The Dry Eye
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One of the most common conditions seen by Optometrists:
15% of the population!

- Dry eye syndrome is commonly under diagnosed and under treated.
- Complaints vary from ocular discomfort to F.B. sensations and light sensitivity, rarely visual loss, secondary infections & scarring, symptoms tend to worsen over time.
- Primarily, dry eye affects the middle-aged, the elderly, and women more than men (9:1)
- Sjogren’s associated dry eye affects between 1 to 2% of the population.
- Evidence suggests that dry eye is the result of a localized immune mediated inflammatory disease of the lacrimal glands and ocular surface.

Dry eye is multifactorial condition.
- Many circumstances where dry eye is associated with other clinical diseases like ocular allergy and blepharitis.
- Research leading to the development of new pathophysiological theories.
- New novel approaches to therapy that addresses the underlying mechanisms, not just treating symptoms.
- Frequent complaint of contact lens patients and post LASIK patients.
- Management is still a significant frustration for both clinicians and patients.
- Dry eye can become a chronic, disabling and life-altering disease similar to chronic arthritis and moderate angina.

Epidemiology

- An estimated 20-30 million people in USA have mild dry eye and some 10 million have moderate to severe dry eye.
- In one study, prevalence was 5.7% among women younger than 50 yrs to 10% over 75 yrs. of age, 2-3 times more common in women than men.
- An estimated one out of ten visits to eye care practitioners.
- As many as 25-35% of Americans have some level of OSD symptoms/signs due to dry eyes.
- 60 million people worldwide use AT.
- Prevalence has increased in recent yrs. due to: aging population, increase medication use, environmental allergens & irritants
Definitions-Dry Eye Syndrome (DES)/ Ocular Surface Disease Disorders

• A dysfunction of the lacrimal functional unit causes an unstable tear film which in turn promotes ocular surface inflammation, epithelial disease, and symptoms of ocular discomfort.
• The term lacrimal keratoconjunctivitis (LKC) seems to be more appropriate to describe the ocular surface inflammation that develops from tear film failure.

Lacrimal Functional Unit

• The ocular surface
• The tear-secreting glands
• The neural network
• Malfunction of any one of these components causes tear film instability

Healthy & Moist Eye depends on:

• Patient’s systemic health
• Ocular surface
• Tear film
• Goblet cells
• Meibomian glands
• Lacrimal glands
• Hormonal balance
• Environmental factors

Tear Film

• Functions: optics, immunity, nourishments, protection
• Lipid-composing mainly of waxy and cholesterol esters secreted by meibomian & Zeis glands-reduce tear film evaporation & stabilizes the film
• Aqueous-containing dissolved inorganic salts, glucose, urea, proteins and glycoproteins from the main and accessory lacrimal glands, 95% of film, microbial agents, hydrates cornea
• Mucin- macromolecules rich in salomucins derived from conjunctival goblet cells, also the non-goblet epithelial cells, creates a stable base for tears, coats FB for removal
• Glycocalyx- Non-goblet cell mucin interface-the superficial epithelial cells have microvilli & microplicae which anchor the mucin to epithelium
• Neuronal feedback loop

The New Tear Model-Bucking Tradition

• Current thinking is that tear film is really not a film but probably a thick aqueous- mucin gel composed of a lot of mucin with a lipid layer floating on top.
The Role of Epithelial Glycocalyx

Neuronal Feedback Loop

- Interrelationship between the ocular surface & the lacrimal gland
- Ocular surface (V nerve) to brain stem to VII nerve to lacrimal gland
- Supports a constant level of tearing and triggers reactive tearing in response to environmental challenges

The Healthy Eye

Dry Eye Disease: An Immune-Mediated Inflammatory Disorder

Pre-disposing Risk Factors

- Age & Sex: Older age, female, hormonal deficiencies (androgen), Hormone replacement therapy
- Environment: air conditioners, heaters, ceiling fans, flying (pilots), smoking, significant caffeine intake, reading, computer work
- Anterior segment disease (primarily blepharitis & posterior meibomianitis)
- Systemic diseases: diabetes, rheumatoid arthritis, SS, acne rosacea, Parkinson's
- Medications
- Contact lens wear
- LASIK

Symptoms of Ocular Surface Disease

Triggers of Dry Eye Disease
Dry Eye Classification

Classification of Dry Eyes (NEI)

- Tear or aqueous deficient dry eye
  1. Sjogren’s syndrome: primary/secondary
  2. Non-Sjogren lacrimal disease
     a. aging
     b. menopause
     c. medications
     d. lacrimal obstruction- cicatrical disease
     e. reflex- neurotrophic keratitis

- Evaporative dry eye
  1. Meibomian gland disease (oil deficient)
  2. Lid surface/blinking anomalies
  3. Contact lens related
  4. Chronic allergy/toxicity
  5. Cicatrical ocular surface disease

Differential Diagnosis of the Dry Eye- Non-Autoimmune (SS) Aqueous Tear Deficiency

- Lacrimal Obstruction /Conjunctival Cicatriziation
  Syndromes (due to scarring, narrowing, & obliteration of ducts)
    - Trachoma
    - Stevens-Johnson Syndrome
    - Ocular cicatricial pemphigoid
    - Drug-induced pemphigoid
    - Chemical burns or mechanical trauma
    - Graft vs Host disease
    - Allergies
    - Vit. A deficiencies

Trachoma
• **Lacral Disease** /Specific dry-eye syndromes/Aqueous (tear deficient dry eye)

**Primary:** acquired lacrimal deficiency or idiopathic KCS syndrome, age-related.
- Congenital alacrima: rare
- Riley–Day syndrome: rare

**Secondary:** Chronic conj.,
- AIDS, Sarcoid, graft-versus-host disease, lymphoma, Gamma radiation, Dacryoadenitis, Medications
Hormonal Influences

- May play a critical role
- Estrogen story
- Androgens
  - Positively regulate the structure & function of the lacrimal gland, meibomian gland & immune system
  - Androgen therapy seems to improve dry eye signs

Medications That May Contribute to KCS

- Beta–blockers: topical or oral
- Antihypertensives
- Anticholinergics
- Antidepressants
- Cardiac anti-arrhythmic drugs
- Parkinson’s agents
- Antihistamines
- Topical preservatives
- Oral contraceptive pill
- Hormone replacement therapy
- Antiandrogens

Hormone Replacement Therapy and Dry Eye

- Women’s Health Study - 25,000
  - On estrogen alone, 1.5 x risk of dry eye
  - Estrogen plus progesterone/progestin gave a 1.3 x higher risk of dry eye
  - For every 3 years on HRT, incur a 15% higher risk of dry eye

Schaumberg, et al. HRT and Dry Eye Syndrome, JAMA, 286(17), 2001

Reflex/ Neurotrophic

- Neuroparalytic keratitis
  - Drugs, corneal surgery ie. LASIK, trauma, tumors, herpes simplex/zoster, diabetes
- VIIth nerve palsy
- Contact lenses
- Reduced reflex & blink rate

Refractive Surgery Aqueous Tear Deficiency

- PRK & LASIK may result in temporary thinning of the TF lipid layer.
- A short term reduction in corneal sensitivity is also common.
- Reduced corneal sensitivity results in a reduced blink rate which can lead to OS drying & cell damage.
- It’s generally reversible with time.
- Nasal hinge flap is better?
Sjogren’s Syndrome Tear Deficiency

• Classically described as a triad of clinical manifestations of dry eyes, a dry mouth, and an autoimmune disease (usually rheumatoid arthritis)
• Criteria for diagnosis is the presence of at least two of the three components
• More common in middle age or postmenopausal women (9 to 1), multisystem involvement is frequent, 2-4M., prevalence of 1-2%
• Primary Sjogren’s synd. — affecting the eyes and mouth: 50% of cases
• Secondary Sjogren’s synd. — affecting eyes or mouth with an ass. autoimmune disease (RA & SLE-10-30%), others scleroderma & polymyositis

SS cont.

• Chronic inflammatory disease that is autoimmune in nature
• Lymphocytic infiltration (by activated T-cells) can occur in the lacrimal and salivary glands where their disrupted function results in dry eyes and a dry mouth
• Role of viral infections such as Epstein-Barr, CMV & herpes virus- triggering immune reaction

Diagnostic Criteria

• Symptoms and objective signs of KCS ie. abnormally low Schirmer’s test, symptoms and objective signs of oral dryness ie. Objectively decreased salivary gland flow, biopsy proved infiltration of the labial salivary glands and serological (serum autoantibodies) evidence of a systemic autoimmune disorder

Systemic Manifestations Associated with Sjögren’s Syndrome*

• Pulmonary
  – Xerotrachea (66)
  – Pulmonary infiltrate (20)

• Gastrointestinal
  – Esophageal dysmotility (90)
  – Pancreatitis (5)
  – Hepatitis (36-72)

• Renal
  – Renal tubular acidosis (12)
  – Interstitial nephritis (12)

• Neurologic (11)
  – Peripheral neuropathy
  – Cranial neuropathy
  – Central nervous system disease

• Hematologic
  – Leukopenia (22)
  – Anemia (6)

• Lymphoma (5-10)

*Mean percentage shown in parentheses. Source: References 1,33.
Non-Hodgkins Lymphoma

• One study found that SS patients are 46% more likely to develop lymphoma
• SS patients should have regular exams to R/O

Systemic Workup of Sjögren’s Syndrome

- **Systemic**
  - Complete history and physical exam
  - Complete blood count, ESR, LFTs, BUN/Cr, ANA, RF, SS-A/SS-B, Total IgG, M, A, SPEP, thyroid-stimulating hormone, U/A
  - Chest Xray

Systemic Workup of Sjögren’s Syndrome

**Other (as indicated)**
- Salivary gland sonogram/magnetic resonance imaging
- Lymph node or bone marrow biopsy
- Additional laboratory testing
  - Rheumatologic (ds-DNA, complement, Sm/RNP, ACE)
  - Organ-specific antibodies (thyroid, liver, neurological)
  - Viral (hepatitis B, C; EBV; human immunodeficiency virus)

Evaporative Dry Eye Conditions

• Oil deficient
  - Absent glands & distichiasis
  - Blepharitis syndromes
• Lid related
  - Blink abnormalities, aperature & lid surface incongruity
• Contact lens
• Surface change
  - Xerophthalmia

Workup of Sjögren’s Syndrome

Blepharitis Syndromes/Lipid Def. (evaporative dry eye)

- The most prevalent form of evaporative DE.; Increases with age
- Staphyl, Seborheic, Mebornitis, Mebomianitis----combinations
- Inflammation of the lid margins with thickening, injection, flaking, crusting
- Microbial exotoxins destabilize the lipid tear film, bacterial lipase break down the lipid into free fatty acids
- MGD (most prevalent form)-exhibit by plugged, capped, thickened, inflammation, atrophied glands, hordeolums, chalazia: abnormal gland expression.

Facial Signs of Rosacea

- Rhinophyma
- Telangiectasia
- Persistent erythema
- Papules
- Pustules
- Hypertrophic seb. glands in facial flushed areas
“Soap suds” film - represent increase fatty acids in tear film

Ulcerative blepharitis

Meibomianitis

Meibomianitis/ Acne Rosacea

**Lid Related/Exposure**

- Blink abnormalities
- Aperture abnormalities
- Lid surface incongruity

**Lid Surfacing Anomalies**

- Any anomaly preventing or restricting complete lid closure and normal blinking patterns can disrupt tear film stability, increase tear evaporation and induce ocular surface staining.
Cont.

- Atypical dry-eye syndromes/epitheliopathies/surfacing problems
  - Thyroid related eye disease
  - Trigeminal nerve paralysis
  - Facial nerve paralysis/Bell’s palsy
  - Lid trauma & symblepharon
  - Lid/lash abnormalities: ectropion, entropion, large pytergia, blepharospasm, dermatochalasis
  - Exposure Keratitis/nocturnal lagophthalmos
  - Dellen formation
  - Environmental factors
  - Parkinson’s Disease

Computor Vision & Dry Eyes

- Often overlooked problem
- Tend to blink less; extension of the interblink period
- Position screen at lower level to decrease the surface area exposed and evaporation

CLs & Dry Eyes

- Prevalent in 20-30% of CL wearers
- Ocular surface sensation decreases with wear
- May cause reduce clearance of tears
- Promotes evaporative tear loss
- Reduced blink rate

Thyroid Eye Disease

- Ectropion