Dry eye is not just a disease, it’s a complex, multifactorial disorder.

Dry Eye Evaluation
- Vision care Exam
  - CONVERSION
- Medical Exam

DEWS
- Dry eye is a 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. It is accompanied by increased osmolarity of the tear film and inflammation of the ocular surface.

Ocular Surface Disease
- Keratoconjunctivitis Sicca
  - Irregular and Poorly Lubricated Corneal Surface
  - Altered Barrier Function

Predisposing factors
- Age
- Gender
- Environment
- Anterior Segment Disease
- Medications
- CL Wear
- Refractive surgery
- Systemic Disease
**Environment**
- Air conditioners or heaters
- Airline travel
- Winter months, allergy season
- Ceiling fan
- Exogenous irritants (smoking)
- Reading time/Computer

**Tear Volume in Ocular Allergy Patients**

**DTS: Clinical Categories**
- Most common presentation: "No lid margin disease"
- Treatment decision based on severity level

**Dry Eye Etiology**
- Tear Deficient
- Evaporative
- Spillage
- Non-Spillage
- Contact Lens
- Surface Change
- Lacrimal Deficiency
- Lacrimal Deficiency Utilization
- Reflex
- Aqueous Deficiency
  - Insufficient tear production by accessory and primary lacrimal glands
  - Sign: low Schirmer (tear volume/flow) score, tear meniscus height (better measurement)
- Mucin Deficiency
  - Insufficient or unhealthy mucin production
  - Sign: rapid tear film break-up time (TFBUT)
- Lipid Deficiency
  - Meibomian gland dysfunction (MGD) causing insufficient or unhealthy lipid production
  - Sign: irregular meibomian gland expression, fast TFBUT

**Dry Eye Evaluation**
- Vision care Exam
- Medical Exam

**Tear Osmolarity**

**Tear Film Instability (cont)**

**Tear Film Instability**
- Note that a patient may have one or more of these deficiencies—they are not mutually exclusive

**Tear Volume**
- Bars represent Treatment days
- Significance: P = .0357

**Claritin®**

**ELESTAT® (Epinastine HCl ophthalmic solution) 0.05%**

**N = 18**

**Ousler et al, Clin Ther 2007, 611:616**

**Behrens et al, submitted**

**Sjogrens Non-Sjogrens Auto-antibodies**

**Tear Deficient**

**Evaporative**

**Spillage**

**Non-Spillage**

**Contact Lens**

**Surface Change**

**Lacrimal Deficiency**

**Lacrimal Deficiency Utilization**

**Reflex**

**Aqueous Deficiency**

**Mucin Deficiency**

**Lipid Deficiency**

**Dry Eye Etiology**

**Dry Eye Evaluation**

**Tear Osmolarity**

**DTS: Clinical Categories**

**Environment**

**Tear Volume in Ocular Allergy Patients**

**DTS: Clinical Categories**

- Most common presentation: "No lid margin disease"
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**Dry Eye Etiology**

**Dry Eye Evaluation**

**Tear Osmolarity**

**DTS: Clinical Categories**

- Most common presentation: "No lid margin disease"
- Treatment decision based on severity level
Osmolarity Provides Improved Standard of Care

- Tear osmolarity is the most accurate diagnostic test for dry eye disease
- Elevated osmolarity is the central mechanism causing ocular surface damage
- Allows a physician to rapidly diagnose & classify patients with a global assessment
  - In combination with a slit lamp exam, physicians can select therapies based on mechanism of disease and severity
- Modulate therapy using a quantitative endpoint


New measurement options of the Keratograph SM

- Overview of the curvature along the lid
- Digital measuring of the height and automatic documentation
- Automatic calibrated and digital measuring of the TMH

The NIKTMH measurement can be performed under infrared light conditions now → no influences on the tear film conditions!!

B.Sc. Florian Winzig

New measurement options of the Keratograph SM

- Meibomian gland transillumination

The NIKBUT measurement can be performed under infrared light conditions now → no influences on the tear film conditions!!

B.Sc. Florian Winzig

New measurement options of the Keratograph SM

What is MMP-9?

- Matrix metalloproteinases (MMP) are proteolytic enzymes that are produced by stressed epithelial cells on the ocular surface
- Non-specific inflammatory marker
- More sensitive diagnostic marker than clinical signs
- Correlates with clinical exam findings
- Normal range between 3.4 and 41 ng/ml
- Ocular surface disease (i.e. dry eye) demonstrates elevated levels of MMP-9 in tears


How to Use InflammaDry: Four-step Process

1. Gently dab the Sample Collector in 6-8 locations on the palpebral conjunctiva (lower eyelid) to collect a tear sample. Do not use a dragging motion.
2. Snap the sample collector into the test cassette and press firmly where indicated.
3. Dip the test cassette into the provided buffer vial for 20 seconds. Replace the cap.
4. Read the results: 2 lines (1 red, 1 blue) = positive, 1 line (blue) = negative

InflammaDry
RPS Technologies
Examination
- Adnexa
- Lids / Lid Margins
- Tears
- Conjunctiva
- Cornea

DIAGNOSTIC TESTS

TEAR EVALUATION
- Tear Meniscus
- TFBUT
- Evidence of Fluorescein Staining
- Tear Consistency - i.e. thickness, debris, evidence of meibomian gland oil and sebaceous secretions
- Shimmers

Tear Meniscus Evaluation

DIAGNOSTIC TESTS
- TEAR EVALUATION
  - Tear Meniscus
  - TFBUT
  - Evidence of Fluorescein Staining
  - Tear Consistency - i.e. thickness, debris, evidence of meibomian gland oil and sebaceous secretions
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Tear Consistency
- i.e. thickness, debris, evidence of meibomian gland oil and sebaceous secretions

Shimmers

Schirmer Test
- No consensus as to which method is best
- Without anesthesia measures reflex tear secretion
- With anesthesia measures basal tear secretion

Schirmer Testing
- Test of both tear film volume and flow rate that is neither relevant nor reproducible
- Uses a 35 x 5-mm strip filter paper placed within temporal third of lower lid
- Normal results (measured at five minutes)
  - Unanesthetized: 15 mm or more
  - Anesthetized (basal tear secretion): 5 to 10 mm
- Eyes can be open or closed
- Little variation in results with age
- Necessary for documentation
- Alternative: Zone Quick® - phenol red string

Fluorescein Staining

Fluorescein Staining

Schaeffer Shirmer
- Always do this as the last test
- Place strip in any part of the eye
- Count to three
- Remove
Anterior Blepharitis

What is OCuSOFT® Lid Scrub™?

- Mild eyelid cleanser that effectively removes oil, debris, and desquamated (dead) skin from the eyelids.
- Recommended for routine daily eyelid hygiene and maintenance.
- Ocusoft lid scrubs BID 1 week prep cataract surgery eradicated Staph epidermidis equal to topical 5% Betadine intraoperatively¹.


Demodex
OcuSoft Tea Tree Kit
- Contains Tea Tree Oil + Buckthorn seed oil
- Ung QHS
- OcuSoft Cleansers

BlephEx Treatment

Baby Shampoo.....really a myth
It is the traditional method taught in school but it has disadvantages which include:
- Requires Mixing and Diluting (Convenience?)
- Poor Patient Compliance (actually is irritating to eye)
- Long Term Use Will Make the Skin Dry
- More Professional Treatments are Available

MGD
Medical treatment

Frothy / Foamy Tears = MGD
**Mild/Acute**
- Hot compresses
- Lid hygiene
- Lipid based tears - mild/moderate
- Osmolarity lowering drops in moderate/severe

**Moderate/Acute**
- Tobradex ST
- Zylet
- AzaSite
- Tobradex generic

**Liposome Spray**
- Self-closed colloidal particles
- Membranes composed of one or more lipid bilayers
- The surfaces of bilayers are hydrophilic while the interior, which contain hydrocarbon chains, are hydrophobic
- Because of the different microenvironments in their structure, liposomes can encapsulate hydrophilic molecules
- Applications for lid disease but also drug delivery, diagnostics, computer vision syndrome and nutraceuticals

**Long Term**
- Pulse dose medications periodically
- Restasis bid
- Essential fatty acids
  - EPA
  - DHA
  - GLA

**Potential Chronic Changes**
- Telangectasia
- 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
  - Periostat (20 mg doxycycline) bid
  - OcuSoft ALODOX – generic 20 mg
Tetracyclines

- Antibiotics inhibit bacterial protein synthesis by binding 30S ribosome
- Anti-inflammatory properties
  - decreases IL-1, TNF-
  - 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

How to Minimize Stomach Problems with Tetracycline

1. Do not take the second pill (bid) before going to bed
2. Do not take pills with acidic beverages
3. Take pills with food (except a high dairy meal)
4. Prescribe the lowest dose available

Treatment

Recurrent Erosion

Epithelial Basement Membrane Dystrophy: Map Dot Fingerprint
The amniotic membrane is the innermost lining of the placenta (amnion). Amniotic membrane shares the same cell origin as the fetus.

- Stem cell behavior
- Structural similarity to all human tissue

**The Amniotic Membrane**

- Ocular Surface Disease
  - Corneal Inflammation
  - Keratitis
  - Conjunctival Inflammation
  - Conjunctivitis
  - Eyelid Inflammation
  - Blepharitis

Inflammation is the Hallmark of All Ocular Surface Diseases

**Inflammation’s Effect on Healing**

- Inflammation: the first sign of wound healing & is also the hallmark symptom of all ocular surface diseases
- Uncontrolled inflammation leads to:
  - Chronic pain and discomfort/irritation
  - Delayed healing, more tissue damage
  - Vision-threatening complication, e.g., scar/haze

Effective control of inflammation is an important strategy to promote healing and minimize the risk of scar/haze.

**PROKERA®: BIOLOGIC CORNEAL BANDAGE**

- PROKERA® utilizes the proprietary CryoTek™ cryopreservation process that maintains the active extracellular matrix of the amniotic membrane which uniquely allows for regenerative healing.
- PROKERA® is the only FDA-cleared therapeutic device that both reduces inflammation and promotes scar less healing.
- PROKERA® can be used for a wide range of ocular diseases with severity ranging from mild, moderate, to severe.
Insertion of Pro-Kera

- Remove from inner pouch
- Rinse with saline (prevents stinging from preservation media)
- Apply topical anesthesia
- Hold upper lid and have patient look down
- Insert into superior fornix
- Slide under lower eyelid
- Check for centration

Ocular Surface Disease: DIFFERENTIALS

Post-Treatment Protocol

- Continue medications
- Apply Temporary Tarsorrhaphy (PRN)
- Tape Tegaderm
- "Breathe Right" nasal strips

Signs and Symptoms of DED are Poorly Correlated
Symptoms of DED but normal osmolarity, MG Expression etc.

- DED that is well controlled
- CL solutions related PATH
- Mild allergic conjunctivitis
- EBM/DMD dystrophy
- Pruritus & early MGD
- Infection - e.g. conjunctivitis
- Anterior blepharitis – Demodex
- OPC
- Asthenopia - vertical, CI etc.
- Salzmann’s Nodular Degeneration
- MGD conjunctivochalasis

Patient with epiphora will actually have osmolarity readings below normal or vice versa.

Treatment

- Emphasis chronic nature of the condition
- Eliminate exacerbating factors – caffeine, air conditioner, meds.
- Drink 4-6 glasses of water per day
- Tear replacements

Basic Algorithm: re AT’s

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Osmolarity</th>
<th>MG Expression</th>
<th>Staining</th>
<th>AT Choice</th>
</tr>
</thead>
<tbody>
<tr>
<td>+/-</td>
<td>&gt;316</td>
<td>Grade 1 or less</td>
<td>minimal or -</td>
<td>Systane, Oasis etc.</td>
</tr>
<tr>
<td>+</td>
<td>&gt;316</td>
<td>Grade 1 or less</td>
<td>Central or significant</td>
<td>TheraTears, Blink, FreshKote, (Consider PF), Genteal Gel</td>
</tr>
<tr>
<td>+/-</td>
<td>&gt;316</td>
<td>Grade 2 or greater</td>
<td>Inferior or -</td>
<td>Systane Balance, Optive Advanced, Retaine MGD, Soothe XP</td>
</tr>
<tr>
<td>+/−</td>
<td>&gt;316</td>
<td>Grade 2 or greater</td>
<td>Inferior or greater</td>
<td>Retaine MGD, Blink, TheraTears</td>
</tr>
</tbody>
</table>

Before Lotemax (qid x 2 weeks then bid x 2 weeks) + FreshKote OS

After 4 weeks OS

Targeted Treatments

- Treatments aimed at local inflammatory processes
  - Topical corticosteroids (Lotemax)
  - Effective anti-inflammatory agents
  - Site specific Steroids
  - Cyclosporin A (Restasis)

Moderate to Severe KCS/Dry Eye OD

After 4 weeks OD

7/22/2015
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 accelerated tear evaporation which can cause damage to the interpalpebral ocular surface."
- Artificial tears provide temporary palliative relief*

Corticosteroids

- Bind to nuclear receptors that bind DNA and regulate gene expression
- Interfere with transcription regulators (e.g., AP-1, NF-κB)
  - anti-inflammatory pathways
    - cytokine production
    - lipid mediators (PGs)
    - cell-adhesion molecules
    - vascular permeability
  - anti-inflammatory pathways
  - 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

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)

Ester vs. Ketone Steroids

- Ester Steroids are inactivated by naturally occurring esterases
  - less side effects
- Ketone Steroids are not inactivated and have propensity to remain in anterior chamber post breakdown as active metabolites

Ester vs. Ketone Steroids

- Ester Prednisolone vs. Ketone Prednisolone
- Loteprednol vs. Prednisolone
- Fluorometholone vs. Dexamethasone
- Medrysone vs. Rimexolone

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 loteprednol etabonate is effective

Percentage Change in Means Between St. and Two Weeks
Subjects with Corneal Staining Score > 10 at Baseline

[Graph: Percentage Change in Means Between St. and Two Weeks]
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 (Kunert et al., Exp Eye Res. 1999;68:383)
  - More cytokine production (Kunert et al., Curr Eye Res. 1999;19:135)

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

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).

Increased Goblet Cell Density in Subset of 12 Patients

Percentage Change in Goblet Cell Density from Baseline

Primary Sign Improvement

Data on file, Allergan, Inc.

Sjogren’s Syndrome

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

Normal tears

- pH = 7.4
- Osmolarity = 288
- EGF (ng/ml) = 0.2 – 3.0
- TGF-b (ng/ml) = 2 – 10
- Lysozyme (mg/ml) = 0.5
- Fibronectin (ug/ml) = 21

Autologous Serum

- pH = 7.4
- Osmolarity = 284
- EGF (ng/ml) = 0.5
- TGF-b (ng/ml) = 6 – 33
- Lysozyme (mg/ml) = 6
- Fibronectin (ug/ml) = 205
- Haemagglutinin A, B, C; HGF, IGF-1, fibronectin, fibroblast GF, GRP, other Ig, etc.

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.

Clinical Evidence for PROKERA®

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

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 conjunctival disease.

SCLERAL LENSES
Scleral lenses are large diameter gas permeable lenses that rest beyond the limits of the cornea and extend onto the sclera.

**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

**Expectations During the First 6 Months of Therapy**

<table>
<thead>
<tr>
<th>1 month</th>
<th>3 months</th>
<th>6 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients notice an onset of benefit</td>
<td>Further increase in tear production</td>
<td>Significant improvement in tear production</td>
</tr>
<tr>
<td>Improvements are maintained with continuation of therapy</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Burning and stinging are the most important reasons that patients discontinue use of Restasis**
- 17% of patients receiving Restasis experienced burning or stinging
- Patients with dry eye have chronic ocular disease and are more sensitive to ocular insults
- Patients with dry eye disease have anesthetic corneas
- With return of tear function there is a return of corneal sensation, burning and stinging
- Patients with dry eye are accustomed to treatment failure and are not willing to continue therapy which may make them feel temporarily worse
Topical Loteprednol Improves Patient Compliance and Restasis Efficacy

- Corticosteroids have been shown to improve tear production by controlling inflammation
- Corticosteroids decreases irritation associated with use of Restasis by 75%
- 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

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

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

MGD Medical-Instrument Treatment
Treatment of MGD/NOMGD

In-Office Therapy
- Manual Expression
- Off-Label Pharmacotherapy
- Oral tetracycline/doxycycline
- Topical Antibiotics – erythromycin, tobramycin
- Topical Steroids – dexamethasone

At Home Therapy
- Warm compresses
- Meibomian gland scrubs
- Home expression
- Blinking
- Office expression
- Secretagogues – Androgens

Additional Manual Expression
- Mastrota Paddle
- Jaeger Plate - modified by M. Gutierrez, OD

You can use the BIO to get a lighted slightly magnified view of the lids.

New Ophthalmic Surgical Instruments

Maskin Expressor
- $575
- Rhein Medical
BRUDER EYE COMPRESSIONS
Microwave Activated

BRUDER EYE HYDRATING COMPRESS and STYE COMPRESS conveniently provide an effective yet natural and drug-free way to help provide and maintain proper eye moisture.

BENEFITS
- Replenishes Moisture Naturally
- Relieves Dryness
- Refreshes Tired Eyes
- Provides Drug Free Relief

FEATURES
- Ready in Minutes from the Microwave
- Naturally Hydrating
- Washable & Reusable
- Clean Moist Heat
- Soft Conforming Design
- Non-Allergenic
- Dust-Free

WARNING
- Hot compresses can change the corneal tissues and structure
- Possible Link to Keratoconus
- Evidence Based Medicine

Meibomina Gland Expression

- Schaeffer Eye Protocol
  1. OSD Evaluation
  2. All staining
  3. RTC expression
  4. RTC-3 weeks

Meibomian Gland Expression

- Fees: $289 / $25
- Out of pocket: ABN
  - Covers 3 Office visits
  - $68.00 Per visit after initial three visits
- 99213 / 99212
- Dry eye progress check before expression

MGD
Maskin Expressor
**Maskin Probe**

1) $158 box (10)
2) 1, 2, 4, 6 MM intraductals
3) Aluminum Handle $104

---

**Panoptx® “Dry Eye Wear”**

- Patented Orbital Seal
- Filtered Vents
- Anti-fog Lenses

**Scleral Lenses**

- Encourage to wear indoors-full time
- Contact lens wearers to remove lenses and use glasses when possible
- Creates a humid environment

---

**Spectacles (Glasses)**

- Encourage to wear indoors-full time
- Contact lens wearers to remove lenses and use glasses when possible
- Creates a humid environment
Scleral lenses are large diameter gas permeable lenses that rest beyond the limits of the cornea and extend onto the sclera.

Non-Obvious MGD (NOMGD)

- MGD may be non-obvious without inflammation and without other obvious signs (NOMGD)
- NOMGD may be precursor to obvious MGD
- Highly prevalent and under-diagnosed - may be most common cause of evaporative eye disease
- In a recent dry eye study of the 52 subjects that had MGD, 48% of them had NOMGD.

Because Not All MGD Is Obvious, Active Disease Identification Is Crucial

- MGD may be present without obvious signs (non-obvious MGD (NOMGD))
- NOMGD may be a precursor to obvious MGD, is highly prevalent and under-diagnosed

Standard Patient Evaluation of Eye Dryness (SPEED) Questionnaire

- Evaluates the frequency and severity of symptoms
- Developed as an easy to use fast screening tool for dry eye disease
- SPEED questionnaire is one of the tools used to identify candidates for LipiView®

Assess the Tear Film With LipiView®

- LipiView® advanced technology offers valuable surface tear film analysis by observing a digital image of the tear film surface to calculate, analyze, manipulate, and store layers of tear film.

TFOS International MGD Workshop

- Over 65 International clinicians, scientists, and industry participants
- 2½-year process
- Published in March 2011, IOVS
- #1 Most downloaded IOVS article for the last 12 months
- Downloaded over 5000 times
- All MGD workshop reports are in the "Top 10"
- Translation into 12 languages

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Assess the Tear Film With LipiView®

- LipiView® advanced technology offers valuable surface tear film analysis by observing a digital image of the tear film surface to calculate, analyze, manipulate, and store layers of tear film.

TFOS International MGD Workshop

- Over 65 International clinicians, scientists, and industry participants
- 2½-year process
- Published in March 2011, IOVS
- #1 Most downloaded IOVS article for the last 12 months
- Downloaded over 5000 times
- All MGD workshop reports are in the "Top 10"
- Translation into 12 languages

Because Not All MGD Is Obvious, Active Disease Identification Is Crucial

- MGD may be present without obvious signs (non-obvious MGD (NOMGD))
- NOMGD may be a precursor to obvious MGD, is highly prevalent and under-diagnosed

Standard Patient Evaluation of Eye Dryness (SPEED) Questionnaire

- Evaluates the frequency and severity of symptoms
- Developed as an easy to use fast screening tool for dry eye disease
- SPEED questionnaire is one of the tools used to identify candidates for LipiView®

Assess the Tear Film With LipiView®

- LipiView® advanced technology offers valuable surface tear film analysis by observing a digital image of the tear film surface to calculate, analyze, manipulate, and store layers of tear film.
LipiView® Report

- Produces a relative measure of the thickness of the lipid layer of the tear film
- Produces a measurement called the Ocular Index of Lipid Interferometric Color Unit (ICU)
- Calculated on a frame-by-frame basis and plotted for ~1 billion data points per eye
- The results are then displayed and are available for printout

Meibomian Gland Evaluator™ (MGE)

- The TearScience® Meibomian Gland Evaluator
  - Applies consistent, moderate pressure
  - Between 0.8 g/mm² and 1.2 g/mm²
  - Allows evaluation of secretions from Meibomian gland orifices through a slit lamp biomicroscope

<table>
<thead>
<tr>
<th>Grade</th>
<th>Secretion Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Clear liquid</td>
</tr>
<tr>
<td>2</td>
<td>Colored/cloudy liquid</td>
</tr>
<tr>
<td>1</td>
<td>Inspissated (toothpaste consistency)</td>
</tr>
<tr>
<td>0</td>
<td>No secretion (includes capped orifices)</td>
</tr>
</tbody>
</table>

Challenges of Current MGD Therapies

- Warm compresses
- Eyelid scrubs
- Manual gland expression

Warm Compresses Have Limited Efficacy

- Anterior lid is highly vascular, therefore, difficulty for heat application to reach gland contents
- Adequate temperatures cannot easily and safely be achieved by the use of external warm compresses

Patient Frustration With Existing Treatments

- Survey including ~550 patients diagnosed with Dry Eye: Those using artificial tears, lubricants, or punctal plugs report little to no success

Lipid/Oil-Based Lubricant Eye Drops

- Palliative – None treat the cause: Dry eye can be blinding & stinging with castor oil/silicone

Summary

- Evaporative Dry Eye is the most common cause of Dry Eye
- Not all MGD is obvious
- Appropriate diagnosis is important
- Tools available to aid in making the right diagnosis include:
  - SPEED score questionnaire
  - Meibomian Gland Evaluator™
  - LipiView® Ocular Surface Interferometer
- Most patients are frustrated with the ineffectiveness of current dry eye therapies

Advanced Treatment of MGD

LipiFlow® Thermal Pulsation System


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.

**THERMODYNOmic TX TO EXPRESS AND EVACUATE MGs**

LipiFlow (TearScience Inc., Morrisville, NC)

A new thermodynamic treatment to express & evacuate the MGs

Heat applied to both inner lid surfaces

Pulsatile pressure applied to outer lid

LipiFlow® Thermal Pulsation System

LipiFlow safely and effectively treats Meibomian gland obstruction in both upper and lower eyelids simultaneously, in an in-office procedure, taking only 12 minutes per eye.

FDA approved LipiFlow July 2011

LipiFlow® Thermal Pulsation System

**Therapeutic Goal of Pulsation**

Activator

Applies intermittent pressure to the outer eyelid

Inflatable air bladder

Insulated lid warmer shields eye from heat and vaults above the cornea to prevent corneal contact

Heats comfortably to liquefy the Meibomian gland contents

Lid warmer

Applies directional heat to inner eyelid

Increase heat transfer efficiency

During the heating phase of the treatment (as opposed to after) Allow the natural flow of lipids to resume

Enable patient to experience little to no discomfort during treatment as compared to manual expression

**LipiFlow® Provides Heat and Pressure to Liquefy and Evacuate Obstructed Glands**

A sterile disposable eyepiece connects to a console used by the physician to control the application of heat and pressure to the eyelids

Lid warmer

Composed of a heater, eye insulation, and vaulted shape

Heat is applied to the palpebral surfaces of the upper and lower eyelids directly over the Meibomian glands

Activator

Composed of an inflatable air bladder and a rigid activator

Graded pulsatile pressure is delivered to the outer eyelid

**Pressure and Pulsation for MGD**

**Korb, DR, Blackie, CA. Meibomian gland therapeutic expression: quantifying the applied pressure and the limitation of resulting pain.**

*Eye Contact Lens*. 2011 Sep;37(5):298 - 301.

**L W E**

**Lid Wiper Epitheliopathy**

**THE LID WIPER DEFINED**

That aspect of the marginal conjunctiva of the upper eyelid that wipes the ocular surfaces during blinking

**THE LID WIPER**

Korb et al., 2002 - 2005

**LID WIPER & AUTOMOBILE WINDSHIELD WIPER**

Windshield Wiper

Clearance Space

Ocular Surface

**LID WIPER**

Windshield Wiper Clearance Space

Ocular Surface
Jack Schaeffer
Financial Disclosure Form

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