OCULAR DEFENSE MECHANISMS

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HOW THE EYE PROTECTS ITSELF

- BONY ORBITS AND BROWS
- LIDS, CILIA, AND BLINKING
- AQUEOUS TEAR FLUID
- CORNEAL DEFENSES
- DEFENSES OF CONJUNCTIVA & LIMBUS
- AQUEOUS, VITREOUS, LENS, UVEA, RETINA
- NORMAL OCULAR BACTERIA & FUNGI
ROLE OF EYELIDS

- CILIA AND COLLECTION OF PARTICLES
- BARRIER FUNCTION
- VASCULATURE AND LYMPHATIC SYSTEM
- FATTY ACIDS, OILS, AND WAXES
- BLINKING
THE BLINK AND BLINKING

- Lid Apposition and Squeeggee Action
- Adherence and the Mucin Thread
- Tear Route During Waking Hrs.
- Lacrimal Patency & Punctal Plugs
- Dakryocystitis & Angular Conj’itis
- Tear Route During Sleep
- Lagophthalmos & Role of REM’s
AQUEOUS TEAR FLUID

- ROLE OF OILY LAYER
- LYSOZYME
- BETA LYSIN
- LACTOFERRIN
- IMMUNOGLOBULINS: IgA
- ROLE OF MUCIN LAYER
AQUEOUS TEAR FLUID
AQUEOUS TEAR FLUID

_role_of_mucin_layer_
PHYSIOLOGICAL DEFENSES OF THE CORNEA

- CORNEAL TEMPERATURE
- OPEN vs. CLOSED EYE; PATCHING
- INTERCELLULAR EPITHELIAL JUNCTIONS
- ADHERENCE TO BASEMENT MEMBRANE
PHYSIOLOGICAL DEFENSES OF THE CORNEA

- MICROVILLI AT EPITHELIAL SURFACE
- SURFACE RENEWAL EVERY 7 DAYS
- INFILTRATION FROM TEARS, LIMBUS
NORMAL OCULAR FLORA (& FAUNA)

- NORMAL BACTERIAL FLORA
- NORMAL FUNGAL FLORA
- NORMAL VIRUSES (?)
- NO NORMAL CHLAMYDIA, PROTOZOANS
- MITES: Demodex folliculorum & brevis
  Worm-Like mites, 0.1-0.4mm long
NORMAL FUNGAL OCULAR FLORA

- FUNGI FROM ENVIRONMENT, AIR, SOIL
- *Candida albicans*
- *Aspergillus fumigatus*
- 83+ DIFFERENT SPECIES IN NORMAL EYES
- INCONSISTENCY WITHIN INDIVIDUALS
- LARGE EFFECT OF CLIMATE, OCCUPATION
- CAN ALSO BE PATHOGENS
NORMAL BACTERIAL OCULAR FLORA

- BACTERIA OF SKIN, RESPIRATORY TRACT
  - Staphylococcus epidermidis: 50-80%
  - Staphylococcus aureus: 20-50%
  - Corynebacterium sp. (Diphtheroids): 20-45%
  - 100+ OTHER SPECIES IN “NORMAL” EYES
NORMAL BACTERIAL OCULAR FLORA

Coag. (–) Staph.

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NORMAL BACTERIAL OCULAR FLORA

- CONSISTENT WITHIN INDIVIDUALS
- CONSTANT WITH CLIMATE / GEOGRAPHY
- SECRETION OF INHIBITORY “BACTERICINS”

Coag. (−) Staph.  Diphtheroid
NORMAL BACTERIAL OCULAR FLORA

- GRAM (-) “PATHOGEN” CARRIERS: ~ 20%
  - Ocular “Typhoid Maries”
  - Making “Eye Contact”
  - Going “Eyeball to Eyeball”
  - Cross-Contamination by Contact Lenses
  - Goldmann Tonometer Tips

- PATHOGENS AND CLIMATE / GEOGRAPHY
NORMAL BACTERIAL OCULAR FLORA

Coag. (−) Staph.

Diphtheroid
NORMAL BACTERIAL OCULAR FLORA

Staphylococcus aureus

Corynebacterium diphtheriae
NORMAL BACTERIAL OCULAR FLORA

Corynebacterium diphtheriae
BACTERIA ON LID MARGINS & CONJUNCTIVA

- THOSE FOUND ON LESS THAN 5% OF EYES
- GRAM (+) COCCI
  - Streptococcus sp.
  - Streptococcus pneumoniae
  - Micrococcus sp.

- GRAM (−) COCCI
  - Neisseria sp.
  - Moraxella catarrhalis
BACTERIA ON LID MARGINS & CONJUNCTIVA

- THOSE FOUND ON LESS THAN 5% OF EYES
- GRAM (+) BACILLI
  - Bacillus sp.

- GRAM (-) BACILLI
  - *Escherichia coli*
  - *Proteus* sp.
  - *Haemophilus* sp.
  - *Pseudo. aeruginosa*
  - *Klebsiella* sp.
  - *Serratia marcescens*
NORMAL BACTERIAL OCULAR FLORA

Bacillus cereus
NORMAL BACTERIAL OCULAR FLORA

Bacillus cereus
NORMAL BACTERIAL OCULAR FLORA

Bacillus cereus
NORMAL BACTERIAL OCULAR FLORA

Micrococcus sp. (yellow colony)
BACTERIA ON EYELIDS

- POST-SURGICAL ENDOPHTHALMITIS DUE TO Normal Bacterial Flora
- MOST COMMON IS COAGULASE (−) STAPHYLOCOCCUS
- INCIDENCE ~ 1 PER 750 SURGERIES Increased 2.5 to 6x for Clear Corneal Cataract Extractions
- BABY SHAMPOO NOT ANTIBACTERIAL 10:1 dilution Harsh on tender eyelid skin
- ANTIBACTERIAL SOAPS CONTAIN BAK or EtOH Not good for use around the eye
BACTERIA ON EYELIDS

**EYELID HYGIENE**

*Linalool*: Liquid distilled from oils of flowers, spice plants, tea trees. It has a pleasant floral scent and is anti-microbial.

Effective vs. *Pseudomonas*
BACTERIA ON EYELIDS

- **STERILID AVAILABILITY**
- Over-the-Counter (OTC)
- In a Kit by Prescription
- with Minocycline HCl tablets to be taken orally.
BACTERIA ON EYELIDS

Eyelid Hygiene

Lid Scrub PLUS ES: >99% effectiveness vs. S. aureus, E. coli, P. aeruginosa, S. marcescens, and M. catarrhalis.
BACTERIA ON EYELIDS

È EYELID HYGIENE
Betadine 5% Ophthalmic Prep Solution: by Alcon

Povidone-Iodine
Normal surgical scrub is 10%
Intended for
  Irrigation of cornea, conj.
  Periocular antiseptic
Sterile and non-irritating
Possible Treatment for EKC
PHYSIOLOGICAL DEFENSES OF THE ANTERIOR SEGMENT

» CONJUNCTIVA AND LIMBUS
  Vascular Supply & Immune System
  Lymphatic System

» AQUEOUS FLUID
  Blood-Aqueous Barrier Break-Down
  IgG, IgA, Complement

» CRystalline lens
  Barrier of Capsule, Anterior Epithelium
  No Immune or Lymphatic Systems
PHYSIOLOGICAL DEFENSES OF THE POSTERIOR SEGMENT

- VITREOUS GEL / FLUID
  Not Much Defense
- UVEA
  Vascular Supply & Immune System
  No Lymphatic System
- RETINA
  Vascular Supply & Immune System
  Blood / Retinal Barrier
  No Lymphatic System
EFFECT OF AGING ON OCULAR MICROBIOLOGY

- Lysozyme decreases
- Conj. cracks, crevices ↑
- Dry eye increases
- Bacterial & fungal conjunctivitis
- Bacterial & fungal keratitis
- Eyelid wrinkles, crevices ↑
- Bacterial & fungal blepharitis
EFFECT OF AGING ON OCULAR MICROBIOLOGY

- CONJUNCTIVAL CRACKS, CREVICES ↑
- EYELID WRINKLES, CREVICES ↑

Bulbar Conjunctiva

Palpebral conjunctiva