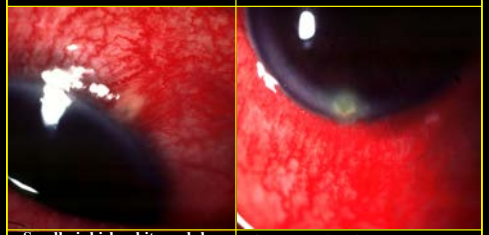
Treatment - topical steroids and systemic tetracycline or doxycyline

Phlyctenulosis

- Uncommon, unilateral - typically affects children
- Severe photophobia, lacrimation and blepharospasm

Conjunctival phlycten

Corneal phlycten



- Small pinkish-white nodule near limbus
- Usually transient and resolves spontaneously

- Starts astride limbus
- Resolves spontaneously or extends onto cornea

Treatment - topical steroids

CORNEAL INFECTIONS

1. Bacterial keratitis
2. Fungal keratitis
3. Acanthamoeba keratitis
4. Infectious crystalline keratitis
5. Herpes simplex keratitis
   - -Epithelial
   - -Disciform
6. Herpes zoster keratitis

Bacterial keratitis

Predisposing factors

- Contact lens wear
- Chronic ocular surface disease
- Corneal hypoaesthesia

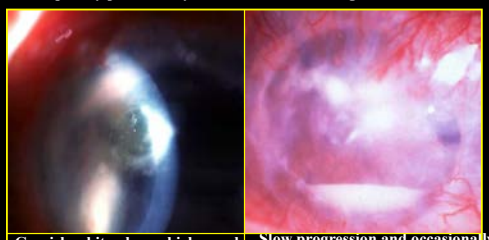
Expanding oval, yellow-white, dense stromal infiltrate

Stromal suppuration and hypopyon

Treatment - topical ciprofloxacin 0.3% or ofloxacin 0.3%

Fungal keratitis

Frequently preceded by ocular trauma with organic matter



Greyish-white ulcer which may be surrounded by feathery infiltrates

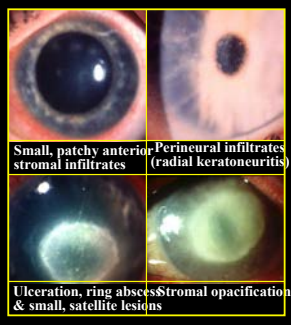
Slow progression and occasionally hypopyon

Treatment

- Topical antifungal agents
- Systemic therapy if severe
- Penetrating keratoplasty if unresponsive

Acanthamoeba keratitis

- Contact lens wearers at particular risk
- Symptoms worse than signs



Small, patchy anterior stromal infiltrates

Perineural infiltrates (radial keratoneuritis)

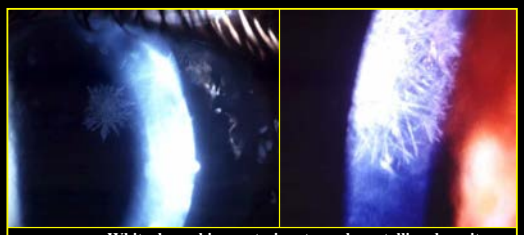
Ulceration, ring abscess & small, satellite lesions

Stromal opacification

Treatment - chlorhexidine or polyhexamethylenebiguanide

Infectious crystalline keratitis

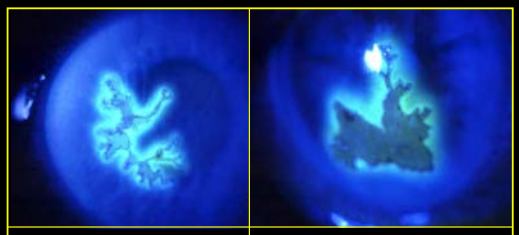
- Very rare, indolent infection (*Strep. viridans*)
- Usually associated with long-term topical steroid use
- Particularly following penetrating keratoplasty



White, branching, anterior stromal crystalline deposits

Treatment - topical antibiotics

Herpes simplex epithelial keratitis



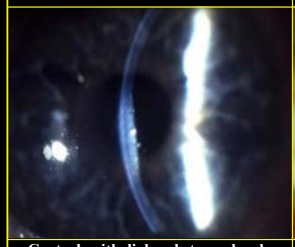
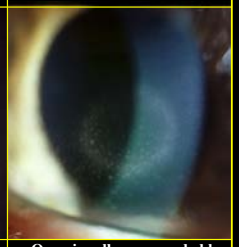
- Dendritic ulcer with terminal bulbs
- Stains with fluorescein

May enlarge to become geographic

Treatment

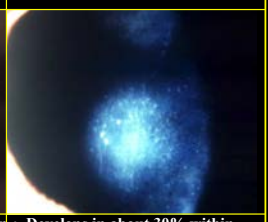
- Aciclovir 3% ointment x 5 daily
- Trifluorothymidine 1% drops 2-hourly
- Debridement if non-compliant

Herpes simplex disciform keratitis

Signs	Associations
	
• Central epithelial and stromal oedema • Folds in Descemet membrane • Small keratic precipitates	• Occasionally surrounded by Wessely ring

Treatment – topical steroids with antiviral cover

Herpes zoster keratitis

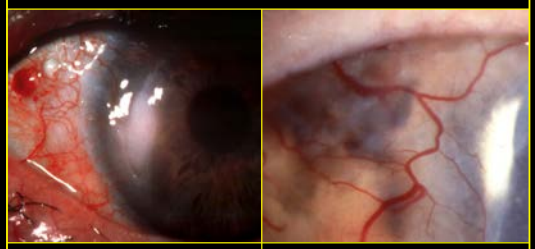
Acute epithelial keratitis	Nummular keratitis
	
• Develops in about 50% within 2 days of rash	• Develops in about 30% within 10 days of rash
• Small, fine, dendritic or stellate epithelial lesions	• Multiple, fine, granular deposits just beneath Bowman membrane
• Tapered ends without bulbs	• Halo of stromal haze
• Resolves within a few days	• May become chronic

Treatment - topical steroids, if appropriate

Acute stromal keratitis

- Uncommon, usually unilateral
- Associated with non-necrotizing scleritis

Progression



Superficial or mid-stromal infiltration	Opacification and vascularization

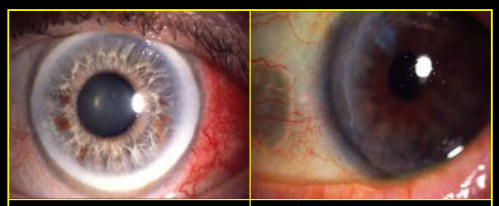
Treatment - topical steroids and systemic NSAIDs

CORNEAL DEGENERATIONS

1. Age-related
   - Arcus senilis
   - Vogt white limbal girdle
   - Crocodile shagreen
   - Cornea guttata
2. Lipid keratopathy
   - Primary
   - Secondary
3. Band keratopathy
4. Spheroidal degeneration
5. Salzmann nodular degeneration

Arcus senilis

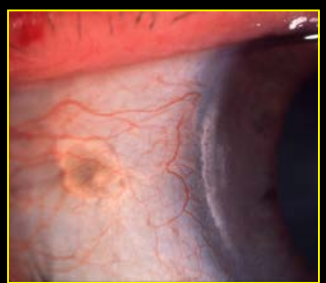
- Innocuous and extremely common in elderly
- Occasionally associated with hyperlipoproteinaemia



· Bilateral, circumferential bands of lipid deposits	· Peripheral border separated from limbus by clear zone
· Diffuse central and sharp peripheral border	· Clear zone may be thinned (senile furrow)

Vogt white limbal girdle

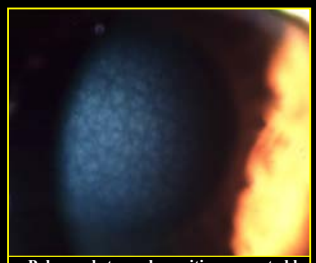
- Innocuous and very common in elderly
- Bilateral



· White, crescentic line along nasal and temporal limbus
· Type 1 - separated from limbus by clear zone
· Type 2 - not separated by clear zone

Crocodile shagreen

- Uncommon and innocuous
- Usually bilateral



· Polygonal stromal opacities separated by clear space
· Most frequently involve anterior stroma (anterior crocodile shagreen)
· Occasionally involve posterior stroma (posterior crocodile shagreen)

Cornea guttata

- Common, bilateral and usually innocuous
- Rarely progression to Fuchs dystrophy

- Tiny dark spots on central endothelium
- Similar peripheral lesions are Hassell-Henle bodies

Causes of Band Keratopathy

1. **Ocular (common)**
   - Chronic iridocyclitis, particularly in children
   - Associated with phthisis bulbi
   - Silicone oil in anterior chamber
2. **Metabolic (rare)**
   - Increased serum calcium and phosphorus
   - Hyperuricaemia
   - Chronic renal failure
3. **Hereditary (rare)**
   - Familial band keratopathy
   - Hereditary ichthyosis
4. **Age-related (uncommon)**

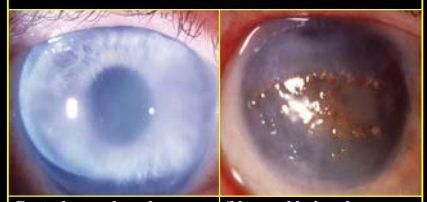
Chelation of band keratopathy

Removal of corneal epithelium | Application of sodium versenate

Spheroidal degeneration

- Rare, typically affects outdoor workers
- Starts with peripheral, interpalpebral, small amber-coloured granules in superficial stroma

Progression



Central spread, coalescence and opacification | Advanced lesions become nodular and elevated

Treatment

- Debridement or superficial keratotomy if mild
- Keratoplasty if severe

Salzmann nodular degeneration

- Uncommon, unilateral or bilateral
- Secondary to chronic keratitis

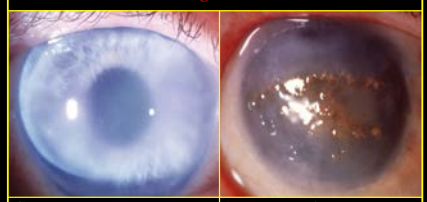
- Discrete superficial stromal opacities and nodules
- Base of nodule may be surrounded by iron deposits

Treatment - similar to spheroid degeneration

Spheroidal degeneration

- Rare, typically affects outdoor workers
- Starts with peripheral, interpalpebral, small amber-coloured granules in superficial stroma

Progression



Central spread, coalescence and opacification | Advanced lesions become nodular and elevated

Treatment

- Debridement or superficial keratotomy if mild
- Keratoplasty if severe

CORNEAL DYSTROPHIES

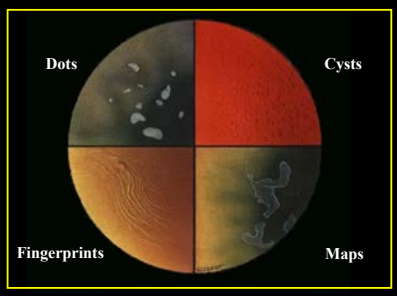
1. Anterior
- Cogan microcystic
- Reis-Bučklers
- Meesmann
- Schnyder

2. Stromal
- Lattice I, II, III
- Granular I, II, III (Avellino)
- Macular

3. Posterior
- Fuchs endothelial
- Posterior polymorphous

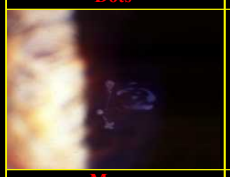
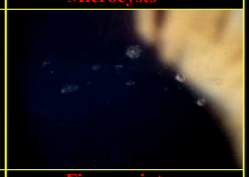
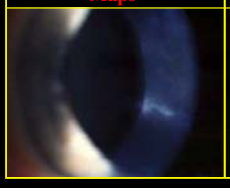
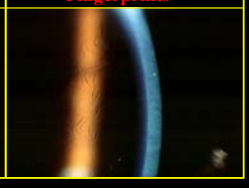
Cogan microcystic dystrophy

- Most common of all dystrophies
- Neither familial nor progressive
- Recurrent corneal erosions in about 10% of cases



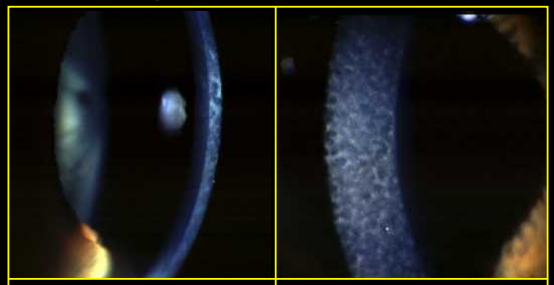
Signs of Cogan dystrophy

Four types of lesions - in isolation or combination

Dots	Microcysts
	
Maps	**Fingerprints**
	

Reis-Bučklers dystrophy

Inheritance - autosomal dominant
Onset - early childhood with recurrent corneal erosions

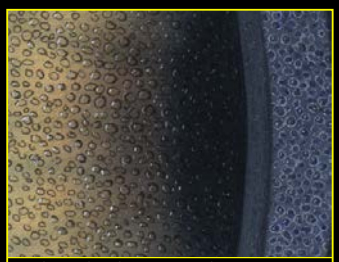


Superficial polygonal opacities	Honeycomb appearance

Treatment - keratoplasty if severe

Meesmann dystrophy

Inheritance - autosomal dominant
Onset - first decade with mild visual symptoms

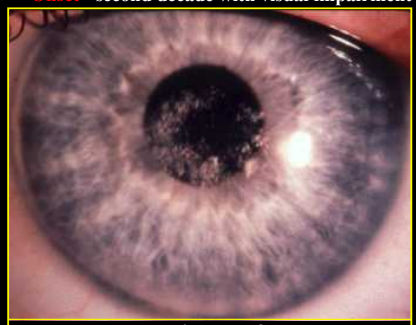


- Tiny, epithelial cysts, maximal centrally
- Clear in retroillumination
- Grey in direct illumination

Treatment - not required

Schnyder dystrophy

Inheritance - autosomal dominant
Onset - second decade with visual impairment



Subepithelial 'crystalline' opacities

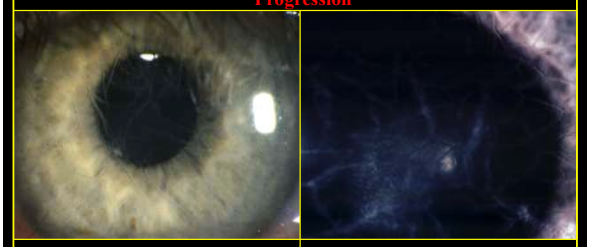
Treatment - excimer laser keratectomy

Lattice dystrophy type I

Inheritance - autosomal dominant

Onset - late first decade with recurrent corneal erosions

Progression

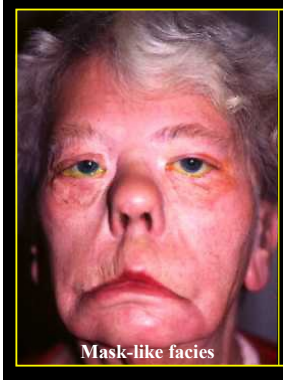


Fine, spidery, branching lines within stroma | Later general haze may submerge lesions

Treatment - penetrating keratoplasty if severe

Lattice dystrophy type II

(Familial amyloidosis with lattice dystrophy, Meretoja syndrome)



Mask-like facies

Inheritance
Autosomal dominant

Onset
Middle age with progressive facial palsy and lattice dystrophy identical to type I

Systemic features
- Cranial and peripheral neuropathy
- Skin laxity
- Renal and cardiac failure

Treatment
Penetrating keratoplasty if severe

Lattice dystrophy type III

Inheritance - autosomal dominant

Onset - fourth decade

- Thick, ropey lines and minimal intervening haze
- May be asymmetrical and initially unilateral

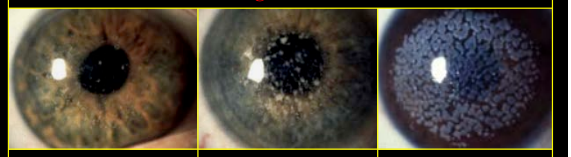
Treatment - penetrating keratoplasty if severe

Granular dystrophy type I

Inheritance - autosomal dominant

Onset - first decade with recurrent corneal erosions

Progression



Initial superficial and central crumb-like opacities | Later deeper and peripheral spread but limbus spared | Eventual confluence

Treatment - penetrating keratoplasty if severe

Granular dystrophy type II

Inheritance - autosomal dominant

Onset - fourth or fifth decade with mild recurrent erosions

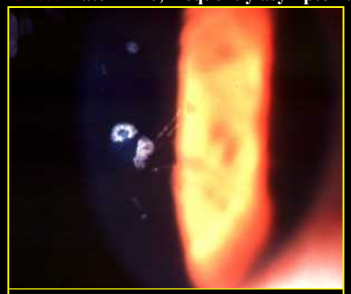
Superficial, discrete crumb-like opacities

Treatment - penetrating keratoplasty if severe

Granular dystrophy type III (Avellino)

Inheritance - autosomal dominant

Onset - late in life; frequently asymptomatic

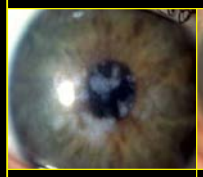
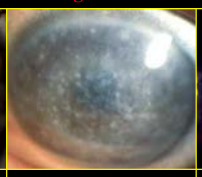
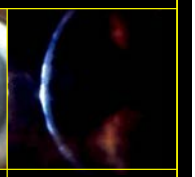


- Few, superficial, discrete, ring-shaped lesions
- Increase in density and size with time

Treatment - not required

Macular dystrophy

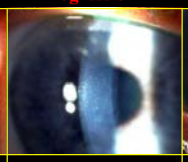
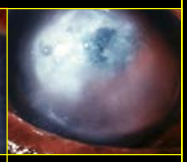
Inheritance - autosomal recessive
Onset - second decade with painless visual loss

Progression		
		
Initial dense, poorly delineated opacities	Later generalized opacification	Thinning

Treatment - penetrating keratoplasty

Fuchs endothelial dystrophy

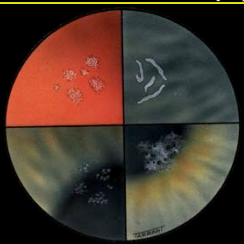
Inheritance - occasionally autosomal dominant
Onset - old age

Progression		
		
Gradual increase in cornea guttata with peripheral spread	Later central stromal oedema	Eventually bullous keratopathy

Treatment - penetrating keratoplasty if advanced

Posterior polymorphous dystrophy

Inheritance - usually autosomal dominant
Onset - difficult to determine because asymptomatic



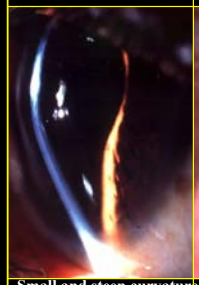
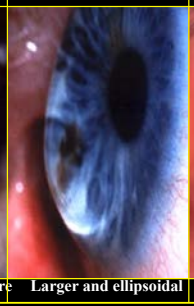
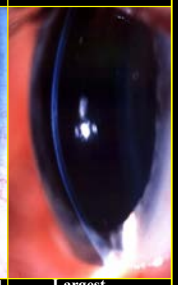
- Subtle, vesicular, geographic, or band-like lesions
- Frequently asymmetrical

Treatment - not required

CORNEAL ECTASIAS

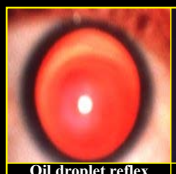
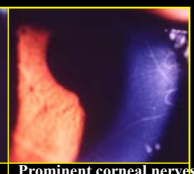
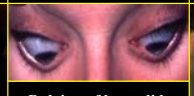
1. Keratoconus
2. Keratoglobus
3. Pellucid marginal degeneration

Morphological classification of keratoconus

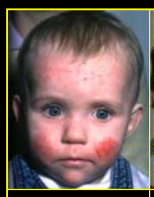
Nipple cone	Oval cone	Globus cone
		
Small and steep curvature	Larger and ellipsoidal	Largest

Signs of keratoconus

Bilateral in 85% but asymmetrical

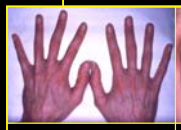
		
Oil droplet reflex	Vogt striae	Prominent corneal nerves
	 Bulging of lower lids on downgaze	
Fleischer ring & scarring	Munson sign	Acute hydrops

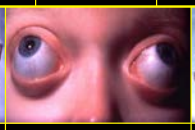
Systemic associations of keratoconus


Atopic dermatitis


Down syndrome

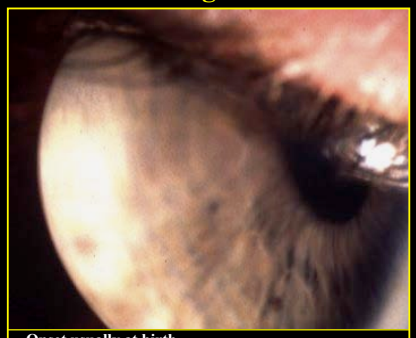

Ehlers-Danlos syndrome


Marfan syndrome


Crouzon syndrome


Osteogenesis imperfecta

Keratoglobus



- Onset usually at birth
- Bilateral protrusion and thinning of entire cornea
- Associations - Leber congenital amaurosis and blue sclera

Pellucid marginal degeneration

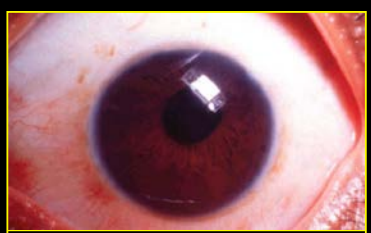
- Onset between 20 and 40 years
- Bilateral crescent-shaped inferior corneal thinning

CONGENITAL CORNEAL ANOMALIES

1. Microcornea
2. Megalocornea
3. Sclerocornea
4. Cornea plana
5. Keratectasia

Microcornea

- Very rare, hereditary, unilateral or bilateral
- Corneal diameter is 10 mm or less
- Shallow anterior chamber but other dimensions are normal



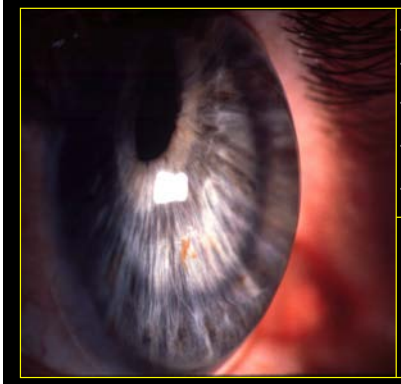
Ocular associations

Glaucoma, cataract, cornea plana, leukoma and iris abnormalities

Associated systemic syndromes

Turner, Ehlers-Danlos, Weill-Marchesani and Waardenburg

Megalocornea



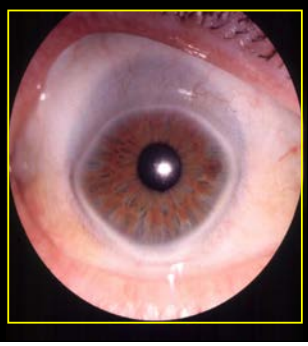
- Very rare, hereditary, bilateral
- Corneal diameter 13 mm or more
- Very deep anterior chamber
- High myopia and astigmatism
- Occasionally lens subluxation

Systemic associations

- Marfan, Apert, Ehlers-Danlos and Down syndromes
- Osteogenesis imperfecta
- Renal carcinoma and mental handicap

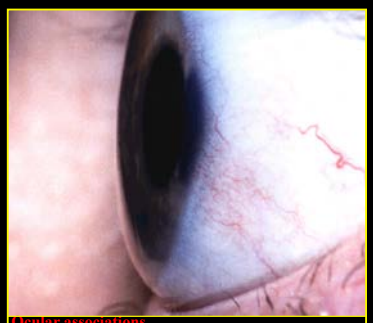
Sclerocornea

- Very rare, usually bilateral
- Peripheral opacification and vascularization of cornea
- 'Scleralization' makes cornea appear smaller



Cornea plana

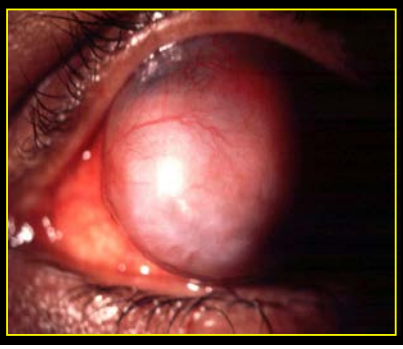
- Very rare, bilateral severe decrease in corneal curvature
- Hypermetropia and shallow anterior chamber



Ocular associations
Glaucoma, microcornea, microphthalmos and Peters anomaly

Keratectasia

- Very rare, usually unilateral
- Severe corneal opacification and protruberance
- Probably caused by intrauterine keratitis



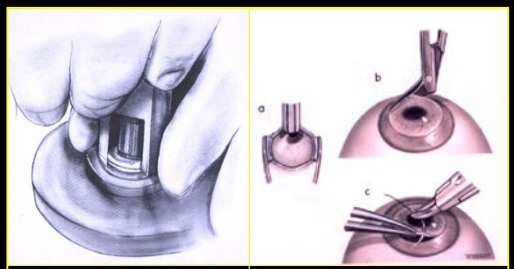
CORNEAL SURGERY

1. Penetrating keratoplasty
2. Keratoprosthesis
3. Refractive surgery
   - Radial keratotomy
   - Photorefractive keratectomy (PRK)
   - Laser in-situ keratomileusis (LASIK)
   - Non-contact laser thermal keratoplasty

Penetrating Keratoplasty

1. Indications
   - Optical (e.g. bullous keratopathy, dystrophies)
   - Tectonic (e.g. severe stromal thinning, descemetocele)
   - Therapeutic (e.g. severe keratitis)
   - Cosmetic
2. Adverse prognostic factors
   - Severe stromal vascularization
   - Absence of corneal sensation
   - Progressive conjunctival inflammation (e.g. pemphigoid)
   - Tear film dysfunction
   - Glaucoma

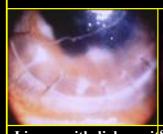
Technique of penetrating keratoplasty



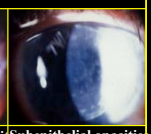
Excision of donor tissue	a, b - Excision of host tissue c - Fixation of donor tissue

Signs of late graft rejection

Epithelial

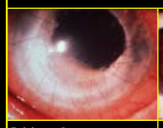


Linear epithelial opacities

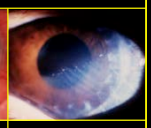


Subepithelial opacities

Endothelial



Iritis and inflammation at graft-host junction



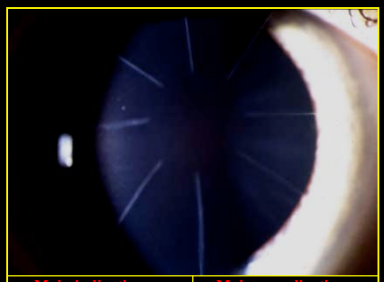
Endothelial precipitates (Khodadoust line)

Treatment

- Intensive topical and periocular steroids
- Occasionally systemic steroids

Radial keratotomy

- Decreases myopia by flattening cornea
- Deep incisions from edge of optical zone to limbus

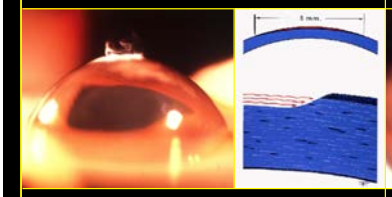
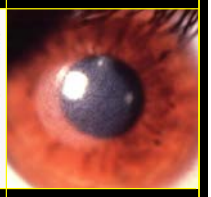


Main indications	Main complications
· Stable myopia of up to 8D · Otherwise normal cornea	· Accidental perforation · Intrastromal epithelial cysts

Photorefractive keratectomy (PRK)

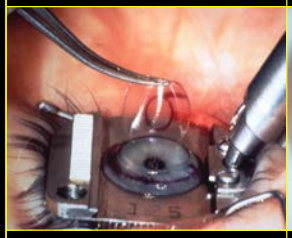
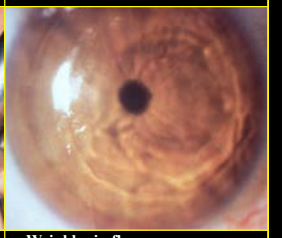
Indications

- Stable myopia up to 6D with astigmatism no more than 3D
- Hypermetropia up to 2.5D

Technique	Main complication
	
Reshaping of cornea by excimer laser ablation of Bowman layer and anterior stroma	Subepithelial haze which usually resolves after 1-6 months

Laser *in-situ* keratomileusis (LASIK)

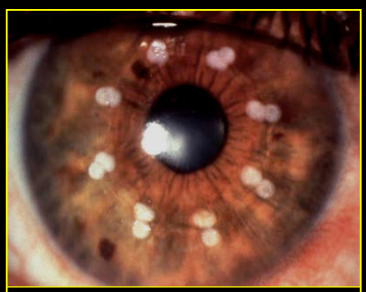
Indications - similar to PRK but corrects higher degrees of myopia

Technique	Complications
	
· Thin flap of cornea fashioned · Bed treated with excimer laser · Flap repositioned	· Wrinkles in flap · Cellular interface proliferation

Non-contact laser thermal keratoplasty

Indications

- Patients over 40 years with hypermetropia up to 2D
- Following overcorrection of myopia



- Corneal curvature is steepened by application of laser heat to stroma
- Holmium laser spots applied to mid-cornea

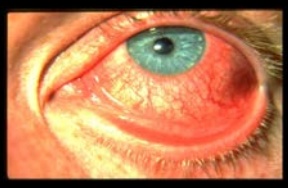
Red Eye

Introdution

- Relevance
  - Red Eye
    - Frequent presentation to GP
    - Must be able to differentiate between serious vision threatening conditions and simple benign conditions

Basics

- Red Eye
  - Refers to hyperemia of the superficially visible vessels of the conjunctiva, episclera, or the sclera
  - Caused by disorders of these structures themselves, or of adjacent structures like the eyelids, cornea, iris, and ciliary body



Differential diagnosis of red eye

- Conjunctival
  - Blepharoconjunctivitis
  - Bacterial conjunctivitis
  - Viral conjunctivitis
  - Chlamydial conjunctivitis
  - Allergic conjunctivitis
  - Toxic/chemical reaction
  - Dry eye
  - Pinguecula/pteyrgium
- Lid diseases
  - Clalazion
  - Sty
  - Abnormal lid function
- Corneal disease
  - Abrasion
  - Ulcer
- Foreign body
- Dacryoadenitis
- Dacryocystitis
- Masquerade syndrome
- Carotid and dural fistula
- Acute angle glaucoma
- Anterior uveitis
- Episcleritis/scleritis
- Subconjunctival hemorrhage
- Factitious

Blepharitis

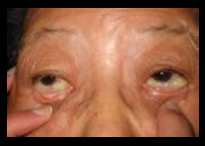
- Adults > children
- Inflammation of the lid margin
- Frequently associated with styes
- Meibomian gland dysfunction
- Lid hygiene, topical antibiotics, and lubricants are the mainstays of treatment

Bacterial Conjunctivitis

- Both adults and children
- Tearing, foreign body sensation, burning, stinging and photophobia
- Mucopurulent or purulent discharge
- Lid and conjunctiva maybe edematous
- Streptococcus pneumoniae, Haemophilus influenzae, and staphylococcus aureus and epidermidis
- Conjunctival swab for culture
- Topical broad spectrum antibiotics

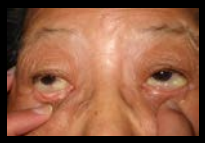
Viral Conjunctivitis

- Acute, watery red eye with soreness, foreign body sensation and photophobia
- Conjunctiva is often intensely hyperaemic and there maybe follicles, haemorrhages, inflammatory membranes and a pre-auricular node
- The most common cause is an adenoviral infection
- No specific therapy but cold compresses are helpful



Allergic Conjunctivitis

- Encompasses a spectrum of clinical condition
- All associated with the hallmark symptom of itching
- There is often a history of rhinitis, asthma and family history of atopy
- Signs may include mildly red eyes, watery discharge, chemosis, papillary hypertrophy and giant papillae
- Treatment consist of cold compresses, antihistamines, nonsteroidals, mast cells stabilizers, topical corticosteroids and cyclosporine



Chlamydial Conjunctivitis

- Usually occur in sexually active individuals with or without an associated genital infection
- Conjunctivitis usually unilateral with tearing, foreign body sensation, lid crusting, conjunctival discharge and follicles
- There is often non-tender preauricular node
- Treatments requires oral tetracycline or azithromycin

Dry Eye

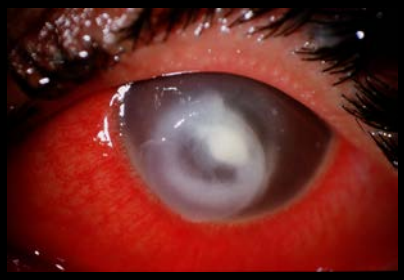
- Symptoms
  - Burning or foreign body sensation
  - Tearing
  - Usually bilateral
- Etiology
  - Idiopathic
  - Collagen vascular diseases
  - Conjunctival scarring
  - Infiltration of the lacrimal gland
  - Vitamin A deficiency
- Treatment
  - Artificial tears

Pterygium

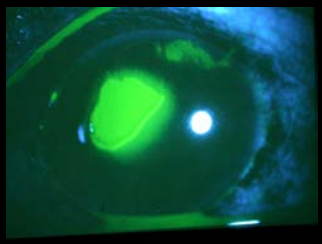
Ectropion

Trichiasis

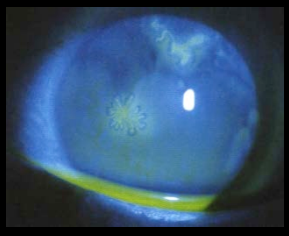
Infectious keratitis



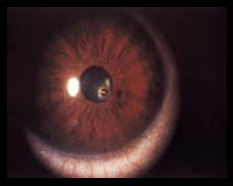
Corneal abrasion



HSV dendrites



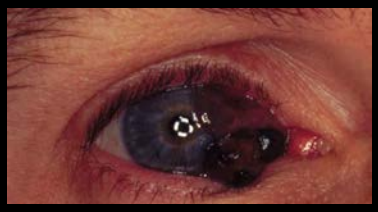
Foreign Body




Nasolacrimal Obstruction

- Can lead to Dacryocystitis
  - Pain, redness, and swelling over the innermost aspect of the lower eyelid, tearing, discharge
  - Organisms
  - Staphylococci, streptococci, and diphtheoids
  - Treatment
    - Systemic antibiotics
    - Surgical drainage

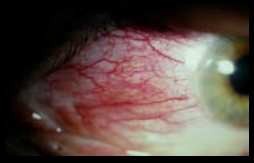
Conjunctival tumor



Iritis

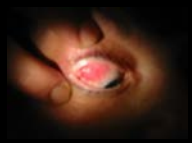
Episcleritis

- Episcleritis
  - Can be localized (sectorial) or diffuse redness
  - Often asymptomatic
  - Usually self limited
  - Treatment is topical or systemic NSAIDs



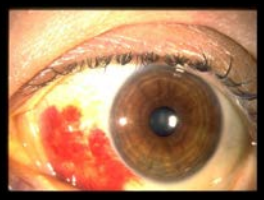
Scleritis

- Pain which maybe severe with tenderness, tearing and photophobia
- Maybe localized, diffuse or associated with nodules
- Can result in scleral necrosis (scleromalacia perforance)
- 30 to 60 % may have an associated systemic diseases
  - RA ……
- May need systemic steroid



Subconjunctival Hemorrhage

- Usually asymptomatic
- Blood underneath the conjunctiva, often in a sector of the eye
- Etiology
  - Valsalva (coughing or straining)
  - Traumatic
  - Hypertension
  - Bleeding disorder
  - idiopathic



Red Eye Treatment Algorithm

- History
  - Trauma
  - Contact lens wearer
  - Severe pain/photophobia
  - Significant vision changes
  - History of prior ocular diseases
- Exam
  - Abnormal pupil
  - Ocular tenderness
  - White corneal opacity
  - Increased intraocular pressure

YES

Refer urgently to ophthalmologist

Is it conjunctivitis?

- History
  - Itching
  - Exposure to person with red eye
  - URTI
  - Past history of conjunctivitis
  - Discharge with morning crusting
  - Exposure to drugs
- Signs
  - Discharge
  - Lid and conjunctival edema
  - Conjunctival redness
  - Preauricular lymph node
  - Facial or eye lid vesicles

Thank you