

## Ocular Surface Disease: Ask The Experts



Marc Bloomenstein, OD, FAAO  
Schantz Laser Eye Center, Scottsdale, AZ



Douglas K. Devries, O.D.  
Eye Care Associates of Nevada, Sparks, NV

### 24 M Financial Disclosures For Marc R. Bloomenstein, OD, FAAO

- Allergan-Speaker/Consultant
- Avellino-Consultant
- Azura-Consultant
- Bausch & Lomb-Speaker/Consultant
- Bruder-Consultant
- Dome-Speaker/Consultant
- EyeVance-Consultant
- Iveric-Consultant
- LENZ-Consultant
- OcuPhire-Consultant
- OcuSOFT-Consultant
- Olleyes-Consultant
- Oyster Point-Speaker/Consultant
- Novartis-Speaker/Consultant
- Reichert-Consultant
- Visus-Consultant
- Sight Science-Speaker/Consultant
- STAAR Surgical-Speaker/Consultant
- Sun-Speaker/Consultant
- Tarsus-Speaker/Consultant
- Thea-Consultant
- Topcon-Consultant

All financial relationships have been mitigated.

## Doug's Disclosures..all Mitigated

**Douglas K. Devries, OD**, and/or spouse had a financial agreement or affiliation during the past year with the following commercial interest in the form of **Consultant**: Alcon, Allergan, Avellino, Akorn, Azura, BioTissue, Bruder, Bausch + Lomb, EyeVance, Kala, Johnson & Johnson Vision, OcuSoft, TearLab, BlephEx, Sight Sciences, Science Based Health, Tarsus, Visus, Novartis, Sun Pharmaceutical, Thea, Ophthalmic Resources Partner, Quidel; **Speakers List**: Allergan, BioTissue, Bausch + Lomb, EyeVance, Kala, Lumenis, OcuSoft, Sight Sciences, Science Based Health, Sun Pharmaceutical; **Stock Shareholder**: RPS

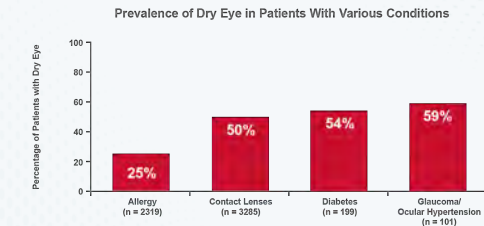
## OSD in CL Wearers

- Symptoms of dryness and discomfort are highly prevalent (up to 50%) among contact lens wearers and are the most commonly cited reason for the discontinuation of contact lens wear.<sup>1</sup>
- 59% of CL wearers were found to have clinically significant MGD.<sup>2</sup>

1. Blackie C. A single wickered thermal pulsation treatment for meibomian gland dysfunction increases mean comfortable contact lens wearing time by approximately 4 hours per day. *Clinical Ophthalmology*. 2016; 12: 169-83.  
2. Machvalnik A, et al. Comparison of Morphological and Functional Meibomian Gland Characteristics Between Daily Contact Lens Wearers and Nonwearers. *Cornea*. 2015 Sep;34(9):1088-94.

## Dry Eye and Other Conditions

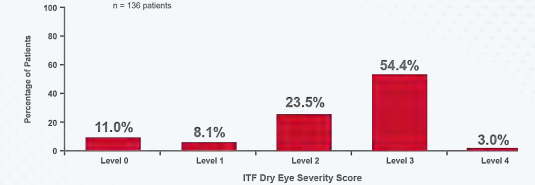
Dry eye disease is common among patients with other conditions



1. Meiss SF, et al. *Optom Vis Sci*. 2008;85(9):669-74.  
2. Douglas KL, et al. *Optom Vis Sci*. 1997;74(9):624-31.  
3. Marshall MR, et al. *BMC Ophthalmol*. 2008;8:110-4. Leung RW, et al. *J Glaucoma*. 2008;17(5):350-5.  
4. Leung RW, Meltzer FA, Nivard R. Prevalence of ocular surface disease in glaucoma patients. *J Glaucoma*. 2008;17(5):350-55.

## Dry Eye Prevalence in Patients Scheduled for Cataract Surgery<sup>1</sup>

80% of Patients Had Dry Eye Severity Score of Level 2 or Higher



- 22.1% of patients had previously received a diagnosis of Dry Eye Disease
- 80.9% of patients had an ITF Dry Eye Level 2<sup>2</sup> or higher, based on the presence of signs and symptoms

1. ITF Level of 2 indicates moderate Dry Eye.  
2. Truffer WS, et al. *Clinical Study Report: Cataract and Dry Eye: prospective health assessment of cataract patients ocular surface study*. 2010. (Unpublished study).

## The Impact of DED on Cataract Surgery Outcomes

- 63% of pre-cataract surgical patients had a TBUT of less than 5 seconds.<sup>1</sup>
- Patients who had osmolarity scores within normal limits were within a half diopter of intent, whereas 17% of those with hyperosmolarity would have missed their IOL calculation by more than a diopter.<sup>2</sup>

1. Truffer WS, Majumdar PA, Donnerfeld ED, McDonald MB, Stonecipher KB, Goldberg DF. The prospective health assessment of cataract patient (PHACO) study: the effect of dry eye. *Clin Ophthalmol*. 2017; 11:1423-1430.  
2. Epitropaki AT, Mantonis C, Berdy GJ, et al. Effect of tear osmolarity on repeatability of keratometry for cataract surgery planning. *Journal Cataract Refract Surg*. 2015 Aug;41(8):1612-7.

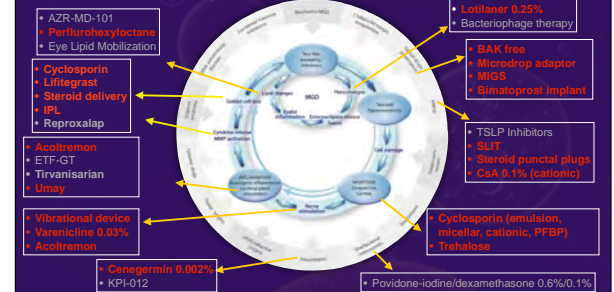
## 5 Triaging Questions from OD Summit

- Do your eyes ever feel irritated, dry or burn?
- Are your eyes red?
- Do you experience blurred vision especially fluctuating vision?
- Do you use or have the urge to use artificial tears?
- How much time to you spend on digital devices per day?

*Ophthalmology Dry Eye Summit, Denver 2014*

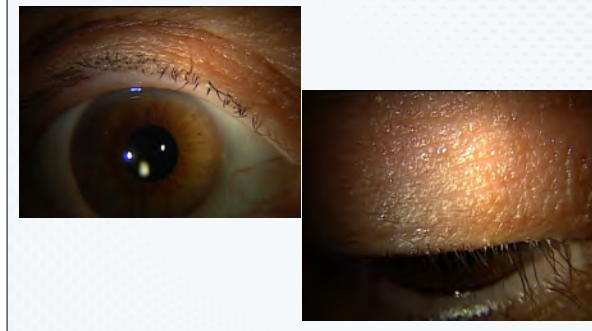
## The Vicious Circle

Adapted Sept 2025 from Baudouin et al. *BJO*. 2016 (100): 300-306



## Begin with the Lid in Mind

### How Many Signs are Present?

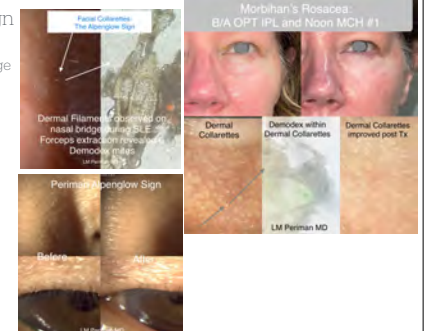


## The Alpenglow Sign

Look at the nasal bridge

- Rapid clinical exam finding to pick up cases of suspected demodex in patients with excellent lid hygiene

- ASCRS 2024, ARVO 2024



## Meibography

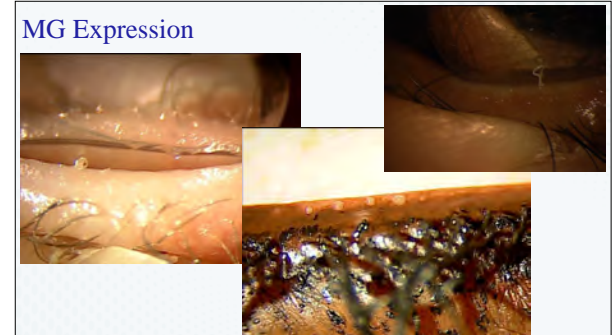


## Eyelid Evertors

- Silicone soft but grips well
- Painless
- Maintains hold
- Like a 3rd hand



## MG Expression

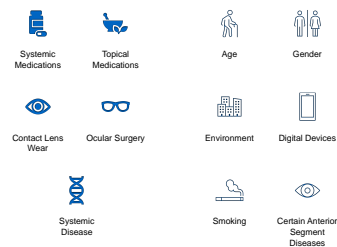


## MG Expression

- Heat Assist
- Extranasal Vibrational Assist
- Technique Pearls:
  - Pin lid with q-tip in non-dominant hand
  - Pt applies energy to side of nose



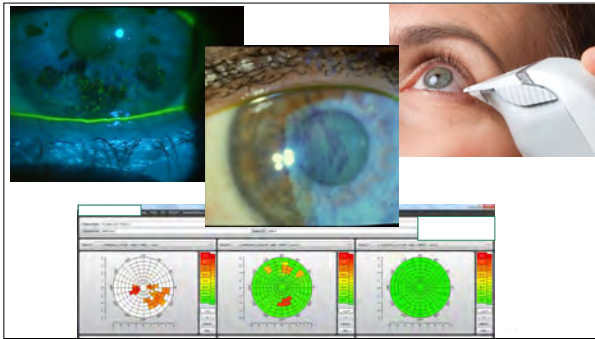
## Risk Factors for Dry Eye Disease



## Questionnaires

DEQ-5  
OSDI  
SPEED

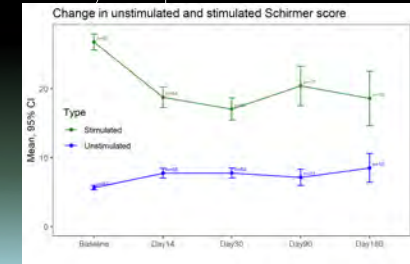




## Neural Stimulation:

- FDA Approvals:
  - Intranasal Electrical (2017)
  - External Vibration (2020)
  - Varenicline 0.03% (2021)
  - TRPM8 agonist (2025)
- Similar improvements on:
  - OSDI, VAS, TMH, Schirmers, Staining across the modalities

## Primary Endpoint Schirmer Score



## Corneal Staining

Data: all subjects - worse eye

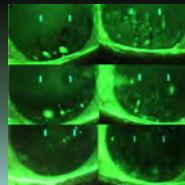
Subject 008 site 02



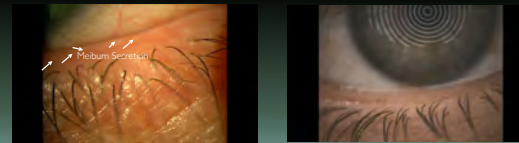
Baseline

Day 14

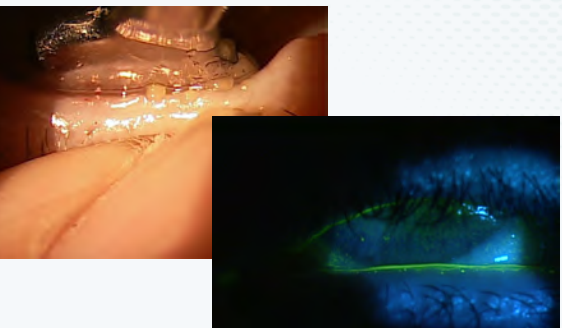
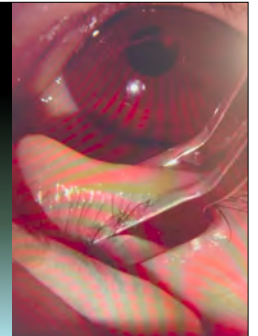
Day 30



## Immediate Response and Meibum Secretion with Mechanical Extranasal Stimulation (iTear100)



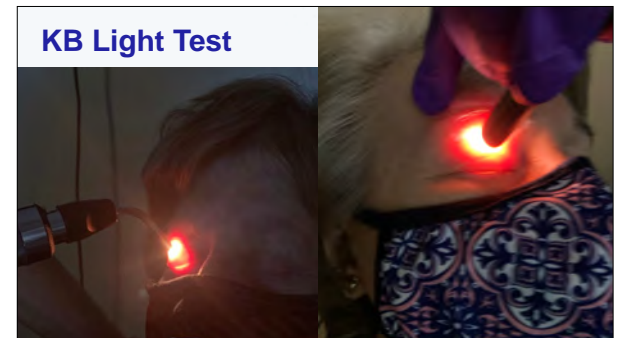
## External Vibration Neural Stimulation Device Assisted Meibomian Gland Expression (MGX)



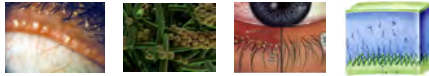
## In Chronological Order My Approach

1. Symptoms (most significant and when?)
2. Good Eyelid assessment with MG expression
  - Corneal stain
  - Conjunctival stain
  - Tear meniscus height
  - TFBUT
3. Ocular surface staining with NAFL

## KB Light Test



## Evaporative Dry Eye Disease



Copyright 2017, Paul M. Karpecki, OD

## Single-ingredient Formulation

100% perfluorohexyloctane  
• No inactive ingredients



- Water free
- Preservative free
- Steroid free



## Expressible MGD



## ELM: For Moderate to Severe DED (Q1 '26 launch)

- Heat**  
Heating of the eyelids lowers meibum (lipid) viscosity
- Vibration**  
Vibration-induced shear thinning™ (VIST™) liquefies the meibum
- Neuro-Modulation**  
Vibration induces neuro-modulation of the 5<sup>th</sup> cranial nerve resulting in natural meibum expression



32

## ELM: Compelling Clinical Evidence

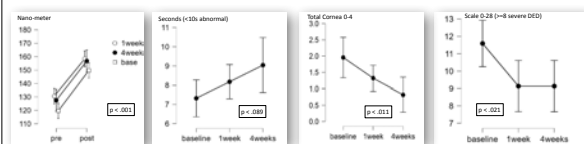


**Study Design**  
• 30 patients received a single 15-minute ELM treatment at baseline, 1 week, and 4 weeks.

- Key Findings**
- Statistically significant Increase in Lipid Layer Thickness (LLT)
  - Improved Tear Break-up Time (TBUT)
  - Statistically significant Rapid Reduction in Corneal Staining
  - Statistically significant Improved Dry Eye Symptoms (SPEED II Questionnaire)

33

## A Single ELM Treatment Delivered at Baseline, 1 week, and 4 weeks, n=30



LLT (Lipid Layer Thickness) [ ]

TBUT (Tear Break-up Time) [ ]

Corneal Staining (0-4 scale) [ ]

SPEED II (Dry Eye Questionnaire) [ ]

\*Statistics performed with JASP 0.16.2

34

## Photobiomodulation: IPL/LLLT

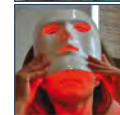
- MGD/EDED
- DEMODEX
- Ocular Rosacea
- CHALAZION
- HORDEOLUM



## LLLT (now half masks)

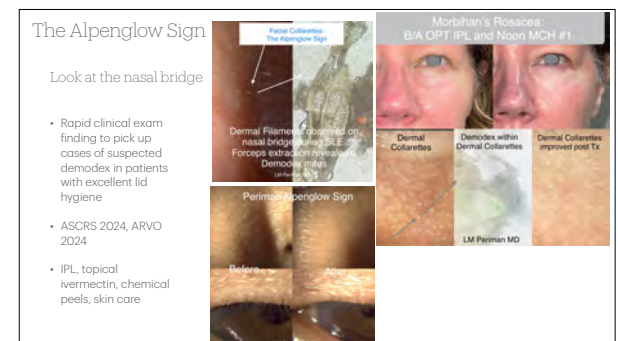
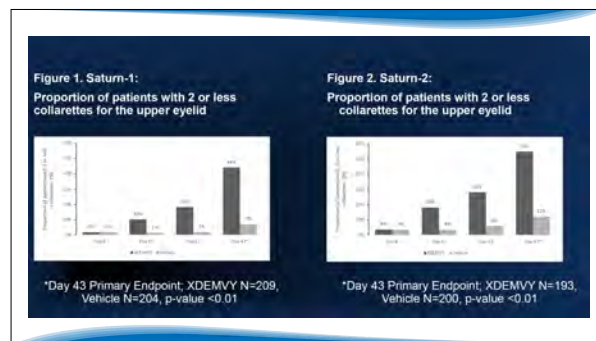
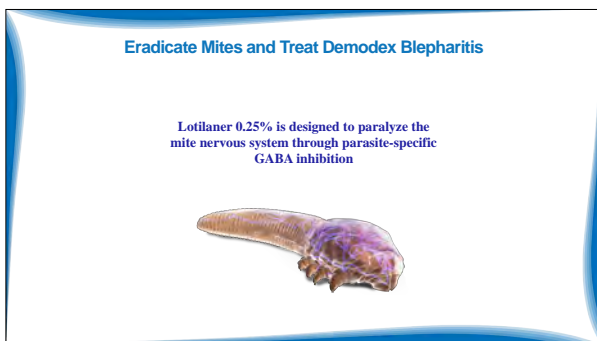
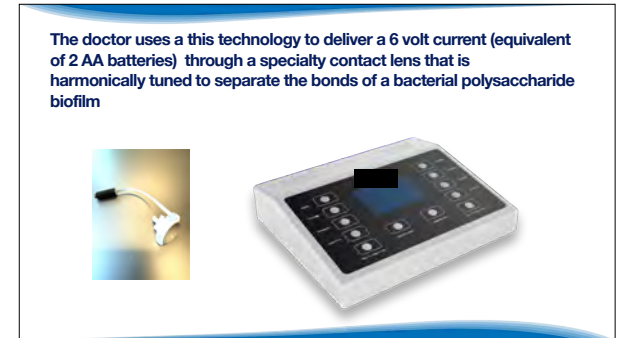
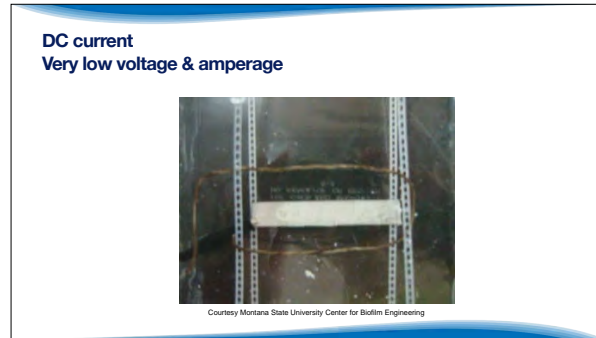
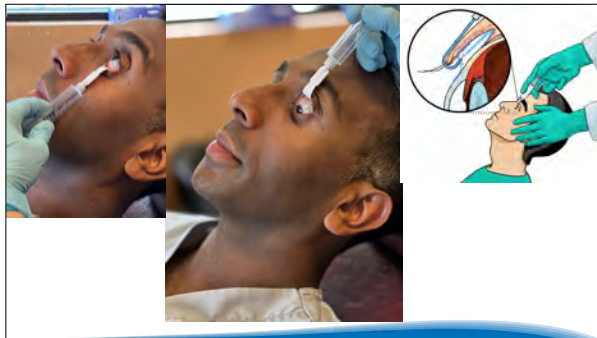
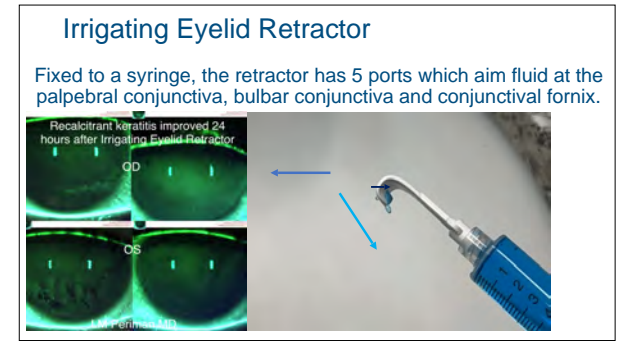
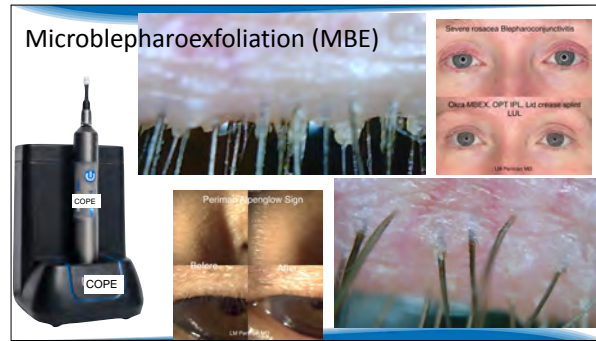
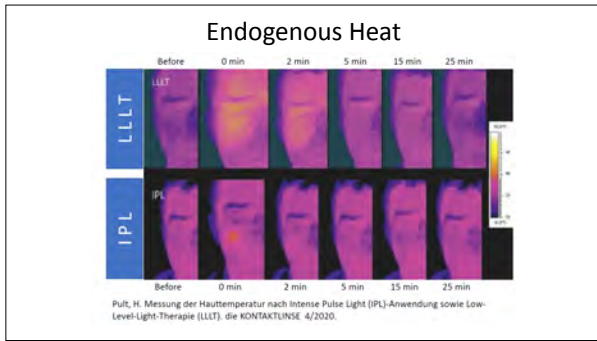


**PHASE 1 – BLUE MASK**  
Blue light stimulates porphyrins and creates an anti-bacterial, anti-parasitic action.



**PHASE 2 – RED MASK**  
Red light stimulates ATP by increasing and improving cellular activity, it reduces inflammation and edema. Targets the Meibomian glands.

35



## Omega fatty acids and Dry Eye

- LA / GLA (ω-6)
  - Increase "good" PG (PGE-1)
    - Against ocular surface inflammation
    - Increase tear production
- Positive action on lipid layer (Graham RH. There's nothing fishy about omega-3 fatty acids for Dry Eye Syndrome. *www.medscape.com/viewarticle/707984*. Sep 3, 2010.)
  - Positive action on tear volume (Roncone M, Bartlett H, Eperjesi F. Essential fatty acids for dry eye: A review. *Cont Lens Anterior Eye* 2010; 33(2):49-54.)
- Help to maintain MG function (Macscall, 2008)



## Supplemental GLA for Dry Eye: 7 Controlled Clinical Trials

- Aqueous-deficient (Barabino S et al. *Cornea* 22: 97-101, 2003.)
- PRK (Macri A et al. *Graefes Arch Clin Exp Ophthalmol* 241:561-6, 2003.)
- Sjögren's (Aragona P, et al. *Ophthalmol Vis Sci* 46:4474-9, 2005.)
- Contact lens (Kokke KH et al. *Contact Lens Ant. Eye* 31:141-6, 2008.)
- MGD (Pinna et al. *Cornea* 26:260-264, 2007.)
- Mild-moderate DE (Brignolle-Baudouin et al. *Acta Ophthalmologica* 89:e591-7, 2007.)
- Post-menopausal women (Sheppard JD, Pflugfelder SC, et al. *Cornea* 32:1297-1304, 2013.)

## Anti-inflammatory and Anti-oxidant Supplements

- Carotenoids
- Vitamin D3
- Turmeric/curcuminoids
- Lutein
- Zeaxanthin



## Aqueous Deficient Dry Eye Disease



INFLAMMATION

TEAR VOLUME

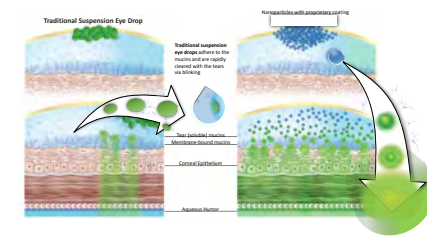
Monitor for MGD

Copyright 2017, Paul M. Karpecki, OD

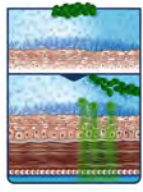
## 0.25% Loteprednol: For Dry Eye Flares- Most Recent FDA Approval

- Dry eye is a chronic inflammatory disease with flares that are characterized by acute exacerbations of signs and/or symptoms
- Loteprednol 0.25% approved for short term signs and symptoms of DED (QID for up to 2 weeks)
- Most dry eye disease patients with or without maintenance dry eye therapy, experience flares and desire rapid relief.
- Regardless of dry eye severity, flares typically occur 4-6 times per year
- Dosing and delivery systems

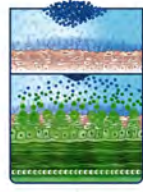
## Loteprednol 0.25% Mucus Penetrating Particles (MPP) Drug Delivery Technology



## Loteprednol 0.25% Mucus-Penetrating Particles Drug Delivery Technology

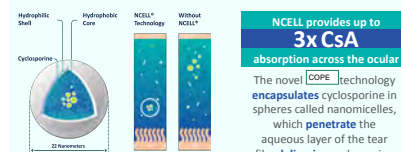


Traditional suspension eye drops adhere to mucus and can be rapidly cleared through blinking



MPP are designed to penetrate through the mucus barrier and deliver increased concentrations of drug to the target ocular tissues

## Nanomicelle Formulation Provides Up to 3x Higher CsA Absorption Over Cyclosporine Emulsion 0.05%<sup>1,2</sup>



**Study design:** Ocular tissue distribution of cyclosporine was evaluated in a total of 26 female New Zealand White rabbits that received a single dose (administered to both eyes) of vehicle, cyclosporine 0.05% or 0.25, with NCELL Technology, or a commercially available cyclosporine 0.05% emulsion (Restasis<sup>®</sup>, Allergan). Pharmacokinetic parameters for cyclosporine exposure were assessed in tears, whole blood, and ocular tissues.<sup>1,2</sup>

**L. Goldberg, et al. *Drug Information Journal*, 2013; 47(1):21-29. J. Chakraborty, et al. *Toxicol Sci*, 2013; 133(1):11-16. K. Manda, et al. *Journal of Pharmaceutical Sciences*, 2013; 102(1):1-10. S. Chakraborty, et al. *Journal of Pharmaceutical Sciences*, 2013; 102(1):1-10.**

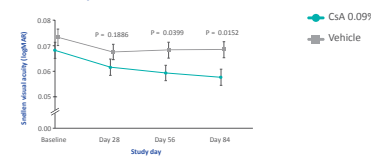
Please see Important Safety Information on slide 4 and full Prescribing Information available at the presentation.

PROPRIETARY - NO UNAUTHORIZED DISTRIBUTION - FOR EDUCATIONAL AND TRAINING PURPOSES ONLY

## Statistically Significant Improvement in Visual Acuity at 2 Months<sup>1,2</sup>

Improvements in visual acuity correlated with reduced central corneal staining as early as day 56<sup>1,3</sup>

### Pooled Analysis of Phase 2b/3 and Phase 3 Studies

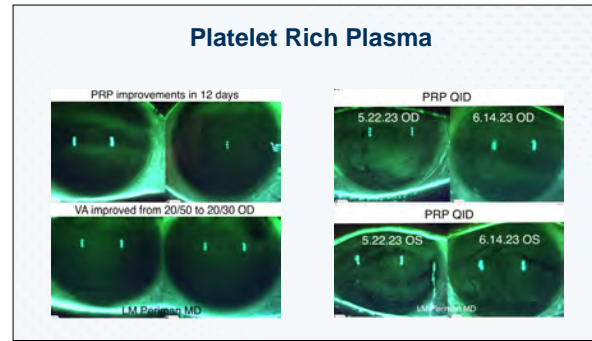
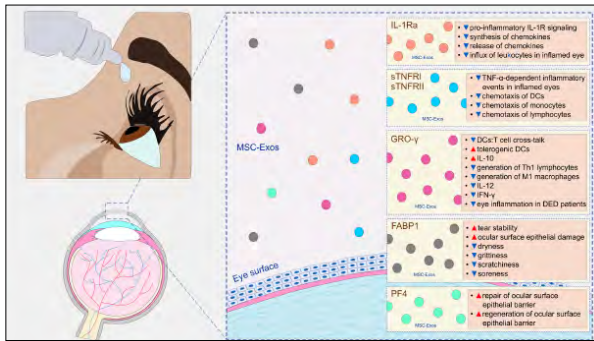


L. Goldberg, et al. *Ophthalmology*, 2013; 120(1):201-217. 2. Karjane, et al. *BMJ Ophthalmol*, 2013; 21(2):141-3. Mahotra, et al. *Cornea*, 2013; 32(1):10-16.

Please see Important Safety Information on slide 4 and full Prescribing Information available at the presentation.

PROPRIETARY - NO UNAUTHORIZED DISTRIBUTION - FOR EDUCATIONAL AND TRAINING PURPOSES ONLY





### Cytokine Extract Drops: Molecular Mechanisms – IL-1Ra

Contains interleukin 1 receptor antagonist (IL-1Ra), soluble receptors of tumor necrosis factor alpha (sTNFR1, sTNFR2), growth-related oncogene gamma (GRO- $\gamma$ ), fatty acid-binding protein 1 (FABP1) and platelet factor 4 (PF4), which alleviate eye inflammation, support tear stability, and prevent ocular surface epithelial damage, contributing to the enhanced repair and regeneration of ocular surface epithelial barrier in DED patients.<sup>1,9,11-13</sup>

IL-1Ra is a naturally occurring cytokine that acts as an inhibitor of inflammatory cytokine IL-1 $\beta$  that has a crucially important role in the recruitment of circulating leukocytes in inflamed eyes of DED patients.<sup>5-6,12,14</sup>

### Molecular Mechanisms – FABP Proteins

Downregulated levels of FABP proteins were noticed in the tears of patients suffering from Sjögren's syndrome and DED.<sup>17</sup>

FABP proteins regulate transepithelial water transport and maintain the epithelial barrier at the ocular surface.<sup>17</sup>

Accordingly, the reduced expression and production of FABP proteins leads to disturbances in the epithelial barrier, causing increased tear evaporation and DED.<sup>17</sup>

Contains a high concentration of FABP1 proteins, which are thought to regulate transepithelial water transport, support tear stability, and prevent ocular surface epithelial damage in the eyes of DED patients, resulting in the possible alleviation of dryness, gritiness, scratchiness, and soreness.<sup>1,9,17</sup>

### Amniotic Membrane Placement

- Persistent corneal staining from OSD ranging from NK to KCS, LSCD, SLK etc.

### Amniotic Membrane- Dehydrated

- Preserved by using vacuum with low temperature heat to retain devitalized cellular components
- FDA approved claims for dehydrated membranes are limited to wound coverage
- Stored at room temperature
- Placed on the ocular surface with an overlying bandage contact lens

Protein	Abbreviation	Neurotrophin-3/Neurotrophin-4	NT-3/NT-4
Growth differentiation factor 15	GDF-15	Basic fibroblast growth factor	bFGF
Interleukin 1 $\alpha$	IL-1 $\alpha$	Beta nerve growth factor	$\beta$ -NGF
Interleukin 1 Beta	IL-1 $\beta$	Epidural growth factor/Epidermal growth factor receptor	EGF/EGF-R
Interleukin 1 receptor antagonist	IL-1ra	Glia cell line-derived neurotrophic factor	GDNF
Interleukin 12 p40	IL-12p40	Heparin binding growth factor	HB-EGF
Interleukin 17	IL-17	Hepatocyte growth factor	HGF
Osteoprotegerin	OPG	Platelet-derived growth factor	PDGF-AA/PDGF-BB
Interleukin 8	IL-8	Placenta growth factor	PlGF
Intercellular adhesion molecule 1	ICAM-1	Stem cell factor	SCF/SCF-R
Tumor necrosis factor	TNF	Transforming Growth Factor Alpha	TGFA/TGF $\beta$ 1/TGF $\beta$ 3
Interleukin 6	IL-6	Vascular endothelial growth factor	VEGF
Interleukin 5 receptor	IL-5R		
Macrophage colony-stimulating factor 1 receptor	M-CSF R		
B lymphocyte chemoattractant (CXCL 13)	BLC		
Eotaxin 2	Eotaxin-2		

### Dry Amniotic Membrane Insertion

- Typically used for SLK or Exposure Keratitis
- Dehydrated amnion forceps
- Dry forceps prevent curling or rolling up of amnion

### Bandage Lens Forceps

- Smooth edge
- Breaks suction
- Prevents epithelial sloughing or defects

## Amniotic Membrane Types

- Cryopreserved

**Pros**

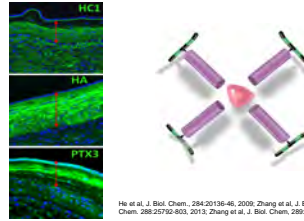
- FDA Approved
- Proprietary Freezing Process
- Ease of use (fitting a contact lens)

**Cons**

- Requires refrigeration and space in office
- Has to be thawed before use
- Ring placement can be uncomfortable
- Shorter shelf-life
- Price

## The Key Complex Responsible for Unique Therapeutic Effects in Fresh AM and CAM

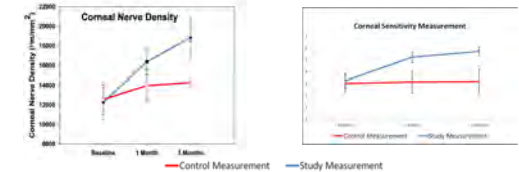
### Heavy Chain-Hyaluronic Acid / Pentraxin 3 (HC-HA/PTX3)



He et al. J. Biol. Chem. 294:20136-46, 2009; Zhang et al. J. Biol. Chem. 287:12433-44, 2012; He et al. J. Biol. Chem. 288:25792-803, 2013; Zhang et al. J. Biol. Chem. 289:13531-42, 2014; Tseng, IOVS, 15-17637, 2015



## Improvements in Corneal Nerve Density & Sensitivity

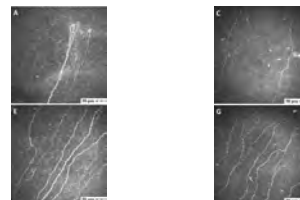


John T. Tigue, S. Shaha H. et al (2017), "Corneal Nerve Regeneration After Self-Retained Amniotic Membrane in Dry Eye Disease." *Journal of Ophthalmology*.

## Amniotic Membrane Insertion: CryoPreserved



## In Vivo Confocal Microscopy Images of Patients Before and After PKS/PKC Placement (Morkin & Hamrah)



E = 36 days after PKS/PKC

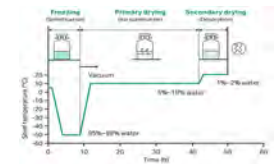
\* Improved corneal neuralgia

1. Morkin, M. I. and P. Hamrah (2016), "Efficacy of self-retained cryopreserved amniotic membrane for treatment of neuropathic corneal pain." *Ocul Surf* 16(1): 132-138.

## Amniotic Membrane Types

- Lyophilized

- A preservation process in which water is removed from tissue products after freezing
- Completed in a vacuum chamber, which allows the ice to change directly from a solid to a gas without passing through the liquid phase
- The lyophilization process avoids exposure to the matrix- and protein-damaging effects of high heat



## Tapered Extended Duration Plugs

### Vertical Canal



## Form Fitting Punctal Plugs

### Vertical Canal is Key

- Fits any size punctae
- Can be flushed with BSS



## Canalicular Gel

- Cross-linked hyaluronic acid gel that allows patient's eyes to be bathed in their own natural tears
- Customized for each individual patient or provide full fill of the canalicular system

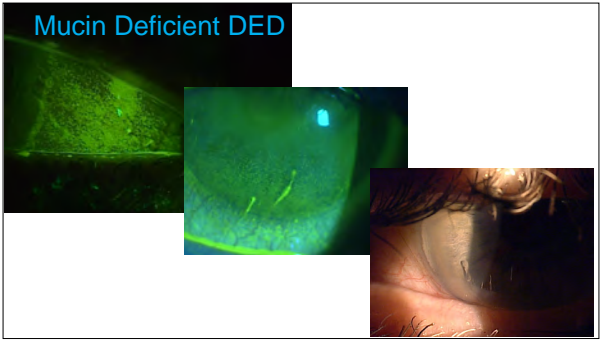


### Intricate Crossing of Hyaluronic Acid Chains to Create Gels

Sites for chemical modification

Hyaluronic Acid before Cross Linking

Cross Linking with BDDE

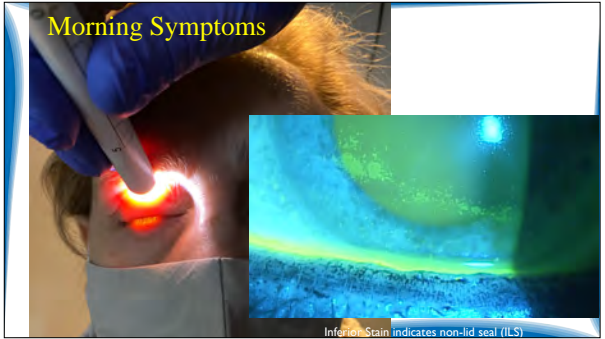


Active Ingredients	White Petrolatum (90%), Lanolin (6.9%), Light Mineral Oil (1.4%)
Inactive Ingredients	Retinol Palmitate (Vitamin A)
Preservative Free	✓
Phosphate Free	✓
Sterile Period (from first opening)	6 months
Presentation	0.18 fl. oz. (5g)
No of Applications	300
Indications	Moderate to Severe Forms of Dry Eye which require a more viscous ointment. Recommended for night time use

### SDP-4:L SILK PROTEIN DERIVED

Differentiated Biologic Product with Unique Properties: **Silkworm Cocoon**

- Highly soluble protein in aqueous formulation
- Broad acting anti-inflammatory activity
- Prolonged wetting without increased viscosity
- Absence of toxicity & immunogenicity
- Transparent, preservative free & single unit dose format
- Highly stable at room temperature

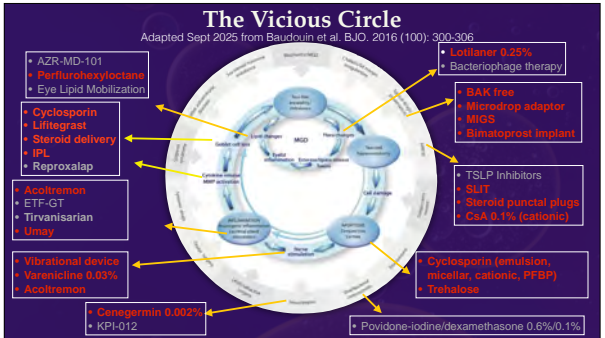


### Morning Symptoms

- And leads to desiccative stress, MGD, blepharitis, exposure keratitis etc.
- It is NOT lagophthalmos
- ILS - is an overnight inadequate lid seal
- Overnight eye seals
- Hypoallergenic
- Oxygen permeable
- Adequate mild adhesive
- Sensitive and regular

**Loteprednol** ointment is a new **preservative-free** steroid ointment.

**Loteprednol** ointment is a corticosteroid indicated for the treatment of post-operative inflammation and pain following ocular surgery.



THANK YOU