Ocular Evaluation
FRONT TO BACK
Pre-ocular tear film/Dry eye syndrome
Thank you Allergan

- Tarsal glands (meibomian glands)
- Gland of Zeis and Moll

- Accessory glands {Glands of Krauss & Wolfring (basal)}

- Produced by goblet cells in the conjunctiva and ocular surface epithelial cells

With kind permission from Allergan
Mucin Layer

• Inner-most of the three layers
• Produced by goblet cells in the conjunctiva and ocular surface epithelial cells
• Coats the hydrophobic corneal epithelium with a hydrophilic layer
• Glycocalyx
  – Long chain molecules formed by corneal cells that help hold mucin to the corneal surface
• Prevents pathogens reaching the ocular surface and maintenance of ocular surface hydration
Thanks to Systane

• Glycocalyx

Exposing the injured cornea to the air and bacterial pathogens
Aqueous Layer

- Accessory glands {Glands of Krauss & Wolfring (basal)}
  - Approximately 95% of the aqueous layer

- Lacrimal gland
  - Crying and reflex tearing

1. Main lacrimal gland
2. Fornix
3. Gland of Krauss
4. Levator muscle
Functions

• Nutrition and defense for cornea
  – Supplies oxygen to avascular corneal epithelium
  – Carries waste products away from cornea

• Proteins
  – Lysozymes
  – Lactoferrin
    • Important for antimicrobial activity and as markers for lacrimal gland function

  – Vitamin A
    • Required for corneal maintenance
Maintains tonicity of tear film

- **Isotonic**- no change in tear volume in the cornea and vision will remain normal (0.9% saline)
- **Hypotonic**- water flows into the cornea >>> corneal swelling (more myopic)
  - Such as crying or swimming
- **Hypertonic**- water flows out of the cornea >>> corneal shrinking (more hyperopic)
  - Swimming in the ocean
Lipid Layer

• Sebaceous (oily); mainly waxy and cholesterol esters
  – Altered polarity (usually low), thickened or contaminated lipid layer can cause problems
• Less than 0.1 micron thick
• Tarsal glands (meibomian glands)
• Gland of Zeis and Moll
• Decrease evaporation of tear fluid and stabilize tear film
What can go wrong?

- Mucin dysfunction
- Lipid dysfunction
- Aqueous dysfunction

Mucin deficiency

Aqueous deficiency

Lipid deficiency

“Dry eye” or Pre-ocular tear film dysfunction- “sign” of larger problem
Cannot isolate tears from the other ocular surface structures
Dry Eye Syndrome:

Pre-ocular tear dysfunction = part of the equation
Ocular surface disease = other part of the equation

- **Defined:** Multifactorial disease of the tears and ocular surface that results in symptoms of discomfort, visual disturbance, and tear film instability with potential damage to the ocular surface; Accompanied by increased osmolarity of the tear film and inflammation of the ocular surface (International Dry Eye Workshop {DEWS}, 2007)

- **Ocul Surf.** 2007 Apr;5(2):75-92
Symptoms of Dry Eye

- Irritation and/or grittiness
- Foreign body sensation
- Eye-Boogers
- Burning
- “Dryness”, although eyes tear consistently
- Itching
- Soreness
- Pain
- Pain upon waking

- General ocular discomfort
- Eye-fatigue
- Light sensitivity
- Blurry vision
- Fluctuation vision
- Contact lens discomfort
- Rubbing eye often
- The old “Blink and squeeze”
- Fishing

Symptoms vary depending on cause of tear film dysfunction
CLINICAL PEARL

• Symptoms extremely important because
  – What are “symptoms”?  
    • Patient’s CC
  – To make a medical diagnosis of DRY EYE SYNDROME
    • The patient MUST present with symptoms
    • You must document at least 3 tests for DES evaluation
  • Moment to reflect:
    – DES is like BV; if I try hard enough I can elicit a complaint that would suggest a binocular vision problem and/or
    – I could do enough testing to suggest binocular vision issues
Dyes

• Sodium Fluorescein
  – No anesthesia
  – Adheres to areas of desquamated epithelial cells (epithelial breaks or areas of cellular loss)

• Rose Bengal
  – Stains devitalized or degenerated epithelial cells
  – Stains filaments
  – Stains corneal mucin-deficient areas
  – May stain areas where mucin layer has been breached
  – STINGS

• Lissamine Green
  – Stains cells that lack proper mucous covering on the ocular surface (dryness)
  – Similar to rose Bengal, except minus sting
• Foamy and frothy

• Lipid plugs

• Filaments
• Debris
• Tear Meniscus (Prism)

Normal tear meniscus

Abnormal tear meniscus
• Tear stability
  – TEAR STABILITY TEST
  – Tear Break-up Time (TBUT)
    • Without anesthetic
    • Always, always, always
    • Pattern
    • < 10 sec = unstable tear film
  – Evaporative dry eye
• Tear Quantity
  – Schirmer’s Test I (without anesthetic)
    • Measuring total tears (reflex + basal)
    • > 15 mm in 5 minutes normal
    • < 5 mm diagnostic of aqueous-deficient dry eye
  – Schirmer’s test II (with anesthetic)
    • Measuring basal tears
    • > 10 mm in 5 minutes normal
    • < 3 mm diagnostic for dry eye
  – Accuracy and reproducibility questioned

Phenol Red Thread Test
• Tear Clearance Test
  – Instill fluorescein into lower fornices >> wait 5 minutes and place Schirmer's strip into fornices for 5 minutes
  – Evaluate length of wetting against standardized grading system
  – Tear Clearance Rate (TCR)
    • Based on intensity of staining on the strip
  – Tear Function Index (TFI)
    • Value of Schirmer's/TCR
• Values below 96 consistent with dry eye
• Values below 34 consistent with Sjögren's syndrome
This is suggestive of ______?
A symptom would be?????
• Higher is better
• High to normal tear production with slow clearance (and epiphora) suggestive of an obstruction
• Conjunctival and Corneal staining
Punctate corneal erosion

Filaments stained with rose bengal

Pattern ???
LOOK for the PATTERNS

--- Inferior band pattern
  Poor lid closure
  Incomplete blink
  Exposure

--- Diffuse pattern
  General ocular conditions
  Allergic
  Toxic

--- Four and eight o'clock staining
  Lid condition
  Staph or seborrheic blepharitis.

--- Interpalpebral conjunctival staining
  Aqueous deficient dry eye.

--- Focal staining
  Damage or loss from lid lesions,
  previous trauma
  Corneal epithelial disorders or damage

CLUES TO SPECIFIC OCULAR SURFACE DISEASES
Other Test for Dry Eye

• Temporary punctal plugs
• Protein measurements
  – LactoPlate, LactoCard, Quantiplate
• Phenol red thread test
• Lacrimal equilibration test
• Tear osmolarity test
  – Normal tears 300 mOsm/Kg (upper limit 311)
  – $\geq 312$ mOsm/Kg = Dry eye
Yet, more.....

- Impression cytology
- Mucin assay test (tear ferning)
- Fluorophotometry
- Manual keratometry
- Evaluation of meibomian glands
Interpreting the Results

• Most of these tests have poor reproducibility
  – Scientific community trying to make more reliable tests for dry eye

• 2-3 clinical tests and subjective questioning
  – Don’t use just one test
Tear Film dysfunction does not exist in a vacuum........

CC related to “dry Eye”; Must evaluate

- Medications used
- Systemic diseases/conditions
- Lashes
- Lids
- Glands
- Conjunctiva
  - Palpebral
  - Bulbar
- Tear film
  - Quantity
  - Quality
- Cornea
- Nasolacrimal drainage system
- Efferent nerves
- Afferent nerves

Full work-up for DES/OSD = Extensive and time consuming- both from gathering “signs” and treatment/management
Dry Eye Syndrome:

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• *Ocul Surf.* 2007 Apr;5(2):75-92
Ocular Surface Disease

- Defined: Any condition that reduces production, alters the composition, or impedes the distribution of the preocular tear film
REMEMBER THESE:

- Chronic Blepharitis
- Acute Ulcerative Blepharitis
Etiopathogenic Characterization= relating to research, however, will use clinically ALL OF THE TIME

As we get older tears do not work as well

Symptoms, symptoms, symptoms

Dry Eye Questionnaire

Figure 1. Major etiological causes of dry eye.

The left hand box illustrates the influence of environment on the risk of an individual to develop dry eye. The term “environment” is used broadly, to include bodily states habitually experienced by an individual, whether it reflects their “milieu interieur” or is the result of exposure to external conditions which represent the “milieu exterieur.” This background may influence the onset and type of dry eye disease in an individual, which may be aqueous-deficient or evaporative in nature.

Aqueous-deficient dry eye has two major groupings, Sjogren syndrome dry eye and non-Sjogren syndrome dry eye.

Evaporative dry eye may be intrinsic, where the regulation of evaporative loss from the tear film is directly affected, eg, by meibomian lipid deficiency, poor lid congruity and lid dynamics, low blink rate, and the effects of drug action, such as that of systemic retinoids. Extrinsic evaporative dry eye embraces those etiologies that increase evaporation by their pathological effects on the ocular surface. Causes include vitamin A deficiency, the action of toxic topical agents such as preservatives, contact lens wear and a range of ocular surface diseases, including allergic eye disease. Further details are given in the text.
Aqueous-Deficient Dry Eye

• Sjögren's
  – Autoimmune destruction of lacrimal and salivary glands
  – Hypossecretion of tears and saliva
  – Primary
  – Secondary

• Non-Sjögren's
  – Lacrimal gland deficiencies
    • Primary >> old age

Keratoconjunctivitis Sicca
Xerostomia
Evaporative Dry Eye = Tear Instability

• Excessive water loss from the exposed ocular surface in the presence of normal lacrimal secretory function

• Intrinsic
  – Regulation of evaporative loss of the tear film directly affected
  – Affecting lid structures or dynamics
  – Meibomian gland dysfunction

• Extrinsic
  – Increase evaporation by their pathological effects
  – Ocular surface disease occurs due to some “outside” exposure IE: allergies, Vitamin A deficiency
Clinical Severity Scale of Dry Eye

- Visual Symptoms
- Conjunctival injection
- Conjunctival staining
- Corneal staining
- Corneal/tear signs
- Lid/meibomian gland dysfunctions
- TBUT
- Schirmer’s score

CCLRU grading scale
Dry Eye Syndrome: A severe condition

<table>
<thead>
<tr>
<th>Dry Eye Severity Level</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discomfort, severity &amp; frequency</td>
<td>Mild and/or episodic; occurs under environmental stress</td>
<td>Moderate episodic or chronic, stress or no stress</td>
<td>Severe frequent or constant without stress</td>
<td>Severe and/or disabling and constant</td>
</tr>
<tr>
<td>Visual symptoms</td>
<td>None or episodic mild fatigue</td>
<td>Annoying and/or activity-limiting episodic</td>
<td>Annoying, chronic and/or constant, limiting activity</td>
<td>Constant and/or possibly disabling</td>
</tr>
<tr>
<td>Conjunctival injection</td>
<td>None to mild</td>
<td>None to mild</td>
<td>+/-</td>
<td>+/-</td>
</tr>
<tr>
<td>Conjunctival staining</td>
<td>None to mild</td>
<td>Variable</td>
<td>Moderate to marked</td>
<td>Marked</td>
</tr>
<tr>
<td>Corneal staining (severity/location)</td>
<td>None to mild</td>
<td>Variable</td>
<td>Marked central</td>
<td>Severe punctate erosions</td>
</tr>
<tr>
<td>Corneal/tear signs</td>
<td>None to mild</td>
<td>Mild debris, ↓ meniscus</td>
<td>Filamentary keratitis, mucus clumping, ↑ tear debris</td>
<td>Filamentary keratitis, mucus clumping, ↑ tear debris, ulceration</td>
</tr>
<tr>
<td>Lid/meibomian glands</td>
<td>MGD variably present</td>
<td>MGD variably present</td>
<td>Frequent</td>
<td>Trichiasis, keratinization, symblepharon</td>
</tr>
<tr>
<td>TFBUT (sec)</td>
<td>Variable</td>
<td>≤ 10</td>
<td>≤ 5</td>
<td>Immediate</td>
</tr>
<tr>
<td>Schirmer score (mm/5 min)</td>
<td>Variable</td>
<td>≤ 10</td>
<td>≤ 5</td>
<td>≤ 2</td>
</tr>
</tbody>
</table>

*Must have signs AND symptoms. TFBUT: fluorescein tear break-up time. MGD: meibomian gland disease

Evaluation of Dry Eye Patient

• Goal
  – Early recognition of OSD and DES
    • Mild cases hard to diagnosis
    • Easier to treat/manage giving the patient “symptom-free” life
  – Identify the causative factor(s)

• History
  – HPI of CC
    • Narrative of timing important
  – ROS
  – Medications taking
  – Remember risk factors for dry eye
    • Outline II
Evaluation of Dry Eye Patient

• Dry Eye Questionnaires
• Gross evaluation
  – Symptoms and clinical observation may not “match”, particularly in mild to moderate dry eye
  – Note lid structure, position, symmetry and blink dynamics (will change behind SL)
• Slit Lamp Evaluation
  – Systematic approach
  – Specific tests