

On behalf of Vision Expo, we sincerely thank you for being with us this year.

**Vision Expo Has Gone Green!**

We have eliminated all paper session evaluation forms. Please be sure to complete your electronic session evaluations online when you login to request your CE Letter for each course you attended! Your feedback is important to us as our Conference Advisory Board considers content and speakers for future meetings to provide you with the best education possible.



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## NUTS AND BOLTS OF DRY EYE TECHNOLOGY

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DENVER COLORADO  
VISION EXPO WEST 2022

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### DISCLOSURES

- Ocular Therapeutix
- Glaukos
- Horizon
- Quidel
- Eyeance
- Alcon
- Tarsus
- Thea
- Kala
- Invisu
- Orais
- RVL
- Oyster Point
- Dome

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### DRY EYE DEFINITION

**DEWS II Report:**

"Dry eye is a multifactorial disease of the ocular surface characterized by a loss of homeostasis of the tear film, and accompanied by ocular symptoms, in which tear film instability and hyperosmolarity, ocular surface inflammation and damage, and neurosensory abnormalities play etiological roles."

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### WHO HAS DRY EYE?

EVERYONE!

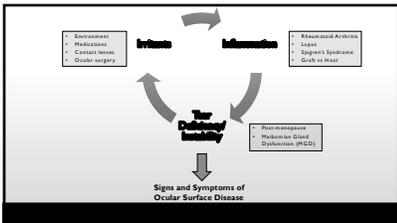
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### US PREVALENCE OF DRY EYE DISEASE (DED)

- Estimated >16 million patients have been diagnosed with DED<sup>1</sup>
- Estimates ~33 million patients suffering from dry eye symptoms<sup>1</sup>
- Almost all adults experience dry eye signs and symptoms
  - DED is often underdiagnosed and undertreated<sup>2</sup>
  - DED is the most common reason for visits to eye care practitioners (ECPs)<sup>3</sup>
  - ~33% of patients present with complaints about dry eye<sup>4</sup>
- Prevalence is projected to increase due to:
  - Aging population
  - Increased screen time (computers and handheld devices)



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### ENVIRONMENTAL

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### WHOLE BODY INFLUENCE

- Graves Disease
- Thyroid eye disease
- Sleep apnea
- Diabetes
- Rheumatoid Arthritis
- Sjogrens
- Lupus
- Chron's disease
- Rosacea
- Eczema
- Riley-Day syndrome
- Allergies
- Inflammatory disease

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**MEDICATIONS**

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- Ocular medications
  - Glaucoma drops
  - Preservatives
- Systemic medications
  - anti-depressants/antxiety
  - Sleeping pills
  - Pain relievers
- Parkinsons medications
- Chemotherapy
- Birth control and hormones
- Acne
- Allergy
- Diuretics
- Blood pressure medications

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**BEFORE THEY ENTER THE ROOM**

- Use your techs!
- Videos or materials in waiting room
- Emails and newsletters
- Questionnaires
  - SPED
  - OSDI
- Multiple points of contact to start the discussion and engage the patient



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**TYPES OF DRY EYE DISEASE**

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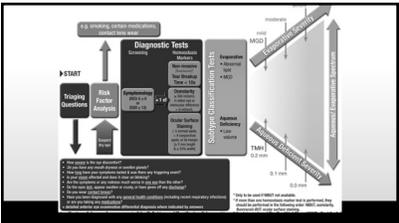
- Evaporative dry eye
  - Resulting from excessive tear evaporation
  - Evaporation leading to tear hyperosmolarity
  - Normally functioning lacrimal gland
- Eyelid related causes
  - Mebomian gland dysfunction
    - Inadequate lid closure/lid not everted
- Aqueous deficient dry eye (ADDE)
  - Resulting from from decreased tear secretion
  - Hyper-evaporative state leading to tear hyperosmolarity

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**NOT MUTUALLY EXCLUSIVE, IT CAN BE BOTH!**

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**HOW DO WE DETERMINE THE UNDERLYING CAUSES?**

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**DIAGNOSTIC TESTING**

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**TRIED AND TRUE: SLIT LAMP EXAM**

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**DON'T FORGET ABOUT THE EYELIDS**

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Look → Lift → Push → Pull

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### GRADE THE LID AND GLAND APPEARANCE

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- Any pitting?
- Any capping?
- Any lid structure abnormality?

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### EXPRESS THE GLANDS

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- Cotton tip applicator
- Your clean finger
- Gland expressor
- Meibomian gland evaluator (J&J)

• Just do it!



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### MEIBOMIAN GLAND COMPRESSION

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- Grade expressibility
- Meibum quality can be described as clear, cloudy, granular or inspissated, grading as follows:
  - Grade 1: olive oil, clear
  - Grade 2: turbid, cloudy
  - Grade 3: cloudy with debris
  - Grade 4: toothpaste-like, or inspissated



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### BLEPHARITIS AND DEMODEX

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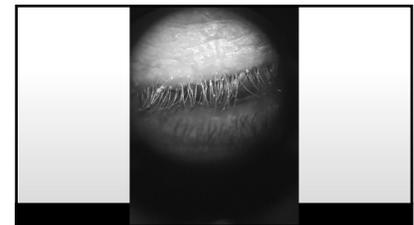
- Saponification
- Lid margin debris
- Lid margin biofilm
- Collarettes
- Telangiectasia
- Lid margin thickening



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Clinical Pearl: Have your patient look down to better identify demodex collarettes.

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### VITAL DYE STAINING

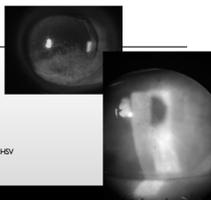
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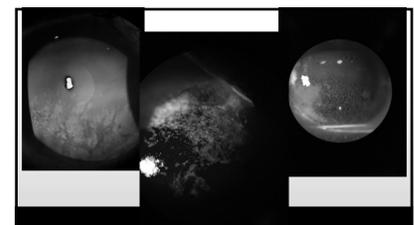
### CORNEAL STAINING

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- Sodium Fluorescein
  - Corneal staining
    - Pattern
    - Location
    - Severity
  - Tear break up time
  - Wipac #12 filter helps
- Rose Bengal
  - Corneal irregularities to rule out HSV



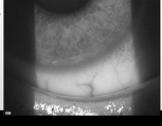
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### LID AND CONJUNCTIVAL STAINING

- Lissamine Green
  - Stains dead and degenerate cells
  - Lid margin for lid wiper epitheliopathy
  - Conjunctival staining



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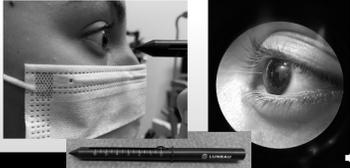
### CORNEAL SENSITIVITY TESTING: ESTHESIOLOGY

- Qualitative
  - Cotton tip applicator
  - Dental floss
- Quantitative
  - Cochet-Bonnet



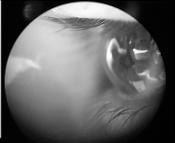
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### COCHET-BONNET



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### COTTON TIP APPLICATOR



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### POINT OF CARE TESTING

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### TEAR OSMOLARITY

- Changes in osmolality are caused by fluctuations in water content
  - Increased evaporation rate
  - Reduction in tear secretion
- Tear hyperosmolality is a trigger for cascade of signaling events
  - Stimulate epithelial cell death
  - Leads to release of inflammatory cytokine production, cell death and loss of goblet cells



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### THE WINNING NUMBERS ARE.....

- Most accepted < 308mOsm/L threshold to diagnose dry eye
  - Normal vs early stages
- > 316mOsm/L is an indicator for mild vs moderate-severe dry eye
- Variability between repeat measurements increases with severity
- Variability between [Lemp et al](#)
  - 4.9  $\pm$  0.9mOsm/L mild
  - 11.7  $\pm$  10.9mOsm/L moderate
  - 26.5  $\pm$  22.7mOsm/L severe

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### MMP-9

- Released in the hyperosmolality cascade
  - Is an inflammatory marker
- Current option: Inflammadry
  - Qualitative, but not quantitative
- Newer testing in development



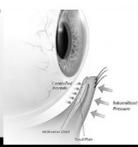
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### MEIBOGRAPHY

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### MEIBOMIAN GLANDS

- Meibomian glands secrete the lipid layer of the tear film
- Meibomian gland dysfunction
  - Result of glands becoming clogged or atrophied
  - Leads to tear film dysfunction
    - Quicker evaporation of tears
    - Decreased tear break up time



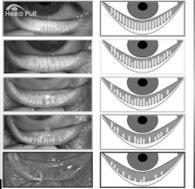
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### MEIBOGRAPHY

- Infrared non contact viewing at the structure and health of the meibomian glands
- Grading atrophy
  - Meiboscore
    - Grade 0 no atrophy
    - Grade 1 1-33%
    - Grade 2 34-66%
    - Grade 3 >66%

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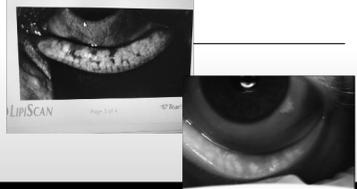
### Meiboscale



Degree	Area of Loss
Degree 0	<0%
Degree 1	5-25%
Degree 2	26% - 50%
Degree 3	51% - 75%
Degree 4	>75%

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### PRE-OPERATIVE MEIBOGRAPHY STUDY

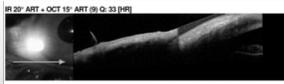
- J8J sponsored study Koetting & Yiu pre-operative cataract retrospective
- 95.1% patients had some level of gland atrophy
- Only 4.9% showed no atrophy on meibography
- Meibography vs SLE
  - More atrophy found on meibography vs the same patients SLE
  - Further breakdown found that there was a correlation between decreased expressibility of meibomian glands to increased meibomian gland atrophy, but NOT between meibum quality and MG atrophy

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### ANTERIOR OCT

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### TEAR FILM RESERVOIR MEASUREMENT



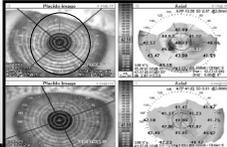
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### CORNEAL REFLECTIONS

- Detect the corneal irregularities often caused by tear film instability
- Non invasive tear break up time
- Placido disc images
  - Topography
- Scheinflug camera
- Manual keratometry

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### IRREGULARLY SHAPED OR SMUDGY PLACIDO DISK

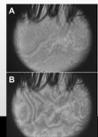


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**INTERFEROMETRY**

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- Analyzes tear film stability and thickness of lipid layer
- Can help distinguish clinical subtypes of dry eye



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**INTERFEROMETRY**

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- Study by Ariza et al
  - Patients with non-Sjögren's aqueous deficient dry eye (ADDE) and MGID showed a very specific interferometric pattern that was different than those who were non-Sjögren's ADDE or MGID only.<sup>8</sup>
  - Patients with only non-Sjögren's ADDE had a shortened NIBUT, an increased lipid layer thickness and a reduced tear secretion.
  - Patients with only MGID had thin lipid layer, but sufficient tear secretion and a shortened NIBUT.<sup>8</sup>

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**VISUAL FLUCTUATION AND TEAR FILM STABILITY**

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**HD ANALYZER OPTICAL QUALITY ANALYSIS SYSTEM**

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- Laser diode emitted onto retina and double passes through ocular media
  - Light reflection is recorded by camera
- Non-invasive calculation of intracocular light scatter and objective corneal index (OSI)
  - Irregularities to air tear film interface on ocular surface measured over 20seconds, 50 images

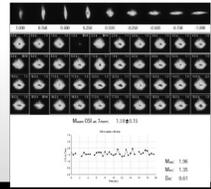
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**TEAR FILM QUALITY PATTERNS HD ANALYZER**

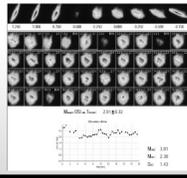
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- Roger Zaldivar, MD, identified three tear film quality patterns that correlate with vision break-up time:
  - (1) ladder (a continuous increase of OSI)
  - (2) staircase (instability of OSI without improvement after blinking)
  - (3) plateau (steady high OSI)<sup>3</sup>
- Plateau is normal, while the other two indicate abnormal tear film dynamics; the ladder pattern will have the highest OSI values.<sup>2</sup>

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**OTHER USES**

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- The HD Analyzer OSI scoring is also used to help determine whether a corneal or lens-based surgery is required.<sup>1</sup>
- Able to perform high-definition images of the meibomian glands.<sup>10</sup>

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**OCULAR SURFACE DISEASE TREATMENT**

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### TOPICAL AND ORAL PRESCRIPTION MEDICATIONS

- Topical cyclosporine
  - Multiple strengths
- Topical lifegrast
- Rosacea and Blepharitis
  - Oral doxycycline or azithromycin
- Significant or more severe DES
  - Oral pilocarpine
- Amniotic membrane drops
- Amniotic membrane
- Autologous serum drops

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### AT HOME TREATMENT

- Warm compresses
- Sleeping moisture goggles
- Humidifier
- Lid Hygiene
- Nutraceuticals

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### LID HYGIENE

- Day to day cleaning
- Blepharitis
- Demodex
- Lid scrubs cleaning
  - Coconut oil
  - Tea tree oil
  - HA



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### WARM COMPRESSES

- Difficult to maintain the temperature needed
- Heating pads of meibomian glands that are obstructed is higher
  - 40 degrees Celsius
- Thermal application for at home
  - Flag in warm compress
  - Microwaveable warm compress
- Heated dressing pads
  - Thermaflo, thermax
- A study of subjects with MSD showed that 12 weeks of lid warming therapy resulted in a therapeutic benefit, with excess ocular surface phospholipase activity (which is detrimental to tear film stability) being reduced

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### MATTERS OF MAKE-UP

- Important Pearls
  - Remove makeup at night
  - **NO WATERPROOF** mascara
  - Mascara removal in less every 2 months
  - Waterproofing or tightening should be avoided
  - Clean brushes
  - Avoid BAK, Alcohol, parabens, retinol, formaldehyde (Quaternium-15)
  - Eyelash/eyebrow tinting or perming is a big no
  - Eyelash extensions not great either

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### BECAUSE IT MATTERS

- If you want to be more involved, go a step further
  - specific eye friendly brands or carry them in office



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### NUTRACEUTICALS

- Essential fatty acids
  - Omega 3 and 6
    - Long chain DHA/EPA (only fish)
    - Short chain ALA (flaxseed, chia)
  - Help to reduce systemic inflammation
- DREAM study
  - 2000mg EPA + 1000mg DHA/day
- Remember not mandated by FDA
  - Independent groups evaluate

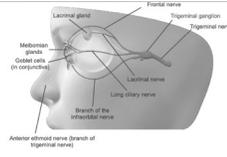
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### INTRODUCING..... NASAL SPRAY FOR DRY EYE!

- Varenicline solution nasal spray
- Activates the trigeminal parasympathetic pathway via the nose
- Increased basal tear film production
- Produced by 3 structures innervated
  - Lacrimal gland
  - Meibomian gland
  - Goblet cells



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Labels in diagram: Lacrimal gland, Meibomian glands, Goblet cells (in conjunctiva), Branch of the sphenoidal nerve, Anterior ethmoidal nerve (branch of trigeminal nerve), Frontal nerve, Trigeminal ganglion, Trigeminal nerve, Long ciliary nerve, Lacrimal nerve.

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## IN OFFICE DED/OSD TREATMENT

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## PUNCTAL OCCLUSION

- "Permanent"
  - Can be removed
  - Doesn't work with all lid anatomy
- Temporary
  - 1 week
  - 3 month
  - 6 month
- Punctal cauterization

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## IPL

- IPL
  - Photothermolysis is one of the proposed mechanisms of action of IPL for dry eye
  - Vasculitis selectively destroy blood vessels by targeting chromophores within the blood vessels
  - Destruction of telangiectasia along the eyelid inhibits access of inflammatory mediators to the meibomian glands
  - Other possible mechanisms include a mild local warming effect to allow better expression of meibum and destruction of bacteria that cause inflammation at the level of the meibomian glands.

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## THERMAL + EXPRESSION

- The purpose of applying physical treatment to the meibomian glands is to improve and/or restore the function of the glands by ameliorating or removing ductal obstruction, thus allowing the glands to become functional
- Meiboflow
- Lipiflow
- Iliu
- Tear-Care

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## 3 YEAR STUDY LIPIFLOW

Jack Greiner, DO, PhD

- MGS scores increased from 4.5 at baseline to 12 at one month ( $p < 0.0001$ ). This improvement continued at three years (score: 18.4). TFBUJ at baseline was 4.1 seconds, and improved to 7.9 seconds at one month ( $p < 0.05$ ). However, the difference between TFBUJ at three years wasn't statistically significant (score: 4.5 seconds).
- Average OSDI score improved significantly from a 26 at baseline to 14.7 at one month ( $p < 0.0001$ ), but returned to baseline levels at three years (22.5;  $p > 0.05$ ).

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## BLEPHARO EXFOLIATION

- Removes biofilm
  - Can be used for blepharitis or demodex with different solutions
  - Can improve expression of meibomian glands when coupled with thermal expression
  - In patients with MGD blepharitis, demodex and ocular rosacea, exfoliation of the eyelid at the lash line helps to remove the inflammatory biofilm that causes chronic lid disease and discomfort.<sup>1</sup>
- Blepharo exfoliation
  - Blephex
  - NuLids (at home)



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## EYELID EXFOLIATION + THERMAL EXPRESSION

- Study Moon et al. of 48 eyes
- Patients with moderate to severe MGD
- Treatment with lid exfoliation combined with meibomian gland expression
- Measurements
  - Clinical findings
  - Symptoms
  - Meibomian gland function
  - Ocular surface MMP-9 levels.

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## TAKEAWAYS

- You have all the tools already!
- Have your patients look down to evaluate for demodex
- Don't get frustrated, there are always more options
- Get your patients involved in their treatment

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