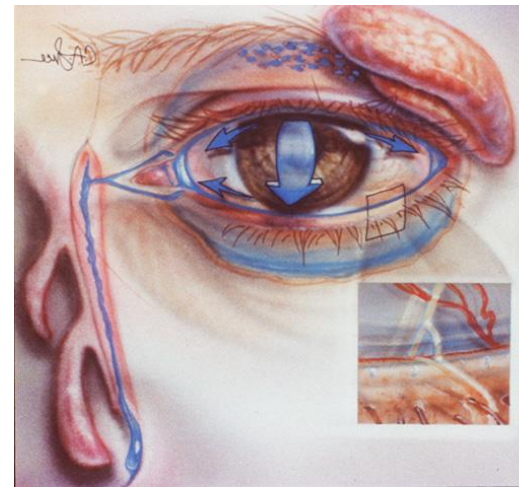
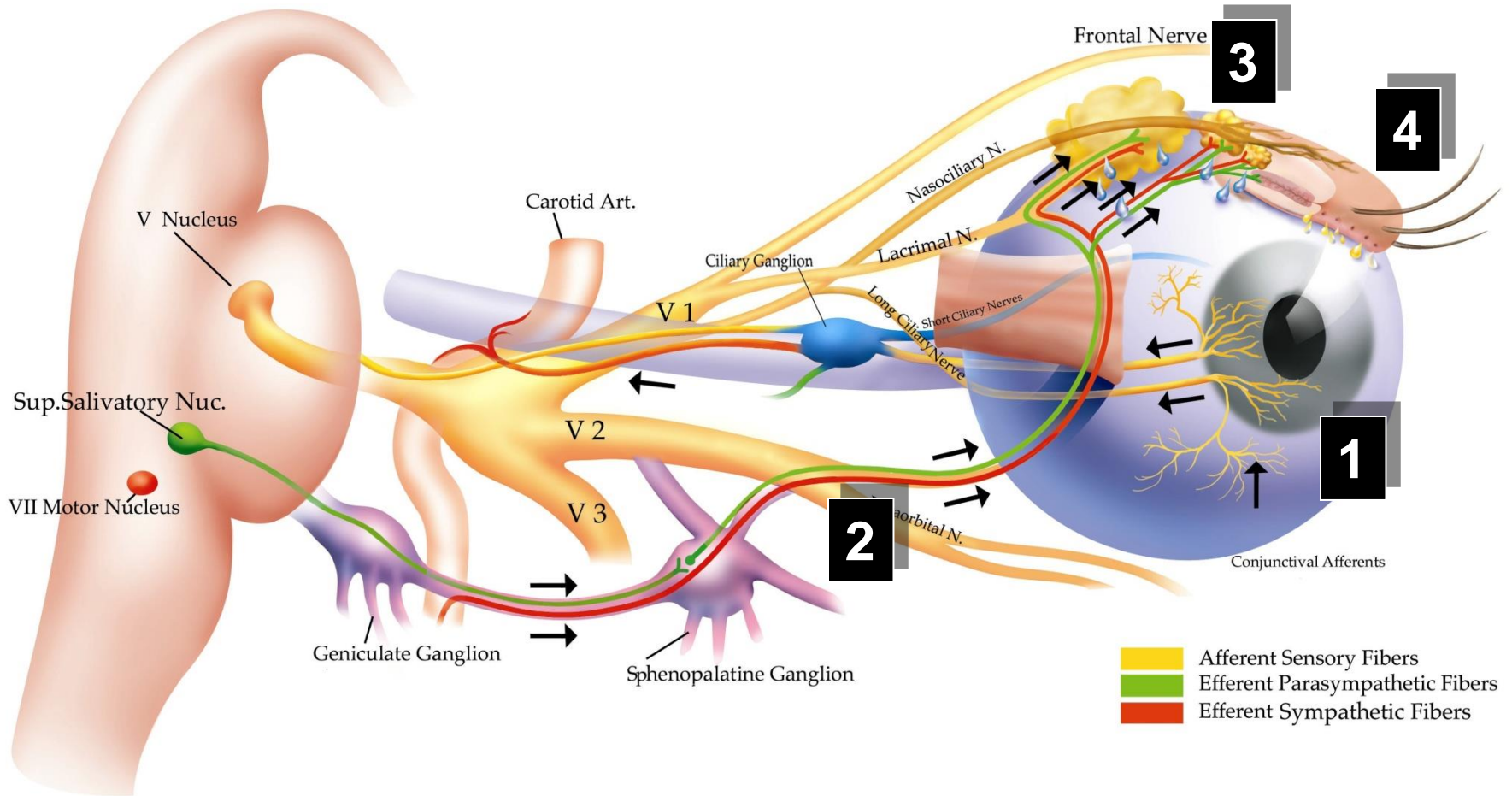


Tearing Due to Dry Eyes

Kimberly Cockerham, MD, FACS
Central Valley Eye Medical Group



Integrated Lacrimal Functional Unit



Dry Eye is a Disease of the Lacrimal Functional Unit

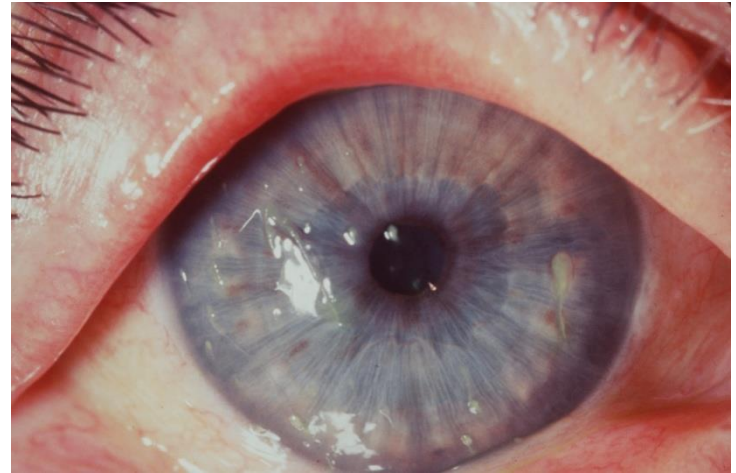


Dry Eye Is Prevalent

- 2.5 million people in the United States¹
- A top reason for visits to EyeMDs and Ods
- Patients often dissatisfied with treatments
 - Frequent drops inconvenient
 - Limited symptomatic relief
 - Frustrated
 - Want new options

Dry Eye Patient Factors

- Older age
- Female gender
- Post-menopausal
- Tobacco smoking
- Contact lens wear
- Prolonged staring (e.g. computer work)



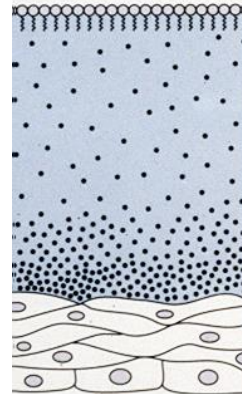
Environmental Factors

- Air Pollution
- Artificial, forced air
- Allergens
- Low humidity



Medications

- Antihistamines
- Antidepressants
- Antispasmodics
- Diuretics
- Oral contraceptives
- Hormonal therapy



Anterior lipid layer		Polar groups oriented in same direction; one or more layers of molecules thick
Dilute mucin solution	Aqueous layer	Mucin diluted forming colloidal solution
Mucin coacervate		Mucin molecules closely associated with each other in aqueous layer
Adsorbed mucin layer		Concentrated; closely adherent to surface irregularities of epithelium
Surface cells of cornea		



Disease Related Factors

- Systemic:
 - Autoimmune disease (TED)
 - Neurologic disease that reduces blink
 - Vitamin A deficiency
- Local:
 - Lacrimal gland infiltration
 - Eyelid malposition, laxity, lagophthalmos
 - Ocular surface disease

Pathophysiology of Chronic Dry Eye Disease

Lacrimal Glands:

- Chronic irritation
- T-cell activation
- Cytokine secretion into tears

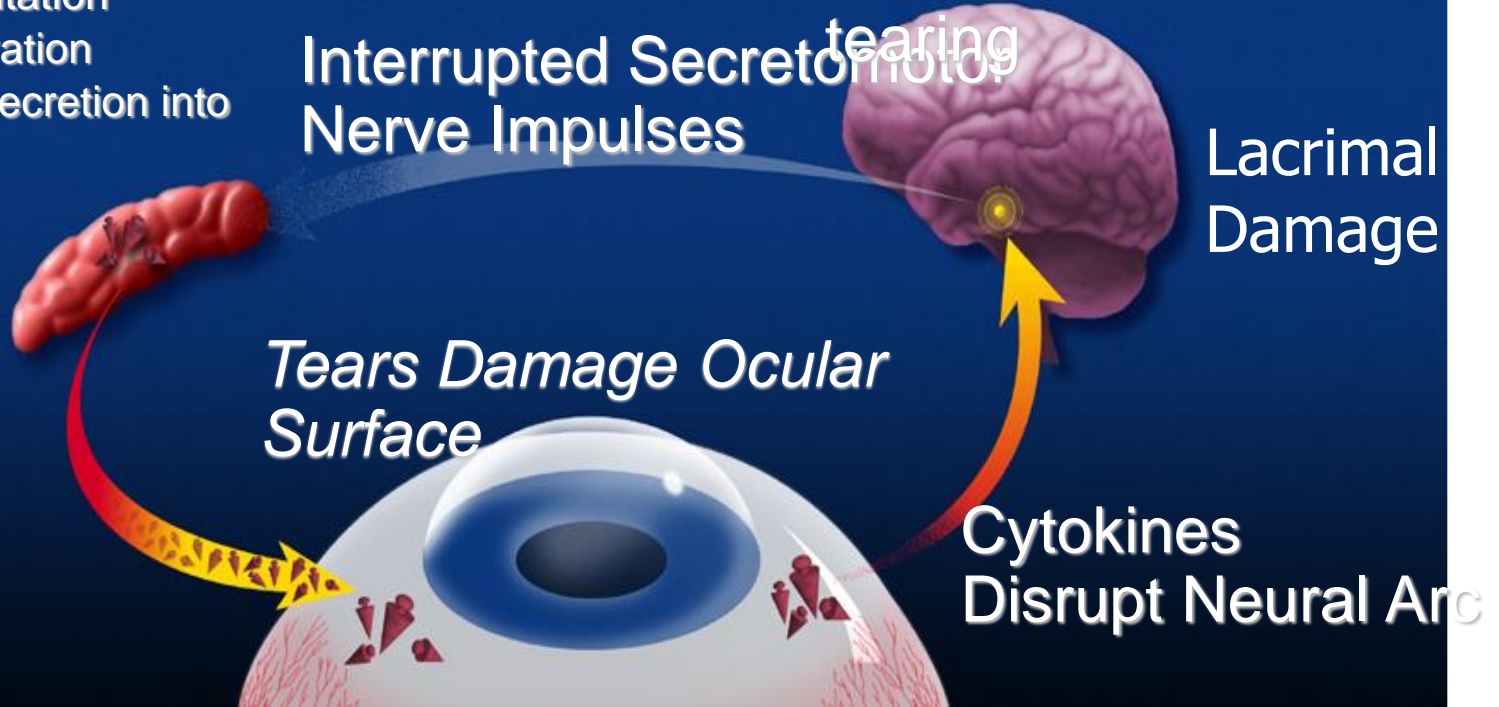
Interrupted Secretomotor Nerve Impulses

Disruption of normal neuronal control of tearing

Lacrimal Damage

Tears Damage Ocular Surface

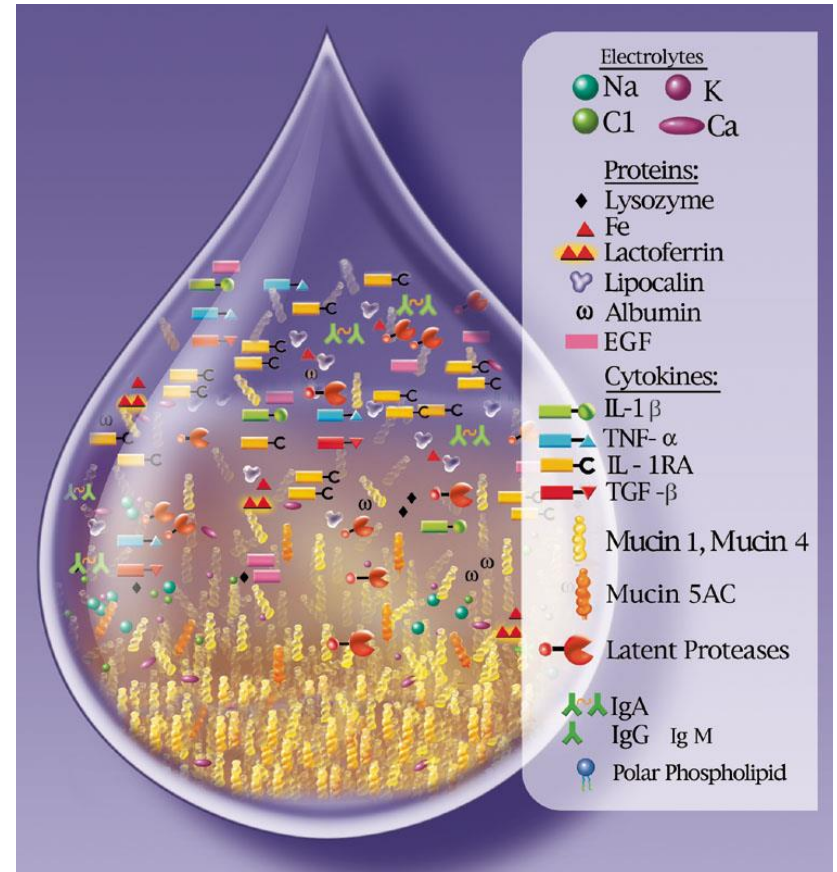
Cytokines Disrupt Neural Arc



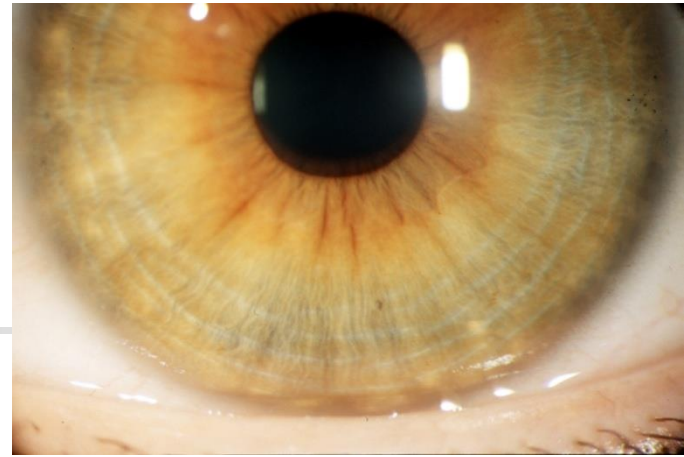
Healthy Tears

■ Complex Mixture

- Antimicrobial proteins
- Growth factors
- Cytokines
 - suppress inflammation
- Mucin secreted by **goblet cells**
 - Viscosity
- Electrolytes
 - Osmolarity



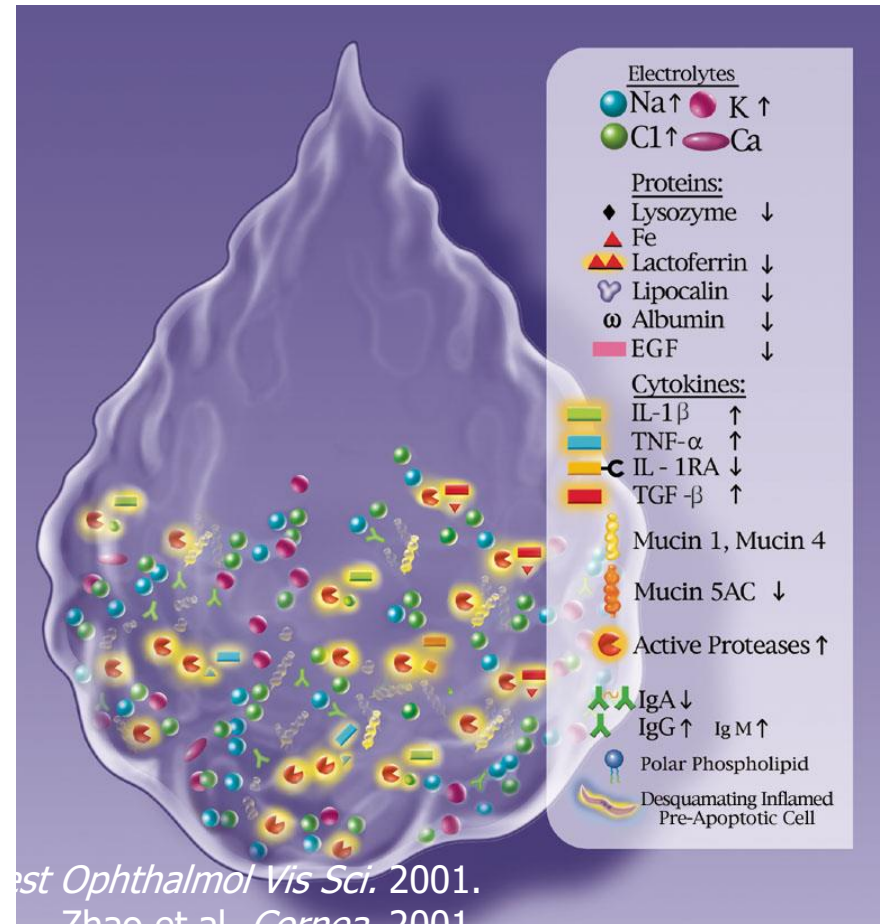
Functions of a Healthy Tear Film



- Optical clarity, refractive power
- Ocular surface comfort, lubrication
- Protection from environmental and infectious insults
 - Antibacterial proteins, antibodies, complement
 - Reflex tears flush away particles
- Trophic environment for corneal epithelium
 - Necessary electrolytes maintain pH
 - Protein factors for growth and wound healing
 - Antioxidants

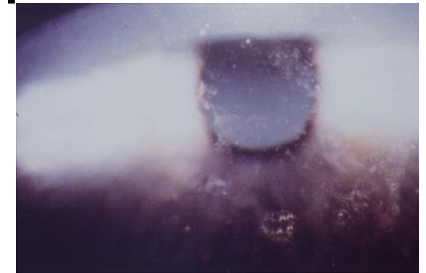
Tears in Chronic Dry Eye

- Decreased proteins and growth factors
- Altered cytokine balance promotes inflammation
- Proteases activated
- Increased electrolytes
- Altered viscosity

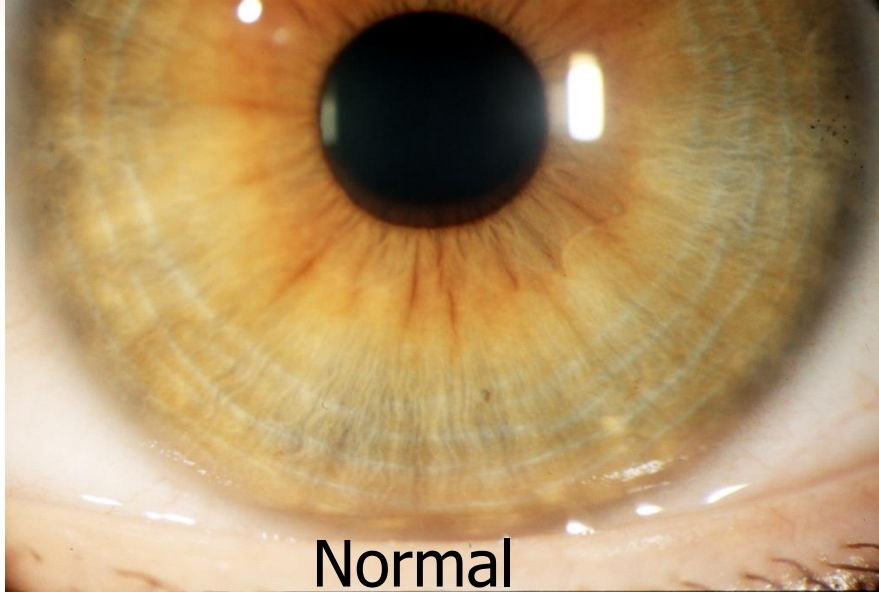


Effects of Altered Tear Composition in Chronic Dry Eye

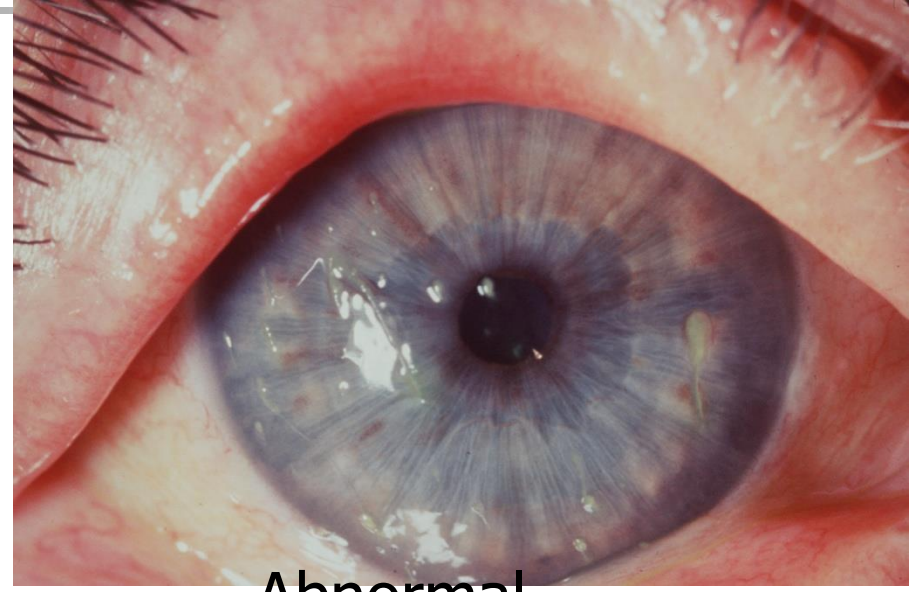
- Ocular surface tissue environment altered
 - Lubrication compromised due to poor viscosity
 - Increased osmolarity
 - Imbalanced growth factors and cytokines fail to promote normal epithelial growth
- Ocular surface damage
 - Loss of corneal epithelial integrity
 - Squamous metaplasia of conjunctival epithelium



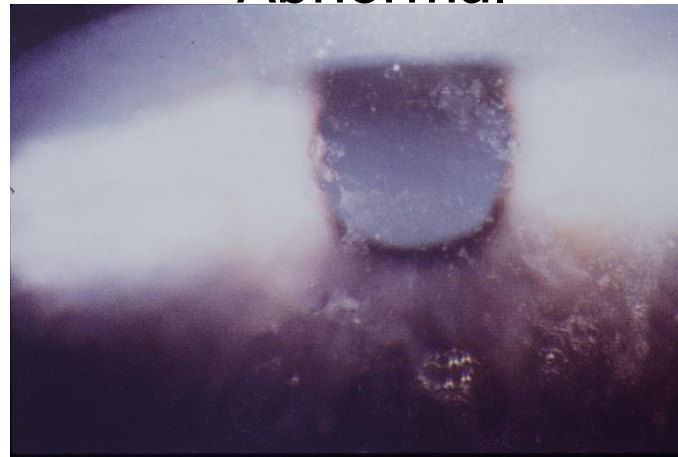
The Look of Dry



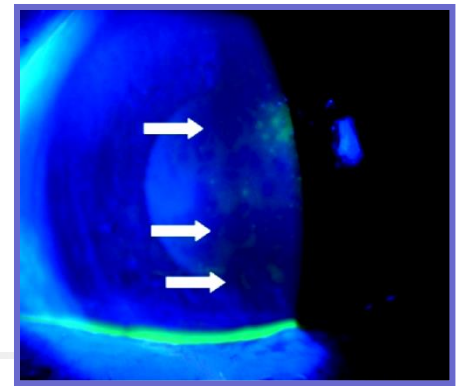
Normal



Abnormal

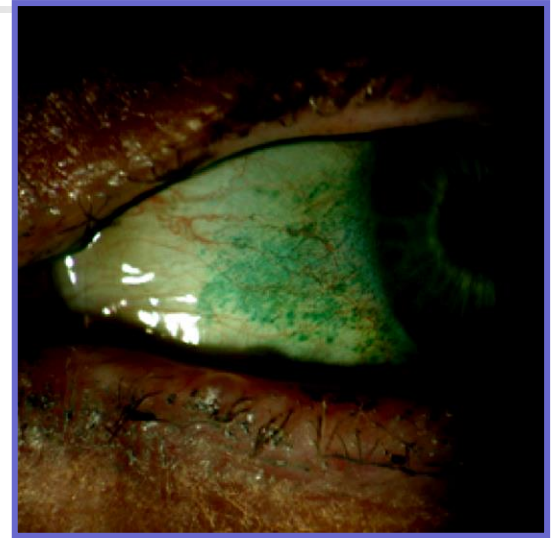
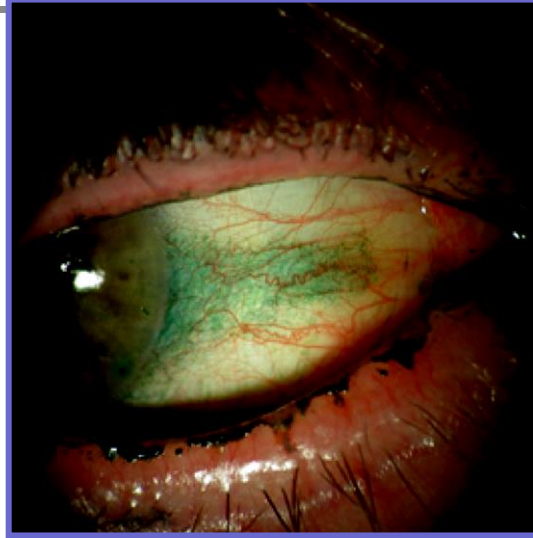
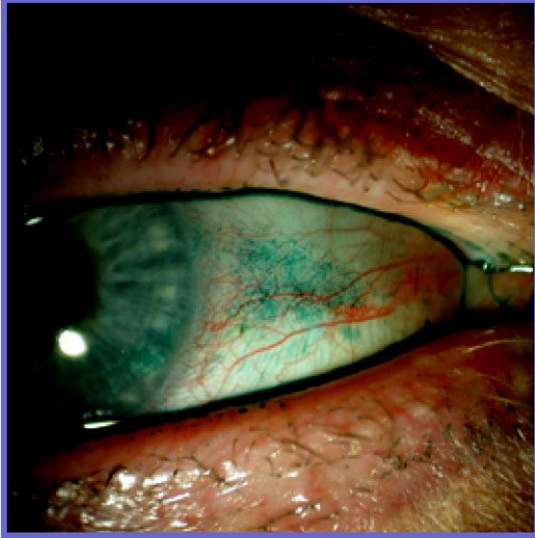


Tear Breakup Time (TBUT)



- Tear film instability is a hallmark of dry eye
 - Correlates with aqueous and evaporative tear deficiency (Pflugfelder et al, 1998)
- TBUT measures tear film quality
 - Fluorescein introduced from strip, yellow filter increases sensitivity
 - TBUT = time from completed blink to 1st dry spot (3 repetitions)
- TBUT < 10 seconds abnormal (Lemp, 1995)
 - *Anesthesia decreases TBUT (de Paiva et al, 2004)*
 - *Abnormal corneal surface - > break-up spots*

Lissamine Green Staining in Dry Eye



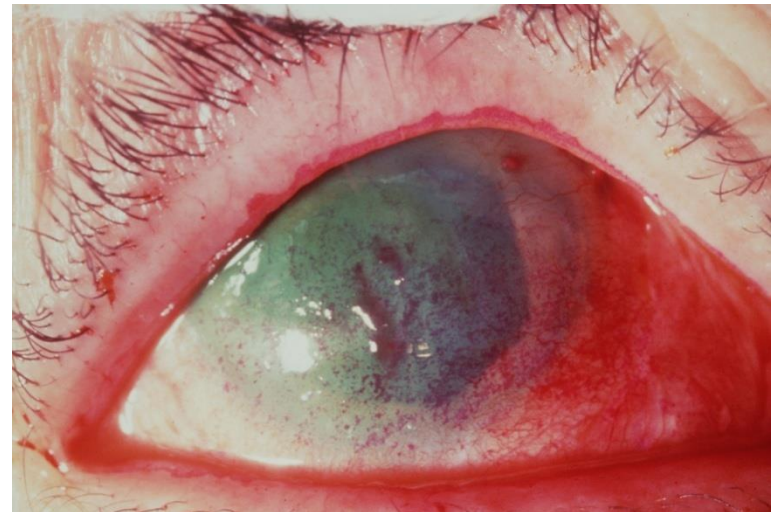
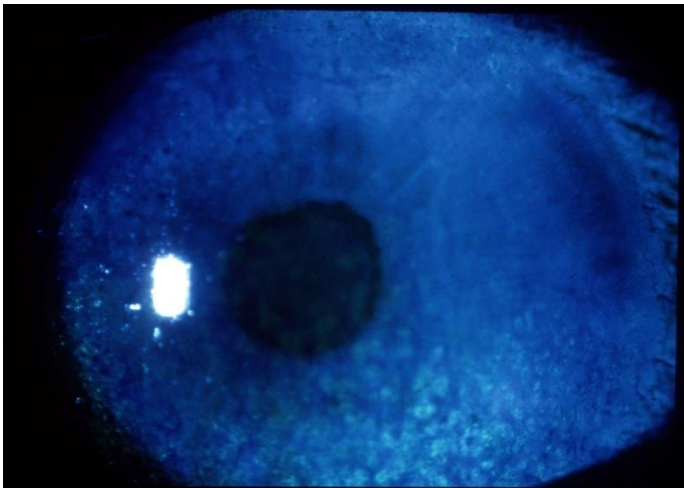
- Lissamine green detects dead or degenerated conjunctival cells

Vital Stains

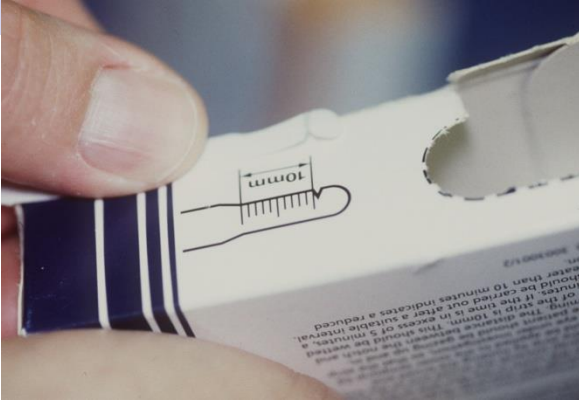
Fluorescein

Rose Bengal

Lissamine Green



Schirmer's Strips





“Dry Eyes” are Very Common

- 25% of office visits in a general practice
- Affects over 20 million Americans
- Prevalence: 14% of adults 48 – 91 years old
- Most common in woman over 50 years old



Dry Eye Patient Factors

- Older age
- Female gender
- Post-menopausal
- Tobacco smoking
- Contact lens wear
- Prolonged staring (e.g. computer work)



Environmental Factors

- Air Pollution
- Artificial, forced air
- Allergens
- Low humidity



Medications

- Antihistamines
- Antidepressants
- Antispasmodics
- Diuretics
- Oral contraceptives
- Hormonal therapy



Disease Related Factors

- Systemic:
 - Autoimmune disease
 - Neurologic disease that reduces blink
 - Vitamin A deficiency
- Local:
 - Lacrimal gland infiltration
 - Eyelid malposition or laxity
 - Ocular surface disease



Dry Eye Management

Mild to Moderate Symptoms

- Minimal signs
- Consider environment/intake
- Add tear replacement
 - Osmolarity
 - Viscosity
 - Combination

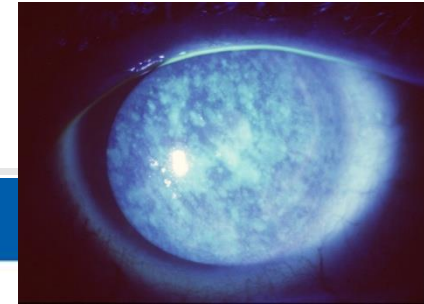


Dry Eye Management

Moderate to Severe Symptoms

- Abnormal tear film, corneal and conjunctival staining visual signs
- Essential fatty acids (EFA)
 - Flaxseed oil, Hydroeye®
- Topical anti-inflammatory agents
 - Cyclosporine
- Oral cholinergics
 - Pilocarpine (Salagen®)
 - Cevimeline

Consensus Treatment Algorithm Guidelines



Dry Eye Consensus Guidelines from *Cornea* 2006

DRY EYE SEVERITY INDEX

LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4
<ul style="list-style-type: none"> Mild to moderate symptoms and no signs Mild to moderate conjunctival signs 	<ul style="list-style-type: none"> Moderate to severe symptoms Tear film signs Mild corneal punctate staining Conjunctival staining Visual signs 	<ul style="list-style-type: none"> Severe symptoms Marked corneal punctate staining Central corneal staining Filamentary keratitis 	<ul style="list-style-type: none"> Severe symptoms Severe corneal staining, erosions Conjunctival scarring

Experts recommend cyclosporine A for level 2, 3, and 4 patients when inflammation is present

- Punctal plugs are not recommended until level 3

Dry Eye Management

Mild to Moderate Symptoms

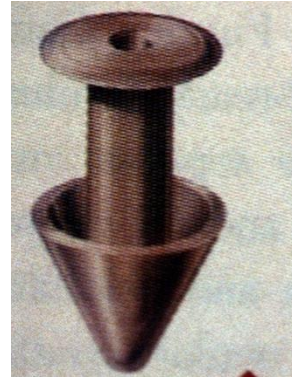
- Minimal or no signs
- Add Essential fatty acids (EFA)
 - Flaxseed oil, Hydroeye®
- Add tear replacement
 - Osmolarity
 - Viscosity
 - Combination
- Restasis or Xiidra



Dry Eye Management

Moderate to Severe Symptoms

- Signs present: Abnormal tear film, corneal and conjunctival staining
- Essential fatty acids (EFA)
 - Flaxseed oil, Hydroeye®
- Topical anti-inflammatory agents
 - Cyclosporine
- If dry mouth also present: consider oral cholinergics
 - Pilocarpine (Salagen®)
 - Cevimeline





Restasis and Xiidra

Dosing and Administration

- Not “as needed” like traditional eye drops
- One drop-each eye in morning & evening
- Vials should be discarded after each use
- Artificial tears may be used for concomitant relief (*no preservatives much better*)

Dry Eye Surgical Management

- Punctal occlusion
- Plugs
- Cautery



Systematic Approach to Tearing

- Dry
- Wet
- Other
 - Ocular Surface
 - Eyelid
 - Orbit

