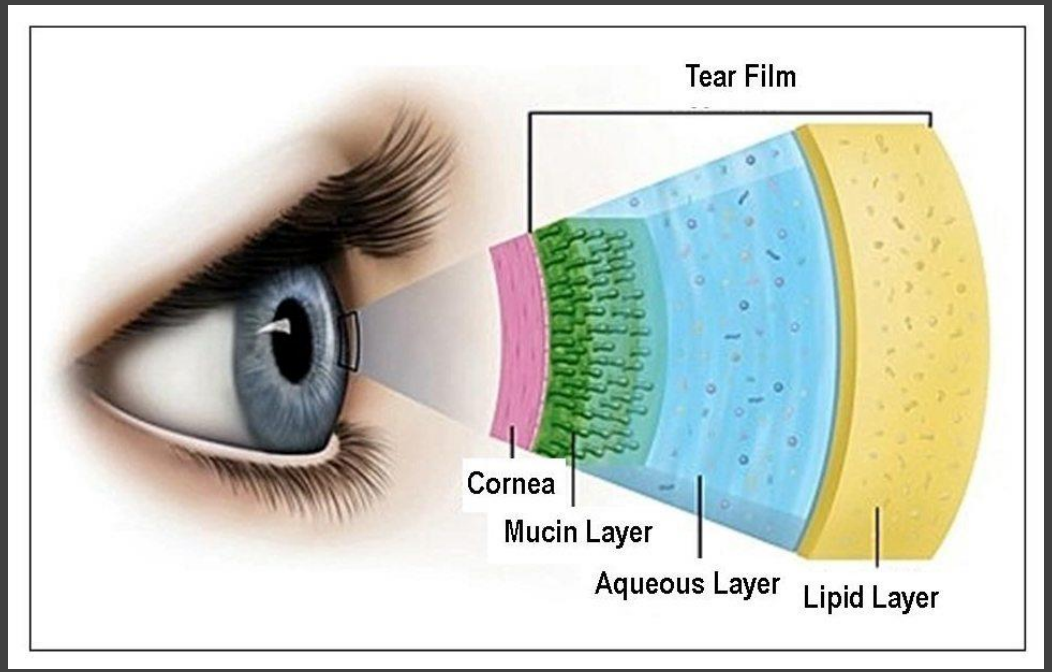
DRY EYE

TEAR FILM

Wolff - first to describe the detailed structure of the fluid covering the cornea → precorneal film.

3 layers:		
Mucus layer	Aqueous layer	Lipid/oily layer



Mucus layer

Innermost layer

About 0.2 µm thick

Consists of mucin (a glycoprotein) secreted by conjunctival goblet cells and glands of Manz

It converts the hydrophobic corneal surface into hydrophilic one by adhering to the glycocalyx on corneal microvilli

Vital role in the stability of tear film

Aqueous layer

The bulk of tear film (7.0 µm)

Intermediate layer

Consists of tears secreted by the main and accessory lacrimal glands

The tears → water and small quantities of solutes such as sodium chloride, sugar, urea and proteins

Alkaline and salty in taste

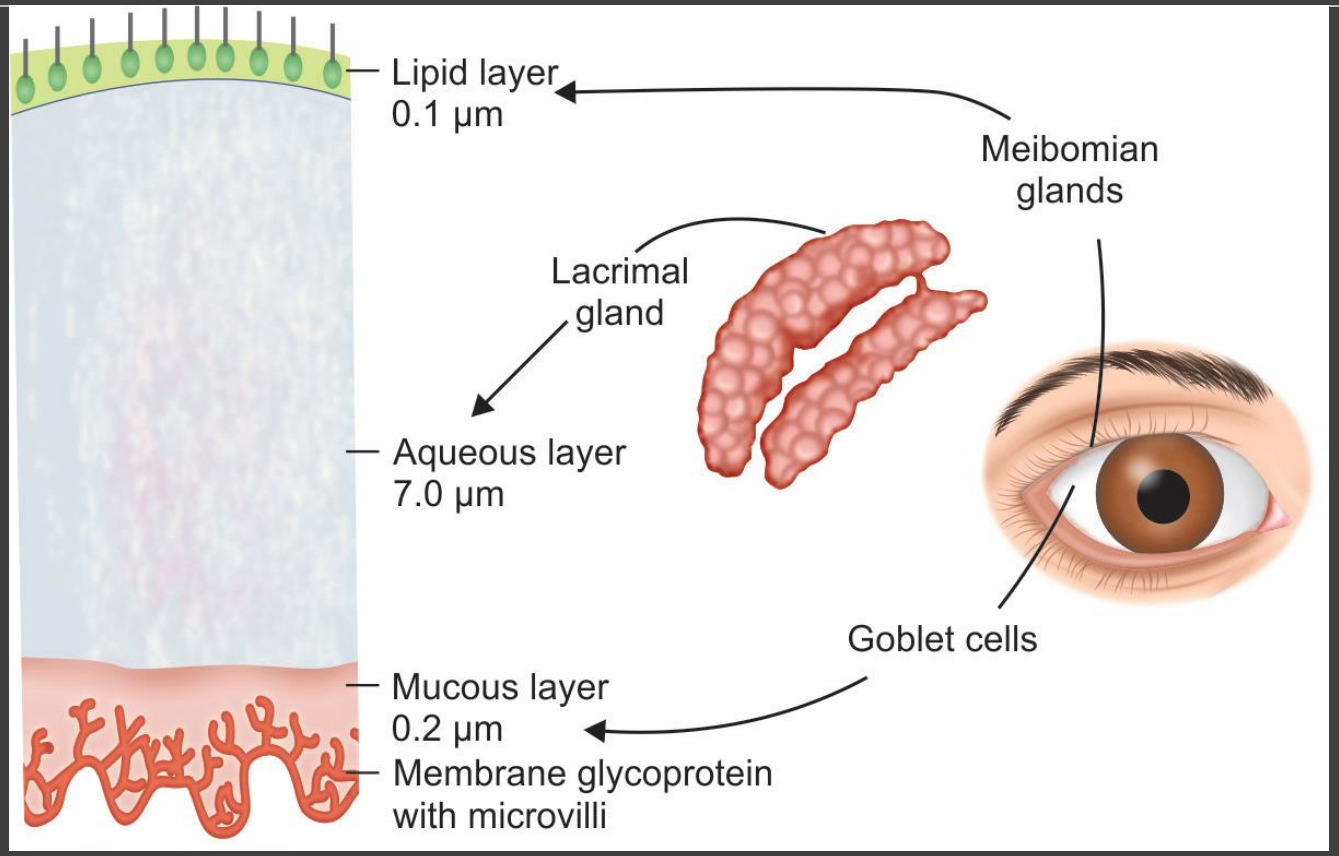
Antibacterial substances like lysozyme, betalysin and lactoferrin.

Lipid layer

Outermost and thinnest (0.1 µm) layer of tear film formed at air-tear interface

Secretions of Meibomian, Zeis, and Moll glands

Prevents the overflow of tears, retards their evaporation and lubricates the eyelids as they slide over the surface of the globe


Lipid layer
0.1 μm
Meibomian
glands
Lacrimal
gland
Aqueous layer
7.0 μm
Goblet cells
Mucous layer
0.2 μm
Membrane glycoprotein
with microvilli

Functions of tear film

1. Forms *smooth optical surface* on cornea by filling in and smoothening small surface irregularities

2. *Keeps* moist the cornea and conjunctiva.

3. *Provides oxygen* to the corneal epithelium.

4. *Washes away debris* and noxious irritants.

5. *Prevents infection* due to presence of anti-bacterial substances.

6. *Facilitates movements* of the lids over the globe

Tear secretion

Tears are continuously secreted throughout the day by

- Accessory lacrimal glands *(basal secretion)*
- Main lacrimal glands *(reflex secretion)*

Reflex secretion – in response to sensations from the cornea and conjunctiva, probably produced by evaporation and breakup of tear film

Hyperlacrimation – due to irritative sensations from the cornea and conjunctiva

Afferent pathway - fifth nerve

Efferent pathway - by parasympathetic (secretomotor) supply of lacrimal gland.

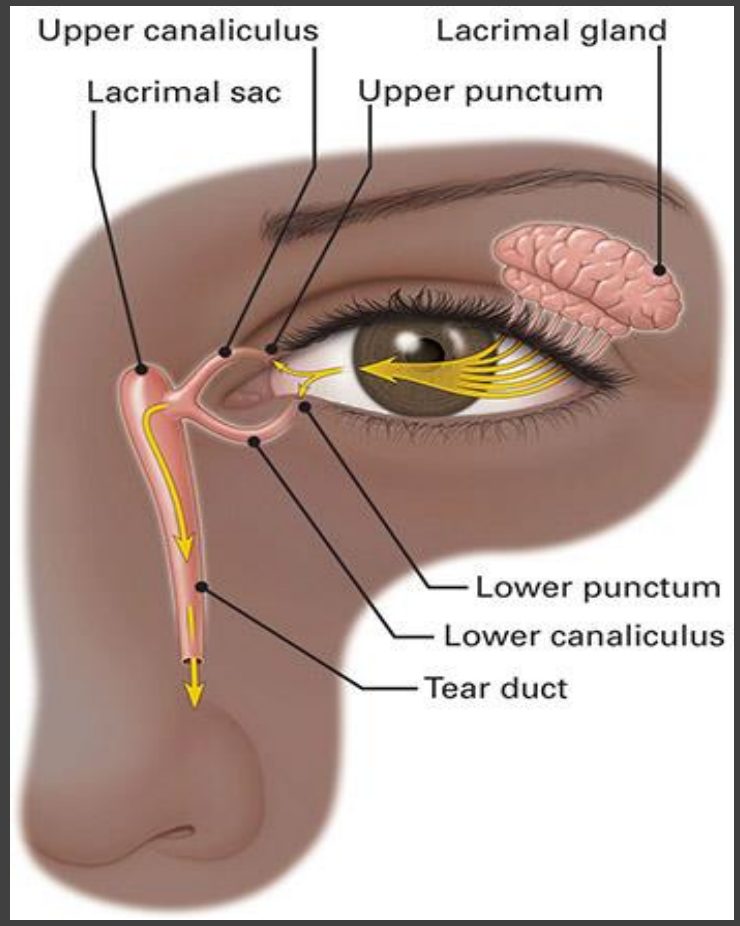
Elimination of tears

From the lacrimal gland, the tears flow downwards and laterally across the ocular surface

A variable amount of tears is lost by evaporation from the ocular surface

The remainder of tears flow along the superior and inferior marginal strips and collects as *lacus lacrimalis* in the inner canthus

Drained by the lacrimal passage into the nasal cavity.



70% tears is drained via inferior canaliculus and 30% via the superior canaliculus

By an active lacrimal pump mechanism constituted by the fibres of orbicularis oculi

Lacrimal pump mechanism

When the eyelids close with each blink there occurs:

• *Contraction of pretarsal orbicularis oculi* which compresses the ampulla and shortens the canaliculi

- This movement propels the tear fluid present in the ampulla and horizontal part of canaliculi towards the lacrimal sac.

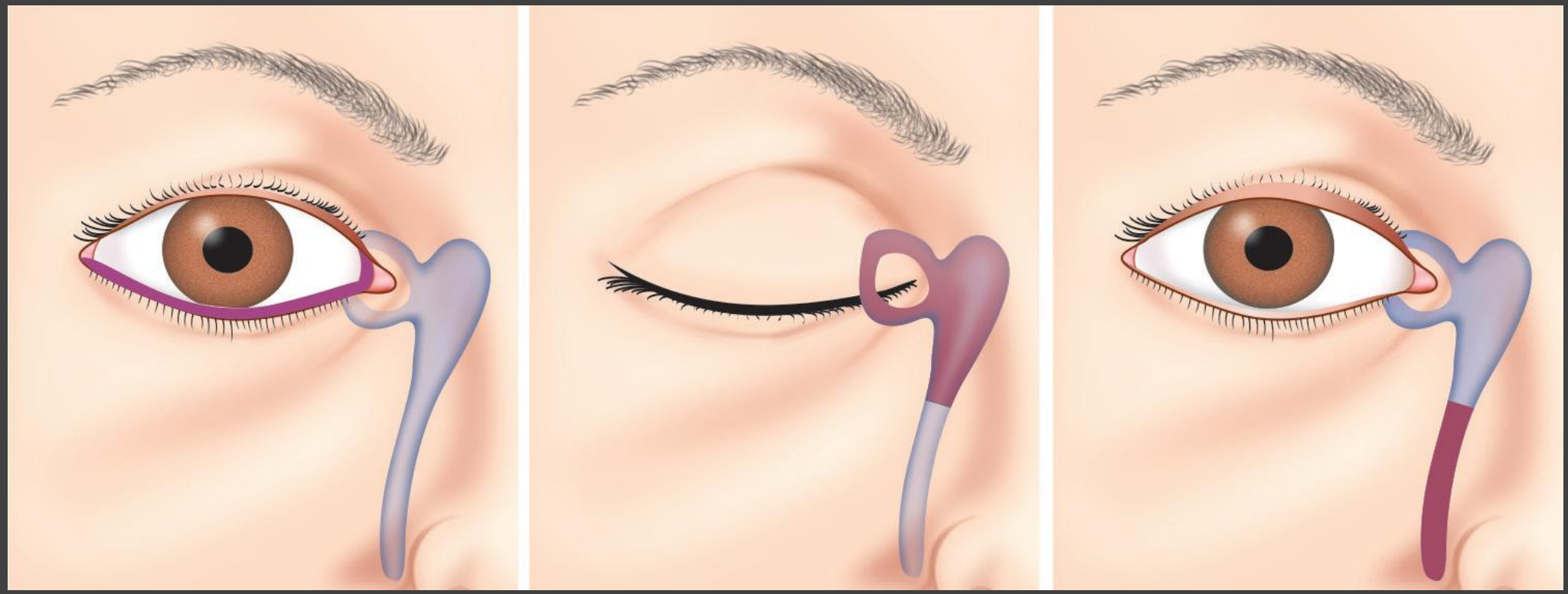
• *Contraction of preseptal fibers of orbicularis* distends the lacrimal sac and creates therein a negative pressure which draws the tear fluid from canaliculi into the lacrimal sac

When the eyelids open following events occur:

• *Relaxation of pretarsal orbicularis* allows the canaliculi and ampulla to expand and reopen, and to draw the tear fluid from the lacus lacrimalis and marginal tear strips.

• *Relaxation of preseptal fibres (Horner's muscle)* results in collapse of sac, as a consequence a positive pressure is created which forces the tears down the NLD into the nose

- Gravity also helps in downward flow of tears along the NLD



In atonia of sac, tears are not drained through the lacrimal passages in spite of anatomical patency → ***epiphora***

DRY EYE

Symptom complex occurring as a sequelae to deficiency or abnormalities of the tear film

ETIOLOGY

According to International Dry Eye Workshop report (DEWS report 2007), the causes of dry eye can be classified as :

1. Aqueous deficiency dry eye
2. Evaporative dry eye

Aqueous deficiency dry eye (Keratoconjunctivitis sicca)

SJOGREN'S SYNDROME

Primary keratoconjunctivitis sicca

Autoimmune disease primarily affecting body's exocrine glands, esp lacrimal and salivary glands

NON-SJOGREN'S KERATOCONJUNCTIVITIS SICCA

1. *Primary age-related hyposecretion* – most common cause

2. *Lacrimal gland deficiencies*
   - Congenital alacrima
   - Infiltrations of lacrimal gland – sarcoidosis
   - Tumours
   - Post-radiation fibrosis of lacrimal gland
   - Surgical removal.

Aqueous deficiency dry eye (Keratoconjunctivitis sicca)

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Autoimmune disease primarily affecting body's exocrine glands, esp lacrimal and salivary glands

NON-SJOGREN'S KERATOCONJUNCTIVITIS SICCA

3. *Lacrimal gland duct obstruction*
   - Old trachoma
   - Chemical burns
   - Cicatricial pemphigoid
   - Stevens-Johnson syndrome.

Aqueous deficiency dry eye (Keratoconjunctivitis sicca)

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Autoimmune disease primarily affecting body's exocrine glands, esp lacrimal and salivary glands

NON-SJOGREN'S KERATOCONJUNCTIVITIS SICCA

4. *Reflex hyposecretion* (neurogenic causes)
   - Familial dysautonomia (Riley-Day syndrome)
   - Parkinson disease
   - Reflex sensory block, reflex motor block
   - 7th cranial nerve damage
   - Reduced corneal sensations after refractive surgery
   - Contact lens wear.

Evaporative dry eye

Conditions which decrease tear film stability and thus increase evaporation

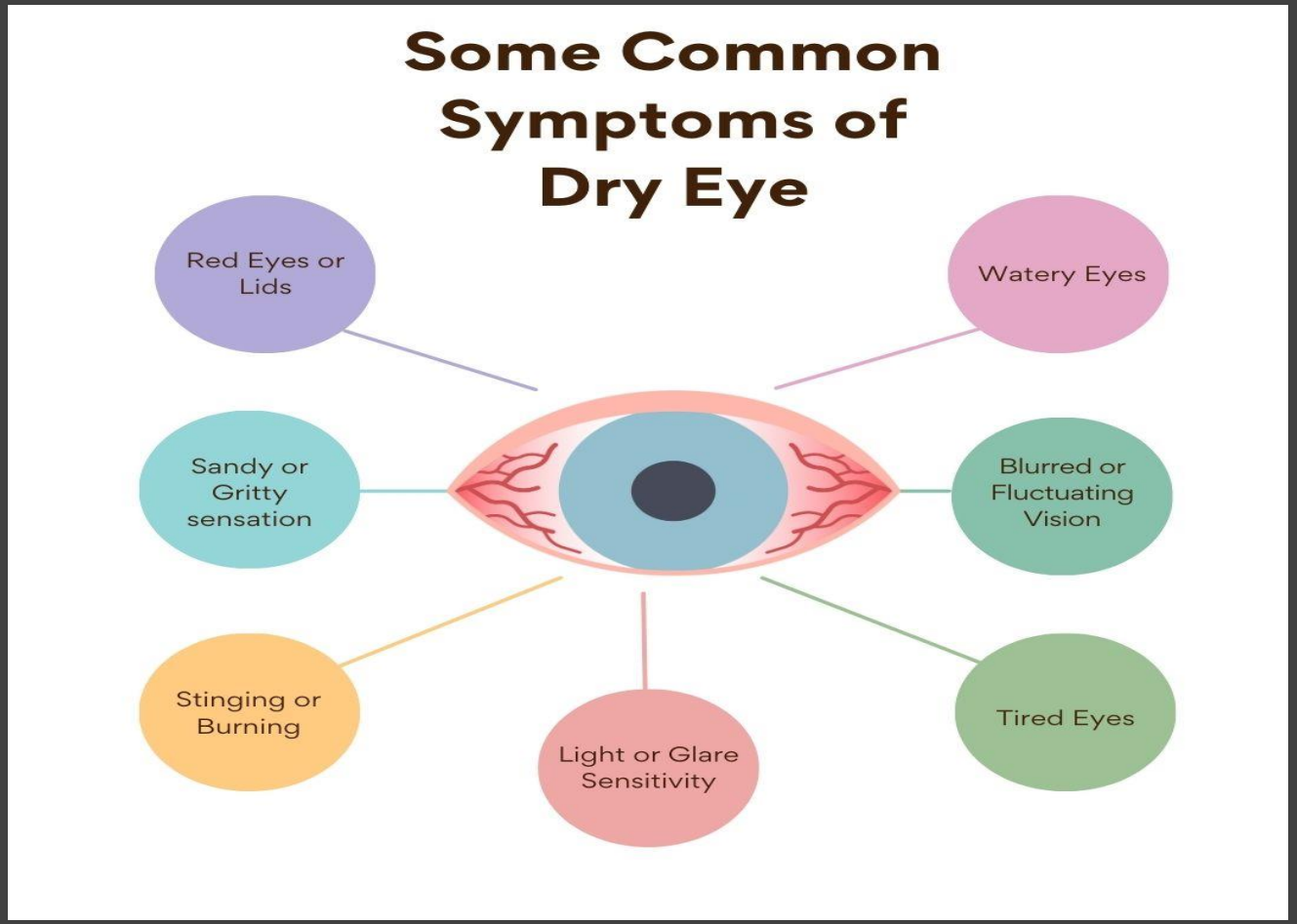
1. *Meibomian gland dysfunction* as seen in chronic posterior blepharitis, rosacea, and congenital absence of meibomian glands.

2. *Lagophthalmos* as seen in facial nerve palsy, severe proptosis, symblepharon and eyelid scarring.

3. *Defective blinking* such as low blink rate as seen in prolonged computer users and other causes.

4. *Vitamin A deficiency and other factors affecting ocular surface*, e.g., topical drugs, preservatives, contact lens wear, ocular surface allergic disease and scarring disorders.

Clinical features



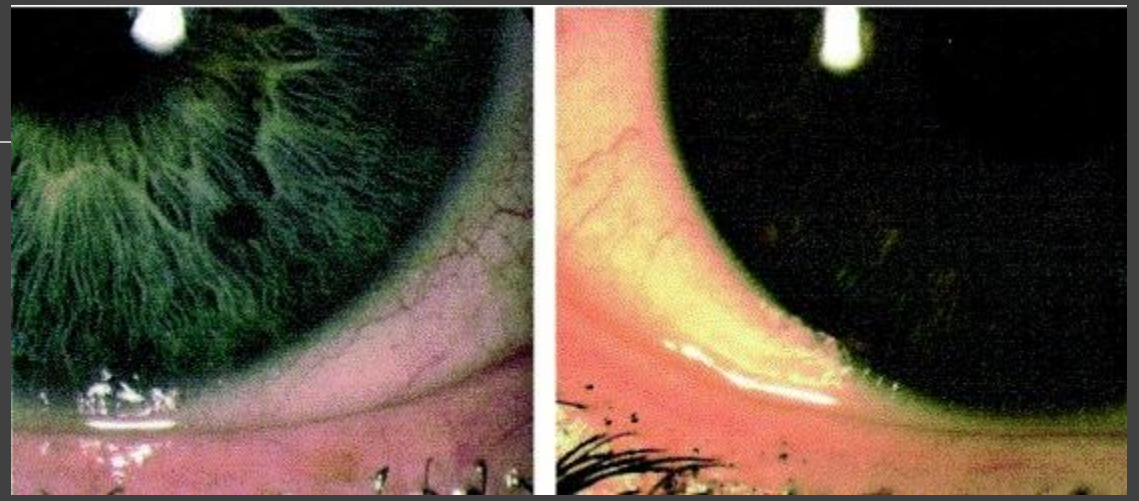
Signs

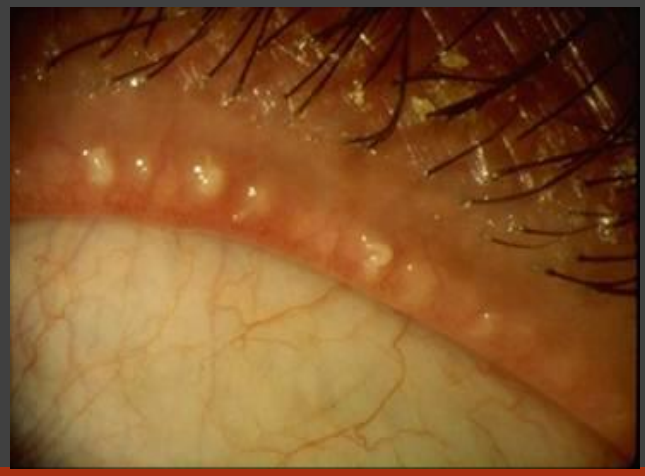
Tear film signs

Presence of stringy mucous and particulate matter

Marginal tear strip is reduced or absent (normal height is 1 mm)

Froth in the tears along the lid margin is a sign of meibomian gland dysfunction



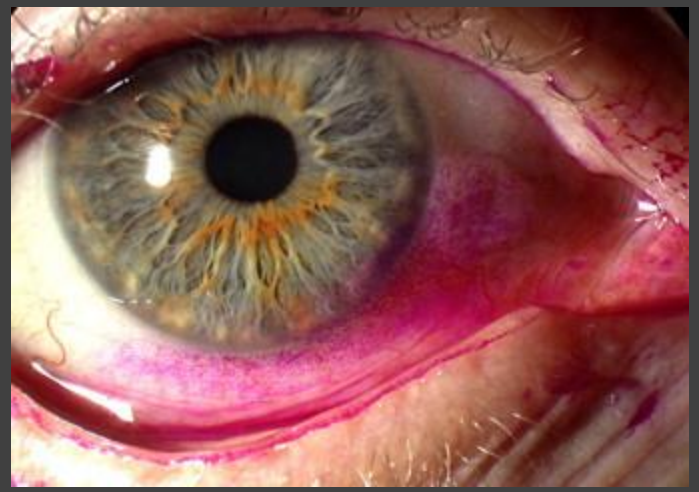


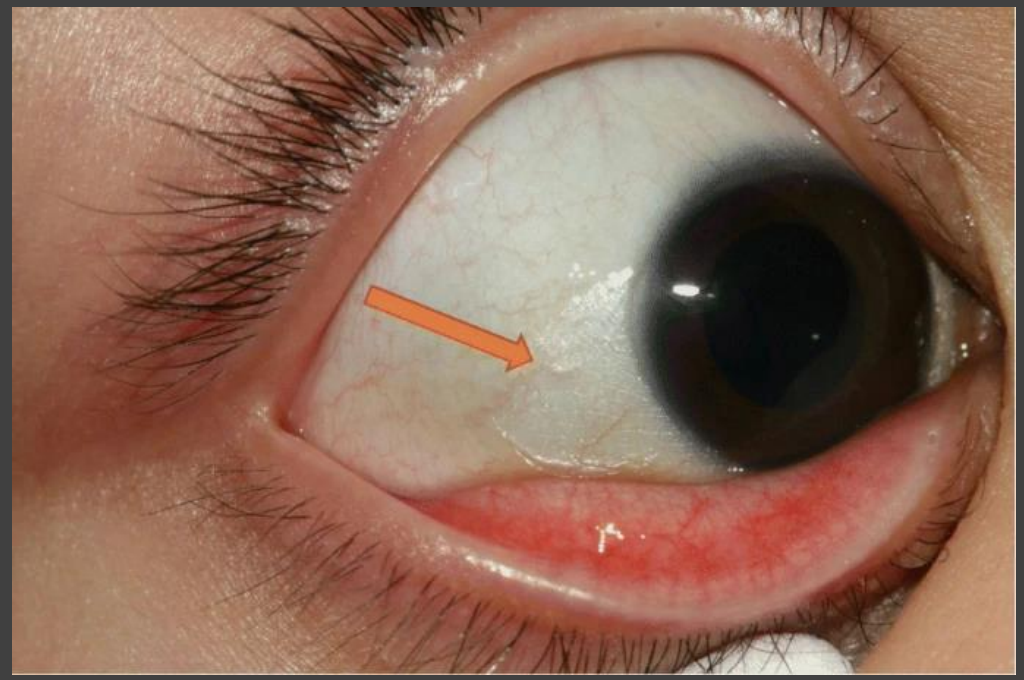
Conjunctival signs

Becomes lustreless, mildly congested

Conjunctival xerosis and keratinization

Rose Bengal or Lissamine green staining may be positive



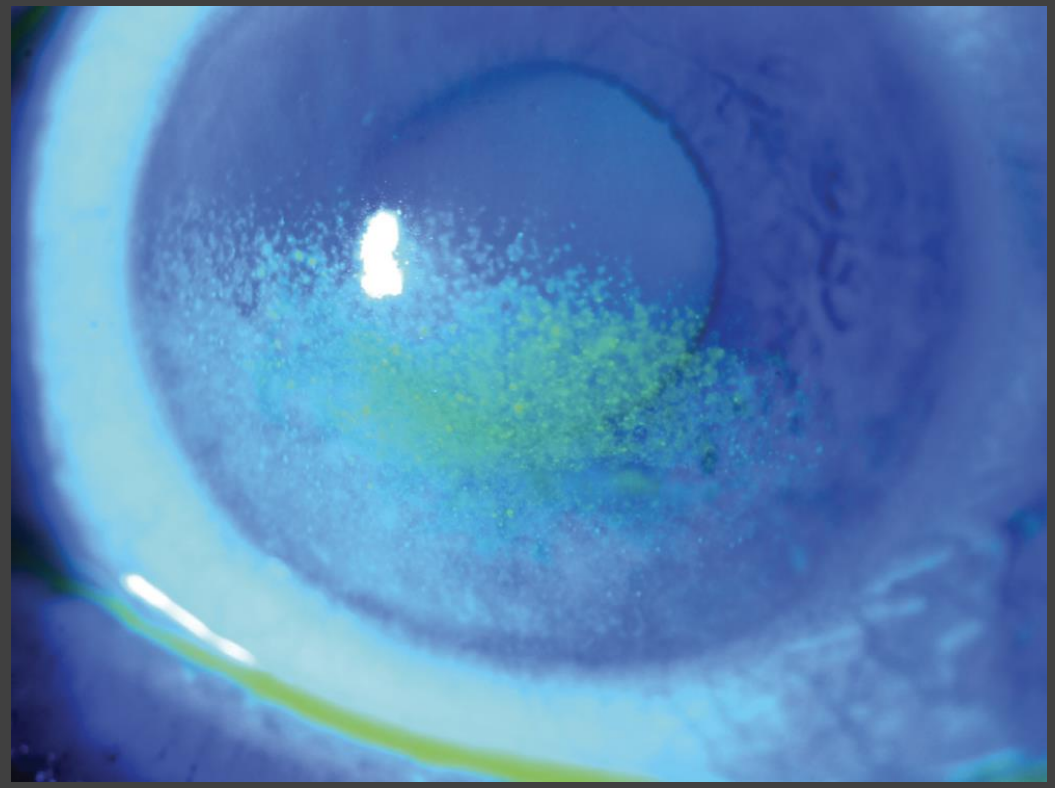


Corneal signs

Punctate epithelial erosions, filaments and mucus plaques

Cornea may loose lustre.

Vital stains - fluorescein, Rose Bengal or Lissamine green may delineate the above lesions



Signs of causative disease

Posterior blepharitis, conjunctival scarring diseases (trachoma, Stevens-Johnson syndrome, chemical burns, ocular pemphigoid) and lagophthalmos

TEAR FILM TESTS

Tear film break-up time (TBUT)

Schirmer-I test

Vital staining with Rose Bengal

Tear levels of lysozyme and lactoferrin

Tear osmolarity

Conjunctival impression cytology

Tear film break-up time (TBUT)

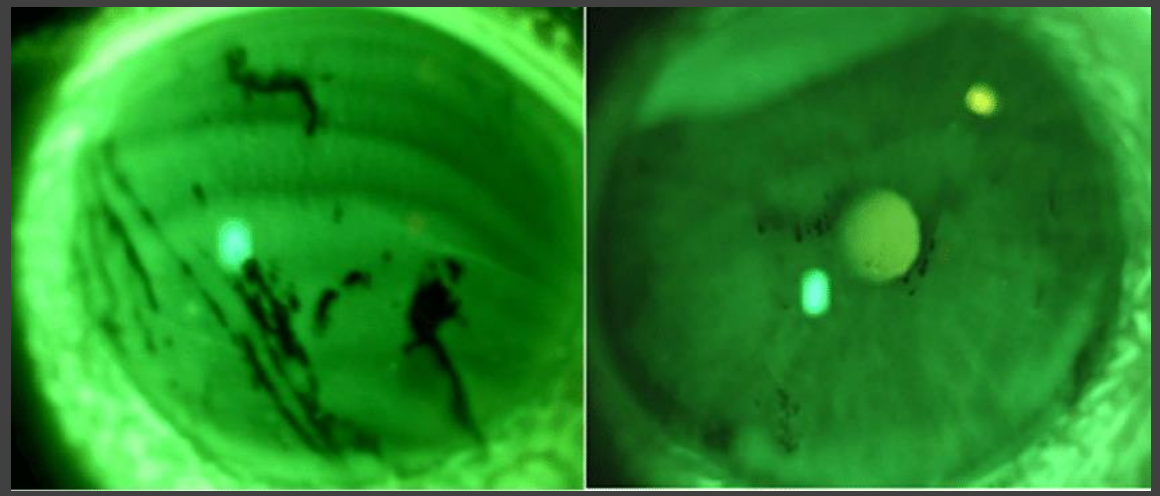
Interval between a complete blink and appearance of first randomly distributed dry spot on the cornea

Noted after instilling a drop of fluorescein and examining in a cobalt-blue light of a slit-lamp

Indicator of adequacy of mucin component of tears

Normal values range from 15 to 35 seconds

Values < 10 seconds imply an unstable tear film



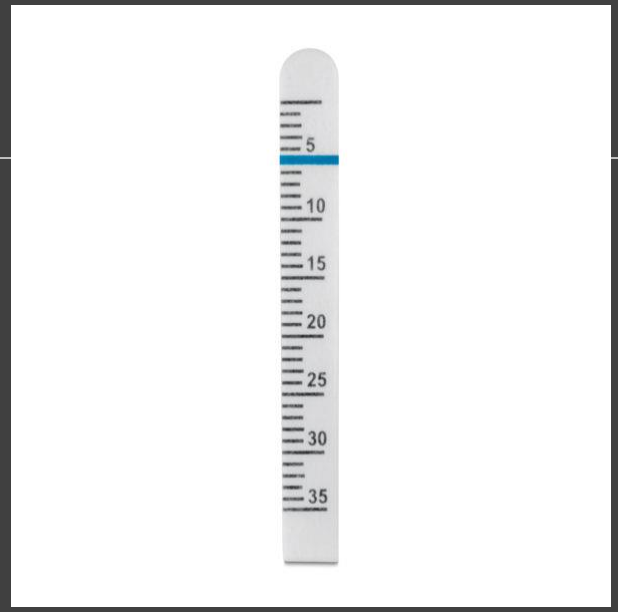
Schirmer-I test

Measures total tear secretions

Performed with the help of a 5 × 35 mm strip of Whatman-41 filter paper

Folded 5 mm from one end and kept in the lower fornix at the junction of lateral one-third and medial two-thirds

The patient is asked to look up and not to blink or close the eyes



Schirmer-I test

After 5 minutes wetting of the filter paper strip from the bent end is measured.

Normal values of Schirmer-I test are more than 15 mm

Values of 5-10 mm → moderate to mild KCS

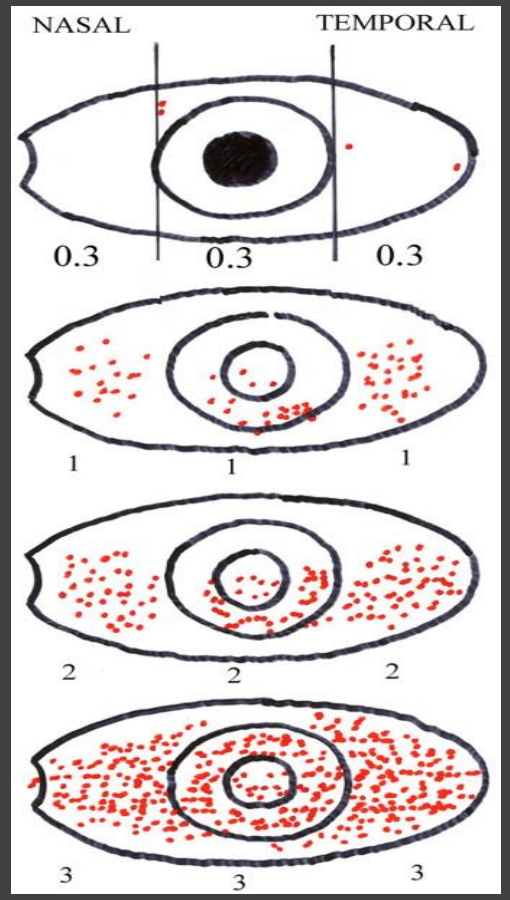
Less than 5 mm → severe KCS

Rose Bengal staining

Very useful test for detecting even mild cases of KCS

Depending upon the severity of KCS three staining patterns A, B and C have been described:

- ‘C’ pattern represents mild or early cases with fine punctate stains in the interpalpebral area
- ‘B’ the moderate cases with extensive staining
- ‘A’ the severe cases with confluent staining of conjunctiva and cornea



Grading of dry eye severity

Based on severity of signs and tear film tests recommended by Dry Eye Workshop (DEWS) Report (2007)

- Level 1 (mild dry eye)
- Level 2 (moderate dry eye)
- Level 3 (severe dry eye)
- Level 4 (very severe dry eye)

TREATMENT

At present, there is no cure for dry eye.

1. *Supplementation with tear substitutes*

Artificial tears remains the mainstay in the treatment of dry eye

Available as drops, ointments and slow-release inserts.

Artificial tear drops contain either cellulose derivatives (0.25 to 0.7% methyl cellulose and 0.3% hypromellose) or polyvinyl alcohol (1.4%).

2. *Topical cyclosporine* (0.05%, 0.1%) is reported to be very effective drug for dry eye in many recent studies

Helps by reducing the cell-mediated inflammation of the lacrimal tissue

3. *Mucolytics*

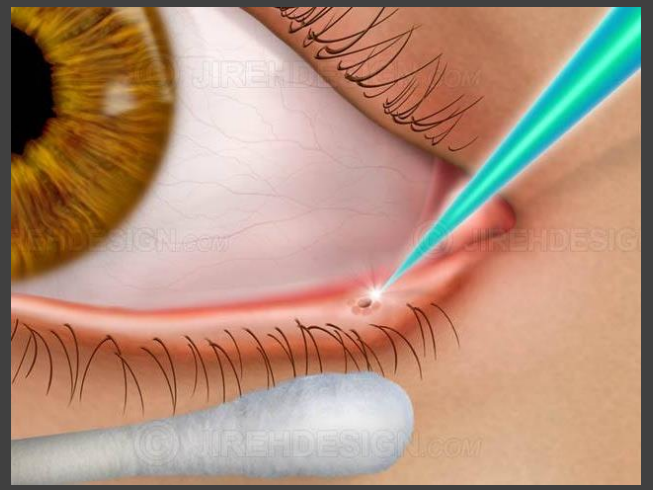
5% acetylcystine used 4 times a day

Helps by dispersing the mucus threads and decreasing tear viscosity.

4. ***Preservation of existing tears by reducing evaporation and decreasing drainage***

- *Evaporation can be reduced* by decreasing room temperature, use of moist chambers and protective glasses

- *Punctal occlusion* to decrease drainage can be carried out by collagen implants, cyanoacrylate tissue adhesives, electrocauterisation, argon laser occlusion and surgical occlusion to decrease the drainage of tears in patients with very severe dry eye



➢ *Permanent lateral tarsorrhaphy* may be required in very severe cases

5. Treatment of the causative disease

- *Systemic tetracyclines* and *lid hygiene* in patients with chronic posterior blepharitis
- *Vitamin A supplement* for the deficiency
- *Treat the cause* of lagophthalmos.

SJOGREN'S SYNDROME

Autoimmune chronic inflammatory disease with multisystem involvement

Typically occurs in women between 40 and 50 years of age

Characteristic feature is an aqueous deficiency dry eye—keratoconjunctivitis sicca (KCS)

- ***Primary Sjogren's syndrome* –** patients present with sicca complex—a combination of KCS and xerostomia (dryness of mouth)
- ***Secondary Sjogren's syndrome*** – dry eye and/or dry mouth are associated with an autoimmune disease, commonly rheumatoid arthritis

Pathological features include focal accumulation and infiltration by lymphocytes and plasma cells with destruction of lacrimal and salivary glandular tissue


thank
you