CLINICAL MANAGEMENT OF OCULAR SURFACE DISEASE IN OPTOMETRY

Paul M. Karpecki, OD, FAAO
Educational & Clinical Director, PECAA
Ocular Surface Disease Health

• Discuss the associated pathology of dry eye
• Discuss modalities of diagnosis, etiology and predisposing factors
• Latest research of dry eye treatments
Ocular Surface Disease

Dry Eye Disease

- 19 years since starting my first dry eye clinic
- 14 of those years were.... frustrating
Predisposing factors

- Age
- Gender
- Environment
- Anterior Segment Disease
- Medications
- CL Wear
- Refractive surgery
- Systemic Disease
Gender

- Sjogren’s: Dry eye is characterized by a triad of dry eye, dry mouth, and associated auto-immune disorders
- Prevalence
  - 0.4%
  - 85% women
Prevalence of Dry Eye
(continued)

Prevalence by Age and Gender – WHS Study

![Graph showing prevalence of dry eye by age and gender for WHS Study.]
Environment

- Air conditioners or heaters
- Airline travel
- Winter months, allergy season
- Ceiling fan
- Exogenous irritants (smoking)
- Reading time/Computer
Most common presentation: “No lid margin disease”

Treatment decision based on severity level
Anterior Blepharitis
Anterior Blepharitis
Anterior Blepharitis
Anterior Blepharitis?
Anterior Blepharitis?
Anterior Blepharitis?
Cliradex

- Contains the active component of Tea Tree Oil (4-Terpineol)
- Preservative-free
- Safe for daily use
- Effectively cleans lashes, eyelids, and the face
- Refreshing menthol feeling
- Great for individuals seeking to improve overall eye and skin health
OcuSoft Tea Tree Kit

- Contains Tea Tree Oil + Buckthorn seed oil
- Bland Ung QHS
- OcuSoft Lid Scrub Plus
BlephEx Treatment

Healthy Lids for Life!
BlephEx Treatment
Frothy / Foamy Tears = MGD
Mild/Acute

- Hot compresses
- Lid hygiene
- Lipid based tears - mild/moderate
- Osmolarity lowering drops in moderate/severe
Bruder Stye Compress
ITEM #34170

Bruder Eye Hydrating Compress
ITEM #34160
Moderate/Acute

• Tobradex ST
• Zylet
• AzaSite
• Tobradex generic
Long Term

- Pulse dose medications periodically
- Restasis bid
- Essential fatty acids
  - EPA
  - DHA
  - GLA
Potential Chronic Changes

- Telangiectasia
- Dislocation of meibomian glands/ gland atrophy
- Scarring
Moderate/severe or not improving

- Add PO tetracycline
- Recommendation:
  - Doxycycline 50mg bid x 4-8 weeks then taper to qd
  - Doxycycline 20 mg bid x 4-8 weeks then taper to qd (periostat concern)
Tetracyclines

- Antibiotics inhibit bacterial protein synthesis by binding 30S ribosome
- Anti-inflammatory properties
  - decreases IL-1, TNF-α
  - decreases NO production
  - decreases HLA Class II antigen expression
  - decreases metalloproteinase production and activation
- Decrease symptoms and joint destruction in RA
Contraindications

- Pregnant or child bearing age
- Children
Cautions

- Photosensitivity
- Chelates with dairy products, antacids etc.
- Minocycline may cause vestibular toxicity
- Number one drop-out reason?
- GI problems
THERMODYNAMIC TX TO EXPRESS AND EVACUATE MGs

A new thermodynamic treatment to express & evacuate the MGs

The device applies controlled heat to the inner upper and lower palpebral conjunctival surfaces and lid margins, while simultaneously applying pulsating pressure over the upper and lower (outer) eyelids.

**THE LIPIFLOW**

(TearScience Inc., Morrisville, NC)

Heat applied to both *inner lid* surfaces
Pulsatile pressure applied to outer lids

FDA approved LipiFlow July 2011
Systemic medications

• Antihistamines
• Diuretics
• Antihypertensives
• Anticholinergics
• Antidepressants
• Cardiac antiarrhythmic
• Oral contraceptives
• Hormone replacement therapy
Tear Volume in Ocular Allergy Patients

- Tear Volume, µL
  - Days of Treatment
  - Topical Meds
    - 0: 13.72
    - 4: 14.72
  - Claritin®
    - 0: 13.34
    - 4: 8.84

- N = 18

- P = .0357

- 34% Reduction

ELESTAT® (Epinastine HCl ophthalmic solution) 0.05%

Ousler et al, Clin Ther 2007, 611:616
Contact lens wear

- Schedule & Care
- Type of Lens
  - Daily Disposable
    - DT1, TruEye
  - Non-ionic, low water content, weekly disposable
    - Hydrogel Vision icuity
  - SiHy 30 day
    - B&L Ultra
Refractive surgery

- Common for first 3-6 months
  - Neurotrophic
  - Goblet cell density
  - Tear flow
Mean Goblet Cell Density: Temporal Bulbar Conjunctiva

- Significantly increased goblet cell density after 12 weeks of topical cyclosporine

*P < .001 vs baseline, tears, and CsA 6 weeks
Mean Goblet Cell Density: Inferior Bulbar Conjunctiva

*P < .01 vs baseline and artificial tears

- Significantly increased goblet cell density after 6 and 12 weeks of topical cyclosporine
Systemic Disease

• Diabetes
• Rheumatoid Arthritis
  – Sjogren’s syndrome
• Thyroid Disease
• Lupus

• Dermatological: Rosacea & Psoriasis
Sjogren’s Syndrome

- Lymphocytic infiltration of lacrimal and salivary glands
- 0.4% prevalence
- Women > Men (younger women)
- Much lower androgen counts
- Treat underlying immune disorder
Which of these conditions are Sjogren’s patients 46x more likely to develop?

A. Leukemia    B. Lymphoma

C. Diabetes    D. Cardiac Arrhythmia
Which of these conditions are Sjogren’s patients 46x more likely to develop?

A. Leukemia  B. Lymphoma

C. Diabetes  D. Cardiac Arrythmia
Sjogren’s Syndrome

• Lymphocytic infiltration of lacrimal and salivary glands
• 5-8% incidence of B-cell non-Hodgkins Lymphoma
• 46.3x more often
  – Moutsopoulos HM et al
Sjogren’s Syndrome

• Medical Treatments: Secretagogues
  – Salagen 5 mg
    • Pilocarpine tablets
    • Avoid in asthma patients, GI ulcer, acute iritis or narrow angles
  – Evoxac 30 mg TID – saliva stimulating drug
    • Very effective with a lot less side effects
Symptoms of Dry Eye

- Burning
- Stinging
- Transient blur
- Dryness
- Photophobia
- Epiphora
- Blurred vision
- Contact lens intolerance
- Injection
- Increased blink rate
- Foreign body sensation
- Grittiness
Epiphora

- SLEEx finding - Conjunctivochalasis or trichiasis
- Nasolacrimal sac obstruction
- Lid Laxity conditions - ectropion
- Dry Eye
Clinic-cytologic study of conjunctivochalasis and its relation to thyroid autoimmune diseases: prospective cohort study.

de Almeida SF, de Sousa LB, Vieira LA, Chiamollera MI, Barros Jde N.

Department of Ophthalmology, External Diseases and Cornea Service, Federal University of Sao Paulo-Paulista Medical School, Sao Paulo, Brazil. sandra.flavia@click21.com.br

Abstract

PURPOSE: To determine the prevalence of conjunctivochalasis in patients with immune thyroid diseases, to determine whether there is any association between the 2 diseases, and to determine cytologic study of conjunctivochalasis through the cytology impression test.

METHODS: A clinical prospective cohort study carried out by the External Diseases Department in the Ophthalmology Sector and the Thyroid Department in the Endocrinology Sector at Federal University of Sao Paulo (UNIFESP). The patients included were divided into 2 groups following these inclusion criteria: a control group of 25 patients without thyroid diseases, confirmed after clinical and laboratory examinations (thyroid hormones), or any other ocular diseases. The study group consisted of 31 patients with thyroid diseases, the diagnosis of which was confirmed by the Endocrinology Sector. The thyroidopathies included were autoimmune diseases but excluded nonautoimmune diseases. A protocol endorsed by the UNIFESP was followed, using clinical and ophthalmological history, biomicroscopy, and impression cytology.

RESULTS: Fifty-two percent of patients without thyroid diseases and 88% of patients with thyroid diseases presented with conjunctivochalasis. The risk ratio was 1.705 (Pr > chi(2) = 0.0038), indicating that there is an association between them. For the impression cytology in inferior bulbar conjunctiva, there was an association between the result of the impression cytology and conjunctivochalasis (Pearson chi(2) = 10.1190 Pr = 0.006).

CONCLUSION: The prevalence of conjunctivochalasis in patients with autoimmune thyroid diseases was 88%. Patients with autoimmune thyroidopathy presented higher percentages of conjunctivochalasis than the control group, confirming the association between them. The cytologic study showed the highest prevalence of abnormal surface features in eyes with conjunctivochalasis.
Examination
External examination

- Skin
- Eyelids
- Cranial nerve function
- Hands
Diagnostic Tests 2014

- Pt questionnaire
- Tear meniscus height
- Tear break-up
- NAFL Dye
- Rose Bengal or Lissamine Green
- Schirmer test - phenol thread test
Diagnostic Testing: Now

1. Pt questionnaire- SPEED
2. TearLab osmolarity
3. Slit lamp examination
   1. CCH, anterior bleph, incomplete closure, allergy
4. MG Expression
5. NAFL Dye
   1. Tear meniscus height
   2. Corneal staining- late indicator
6. Meibomography
7. Blink analysis
Diagnostic Advances

- TearLab
- Osmolarity testing
- FDA approved
- 10 milli-microliters of tears
- Instant measurements of osmolarity in your clinic!
Hyperosmolarity and Inter-eye Differences Increase with Disease Severity and Return to Normal with Effective Treatment
Characteristics of Osmolarity

• Healthy eyes are normal and stable
• Tears in proper homeostasis should be equivalent to blood osmolarity which is between 280-295 mOsm/L
• In DED, tear osmolarity is elevated
• In DED, the tear film becomes unstable leading to inter-eye variability
• Symptoms do NOT correlate with osmolarity
• DED, as defined by elevated tear osmolarity, is far more prevalent than previously assumed
Tear Film Instability Increases With DED Severity

Mathematical model derived from Fig. 3:
OCULAR RESPONSE ANALYZER (ORA): One Device, Four Parameters:

- **IOPG** - Goldmann Correlated IOP
- **IOPCC** - Corneal Compensated IOP
- **CH** - Corneal Hysteresis
- **CRF** - Corneal Resistance Factor
Comparison to Young Patient
Treatment
Ocular Surface Disease: DIFFERENTIALS
Signs and Symptoms of DED are Poorly Correlated

Table 1. Correlation coefficients of determination among 344 subjects (n = 82, normal; n = 262, dry eye disease).

<table>
<thead>
<tr>
<th></th>
<th>Osm</th>
<th>TBUT</th>
<th>Sch</th>
<th>Cor</th>
<th>Conj</th>
<th>Meib</th>
<th>OSDI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Osmolarity</td>
<td>0.06</td>
<td>0.05</td>
<td>0.08</td>
<td>0.12</td>
<td>0.05</td>
<td>0.05</td>
<td>0.05</td>
</tr>
<tr>
<td>TBUT</td>
<td>0.06</td>
<td>0.08</td>
<td>0.14</td>
<td>0.15</td>
<td>0.15</td>
<td>0.09</td>
<td></td>
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<tr>
<td>Schirmer’s</td>
<td>0.05</td>
<td>0.14</td>
<td>0.14</td>
<td>0.13</td>
<td>0.05</td>
<td>0.06</td>
<td></td>
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<tr>
<td>Corneal</td>
<td>0.08</td>
<td>0.15</td>
<td>0.13</td>
<td>0.36</td>
<td>0.11</td>
<td>0.15</td>
<td></td>
</tr>
<tr>
<td>Conjunctival</td>
<td>0.12</td>
<td>0.15</td>
<td>0.36</td>
<td></td>
<td>0.13</td>
<td>0.14</td>
<td></td>
</tr>
<tr>
<td>Meibomian</td>
<td>0.05</td>
<td>0.15</td>
<td>0.11</td>
<td>0.13</td>
<td>0.17</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OSDI</td>
<td>0.05</td>
<td>0.09</td>
<td>0.16</td>
<td>0.17</td>
<td>0.17</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>0.07</td>
<td>0.12</td>
<td>0.09</td>
<td>0.17</td>
<td>0.11</td>
<td>0.11</td>
<td></td>
</tr>
</tbody>
</table>

Osm = osmolarity, TBUT = tear film breakup time, Sch = Schirmer test without anaesthesia, Cor = fluorescein corneal staining, Conj = lissamine green conjunctival staining, Meib = Bron/Foulks meibomian gland grading, OSDI = Ocular Surface Disease Index.

Symptoms of DED but normal osmolarity, minimal other signs

- DED that is well controlled
- CL solutions related -PATH
- Mild allergic conjunctivitis
- EBMD- MDF dystrophy
- Pinguecula & early Pterygium
- Infection - e.g. conjunctivitis
- Anterior blepharitis
  – Demodex

- GPC
- Asthenopia - vertical, CI etc.
- Salzmann’s Nodular Degeneration
- Mild/mod conjunctivochalasis

Patient with epiphora will actually have osmolarity readings below normal or very low
Treatment

• Emphasis chronic nature of the condition
• Eliminate exacerbating factors
  – smoking, air conditioner, meds.
• Drink 4-6 glasses of water per day
• Tear replacements
Treatment – AT’s

- Osmolarity lowering:
  - Blink Tears & TheraTears
- EBMD/corneal staining
  - FreshKote
- Lipid Deficient
  - Systane Balance, Soothe XP, Retain, Refresh Optive Advanced
- Aqueous deficient
  - Optive/Refresh, Systane Ultra
- Severe -----> Systane/Genteal gel
Before Lotemax (qid x 2 weeks then bid x 2 weeks) + FreshKote OS
After 4 weeks OS
Moderate to Severe KCS/
Dry Eye OD
After 4 weeks OD
Nutritional Supplements:
Essential fatty acids

- Omega fatty acids:
  - ALA - e.g. Flaxseed oil
  - EPA-DHA – e.g. Fish oils
  - GLA
    - Evening Primrose Oil
    - Black Currant Seed Oil etc.
HydroEye (HE) Clinical

**Purpose**: Evaluate HE in postmenopausal women with moderate-severe KCS & tear dysfunction

**Dual Sites**: Virginia Eye Consultants & Baylor University

**Type**: Double-blind, placebo-controlled, randomized

**Duration**: 6 months
Key Findings: Symptoms

HydroEye® therapy significantly decreased the mean OSDI score over the treatment period ($p=0.004$), while the OSDI score was essentially unchanged in the placebo group;

At the end of 24 weeks, OSDI scores were significantly reduced in the HydroEye® group compared to placebo ($p=0.05$).
Primary Sign Improvement

CD-11c Staining

†Significant increase in CD-11c-positive cell staining compared to baseline, P=0.004
*Significantly greater CD-11c staining intensity compared to supplement, P=0.001
Primary Sign Improvement

† Significant increase in HLA-DR-positive cell staining vs. baseline, P=0.03

*Significantly greater staining intensity for HLA-DR compared to placebo, P=0.001
Targeted Treatments

- Treatments aimed at local inflammatory processes
  - Topical corticosteroids (Lotemax)
    - Effective anti-inflammatory agents
    - Site specific Steroids
  - Cyclosporin A (Restasis)
Dry Eye Disease—A Real Condition That Needs More Than a Palliative Solution

• “Dry eye is a disorder of the tear film due to tear deficiency or excessive tear evaporation which can cause damage to the interpalpebral ocular surface.”¹

• Artificial tears provide temporary palliative relief²

“Artificial tears are inadequate because they fail...to prevent progression of Dry Eye disease.”³

J. Daniel Nelson, MD
Corneal Specialist
University of Minnesota

Corticosteroids

- Bind to nuclear receptors that bind DNA and regulate gene expression
- Interfere with transcription regulators [e.g., AP-1 & NF-kB]
- Most inflammatory pathways
  - Cytokine production
  - Lipid mediators (PGs)
  - Cell adhesion molecules
  - Lymphocyte trafficking
  - Vascular permeability
- Ring modifications alter potency and membrane stabilizing effects
Steroids and Dry Eye

Symptomatic improvement in irritation symptoms in 83% and objective improvement (↓ redness, dye staining and tarsal papillae, ↑ FTC) in 80% of 70 patients treated for 2 weeks with non-preserved methylprednisolone

Prabhasawat & Tseng BJO 1998
Steroids and Dry Eye

- Moderate (43%) or complete (57%) relief of irritation symptoms accompanied by corneal FL staining and resolution of filamentary keratitis in 21 SS patients treated for 2 weeks with non-preserved methylprednisolone (Marsh & Pflugfelder 1999)

- Patients often have long lasting relief after 2-week pulse therapy
Sjögren’s Syndrome KCS

Steroids Effectively Treat KCS (Marsh Ophthalmology 1999)

Pre-Steroid

Post-Steroid
Anti-inflammatory Therapy of KCS

Corticosteroids

- Improve signs and symptoms
- Improve tear clearance
- Normalize mucus production
- Often have sustained benefit after a 2 week pulse
- Bioengineered steroid loteprenol etabonate is effective
Percentage Change in Means Between BL and Two Weeks

Subjects with Corneal Staining Score ≥ 10 at Baseline

<table>
<thead>
<tr>
<th></th>
<th>Lotemax</th>
<th>Placebo</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUB</td>
<td>-41.8</td>
<td>-28.4</td>
</tr>
<tr>
<td>OBJ</td>
<td>-30.6</td>
<td>-9.7</td>
</tr>
<tr>
<td>CCS</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>LMI</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>ITH</td>
<td>-15.8</td>
<td>-10.0</td>
</tr>
<tr>
<td>IBH</td>
<td>-25.0</td>
<td>33.3</td>
</tr>
<tr>
<td>NBH</td>
<td>-31.8</td>
<td>12.5</td>
</tr>
<tr>
<td>RED</td>
<td>-47.3</td>
<td>-11.7</td>
</tr>
</tbody>
</table>
How Does Restasis™ Work?

• Restasis™ prevents T-cell activation
  (Kunert et al, Arch Ophthalmol. 2000;118:1489)
  – Activated T cells produce inflammatory cytokines that result in:
    • Recruitment of more T cells  (Stern et al, IOVS. 2002;43:2609)
    • More cytokine production  (Pflugfelder et al, Curr Eye Res. 1999;19:201)
Topical Cyclosporine

• Restasis Ophthalmic Emulsion (Allergan)
  – Useful in long-term management of inflammatory DES
  – BID dosage
  – Cyclosporine A (CsA) 0.05% in castor oil vehicle
  – Mechanism of action:
    • Inhibits activation of inflammatory T-lymphocytes, and induces immune cell apoptosis, stimulating lacrimal gland tear production
  – 3-4 months to achieve clinically significant effect, 6 months for full therapeutic potential
  – 59% Patients achieved improvement from baseline Schirmer scores at 6 months
  – Excellent safety profile
Increased Goblet Cell Density in Subset of 12 Patients

Percentage Change in Goblet Cell Density from Baseline

<table>
<thead>
<tr>
<th>Time (Days)</th>
<th>RESTASIS® Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>48</td>
<td>191%</td>
</tr>
<tr>
<td>96</td>
<td></td>
</tr>
<tr>
<td>143</td>
<td></td>
</tr>
<tr>
<td>191</td>
<td></td>
</tr>
</tbody>
</table>

$P = .013$

1. Data on file, Allergan, Inc.
Expectations During the First 6 Months of Therapy

Patients notice an onset of benefit

Further increase in tear production

Significant improvement in tear production

Improvements are maintained with continuation of therapy

1 month 3 months 6 months
TBUT Scores Over Two Years

Adapted from Rao 2010

- **RESTASIS® = Cs (n=36)**
- **REFRESH ENDURA® = AT (n=22)**

* p<0.001 vs. REFRESH ENDURA®

Cs-Cs = cyclosporine 0.05% first year; randomized to cyclosporine 0.05% in second year
AT-Cs = artificial tears first year; randomized to cyclosporine 0.05% in second year
Cs-AT = cyclosporine 0.05% first year; randomized to artificial tears in second year

Data extrapolated from Rao 2010 and 2011

† p<0.001 vs. AT-Cs and Cs-AT
Oxford Staining Scores Over 2 Years

![Graph showing Oxford Staining Scores Over 2 Years](image)

- **RESTASIS® = Cs (n=36)**
- **REFRESH ENDURA® = AT (n=22)**

- *p<0.036 vs. REFRESH ENDURA®

- Cs-Cs (n=20)
- AT-Cs (n=20)
- Cs-AT (n=8)

- Data extrapolated from Rao 2010 and 2011

- †p=0.004 vs. Cs-AT
- ‡p<0.001 vs. Cs-AT


Topical Loteprednol Improves Patient Compliance and Restasis Efficacy

- Corticosteroids have been shown to improve tear production by controlling inflammation\(^1\)
- Corticosteroids decreases irritation associated with use of Restasis by 75\(^%\)\(^2\)
- Recommend a mild corticosteroid such as loteprednol qid for two weeks and then bid for 2 weeks for patients who complain of irritation with Restasis, high maintenance patients, and patient who want more rapid relief

1 Marsh, Pflugfelder. *Ophthalmology* 1999
2 Shepard, ASCRS 2005
No Cyclosporine in Blood

- No detectable cyclosporine in blood of any RESTASIS® ophthalmic emulsion–treated patient
- Toxicity associated with systemic or oral cyclosporine was not observed with cyclosporine 0.05% ophthalmic emulsion

Please see slides 6 & 7 for important safety information.

Options for Non-Responsive Patients
Punctal Occlusion

- May worsen certain conditions
  - Allergies
  - MGD
  - Inflammatory dry eye?
- Treat those conditions first then plug
- Ideal FIRST treatment option for:
  - Neurotrophic keratopathy
  - Post-LASIK dry eye
  - Lagophthalmos
<table>
<thead>
<tr>
<th>Normal tears</th>
<th>Autologous Serum</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH = 7.4</td>
<td>pH = 7.4</td>
</tr>
<tr>
<td>Osmolality = 298</td>
<td>Osmolality = 296</td>
</tr>
<tr>
<td>EGF (ng/ml) = 0.2-3.0</td>
<td>EGF (ng/ml) = 0.5</td>
</tr>
<tr>
<td>TGF-b (ng/ml) = 2-10</td>
<td>TGF-b (ng/ml) = 6-33</td>
</tr>
<tr>
<td>Vitamin A (mg/ml) = 0.02</td>
<td>Vitamin A (mg/ml) = 46</td>
</tr>
<tr>
<td>Lysozyme (mg/ml) = 1.4</td>
<td>Lysozyme (mg/ml) = 6</td>
</tr>
<tr>
<td>Fibronectin (ug/ml) = 21</td>
<td>Fibronectin (ug/ml) = 205</td>
</tr>
<tr>
<td></td>
<td>Hepatocyte GF, NGF, IGF-1, substance p, Complement, Fibroblast GF, c GRP, other Ig, etc.</td>
</tr>
</tbody>
</table>
LACRISERT® (hydroxypropyl cellulose ophthalmic insert)

LACRISERT is indicated in patients with moderate to severe dry eye syndromes (DES), including keratoconjunctivitis sicca.

LACRISERT is indicated especially in patients who remain symptomatic after an adequate trial of therapy with artificial tear solutions.

LACRISERT is also indicated for patients with exposure keratitis, decreased corneal sensitivity, and recurrent corneal erosions.
PROKERA®

Class II medical device comprising of CRYOTEK™ amniotic membrane into a thermoplastic ring set

Combines the functionality of a symblepharon ring with the biologic actions of CRYOTEK™ amniotic membrane to create a unique treatment option for corneal and limbal wound healing
Clinical Evidence for PROKERA®

- A safe and effective method to promote healing of the corneal surface with minimal side effects\(^1\)
- Inhibits abnormal angiogenic processes and inflammation, thus promoting scarless healing\(^1\)-\(^7\)
- Stimulates healthy re-epithelialization of the corneal wound without sutures\(^1\),\(^2\),\(^4\)-\(^6\),\(^8\)
- Provides pain relief and reduces haze, resulting in improved visual acuity by a mean (SD) of 2.5 (2.6) Snellen lines\(^2\)

# Ocular Surface Disorders

<table>
<thead>
<tr>
<th>Diseases with Pre-existing Epithelial Defects</th>
<th>Diseases without Epithelial Defects</th>
<th>Diseases with Unhealthy Epithelium or Basement Membrane</th>
</tr>
</thead>
<tbody>
<tr>
<td>to promote wound healing and reduce complications (debridement is optional)</td>
<td>to prevent further damage and promote regeneration (no debridement/PTK)</td>
<td>to promote regeneration (after debridement/PTK)</td>
</tr>
<tr>
<td>• neurotrophic persistent corneal epithelial defect</td>
<td>• dry eye syndrome</td>
<td>• recurrent corneal erosion, EBMD</td>
</tr>
<tr>
<td>• post-infectious recalcitrant corneal ulcers (e.g. herpetic, vernal, and bacterial)</td>
<td>• superficial (punctate) keratitis</td>
<td>• Salzmann’s nodular degeneration</td>
</tr>
<tr>
<td>• non-healing epithelial defect after PRK/PTK</td>
<td>• filamentary keratitis</td>
<td>• bulous keratopathy during/following DSEK</td>
</tr>
<tr>
<td>• acute chemical/thermal burns</td>
<td>• radiation keratitis; whorl pattern indicative of limbal stem cell injury</td>
<td>• haze after PTK</td>
</tr>
<tr>
<td>• acute Stevens-Johnson syndrome/toxic epidermal necrolysis</td>
<td>• exposure (Graves) keratopathy</td>
<td>• partial limbal stem cell deficiency</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• corneal dystrophy (e.g., Reiss-Buckler)</td>
</tr>
</tbody>
</table>

## Refractive Indications

### Before Surgery
- to treat pre-existing ocular surface disorders and restore corneal integrity before refractive, corneal, or cataract surgery

### After Surgery
- to enhance healing
- to prevent post PRK haze
PROKERA® Insertion

- Set patient expectations! Inform the patient they may experience some initial stinging and foreign body sensation
- Apply topical anesthesia
- **Rinse** the PROKERA® with a sterile solution (saline, BSS etc…)
- Hold the upper eyelid
- Ask the patient to look down
- Insert the PROKERA® into the superior fornix, preferably using your fingers to hold the ring
- Slide the PROKERA® under the lower eyelid
<table>
<thead>
<tr>
<th></th>
<th>PROKERA® Slim</th>
<th>PROKERA®</th>
<th>PROKERA® PLUS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Outer Ring Diameter:</strong></td>
<td>21.6 mm</td>
<td>21.6 mm</td>
<td>21.6 mm</td>
</tr>
<tr>
<td><strong>Inner Ring Diameter:</strong></td>
<td>17.9 mm</td>
<td>15.5 mm</td>
<td>15.5 mm</td>
</tr>
<tr>
<td><strong>Device Height</strong></td>
<td>0.7 mm</td>
<td>1.1 mm</td>
<td>1.1 mm</td>
</tr>
<tr>
<td><strong>Tissue Thickness</strong></td>
<td>Single Layer</td>
<td>Single Layer</td>
<td>Multiple Layers</td>
</tr>
<tr>
<td><strong>Ring Description</strong></td>
<td>Ring &amp; Elastomeric Band System (polycarbonate)</td>
<td>Dual Ring System (polycarbonate)</td>
<td>Dual Ring System (polycarbonate)</td>
</tr>
</tbody>
</table>
SCLERAL LENSES
Scleral lenses are large diameter gas permeable lenses that rest beyond the limits of the cornea and extend onto the sclera.
Progression of Dry Eye Disease

- Dry eye is a progressive, potentially irreversible disease
- Left untreated, the cycle of inflammation and dysfunction may cause permanent damage to the lacrimal gland
DTS Treatment Algorithm

**LEVEL 1**
- Patient education
- Environmental modifications
- Control systemic medications

If no improvement, add level 2 treatments

- Preserved tears
- Allergy control

**LEVEL 2**
- Unpreserved tears
- Gels/nighttime ointments
- Nutritional support
- Cyclosporin A
- Topical steroids
- Secretagogues

If no improvement, add level 3 treatments

**LEVEL 3**
- Tetracyclines
- Punctal plugs (control inflammation 1st)

If no improvement, add level 4 treatments

**LEVEL 4**
- Systemic anti-inflammatory therapy
- Acetylcysteine
- Moisture goggles
- Surgery (punctal cautery)
Dry Eye Disease Conclusion:

- Inflammation at the root of the pathology as a cause or effect with osmolarity
- MGD = DED and key to DED
- Numerous new treatment options that now make treating dry eye enjoyable
- Likely the most common condition we will see over the next two decades
GLAUCOMA SIMILARITY

• Look at the structure and functioning of the MGs and ocular surface

• Multiple testing:
  – IOP = osmolarity
  – VF testing = corneal staining
  – OCT = meibomography/LipiView
  – MG expression = ONH examination
FUTURE: DENTAL MODEL

• Tooth Brush & Floss = Hydrating compress and lid hygiene products

• Dental cleaning = mechanical cleaning i.e. LipiFlow

• Dental X-rays = Meibomography/Lipiview
Patient Ocular Surface Disease Questionnaire

- Ocular Surface Questionnaire

- Patient Name: _________________________________
- Date: ____________________
- Demographic information
- 1. Please check any that apply to you? Are you:
  - Female?: □
  - Using a computer more than 1 hour a day?: □ ___hrs
  - Pregnant or Nursing?: □
  - Reading for more than 1 hour per day?: □
  - Over age 40?: □
  - A contact lens wearer?: □
  - A Tobacco user?: □
  - Traveling in airplanes more than twice per month?: □
  - Routinely using a ceiling fan in your bedroom?: □
  - Drinking more than 3 caffeinated (coffee, tea or cola’s) drinks per day?: □
  - Getting less than 7 hours of sleep per night in an average week?: □

- Approximately how many glasses of water do you drink per day?
  - 3 or more □
  - Less than 3 □

- Approximately how many servings of fish do you eat per week?
Risks Factors for Dry Eye
Association with Dry Eye is Suggested by Literature

• Asian race
• Certain medications:
  - Tricyclic antidepressants
  - Selective serotonin reuptake inhibitors
  - Diuretics
  - Beta-blockers
  - Isotretinoin
• Diabetes
• HIV
• Chemotherapy
• PK or large-incision corneal surgery
• Low humidity environments

Consistent Association with Dry Eye is Well Documented

- Increasing age
- Female gender
- Hormone replacement therapy
- Omega-3 and Omega-6 fatty acids
- Systemic antihistamine use
- Connective tissue disease
- Refractive surgery
- Vitamin A deficiency
- Androgen deficiency
- Rosacea
Consistent Association with Dry Eye is Unclear:

- Cigarette smoking
- Hispanic ethnicity
- Anti-cholinergics:
  - Anxiolytics
  - Antipsychotics
- Alcohol
- Menopause
- Botox injection
- Acne
- Gout
- Oral contraceptives
- Pregnancy