

DRY EYE IN CL PRACTICE

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DRY EYE IN CL PRACTICE

Because dry eye is so prevalent among contact lens wearers, eyecare practitioners must stay up to date with the latest research and the newest products

DRY EYE AND THE TEARFILM

Complete tear film is essential to:

1. Ocular health
2. Optical performance of the eye
3. Successful Contact Lens Wear

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But Doc, I am an eagle: I can't be seen wearing glasses... Can't you prescribe contact lenses?

PURPOSE OF TALK

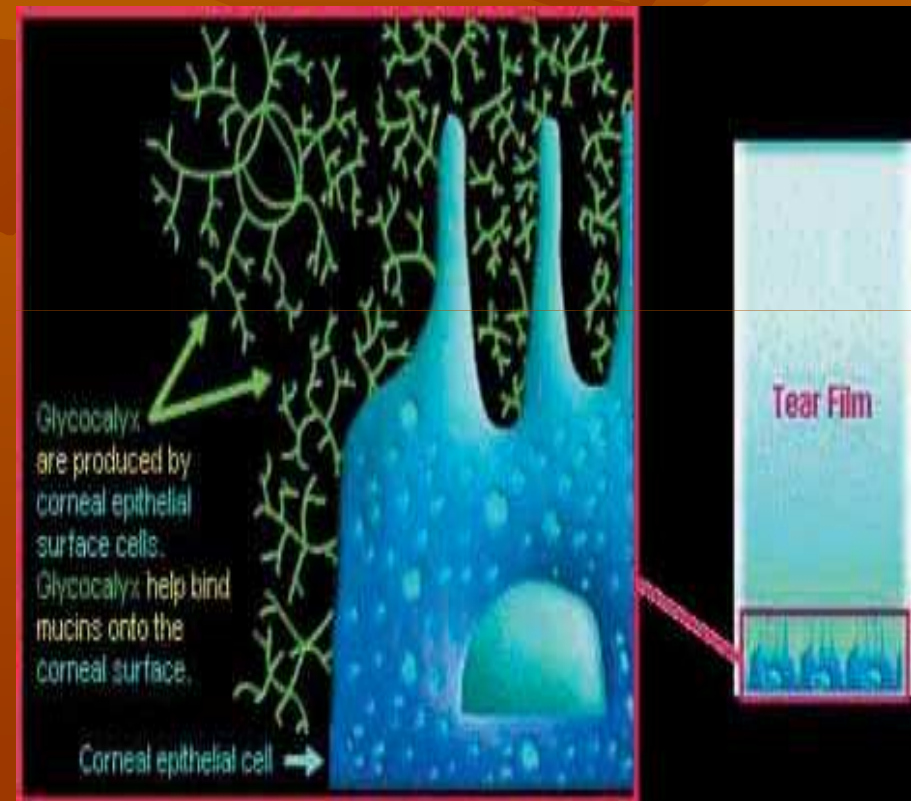
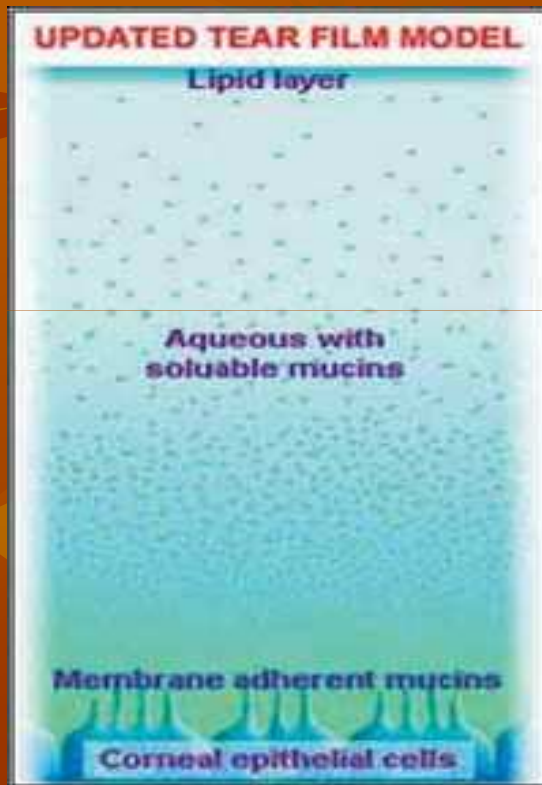
- Overview of Tear Film
- Impact of CL Related Dry Eye
- Definition & Classification of Dry Eye
- Neurophysiology of Tear Secretion
- Mechanisms of Ocular Surface Disease
- Diagnosing Dry Eye
- Issues of Comfort
 - Tear Film & Contact Lenses
 - Effect of CL Materials
 - Lens Care Systems
- Treatment

The background of the slide is a solid dark orange color, overlaid with a pattern of lighter orange, stylized autumn leaves. The leaves are scattered across the frame, with some showing prominent veins. The overall aesthetic is warm and seasonal.

THE TEARFILM

QUICK OVERVIEW

NORMAL TEARFILM



An epithelial cell is like a goldfish...
You must maintain a delicate balance in the surrounding environment for it to survive

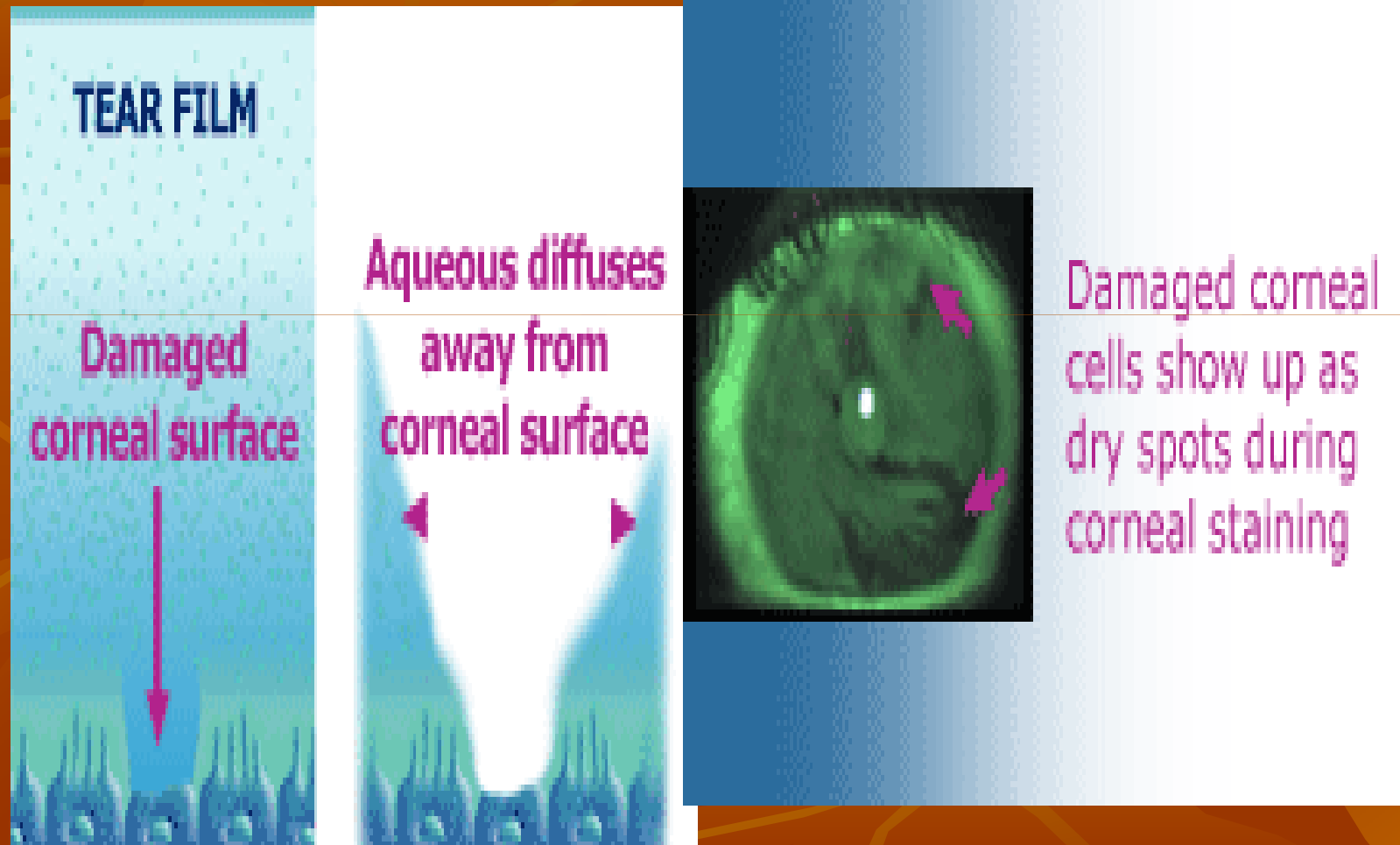


- Amino acids
- Temperature
- Oxygenation
- Glucose
- pH
- Shearing forces
- Nutrients
- Osmolarity
- Hydration

Mark B Abelson

2005

DYSFUNCTIONAL TEARFILM



The background of the slide is a solid dark brown color. Overlaid on this background are several large, stylized leaves in various shades of brown and tan, creating a subtle autumnal pattern. The leaves are scattered across the frame, with some appearing more prominent than others.

The Impact of CL Related Dry Eye

What is the Impact of CL-Related Dry Eye?

- Approximately 50% of cl wearers report to experience dry eye symptoms (Nichols 2005)
- CL wearers experience dry eye symptoms
 - 12 x > than clinical emmetropes
 - 5 x > than spectacle wearers (Nichols 2005)

What is the Impact of CL-Related Dry Eye?

- 24 % of all subjects who had some experience with contact lenses had *permanently* discontinued contact lens wear
- 26 % of current wearers were dissatisfied with contact lens wear.
- Dissatisfied lens wearers tend to be female while those who discontinued tend to be male
- Age when starting cl wear NB determinant of future satisfaction and continuation with lens wear
- Symptoms of *dryness and discomfort* are leading causes of decreased contact lens wear time or cl discontinuation.(Nichols 2005)

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Dry Eye

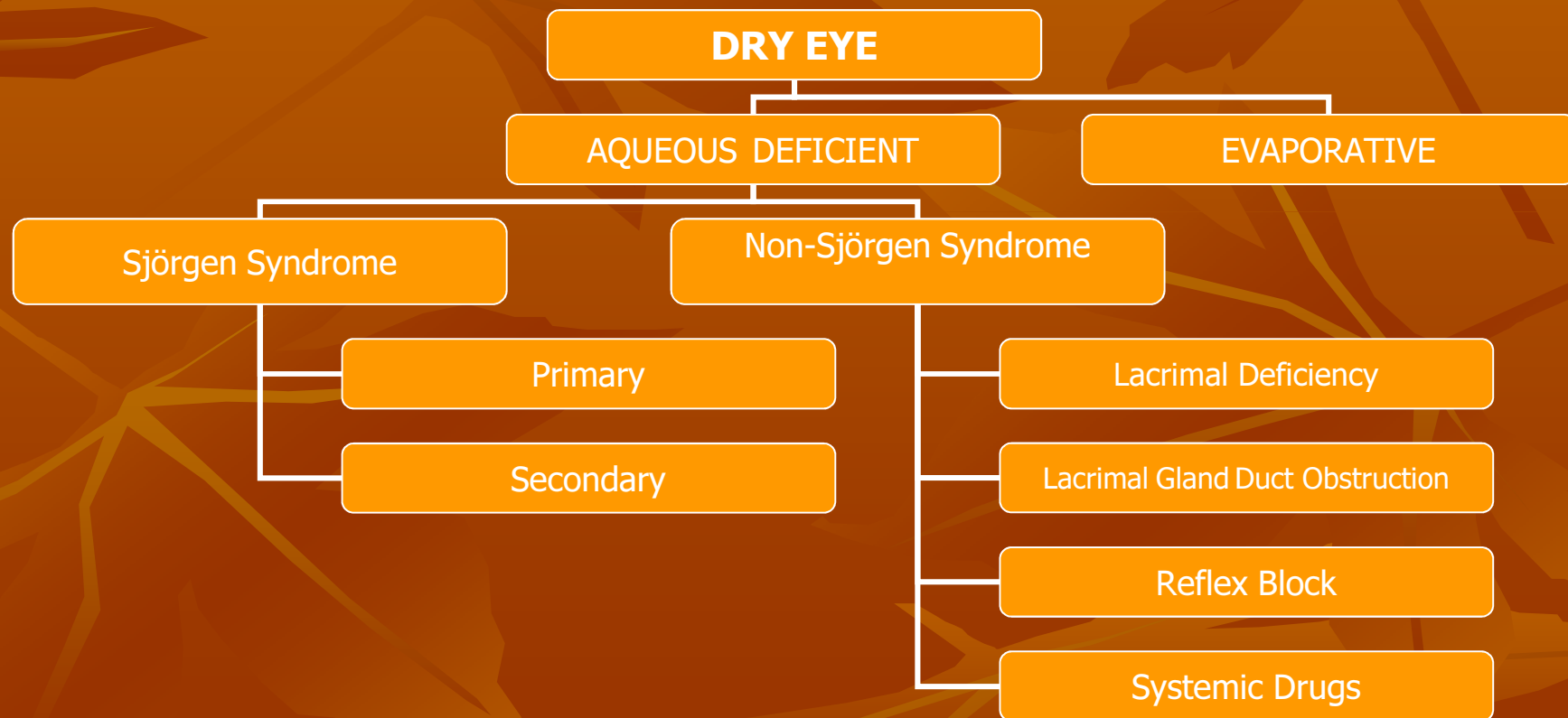
Definition & Classification

Definition (DEWS 2007)

- Dry eye is a disorder of the tear film due to tear deficiency or excessive evaporation which causes damage to the interpalpebral ocular surface and is associated with symptoms of ocular discomfort (NEI 1995)
- Dry eye is a *multifactorial disease* of the tears and ocular surface that results in symptoms of discomfort, visual disturbance, tear film instability with potential damage to ocular surface. It is accompanied by increased *osmolarity* of the tear film and *inflammation* of the ocular surface (DEWS 2007)

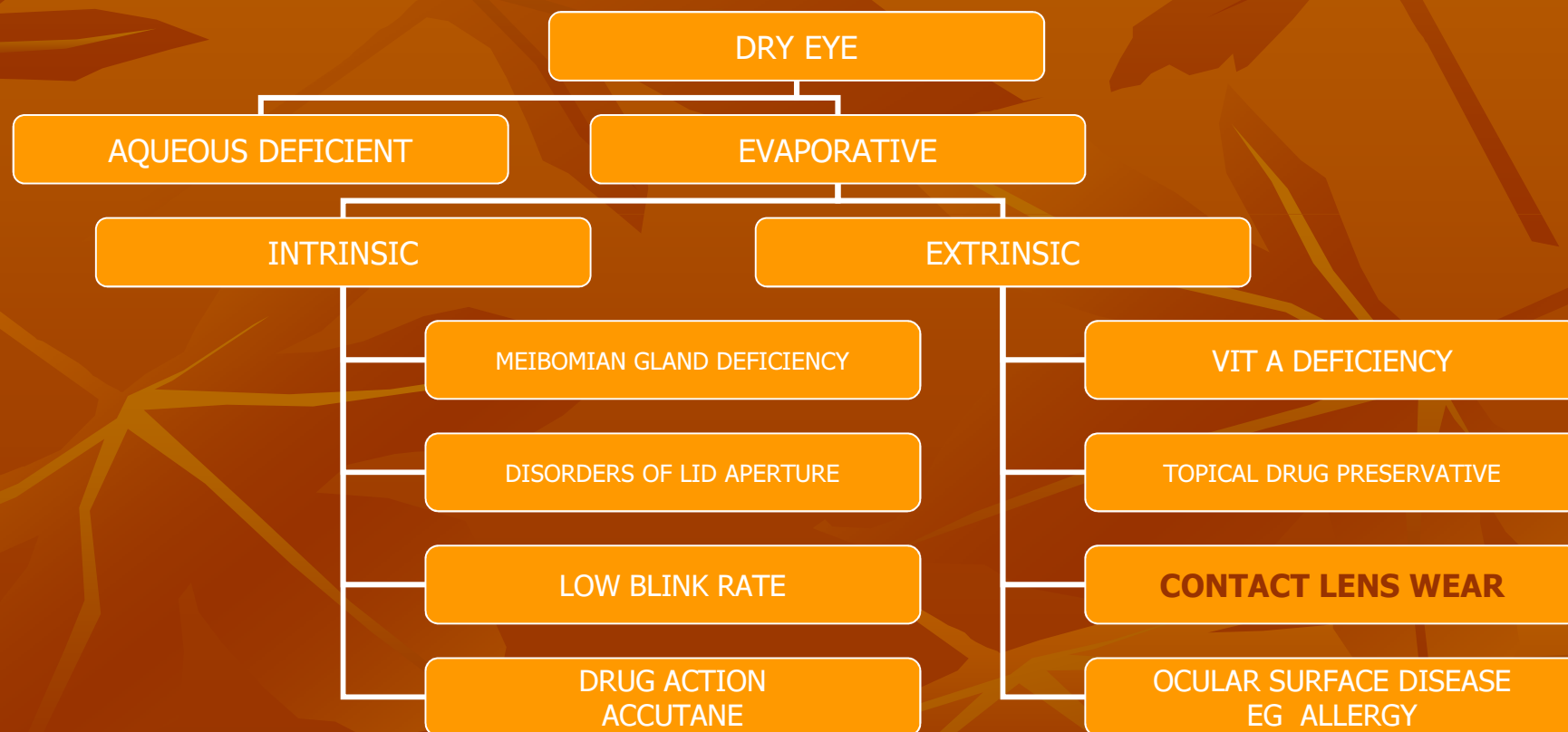
OSD – Classification

DEWS 2007



OSD – Classification

DEWS 2007



OSD – Classification

Effect of the Environment

DEWS 2007

Milieu Interior

- Low Blink Rate
 - VTU
 - Wide lid aperture
- Aging
- Low androgen pool
- Systemic Drugs
 - Antihistamines
 - Beta-blockers
 - Anti-spasmodics
 - Psychotropic drugs

Milieu Exterior

- Low Relative Humidity
 - Natural environment
 - Airconditioning
 - Aircrafts
- High wind velocity
- Occupational environment

Pathological vs. Marginal



NEUROPHYSIOLOGY

Of

TEAR SECRETION

The Healthy Eye

Normal tearing
depends on a
neuronal feedback loop



Lacrimal Gland Function Unit (Stern et al. 1998)

- LFU composed of the lacrimal glands (both main and accessory), the ocular surface and the interconnecting innervation.
- Stimulation of sensory fibers from cornea results in the generation of afferent nerve impulses through the ophthalmic branch of the Trigeminal Nerve (V).
- These impulses travel through the trigeminal ganglion and on to the mid-brain (pons) where they synapse and the signal is integrated with cortical and other neural input.

Lacrimal Gland Function Unit

- The efferent branch of the loop sends fibers through the pterygopalatine ganglion to the main and accessory (Wolfring and Krause) lacrimal glands (Stern et al., 1998).
- There is some belief that the nerve endings found around the meibomian glands and conjunctival goblet cells also travel this route (LeDoux et al., 2001 and Diebold et al., 2001).
- This lends credence to the concept that the three major tear film components (mucin, aqueous and lipid) are secreted to the ocular surface in a controlled and coordinated fashion

Neurophysiology of Tear Secretion

- The *rate* of lacrimal gland fluid secretion is controlled primarily by the parasympathetic system, with modulation by sympathetic system.

(Mircheff (1989) and Lamberts (1994))

Neurophysiology of Tear Secretion

- Androgen & Estrogen receptors are present in acinar epithelial cell nuclei of LG & MG, regulate secretion
- Androgens anti-inflammatory, estrogens pro-inflammatory
- Blinking is main control of the release of meibum stored in MG

Neuro-hormonal control of secretion in LFU tissues



MECHANISMS OF OCULAR SURFACE DISEASE

**UNDERLYING
PATHOPHYSIOLOGY**

Unified Theory

Stern,.et.al 1998

- Published 1998, based on Stern's theory of tear secretion through LFU
- Proper functioning of the LFU is required to secrete tears of normal composition which helps to maintain a **normal homeostatic environment for the epithelia of the ocular surface.**
- In addition to maintaining normal lacrimal and meibomian glandular function, androgens also exert anti-inflammatory activity

Unified Theory

Stern,.et.al 1998

- 2 major factors in helping to maintain the tissues and function of the LFU.
- 1st: The presence of *circulating androgens* that help to maintain an anti-inflammatory umbrella over the tissues of the LFU (Sullivan and Edwards, 1997; Rocha et al., 1998; Sullivan et al., 2002).

Unified Theory

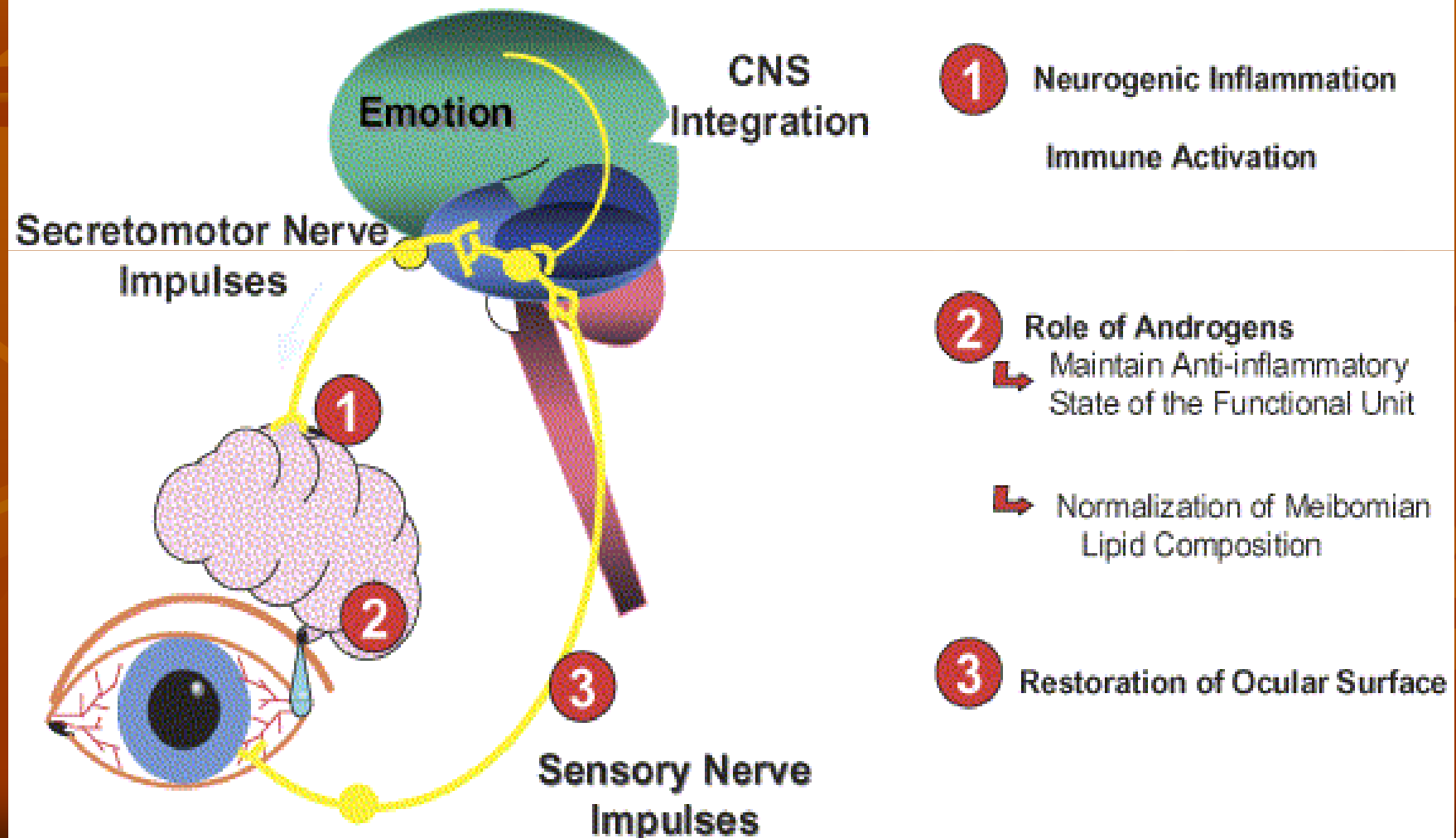
Stern,.et.al 1998

2nd: Immune system

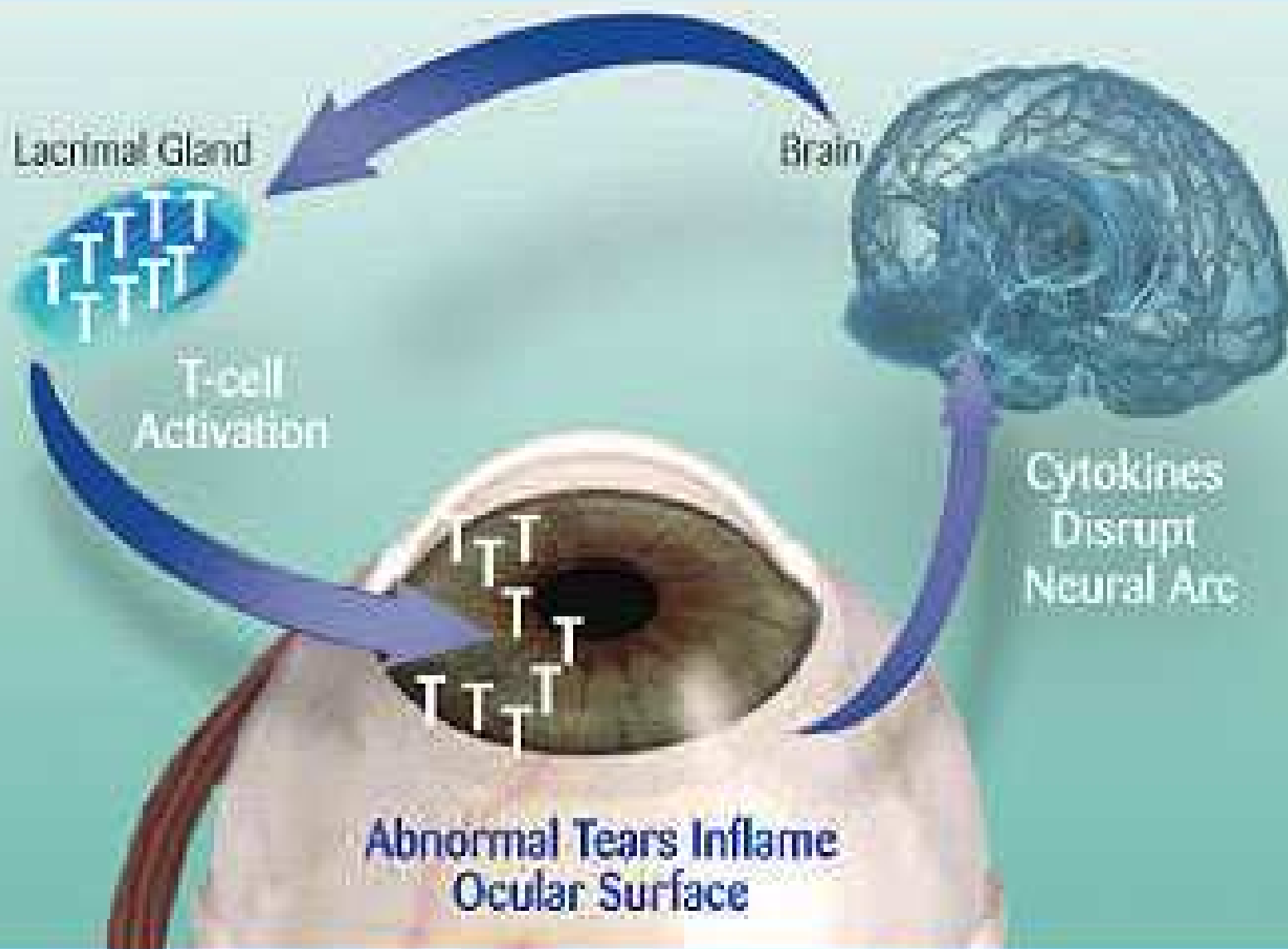
- Immunovigilant T-cells migrate through the LG, MG in search of inflammation
- Normally T-cells undergo apoptosis while leaving the gland enroute to lymph nodes
- With inflammation, epithelial cells of LG, OS, MG express antigens which bind to T-cells
- T-cells activate & secrete cytokines leading to more inflammation (Pflufelder, Beuerman, Stern 2004)

Lacrimal Gland Function Unit (Stern et al., 1998)

LACRIMAL GLAND FUNCTIONAL UNIT



DRY EYE: AN INFLAMMATORY CYCLE¹



CYTOKINES DELIVERED TO OCULAR SURFACE

New approach for better comprehension of diseases of the ocular surface

MECHANISTIC VIEW - Baudouin C (2004)

- Standard aetiologies (MGD, HRT, Allergies...) seen as risk factors to enter a self-stimulated biological process involving the ocular surface
- Chronicity, severity & presence of more than one risk factor may cause patient to enter self stimulated loop
- Tear film instability/imbalance key point of dry eye disease

Mechanistic view, sequelae

- Tear film impairment will cause hyperosmolarity of tears & superficial epithelial cells of cornea & conjunctiva
- Resident inflammatory T-cells stimulated
- Cell damage to cornea & conjunctiva by apoptosis, mechanical & osmotic stress
- Mucus, glycocalyx & adhesion forces destabilized
- LFU neuro-sensory reflex arc stimulated
- LG, MG neurogenic inflammation
- Cytokine release, MMP activation, inflammation of ocular surface

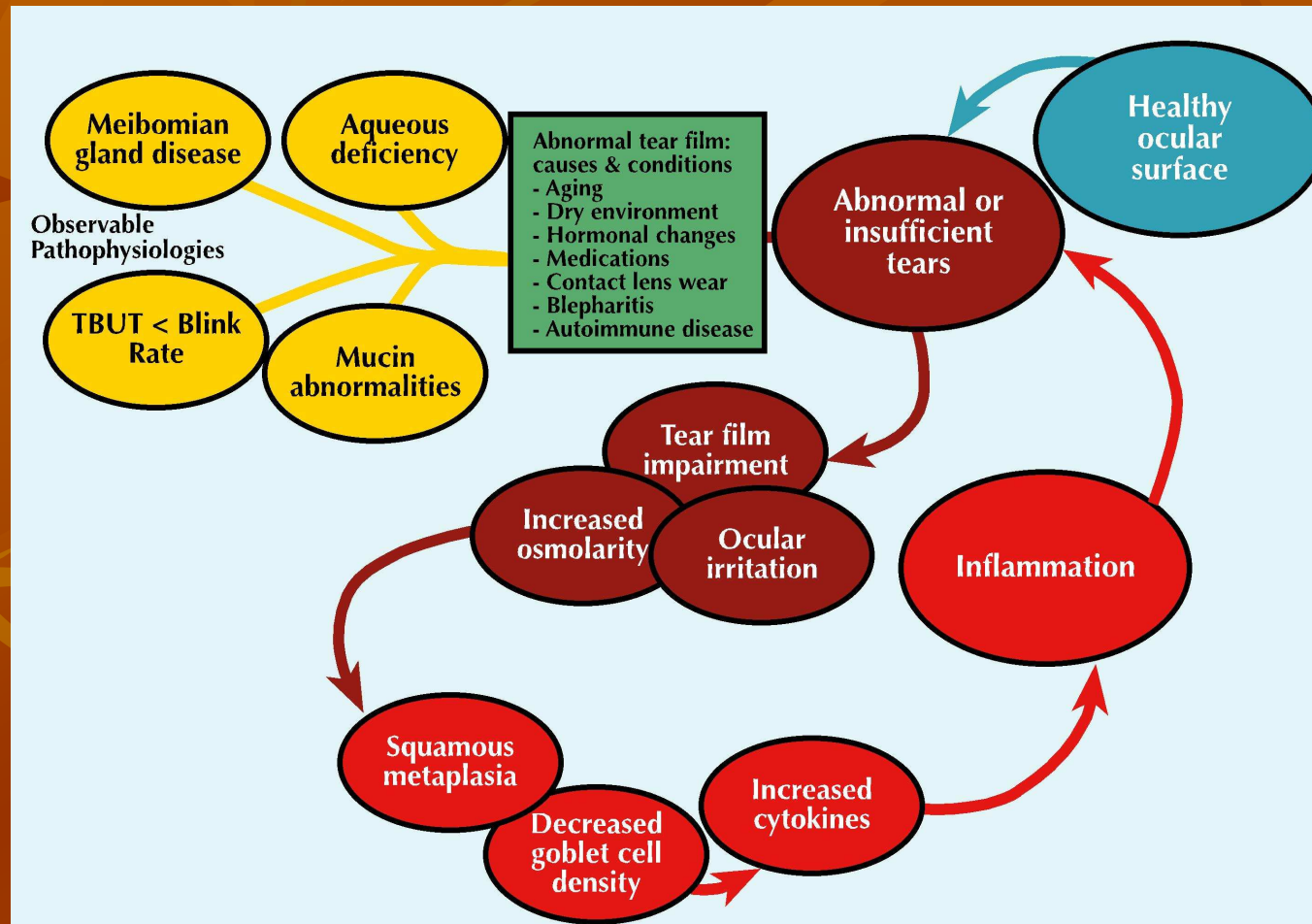
Sequalae continued


- Goblet cells are lost with further tear film instability
- With bacterial or viral disease present, endotoxins, lipopolysaccharides, and or lipase activation causing eyelid inflammation & MGD lead to tear film impairment
- Can participate in the vicious circle or be an independent or complementary loop
- Eventually stem cells are lost leading to epithelial and stromal damage

Mechanistic View

- Clinically this approach may explain examples of dry eye syndrome occurring after ocular surgery, contact lens wear, chronic allergy or systemic or topical drugs.

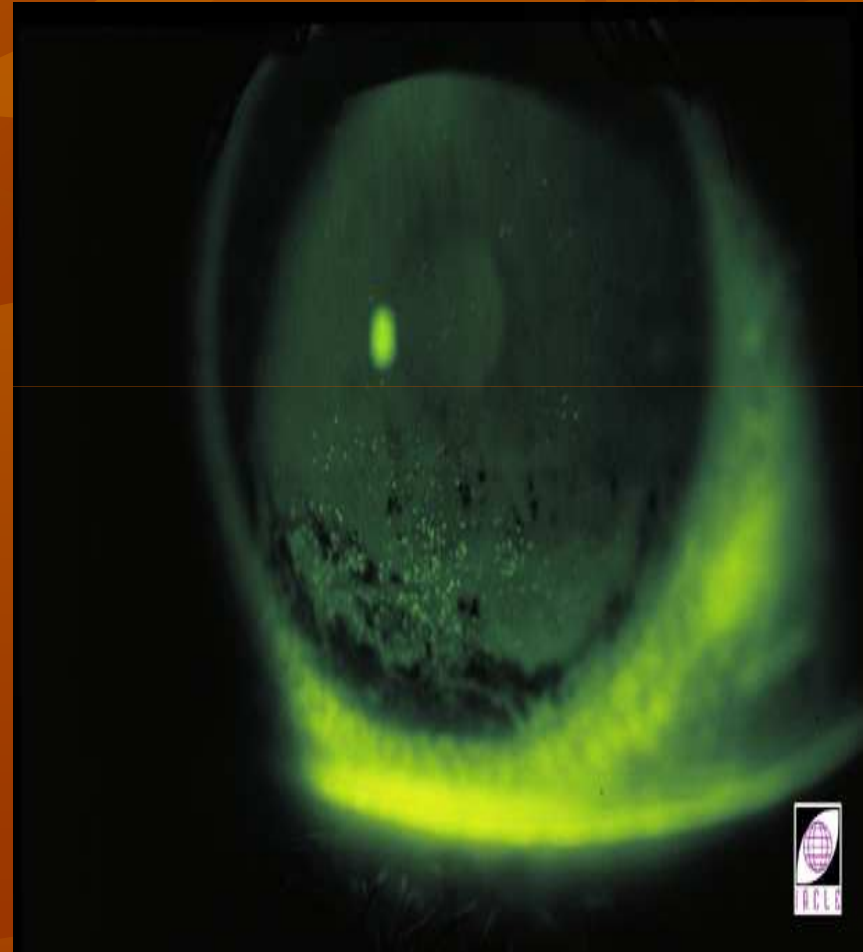
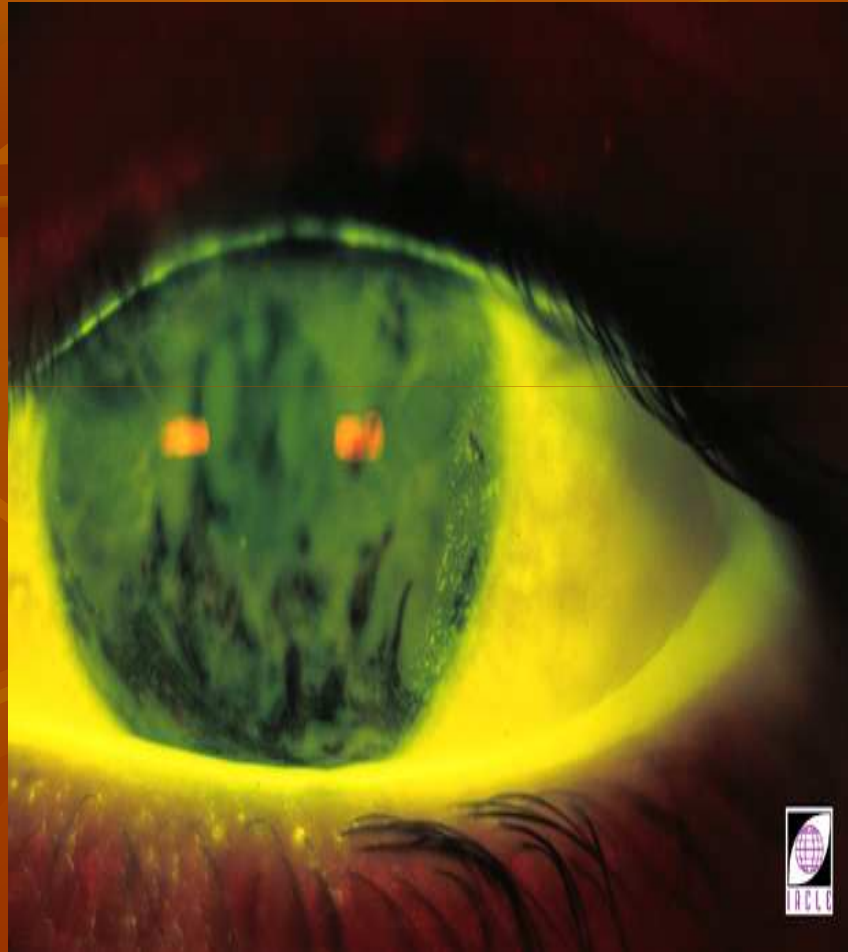
Dry Eye Cascade



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DIAGNOSING DRY EYE

Diagnosing Dry Eye – Not all look like this....



Diagnosis

- Symptomatically, dry eye fits the definition of a chronic pain syndrome.
- Although symptoms may vary during the day, the patients are in constant pain and are relegated to thinking about their eyes all day which makes many otherwise routine daily tasks more difficult.
- A large percentage of these patients become clinically depressed and require systemic anti-depressive therapy

Diagnosis

- Poor correlation between signs & symptoms
 - 57% symptomatic had objective signs
 - Attributed to symptoms preceding signs (Tomlinson)
- In many cases ocular surface's have been shown to be highly infiltrated with CD4 positive T-cells while still looking white under examination. (Not classical "red eye")
- The key sign to look for in patients is chronicity.
(Goa et al 1998, Brignole et al 2000)

Diagnosis

- Korb 1999 surveyed experts in dry eye
- Most used the following 4 tests to confirm dry eye
 - 1. **Case history**
 - 2. TBUT
 - 3. Rose Bengal or lissamine green stain
 - 4. Flourescein stain

Remember the tests only work after you have used your EARS

Symptomatology

- Clinical assessment must include thorough evaluation of **history and symptoms**
- Standardized questionnaire aids in consistency
- Several questionnaires have been developed, but most commonly used is designed by McMonnies 1996
 - Help predict presence of dry eye and/or monitor effects of therapy
 - <http://dryeyeni.com/dry-eye-questionnaire>

Patients rated their severity worse than professionals 23% to 60% of the time

Robin L. Chalmers, O.D., F.A.A.O

- 19% of patients rated their condition "severe," while the doctors rated only 9% severe.
- 36% of patients rated their condition "moderate," while the doctors rated only 20% moderate.
- 23% of patients rated their condition "mild," while the doctors rated 47% mild.

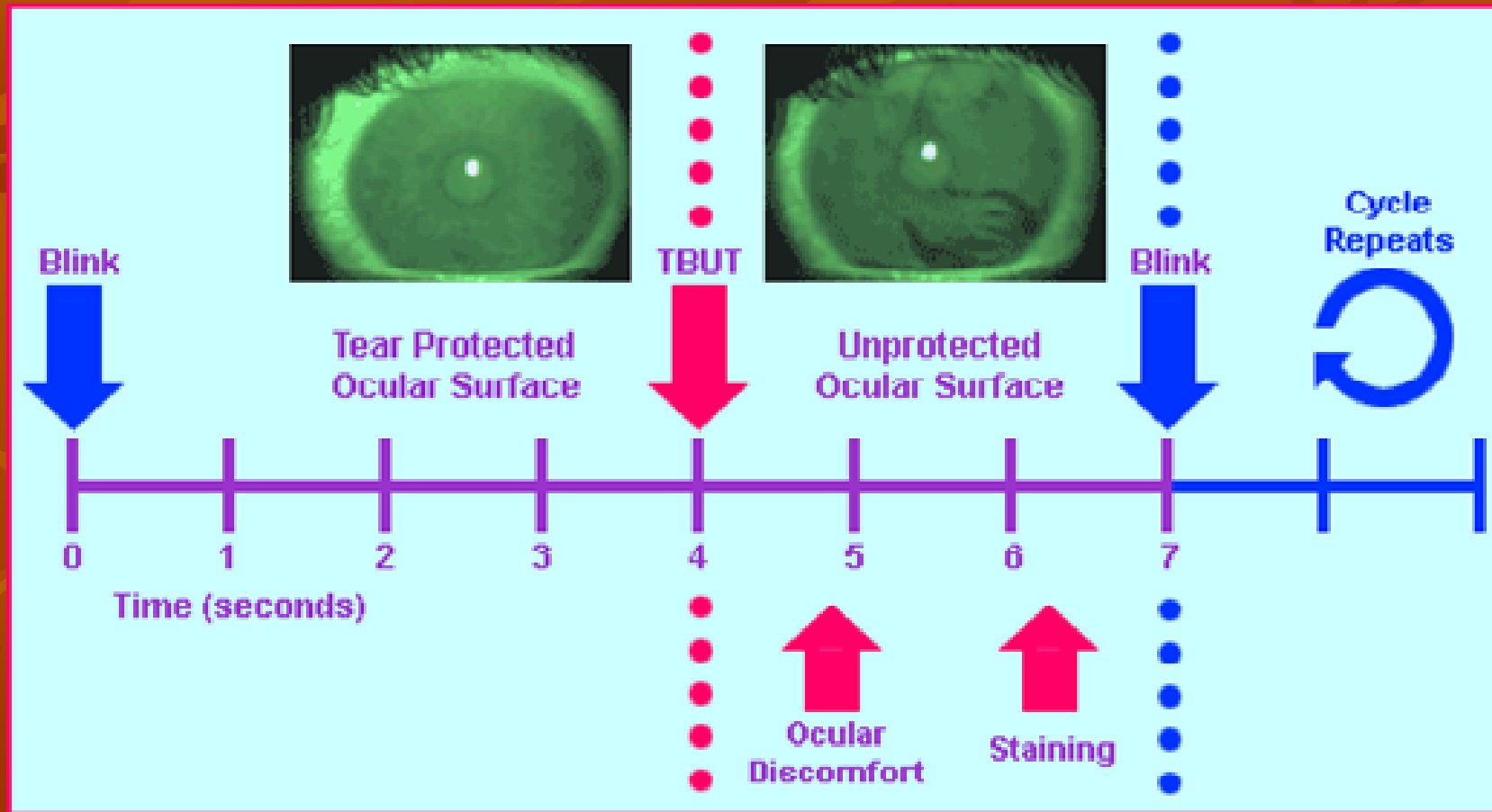
Issue with Px Compliance

www.clangnuts.com



*"Whoa - watch where you're standing Brian -
I've dropped a contact lens!"*

Ocular Protection Index



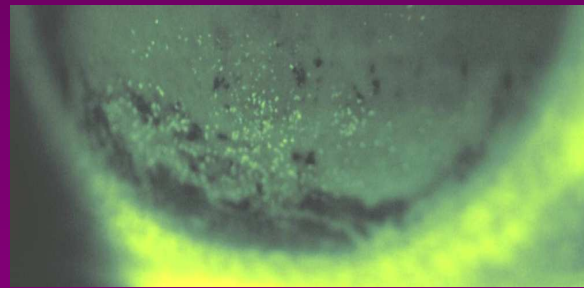
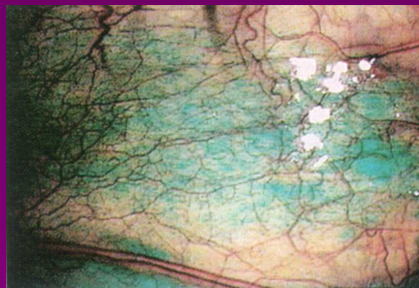
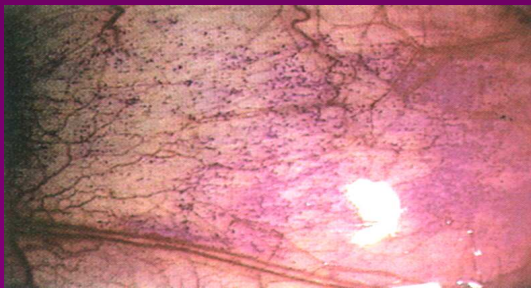
Diagnosis

DRY EYE

OCULAR SURFACE DAMAGE

Usually demonstrated by vital staining:

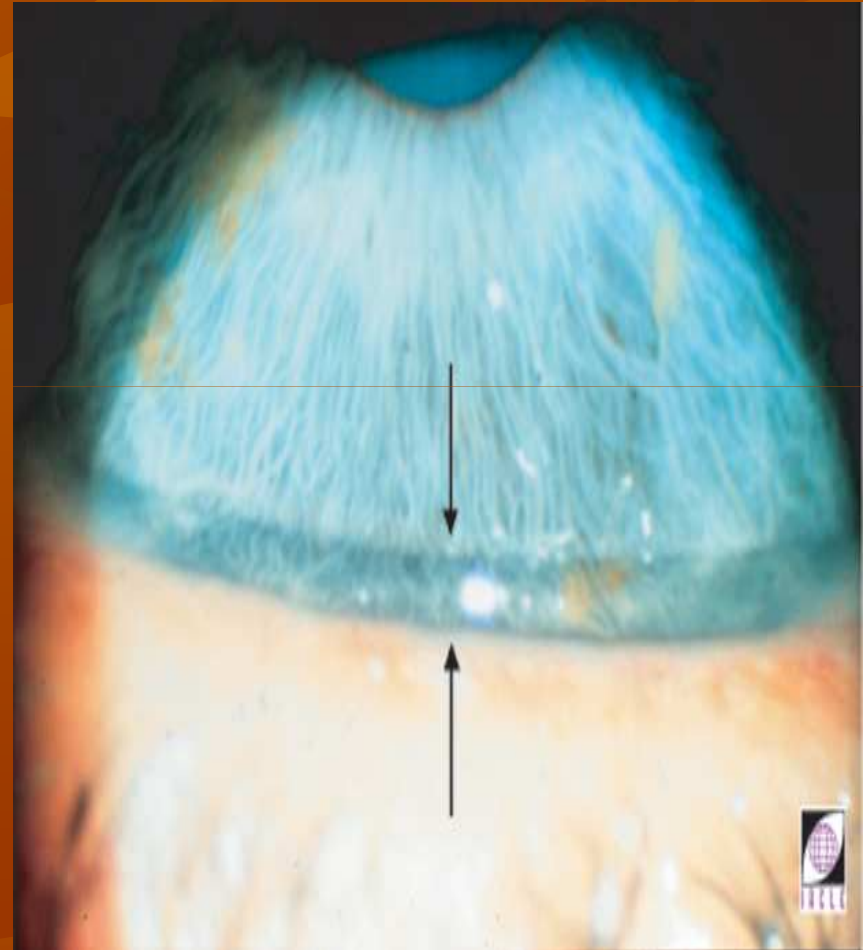
- Rose Bengal
 - *rating system exists (van Bijsterveld, 1969)*
- More recently, Lissamine Green used
 - *better tolerated*
- Sodium fluorescein also has a role
 - *observe with yellow barrier filter (W12, OG515)*



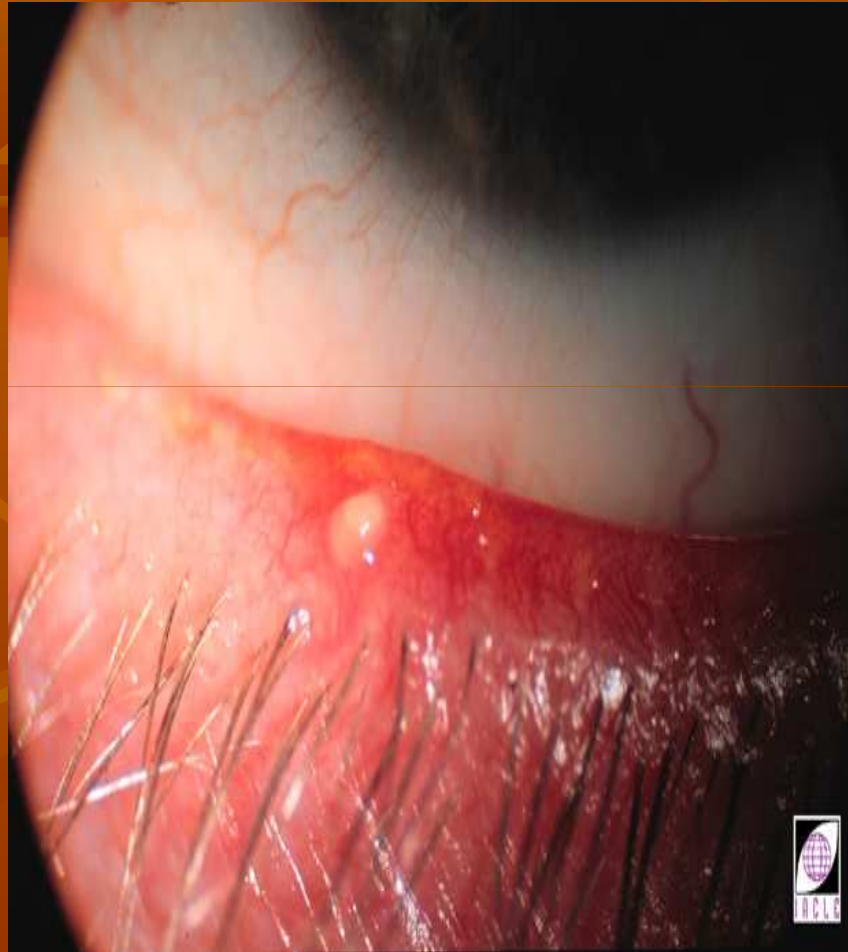
Dry Eye Signs



Diagnosis

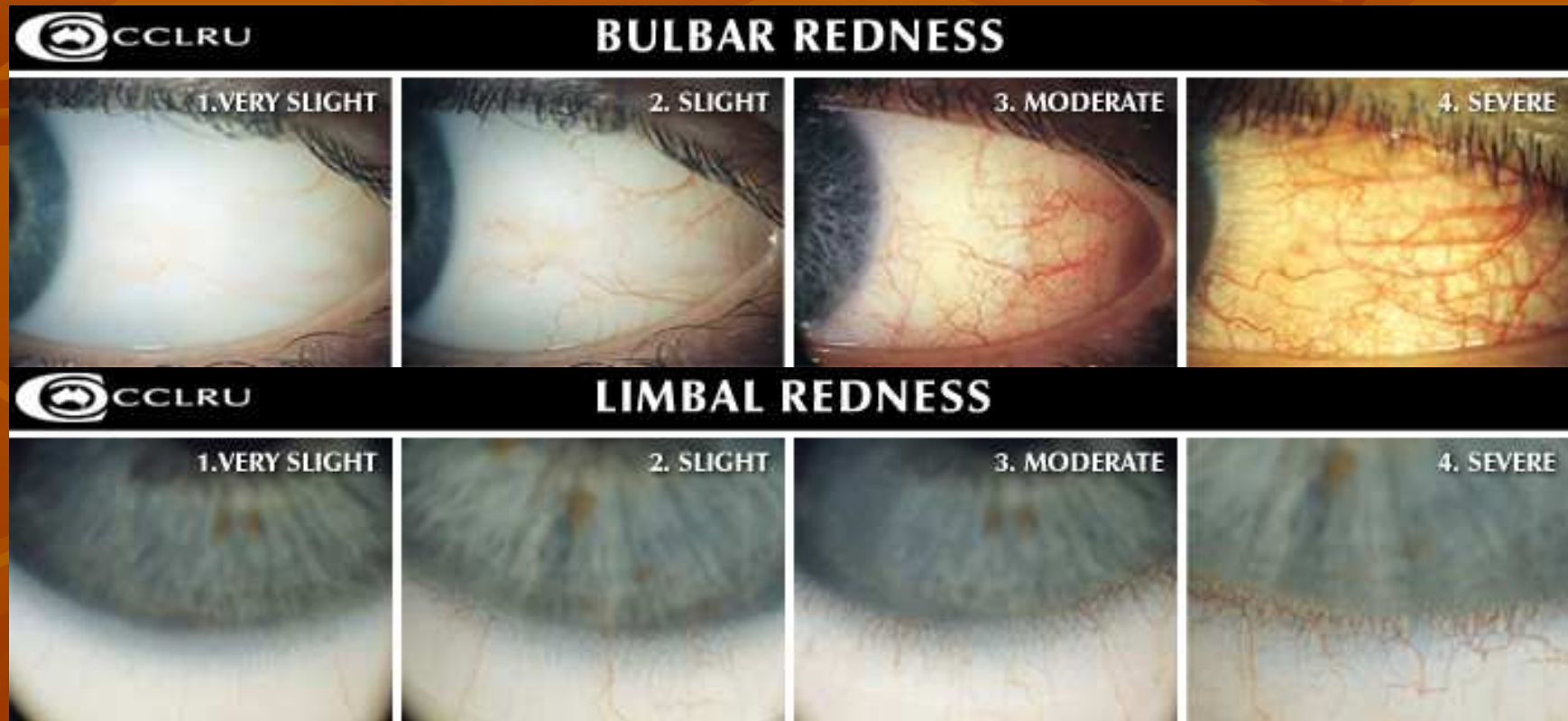


Diagnosis



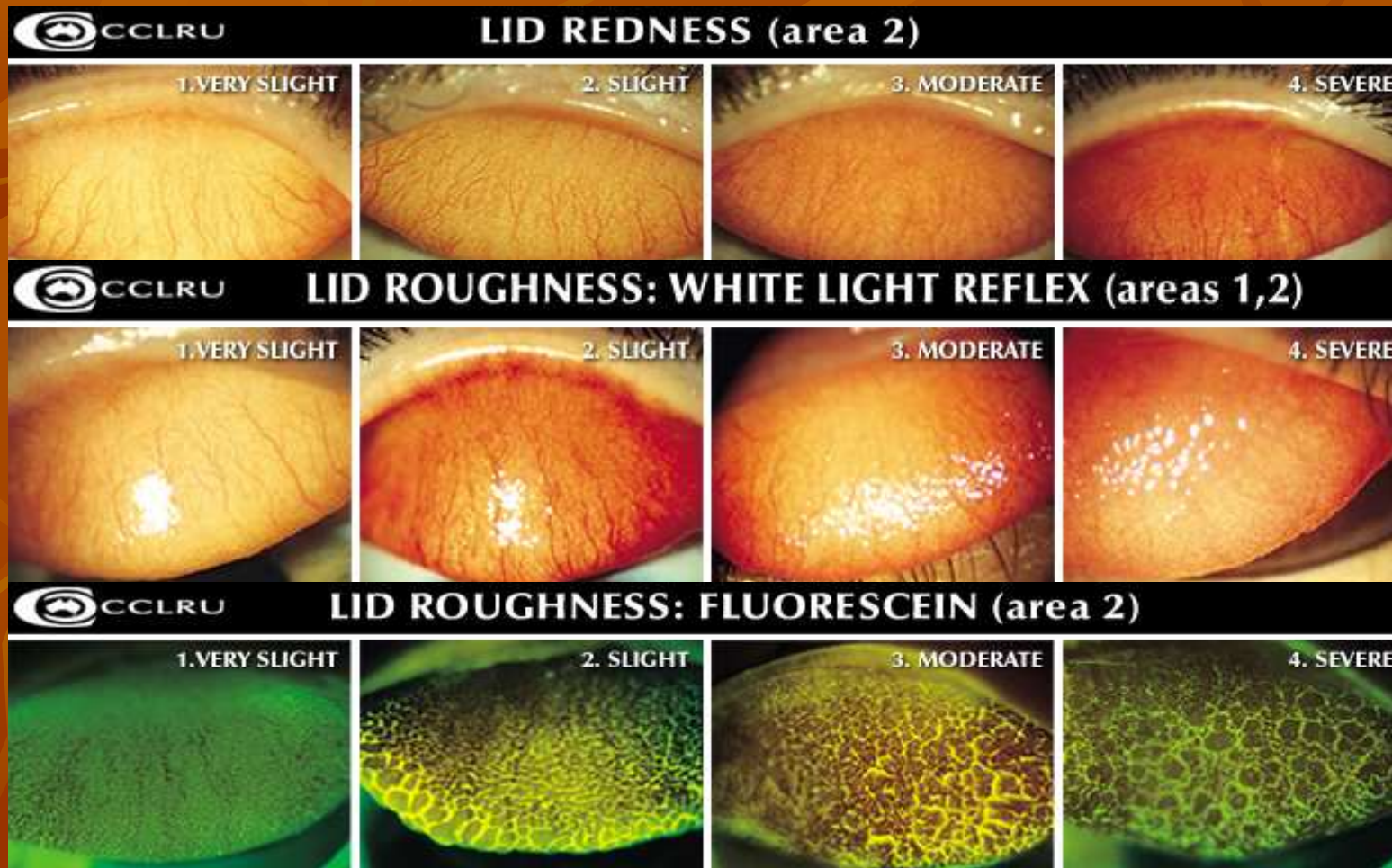
CCLRU GRADING SCALES

http://www.siliconehydrogels.org/grading_scales/DATA/front_page.htm



CCLRU GRADING SCALES

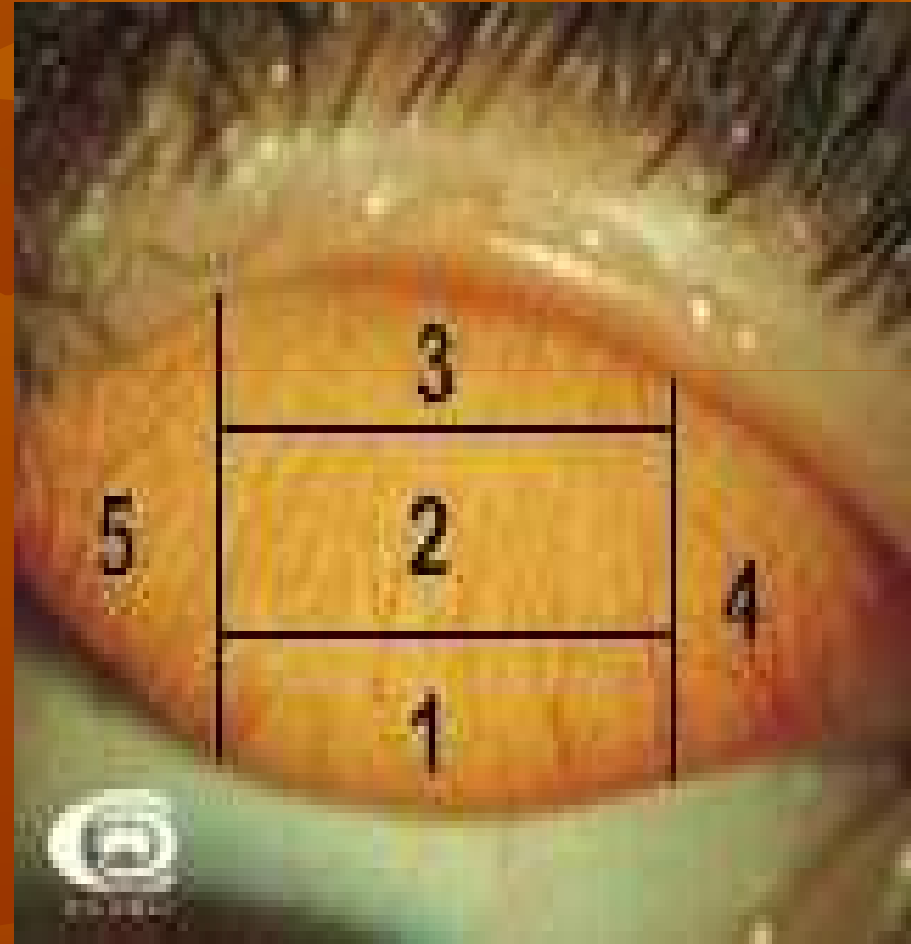
http://www.siliconehydrogels.org/grading_scales/DATA/front_page.htm



CCLRU GRADING THE PALPEBRAL CONJUNCTIVA

http://www.siliconehydrogels.org/grading_scales/DATA/front_page.html

- The palpebral conjunctiva is divided into five areas to grade redness and roughness
- Areas 1, 2 and 3 are most relevant in contact lens wear



CORNEAL STAINING GRADES

- The cornea is divided into five areas. The type, extent and depth of staining are graded in each area.
- *Type*
 - 1 Micropunctate
 - 2 Macropunctate
 - 3 Coalescent macropunctate
 - 4 Patch



- *Extent: Surface Area*
 - 1: 1 - 15%
 - 2: 16 - 30%
 - 3: 31 - 45%
 - 4: > 45%
 - *Depth**
 - 1 Superficial epithelium
 - 2 Deep epithelium, delayed stromal glow
 - 3 Immediate localized stromal glow
 - 4 Immediate diffuse stromal glow
- *Based on penetration of fluorescein and slit lamp optic section

Test Correlation

Dry eye tests have low result correlation to each other.
(Alan Thomlinson)

- **Schirmer & Rose Bengal**

- 25% sensitivity
- 90% of normal's diagnosed
- 31% positive predictive value

- **Osmolarity**

- 70% sensitivity
- 92% specificity
- 60% positive predictive value

Tearlab Osmolarity System



- New technology now available to test tear osmolarity
- Normal 312mOsm/L
- Abnormal > 329 mOsm/L
- Expensive
- Gold standard for dry eye testing



Tear Film & Contact Lenses

ISSUE WITH COMFORT

Clinical & Tear composition

Characteristics of Intolerant wearers

- Intolerant patients have more degraded lipid compounds. Glasson et al (2002, 2003)
- Greater levels of tear cholesterol esters associated with increased discomfort & unstable lipid layer. Guillon et al (2002)
- Tear volume (Zone Quick), NITBUT significantly reduced in intolerant wearers. Glasson et al (2002)
- TBUT < 10 seconds in 85% of intolerant wearers. Andres et al (1987)

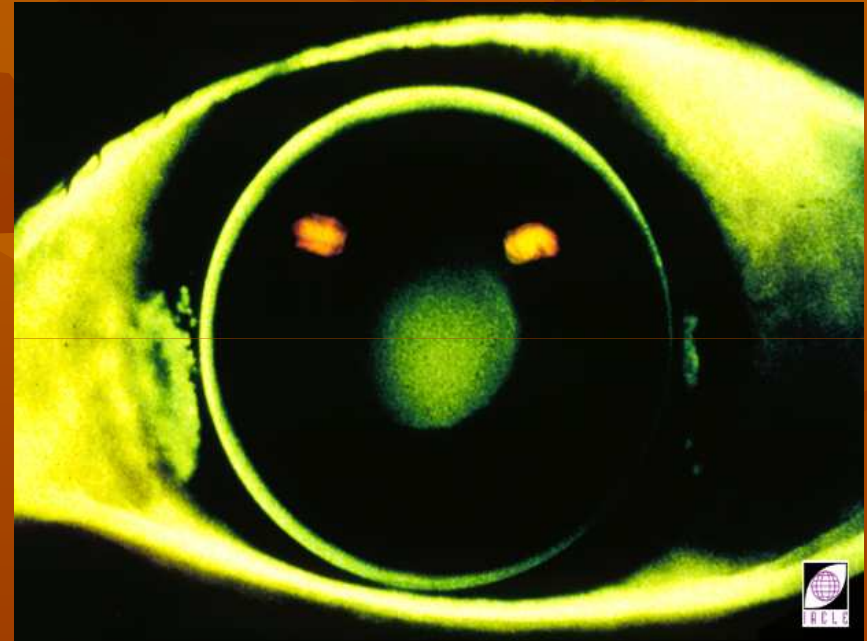
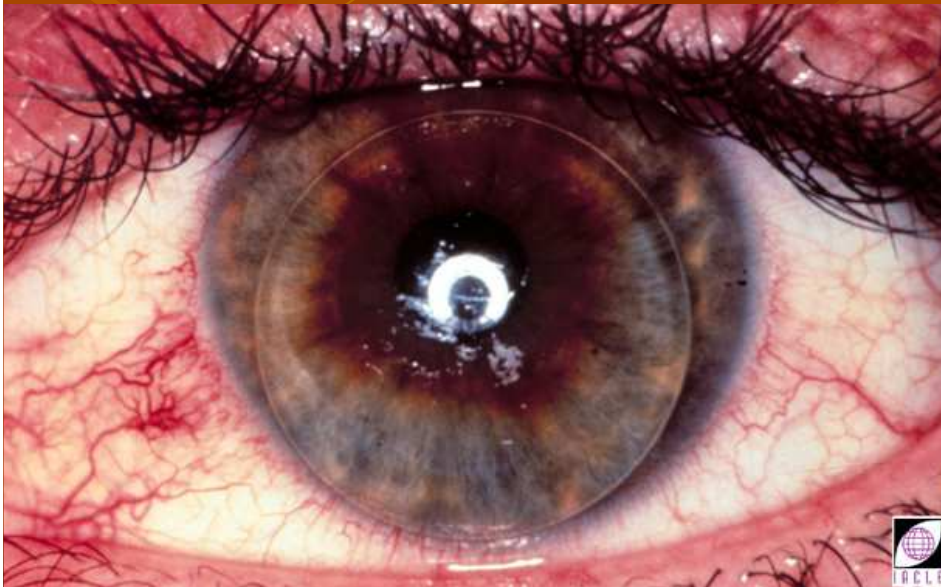
Contact Lenses And Tear Film

- Very little tear exchange occur under a soft lens, so what happens to the different components of the tear film?
- What lies on top of the lens?
- Does mucus make its way to the surface or does the aqueous layer lie directly on the lens?
- Does the lipid layer cover the aqueous, or is it thinned or absent?
- Is blink rate affected by the lens, affecting the lipid layer?

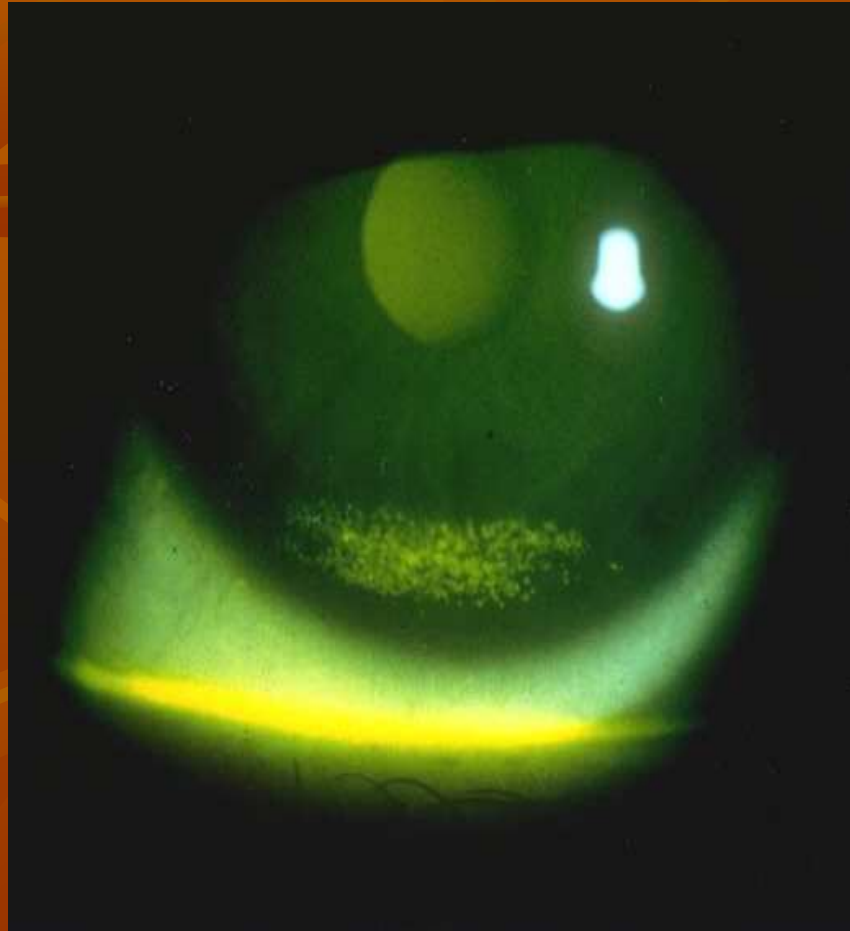
Effects on the Tear Film: RGP's

RGP's dry more at the
edges & front surface
of the lens

May cause stagnation of
post-lens TF



Inferior Arcuate Staining



- Soft lenses dry on the front surface – inferior arcuate staining
- Pervaporation staining – epithelial dessication if SCL
 - Too thin
 - High water content


Contacts & Tear Film

- Lens affects lid conformity & sensation; leads to poor mucus spreading, inflammation, MGD
- Lipid layer rupture, lipid layer is absent on RGP lenses
- TBUT reduced up to 58%, more with soiled surfaces



Contacts & Tear Film

- Can affect the glycocalyx, compromise epithelial health and affect corneal metabolism
- LFU is activated by inflammation, reduced tear production.....
- Most importantly, evaporation is increased & tear thinning time is decreased
- **All the above contribute to osmolarity changes**

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Effect of Lens Materials

ISSUE WITH COMFORT

Dry Eye Symptoms

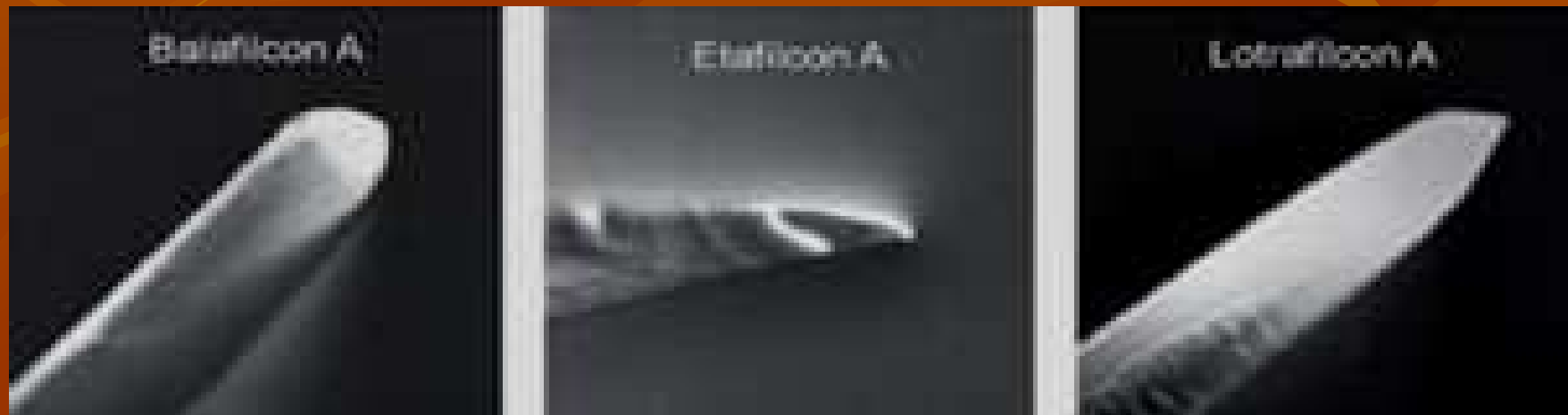
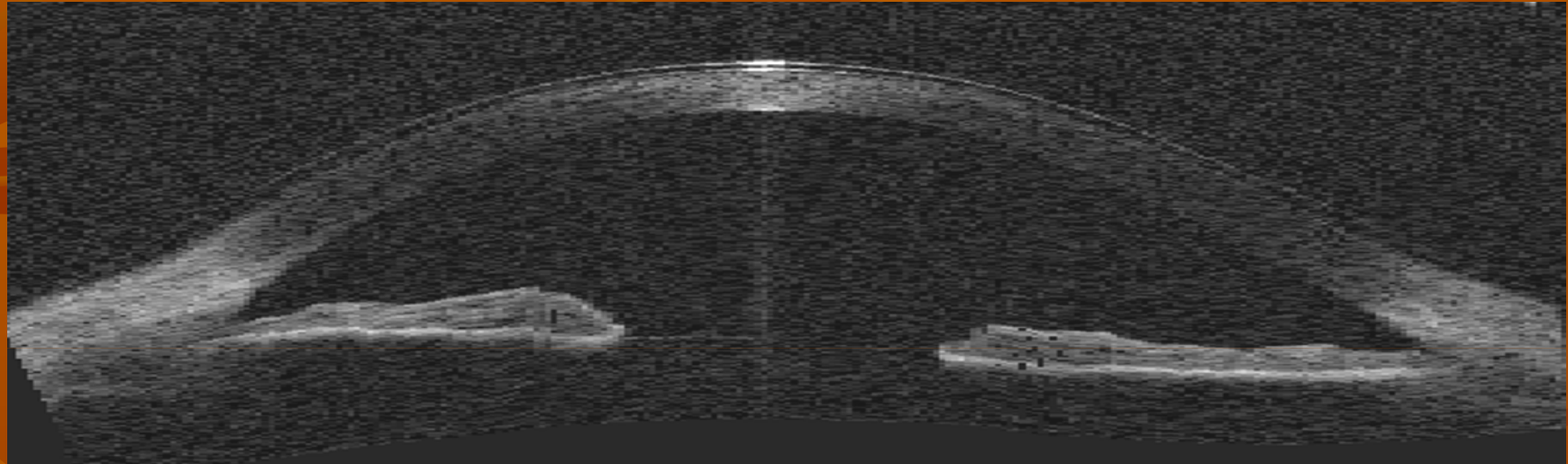
Effect of Lens Materials

- No correlation between lens dehydration and subjective symptoms of dryness or discomfort (Fonn et al.; 1999)
 - Dehydration of high water-content (low refractive index) is not the mechanism associated with symptoms
 - Polar head groups associated with tear film lipid molecules may be attracted to lenses of higher water content (or silicone expression), leaving their nonpolar tails extended away from the lens surface leading to evaporation and/ or non-wetting (PLTT & TFBU)
 - Leads to direct increase in osmolarity → inflammation

How do material compare?

- **Fonn et al. (1999, 2003)** examined comfort over 7 hour in symptomatic & non symptomatic wearers.
 - - Materials included; omafilcon A, etafilcon A, nefilcon A & lotrafilcon A
 - Comfort decreased equally with all materials over time only for ***symptomatic*** wearers
- **Thai et al. (2004)** examined aspects of biocompatibility using measures of tear physiology
 - Materials included; polymacon, omafilcon A, phemfilcon A, balafilcon A, etafilcon A
 - No significant differences among lens materials, irrespective of surface treatments
 - Except improved pre-lens tear film structure for omafilcon A

Lens edge and fit





Lens Care Systems

ISSUE WITH COMFORT

Care Solution Considerations

- Solutions have NB role in disinfecting lenses
- Recent events with product recalls remind us that we should never take the care system for granted
- It is also necessary to consider the interaction between CL materials and care systems, as the long and/or short term effect of solution incompatibility on discomfort and dryness is still uncertain
- SICS – solution induced corneal staining
 - Controversial topic as some degree of corneal staining is somewhat common in general non-wearing population



Treatment

General Treatment

- Tears, gels and ointments
- Systemic medication, tetracycline's
- Nutrition
- Topical anti-inflammatories & antibiotics
- Immunomodulatory agents
- Punctal occlusion
- Lid hygiene
- Topical androgen therapy
- Mucolytic agents

Treatment, C/L related dry eye

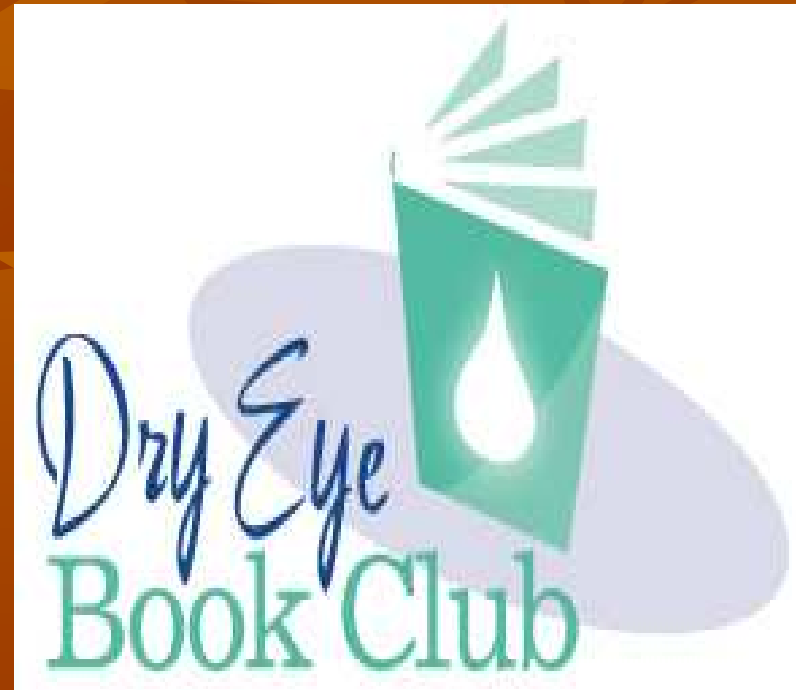
- Try treat the underlying cause, not just the symptoms
 - Detailed Case Hx
 - Be anti-smoking advocate
 - Change in make-up/CL solution/Eyedrops?
 - Complete dry eye work-up
 - Treat ocular surface problems first
 - Lid scrubs
 - Warm compresses

Treatment, C/L related dry eye

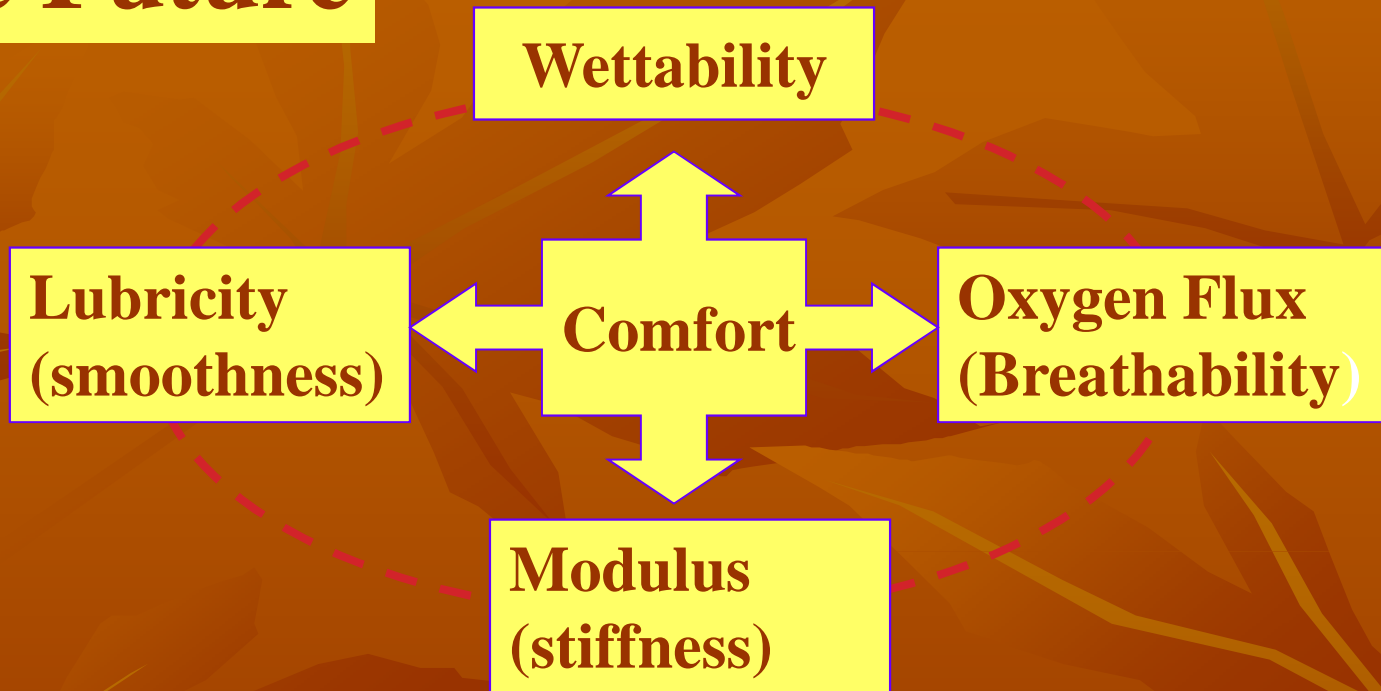
- Tear supplements, unpreserved
- Punctal occlusion
- Newer materials designed for drier eyes
- Increase lens bulk, lower water content
- Reduce coefficient of friction, improve lubricity, lens design
- Eliminate surfactants & preservatives, hydrogen peroxide seems best, single use lenses
- **Daily Disposables**
- Nutrition, Omega 3 +++
- Increase humidity in environment
- Midday soaks for rehydration
- Optimize blink frequency & fullness
- Cyclosporine bid
- doxycycline

Join the
Dry Eye Book Club
<http://www.dryeyebookclub.com>

- I love a good cry when I read a terrific book. Who doesn't? As women, we often find emotional release in the tears we shed over books like those on our **list of tear-jerkers.**



The Future



**“It shows off your astigmatism
very nicely”**



Enkosi

Merci



Tesekkürler

ขอบคุณ

Obrigado!



Dikey

Köszönettel

תודה

Gracias

Dankie

Bedankt

Vielen
Dank

Grazie

