Don't forget the conjunctiva……..

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Overview
• Basic anatomy & histology
• Lubricating & maintaining healthy surface
• Enabling/predicting successful CL wear
• Defending the ocular surface
• Indicating general health conditions
• Repairing, replenishing, replacing

Basic anatomy
• Thin, transparent mucous membrane
  • Palpebral
    ◦ Lining the inner surface of the lids, from lid margins to fornices
  • Bulbar
    ◦ Covering the sclera from fornices to limbus
  • Plica semilunaris
  • Caruncle

Histology
• Superficial epithelial layer
  ◦ Contains mucin-secreting goblet cells
• Deeper, connective tissue stroma
  ◦ Superficial adenoid layer
    ◦ Contains lymphatic vessels and lymphocytes
  ◦ Deeper fibrous layer
    ◦ Contains most of the blood vessels and nerves
    ◦ Accessory lacrimal glands of Krause & Wolfring
    ◦ Vast numbers of mast cells

Traditional tear film model
• Help to stabilise the tear film
• Ensure aqueous adheres to ocular surface
• “Sticky” mucins make epithelium wettable (not hydrophobic)
• Clear dirt, debris, allergens & pathogens
• …and prevent allergens & pathogens from entering corneal epithelium

Mucins…..
• Conjunctival goblet cells secrete soluble mucin
• Corneal & conjunctival epithelial cells secrete membrane-adherent (sticky) mucin
• Ageing, CL wear, poor nutrition can all deplete goblet cell numbers

Newer tear film model
Reduction of conjunctival mucins can be catastrophic to the tear film:
- Aqueous can’t adhere and its content reduces
- Tears increase in osmolarity (highly concentrated)
- Osmosis draws water from the ocular surface
- Conjunctival epithelium dries (staining)
- Corneal epithelium loses wettability (increased tear breakup time, staining)

It gets worse……!
- Hyperosmolarity provokes inflammation in the conjunctiva…
- …further reducing goblets cells and mucin
- Aqueous can’t adhere to epithelial surface…
- …tears become even more concentrated
- Further inflammation ensues…
- …provoking further damage to the conjunctiva and to the lacrimal gland and meibomian glands
- It’s a vicious circle……that begins with an unhealthy conjunctiva

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"Do my eyes look white?"
Conjunctival hyperaemia [redness]: an indicator of distress
- Hypoxia
  - Limbal hyperaemia
- Infection
  - Bulbar/limbal hyperaemia

CL-induced acute red eye [CLARE]
- Associated with overnight wear
- Severe discomfort
- Generalised hyperaemia
- Corneal infiltrates & staining
- Linked with gram –ve bacterial contamination of CLs

Conjunctival staining
- Temporal (or nasal)
  - Dryness
- Lid wiper
  - Lid wiper epitheliopathy
- Inferior bulbar (more commonly corneal)
  - Lagophthalmos
Other CL-related signs

- Conjunctival epithelial flaps
- Lid parallel conjunctival flaps

...and another CL-related conjunctival sign

- Papillary conjunctivitis
  - which leads us to....

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The most immunologically active tissue of the ocular surface

- Mucins
  - Trap and clear allergens & pathogens
  - Epithelial cell tight junctions
  - Present a mechanical barrier
- Mast cells
  - Abundant in conjunctiva
  - Degranulate in response to allergens
- Lymphocytes
  - Abundant in adenoid layer of cornea
  - Group together to form follicles
  - In viral & allergy conditions

Some allergic eye conditions

- Seasonal allergic conjunctivitis (SAC)
  - eg grass, tree pollens
- Perennial allergic conjunctivitis (PAC)
  - eg dust mites, pet dander
  - Both cause: itching, tearing, redness, swelling, papillae

- Atopic keratoconjunctivitis (AKC)
  - Family history of eczema, asthma, hayfever
  - Associated with keratoconus
- Vernal keratoconjunctivitis (VKC)
  - Rare in UK
  - Both can cause: severe itching; redness; swelling; mucous discharge; giant papillae; corneal scarring
- Contact ocular allergy (COA)
  - Antibiotics; antivirals; anaesthetics; timolol; BAK
  - Redness; swelling; follicles; punctate keratitis

...and some more serious ones

- Contact ocular allergy (COA)
- Atopic keratoconjunctivitis (AKC)
- Vernal keratoconjunctivitis (VKC)
- Contact ocular allergy (COA)

Follicles or papillae?

- Papillae
  - Allergic conjunctivitis or mechanical reaction
  - Pannus “rhombomeres”
  - Central, dilated vessel
- Follicles
  - Viral or chlamydial conjunctivitis
  - Contact ocular allergy
  - Dome-shaped nodule
  - Pale, no central vessel

Tranta’s dots in VKC
- White blood cells and epithelial cell debris

...and some more familiar ones

- Contact lens associated papillary conjunctivitis (CLAPC)
  - 0.3 to 1mm papillae; mucous discharge
  - Allergy to deposits/solutions?
  - Change to daily disposables
- Giant papillary conjunctivitis (GPC)
  - >1mm papillae; mucous discharge
  - Common finding in allergic conjunctivitis
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Subconjunctival haemorrhage
• Conjunctival or episcleral vessel breaks
• Blood spreads into sub-conjunctival space
• Local trauma, e.g. vigorous eye rubbing
• Coughing, sneezing, vomiting, straining

Subconjunctival haemorrhage
• Repeat occurrences:
  • Can indicate hypertension, diabetes
  • May be linked to central retinal vein occlusion and stroke
  • Are more likely if taking Warfarin, aspirin, Fish oil, vitamin E

Anaemia
• Inspecting lower tarsal conjunctiva
  • Indicates haemoglobin levels in the blood

Liver disease
• Bilirubin
  • Yellow pigment formed from haemoglobin when red blood cells are broken down and replaced
• Healthy liver
  • Bilirubin processed and excreted in bile
• Diseased liver
  • Bilirubin accumulates in bloodstream & tissues

Stem cells
• Essential for replenishment & maintenance of “renewable” tissues:
  • Blood, skin, gut, muscle, cornea
• Unique ability to self-renew or differentiate

Types of stem cells
• Embryonic stem cells (ESCs)
  • Grown in lab using cells from early embryo
  • Unlimited potential to produce all types of cells
• Tissue stem cells
  • Found in our bodies throughout life
  • Produce only their own type of cell
  • Include blood, skin, bone marrow and limbal cells
• Induced pluripotent stem cells (iPSCs)
  • Like ESCs, but made in lab from adult specialized cells
  • Reprogrammed to behave like stem cells
  • Newer technology
  • iPSCs made from human cord blood recently used to repair mouse retina

Limbal stem cells
• From conjunctival palisades of Vogt
• Responsible for reproducing corneal cells
• Natural replenishment plus replacement of damaged cells
• May be destroyed by disease or injury
  • Thermal, chemical or surgical injury
  • Microbial infection
• Contact lens complications
• Resulting in:
  • Neovascularisation, chronic inflammation, pain, scarring, loss of vision
Limbal stem cells produce corneal epithelium

Stevens Johnson Syndrome
- One cause of limbal stem cell deficiency
- Acute reaction to eg antibiotics
- Destroys goblet cells

Limbal stem cell graft

Treatment of acid burn
- Only the epithelium was affected

Treatment of alkali burn
- Stromal also affected
- Keratoplasty done after stem cell graft
- Grafted stem cells successfully covered donor cornea

Pterygium
- Fibrovascular growth
- UV exposure and age-related
- Surgery (if/when required):
  - Autograft
  - Amniotic membrane graft
  - Can be sutureless

Peripheral light focussing
- Pterygium more common nasally
- Cortical cataract also often begins in inferior nasal area

Pterygium removal
- Before surgery
- 1 week after graft
- 2 weeks after graft

For refs/further reading: Dispensing Optics Sep 2012
Don’t forget the conjunctiva

Self-assessment Qs

Short answer questions

1. List the layers of the conjunctiva.
2. Briefly describe the role of mucins in maintaining a healthy ocular surface.
3. State two areas of the conjunctiva which may stain in a dry eye.
4. Name two types of white blood cell present in the conjunctiva.
5. State two general health conditions which make provoke a change in the appearance of the conjunctiva.
6. List two conditions whose treatment may involve the use of limbal stem cells.