THE PROTECTION OF THE EYE

(*lacrimal apparatus)*

The lacrimal apparatus consist of:

- **Secretory portion** - lacrimal gland- excretory ducts- gll. lacrimales accesoriae
- **Collecting portion** – puncta- canaliculi- lacrimal sac- lacrimal duct- inferior nasal meatus
- **Accessory lacrimal glands**
  - Goblet cells
  - Krause glands
  - Wolfring glands
  - Crypt of Henle
  - Gland of Manz

Tears

- Tear is a secretion from the lacrimal gland
- It is slightly alkaline and consists mainly of water, small quantities of salts, such as sodium chloride, sugar, urea, protein and lysozyme, a bactericidal enzyme
- The secretion of tear does not begin before 3-4 weeks after birth
- The average normal secretion of tears is 0.5-2.2 ml
- The normal pH of tear is 7.5

Tear film

- **<u>Is composed of three layers:</u>**
    1. **The outer oily layer** (approximately 0.1 µm thick)
        - With its hydrophobic properties, it prevents rapid evaporation like a layer of wax
    2. **The middle watery layer** (approximately 8 µm thick)
        - Its task is to clean the surface of the cornea and ensure mobility of the palpebral conjunctiva over the cornea and a smooth corneal surface *for high-quality optical images*.
    3. **The inner mucin layer** (approximately 0.8 µm thick)
        - This layer prevents the watery layer from forming beads on the cornea and ensures that the *watery layer moistens the entire surface of the cornea and conjunctiva.*
- NB: Lysozyme, beta-lysin, lactoferrin, and gamma globulin (IgA) are **tear-specific proteins** that give the tear fluid *antimicrobial characteristics*

Spread of the tear film

- The tear film is mechanically distributed over the ocular surface through a neuronally controlled blinking mechanism.

- **<u>Three factors are required for effective resurfacing of the tear film:</u>**

1. Normal blink reflex.
2. Contact between the external ocular surface and the eyelids.
3. Normal corneal epithelium.

Examination Methods

1. Evaluation of Tear Formation

- **Schirmer tear testing:**
  - *This test provides information on the quantity of watery component in tear secretion.*
  - ***Test:*** A strip of litmus paper is inserted into the conjunctival sac of the temporal third of the lower eyelid.
    - *Normal:* After about five minutes, at least 15mm of the paper should turn blue due to the alkaline tear fluid.
    - *Abnormal:* Values less than 5mm are abnormal (although they will not necessarily be associated with clinical symptoms).

Tear break-up time (TBUT):

- *This test evaluates the stability of the tear film (lipid layer)*
- ***Test:***
  - Fluorescein dye (10 µl of a 0.125% fluorescein solution) is added to the precorneal tear film.
  - The examiner observes the eye under 10–20 power magnification with slit lamp and cobalt blue filter and notes when the first signs of drying occur :
    - *without the patient closing the eye*
    - with the patient *keeping the eye open as he or she would normally*.
- *Normal:* TBUT of *at least* 10 seconds is normal.

2. Evaluation of Tear Drainage

- **<u>Probing and irrigation:</u>**
- These examination methods are used to locate stenoses and eliminate obstructions
- After application of a topical anesthetic, a conical probe is used to dilate the punctum.
- Then the lower lacrimal system is flushed with a physiologic saline solution introduced through a blunt cannula
- If the passage is *unobstructed,* the solution will drain freely into the nose.
- Canalicular stenosis will result in reflux through the irrigated punctum.
- If the stenosis is deeper, reflux will occur through the opposite punctum

Symptoms and signs of lacrimal system disease

- **Excsessive tear formation indicates :**
  - reflex stimulation of the lacrimal gland- *lacrimation*
  - occlusion in the lacrimal drainage system- *epiphora*
- **Neoplasms or inflammation of lacrimal gland:**
  - Local swelling
  - S- shaped curve of the upper eyelid
  - Pus secretion

Symptoms and signs of lacrimal system disease

- **Decreased tear formation usually indicates:**
  - atrophy of the basic secretors of the conjunctiva and eyelids
  - conjunctival abnormalities
  - Malposition (e.g. ectropion) of the lacrimal puncta.
  - Obstruction at any point along the drainage system
  - Lacrimal pump failure, which may occur secondarily to lower lid laxity or weakness of the orbicularis muscle (e.g. facial nerve palsy).

Disorders of the Lacrimal System

(inflammation)

Dacryoadenitis

- *inflammation of the lacrimal gland*
- **Etiology:**
  - *Pneumococci, staphylococci, streptococci*
  - Acute:
    - associated with infectious diseases such as mumps, measles, scarlet fever, diphtheria, and influenza
  - Chronic:
    - associated with sarcoidosis, sjorgen sy, lymphoma

Dacryoadenitis

- **Symptoms :**
- ***Acute***
  - *unilateral*
  - inflamed *swollen gland* is especially *tender to palpation*
  - The upper eyelid exhibits a characteristic ***S-curve***
- ***Chronic:***
  - bilateral
  - usually there is no pain
    - The symptoms are less pronounced than in the acute form.
    - ***S-curve***

Dacryoadenitis

- **<u>Treatment:</u>**
  - depend on the *underlying disorder*
  - *hot compress*
  - *local antibiotics, antivirals, …*
  - *Systemic KS- chronic form*

Dacryocystitis

- *is an infection or inflammation of the nasolacrimal sac, usually accompanied by blockage of the nasolacrimal duct*

- Congenital
- Aquired
- Acute
- Chronic

Acute dacryocystitis

- *Acute suppurative inflammation of the lacrimal sac*
- **Etiology:**
  - The cause is usually a *stenosis within the lacrimal sac*
  - The retention of tear fluid leads to infection from *STA, Pneumococci, Pseudomonas*
- **Symptoms:**
  - inflamed, painful swelling lacrimal sac
  - Fever
  - lymhadenopathy
  - The pain may be referred as far as the forehead and teeth

Acute dacryocystitis

- **Complications**
  - *Orbital celulitis*
  - An *abscess in the lacrimal sac* may form in advanced disorders
    - it can spontaneously rupture the skin and form a *draining fistula*.
- **Treatment:**
  - local and systemic antibiotics
  - warm compresses
  - stab incision
  - dacryocystorhinostomy

Neonatal dacryocystitis

- **Etiology:**
  - Approximately 6% of newborns have a stenosis of the nasolacrimal duct due to a *persistent mucosal fold* (lacrimal fold or valve of Hasner).
  - The resulting retention of tear fluid provides ideal growth conditions *STA, streptococci, and pneumococci.*
- **Symptoms and diagnostic considerations:**
  - Shortly after birth (usually within two to four weeks), *pus is secreted from the puncta*
  - The disease continues subcutaneously and pus collects in the palpebral fissure
- **Treatment:**
  - antibiotic and antiinflammatory eyedrops and nose drops
  - massaging the region several times daily
  - irrigation

Dry eye disease (DED)

- Is *a multifactorial disease of the ocular surface characterized by a loss of homeostasis of the tear film, and accompanied by ocular symptoms, in which tear film instability and hyperosmolarity, ocular surface inflammation and damage, and neurosensory abnormalities play etiological roles*

- **Keratoconjunctivitis sicca (KCS)**
  - refers to any eye with some degree of dryness
- **Xerophtalmia**
  - describes a dry eye associated with vitamin A deficiency
- **Xerosis**
  - refers to extreme ocular dryness and keratinization that occurs in eyes with severe conjunctival cicatrization
- **Sjorgen syndrome**
  - is an autoimmune inflammatory disease which is usually associated with dry eyes

Classification of DED

- Evaporative loss due to meibomian gland dysfunction is the most common cause of dry eye

- **<u>Causes of evaporative loss include the following:</u>**
- Meibomian gland dysfunction
- Disorders of lid aperture (lagophthalmos, etc)
- Low blink rate
- Vitamin A deficiency (xerophthalmia)
- Topical drugs and preservatives
- Contact lens wear or abuse
- Ocular surface disease (eg, atopic keratoconjunctivitis, etc.)

Classification of DED

- **<u>Causes of deficient aqueous production include the following:</u>**
- SS-associated dry eye disease (primary and secondary)
- Lacrimal gland deficiency or dysfunction
- Lacrimal gland duct obstruction
- Reflex hyposecretion
- Systemic drugs

Dry eye disease

- **Signs and symptoms**
- Foreign-body sensation and ocular dryness and grittiness
- Hyperemia
- Mucoid discharge
- Ocular irritation
- Excessive tearing (secondary to reflex secretion)
- Photophobia
- Fluctuating or blurry vision

Dry eye disease

- **Diagnosis:**
  - Vital staining of corneal and conjunctival epithelium with fluorescein
  - Break-up time test – assesse precorneal tear film stability
  - Schirmer test – mesuring the amount of secretion

Treatmet:

- Education and environmental/dietary modifications
- Artificial tear substitutes, gels, emulsions and ointments
- Serum eye drops. (Autologous)
- Anti-inflammatory agents
- Contact lenses.
- Punctal occlusion
  - Reduces drainage and thereby preserves natural tears and prolongs effect of artificial tears