

CRST

Cataract & Refractive Surgery Today

COLLABORATIVE | EYE

DRY EYE MANAGEMENT STRATEGIES: APPROPRIATE TREATMENT DECISION-MAKING IN PATIENTS WITH DRY EYE

A CME/CE activity provided by Evolve Medical Education LLC.

Supported through an educational grant by Shire.

Distributed with *Cataract & Refractive Surgery Today* and *Collaborative Eye*.

In cooperation with Evolve Medical Education LLC, the University of Houston College of Optometry has reviewed and endorsed this course.


Terry Kim, MD, Moderator
Sumit "Sam" Garg, MD
Preeya K. Gupta, MD
Mark Milner, MD
Walter Whitley, OD, MBA, FAAO
Elizabeth Yeu, MD

Supported by

UNIVERSITY of HOUSTON
COLLEGE of OPTOMETRY

Provided by

The logo for Evolve Medical Education, featuring a stylized orange sunburst icon above the word "evolve" in a blue sans-serif font, with "medical education" in a smaller blue font below it.

The logo for COPE (Continuing Optometric Professional Education), featuring the word "cope" in white lowercase letters on a blue rectangular background, with a white checkmark icon to the right of the text.

Dry Eye Management Strategies: Appropriate Treatment Decision-Making in Patients With Dry Eye

CME Release Date: 3/27/2018 CME Expiration Date: 3/26/2019

COPE Release Date: 3/27/2018 COPE Expiration Date: 3/12/2021

FACULTY



TERRY KIM, MD, MODERATOR

Professor of Ophthalmology
Duke University School of Medicine
Chief, Cornea and External Disease Division
Director, Refractive Surgery Service
Duke University Eye Center
Durham, North Carolina



SUMIT "SAM" GARG, MD

Associate Professor of Ophthalmology
Cataract, External Disease/
Corneal Surgery & Refractive Surgery
University of California
Irvine School of Medicine
Irvine, California



PREEYA K. GUPTA, MD

Associate Professor of Ophthalmology
Duke University Eye Center
Division of Cornea and Refractive Surgery
Clinical Director, Duke Eye Center
Durham, North Carolina



MARK MILNER, MD

Associate Clinical Professor
Yale University Medical School
Department of Ophthalmology
Haven, Connecticut



WALTER WHITLEY, OD, MBA, FAAO

Director of Optometric Services
and Residency Program Supervisor
Virginia Eye Consultants
Norfolk, Virginia



ELIZABETH YEU, MD

Assistant Professor of Ophthalmology
Eastern Virginia Medical School
Norfolk, Virginia

CONTENT SOURCE

This continuing medical education (CME)/continuing education (CE) activity captures content from a roundtable discussion that occurred on January 25, 2018.

ACTIVITY DESCRIPTION

For those patients with mild or moderate dry eye disease, current treatments are insufficient. The overwhelming majority of eye care professionals (almost 95%) believe a significant treatment gap exists between artificial tears and more aggressive therapies. There also is now a general consensus in the community that dry eye disease is associated with ocular surface inflammation. Our understanding of diagnostics and new therapeutic approaches is significantly more evolved. We are now proactively treating dry eye and are making a real improvement in understanding how the disease works.

TARGET AUDIENCE

This certified CME/CE activity is designed for anterior segment

specialists and optometrist involved in the management of dry eye disease.

LEARNING OBJECTIVES

Upon completion of this activity, the participant should be able to:

- Discuss the prevalence of dry eye disease and the related signs and symptoms of patients.
- Develop a differential diagnosis for patients with complaints of dry eye.
- Propose an individualized treatment plan for patients using current US Food and Drug Administration-approved therapies.
- Evaluate how dry eye disease can complicate surgical outcomes and how best to manage dry eye disease in these states.
- Differentiate the need for constant maintenance and ongoing ophthalmic care for the various dry eye disease treatments.

GRANTOR STATEMENT

Supported through an educational grant by Shire.

ACCREDITATION STATEMENT

Evolve Medical Education LLC (Evolve) is accredited by the Accreditation Council for Continuing Medical Education (ACCME) to provide continuing medical education for physicians.

Evolve is an approved COPE Administrator.

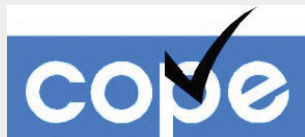
CREDIT DESIGNATION STATEMENT

Evolve designates this enduring material for a maximum of 1 *AMA PRA Category 1 Credit*[™]. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

This course is COPE approved for 1.0 hours of CE Credit for Optometrists.

COPE Course ID: 57163-AS

COPE Activity ID: 115238



TO OBTAIN CREDIT

To obtain credit for this activity, you must read the activity in its entirety and complete the Post Test/Activity Evaluation/Satisfaction Measures Form, which consists of a series of multiple choice questions. To answer these questions online and receive real-time results, please visit evolvemed.com and click "Online Courses." Upon completing the activity and self-assessment test, you may print out a CME certificate awarding 1 *AMA PRA Category 1 Credit*[™] or a CE certificate awarding 1 COPE Credit. Alternatively, please complete the Post Test/Activity Evaluation/Satisfaction Form and mail or fax to Evolve Medical Education LLC, 353 West Lancaster Avenue, Second Floor, Wayne, PA 19087; Fax: (215) 933-3950.

DISCLOSURE POLICY

It is the policy of Evolve that faculty and other individuals who are in the position to control the content of this activity disclose any real or apparent conflict of interests relating to the topics of this educational activity. Evolve has full policies in place that will identify and resolve all conflicts of interest prior to this educational activity.

The following faculty/staff members have the following financial relationships with commercial interests:

Terry Kim, MD, has had a financial agreement or affiliation during the past year with the following commercial interests in the form of *Consultant*: Acucela; Aerie Pharmaceuticals; Alcon/Novartis; Allergan/Actavis; Avedro; Avellino Labs; Bausch & Lomb/Valeant; BlepHex; CoDa/Ocunexus Therapeutics; Kala Pharmaceuticals; NovaBay Pharmaceuticals; Ocular Therapeutix; Omeros; Powervision; Presbyopia Therapies; Shire; SightLife Surgical; Simple Contacts; TearLab; and TearScience. *Stock Shareholder*: Kala Pharmaceuticals; NovaBay Pharmaceuticals; Ocular Therapeutix; Omeros; SightLife Surgical; Simple Contacts; and TearScience.

Sumit "Sam" Garg, MD, has had a financial agreement or affiliation during the past year with the following commercial interests in the form of *Consultant*: Aerie Pharmaceuticals; Carl Zeiss Meditec; Ivantus; Johnson & Johnson Vision; Kala Pharmaceuticals; RVO; RySurg; Shire; SightLife Surgical; TearScience; and Vision Care. *Speaker's Bureau*: Carl Zeiss Meditec; and Johnson & Johnson Vision.

Preeya K. Gupta, MD, has had a financial agreement or affiliation during the past year with the following commercial interests in the form of *Consultant*: Alcon/Novartis; Allergan/Actavis; Aurea; Biotissue; Carl Zeiss Meditec; Johnson & Johnson Vision; Novabay Pharmaceuticals; Ocular Science; Shire; TearLab; and TearScience.

Mark Milner, MD, has had a financial agreement or affiliation during the past year with the following commercial interests in the form of *Consultant*: Allergan/Actavis; Avedro; Bausch & Lomb/Valeant; Kala Pharmaceuticals; Ocular Science; Omeros; Shire; and Sun Pharmaceuticals. *Speaker's Bureau*: Allergan/Actavis; Avedro; Bausch & Lomb/Valeant; Biotissue; Ocular Science; Shire; and Sun. *Grant/Research Support*: Aldeyra; Biotherapeutics; Eye Gate; ICare; and Kala Pharmaceuticals. *Stock Shareholder*: EyeVance; Percept Tech; and RPS.

Walter Whitley, OD, MBA, FAAO, has had a financial agreement or affiliation during the past year with the following commercial interests in the form of *Consultant*: Allergan/Actavis; Carl Zeiss Meditec; Dreamvision; Ocusoft; Shire; and Sun. *Speaker's Bureau*: Alcon/Novartis; Allergan/Actavis; Bausch & Lomb/Valeant; Glaukos; and Johnson & Johnson Vision.

Elizabeth Yeu, MD, has had a financial agreement or affiliation during the past year with the following commercial interests in the form of *Consultant*: Kala Pharmaceuticals; and Sun Pharmaceuticals. *Advisory Board/Speaker's Bureau*: Alcon/Novartis; Allergan/Actavis; Bausch & Lomb/Valeant; BioTissue; iOptics; Johnson & Johnson Vision; Ocular Science; OcuSoft; Ocular Therapeutics; Omeros; Shire; SightLife Surgical; TearLab; TearScience; and Veracity Innovations. *Grant/Research Support*: Alcon/Novartis; Ocular Science; and Topcon. *Stock Shareholder*: GlassesOff; Modernizing Medicine; Ocular Science; and Strathspey Crown.

EDITORIAL SUPPORT DISCLOSURES

Erin K. Fletcher, MIT, director of compliance and education, Evolve; and Michelle Dalton, writer, have no financial relationships with commercial interests. Jaya Kumar, MD, peer reviewer, has no financial relationships with commercial interests.

OFF-LABEL STATEMENT

This educational activity may contain discussion of published and/or investigational uses of agents that are not indicated by the FDA. The opinions expressed in the educational activity are those of the faculty. Please refer to the official prescribing information for each product for discussion of approved indications, contraindications, and warnings.

DISCLAIMER

The views and opinions expressed in this educational activity are those of the faculty and do not necessarily represent the views of Evolve, *Cataract & Refractive Surgery Today*, *Collaborative Eye*, or Shire.

DIGITAL EDITION

To view the online version of the material, please visit go to evolvemed.com/online-courses/.



Dry Eye Management Strategies: Appropriate Treatment Decision-Making in Patients With Dry Eye

Dry eye disease is prevalent in the United States, yet many patients go undiagnosed due to an overall lack of patient and clinician awareness of signs and symptoms. Some patients with dry eye will have ocular discomfort, pain, foreign body sensation, fatigue, and visual disturbances, while other patients will be asymptomatic. Dry eye can have a significant impact on refractive outcomes. Therefore, it is critical that clinicians diagnose, treat, and effectively manage dry eye before patients undergo cataract or refractive surgery. The following roundtable brings together dry eye specialists to discuss the latest advances in diagnostic tests and overall management of the disease.

—Terry Kim, MD, Moderator

INCREASING DRY EYE AWARENESS IN PATIENTS AND CLINICIANS

Q | TERRY KIM, MD: There are approximately 30 million patients with dry eye disease (DED) in the United States, but only half of these patients have been diagnosed.¹ Clearly, we need to increase disease awareness. Has anyone seen an improvement in disease state awareness over the last 3 years? Are more patients seeking treatment for dry eye symptoms?

MARK MILNER, MD: There's no question that there has been an increase in patient awareness of DED. This is in part because more companies have commercially available drugs, such as cyclosporine and lifitegrast, and are now promoting DED state awareness to both practicing eye care professionals and directly to consumers. With several treatments now available, and newer ones on the horizon, patients are asking directly for them. There are also more options, such as practice, industry, and consumer websites, where patients can learn about DED. As more patients become proactive in their care, doctors are being forced to address their signs and symptoms. Physicians are also realizing the importance of the tear film in relation to vision and how failure to address an abnormal tear film can negatively impact outcomes in many of their procedures. Physicians are either increasingly recognizing the importance of treating this ocular surface disease (OSD), or they're referring patients to dry eye specialists to help manage the problem.

WALTER WHITLEY, OD, MBA, FFAO: We've seen more excitement around treating dry eye in the last few years because of the increase in diagnostic technology and therapeutic treatment options. There are several different pharmaceutical companies doing direct consumer marketing, so more patients and providers are talking about DED as well.

SUMIT "SAM" GARG, MD: I generally agree, but I'm still surprised at the number of symptomatic patients who have seen eye care providers in the

past who come in undiagnosed. Patients come to the clinic complaining of pain, irritation, watering, and a foreign body sensation, but physicians aren't recommending basic treatment such as omega-3 fatty acid implementation, warm compresses, and artificial tears. Instead, physicians are still brushing dry eye under the rug to a degree. There's still room for us to educate our colleagues and our patients, because even though patients are coming in—some of whom are quite informed—there are still physicians and patients who are missing the opportunity to treat dry eye.

ELIZABETH YEJU, MD: Dry eye isn't always easy to diagnose. Some patients will present with classic symptoms that clearly correspond with staining on the ocular surface exam. However, some patients will be extremely symptomatic, and you don't see much staining on the exam. This makes dry eye difficult to appropriately diagnose, assess, and treat. Furthermore, the majority of comprehensive exams are being done by optometrists, which includes taking care of patients who are contact lens intolerant. That's a point of education as well. Taking care of these patients isn't simply about switching contact lenses and solutions; these symptoms can stem from dry eye, OSD, and limbal stem cell deficiency, which develop over time from contact lens overuse.

DR. MILNER: That's a great point. No matter what type of practice or specialty you have in eye care, you're seeing dry eye patients. If you fit contact lenses, you know that contact lens wear exacerbates dry eye, and dry eye patients have an increased risk of contact lens intolerance.²⁻⁵ If you are a glaucoma specialist, you're going to see your share of dry eye patients as a result of glaucoma surgery and topical medications.^{6,7} If you do LASIK, there's no question that you may exacerbate dry eye in some patients, and you also understand that treating the tear film prior to surgery is critical for good refractive outcomes.^{8,9} I think it is so important for doctors, who may be a little reluctant to manage these patients, to change their thinking and embrace this disease.

DR. GARG: Many retina specialists ignore dry eye because they are so focused on the back part of the eye. But many of my severe, difficult-to-manage patients are elderly with retinal comorbidities whose eye surfaces are being ignored. This leads to them having ocular surface breakdowns. They end up with neurotrophic epithelial defects, which can lead to ulcerations. We're also seeing more dry eye in pediatric patients, which likely has to do with extended screen time. These patients are all under 16, and the majority have a digital device that they use on a regular basis.

UNDERSTANDING CHANGING PATIENT DEMOGRAPHICS

DR. YEU: The classic dry eye patient is no longer a perimenopausal female. The classic patient is now coming in for a LASIK evaluation. It's the younger patient who is gaming or who has an erratic schedule because they are a college student with a poor diet and are engaged in extended screen time. We also have dry eye patients who are coming in for cataract surgery complaining of fluctuation in vision. There's not a single type of patient for dry eye—it's a gender-neutral disease. Yes, hormones play a role, and it's still more commonly seen in women, but it is affecting younger and younger patients. If we don't care for these patients appropriately now, I'm concerned about what will happen in 10 years when they stop responding to therapy because they've already burned out their meibomian glands.

DR. MILNER: Young people are getting dry eye, in part, because of increased screen time,¹⁰ and we all agree this is a problem. However, we've also missed diagnosing young people with autoimmune diseases that can cause dry eye, such as Sjogren syndrome, and we need to start looking for it. We now have blood tests that identify novel antibodies, such as SP-1 (salivary gland protein), PSP (parotid secretory protein), and CA-6 (carbonic anhydrase VI), in addition to the standard Sjogren antibodies (SS-A/Ro, SS-B/La, and ANA), enabling us to better diagnose Sjogren.¹¹ Patients with dry eye caused by Sjogren exhibit lower Schirmer's scores, have a lower tear break-up time, and have higher ocular staining scores.¹² A 2018 study found that tear proteins' concentrations, such as LACTO (lactoferrin) and LIPOC-1 (lipocalin-1), showed a significant higher accuracy compared with the traditional ocular clinical tests for reaching a Sjogren diagnosis. Researchers concluded that these biomarkers could likely be promising in the early diagnosis of Sjogren.¹³

DR. KIM: Peer-reviewed data have shown an increased prevalence of dry eyes in office workers.¹⁴ There was an interesting study in *BMC Ophthalmology* from Moon et al that looked at children with DED and linked smartphone use as a risk factor.¹⁰ It was very interesting to see the increased prevalence of dry eye diagnosed in children who are older and more commonly using these devices, and children who are in urban versus rural settings. Our traditional and conventional thinking about DED has changed. It's no longer the peri- and postmenopausal woman making up the majority of our patient population. Our thoughts on disease state have also changed. We used to think DED represented aqueous deficiency only, and now

we're learning about the prevalence of meibomian gland dysfunction (MGD).

DR. GARG: We're looking at DED much more academically than we used to, in that we're routinely using questionnaires and point-of-care testing. We're looking at staining patterns, and we're using different dyes. We're using meibography, we're looking at our topographies differently, and we're looking at the raw images rather than just the number in an effort to educate ourselves and our patients. When you do a point-of-care testing with MMP-9, tear osmolarity, meibography, or others and show patients the test results, they are more inclined to treat their dry eye. Patients understand the results because it's a very simple concept. They become motivated to adhere to treatment recommendations.

DR. WHITLEY: When patients have struggled with dry eye symptoms while wearing contacts, the traditional thinking has been to change the type of lens used. However, the dropout rates of contact lens wear haven't changed over time, and the technology has improved. It's clearly not just about the lens, and we're starting to understand that.

Before we put a patient in new contact lenses, we now do a medical contact lens evaluation to determine the health of their ocular surface. Do they have a pristine ocular surface that would promote healthy lens wear and clear comfortable vision? Now, our approach is more akin to bringing clinical research into our daily practice. We have great tools to help make a diagnosis, help monitor our patients, and manage them over time.

DR. MILNER: One of the big differences between how we think about dry eye today compared to 20 years ago is that we now better understand that there's an inflammatory process involved.¹⁵ The old thinking was that Sjogren patients were inflammatory and non-Sjogren patients were noninflammatory. We now know that DED, in general, is an inflammatory process.

Additionally, we now have treatments that go to the heart of the problem to reduce the inflammation as opposed to the drops, ointments, and gels that were just palliative years ago. We also now understand the concept of a dysfunctional tear syndrome; dry eye is not just about low tear volume, but about a poor tear quality as well. Most clinicians separate dry eye patients into aqueous deficiency and evaporative dry eye, with MGD being a majority of the evaporative dry eye category. However, evaporative dry eye also includes goblet cell deficiency, and exposure because patients who can't close their eyes well have a form of evaporative dry eye, too.

Finally, the other big difference is that we now understand that dry eye may become a chronic, progressive disease if left untreated. It's not just a benign irritation to the eye; it may ultimately damage the ocular surface.

ADVANCES IN DRY EYE DIAGNOSTICS

POINT-OF-CARE TESTING

Q | DR. KIM: I think most of us have started to use some of these point-of-care tests that have been mentioned such

Patient Name: _____

Date: _____

<input type="checkbox"/>	RIGHT EYE
<input type="checkbox"/>	LEFT EYE

DRY EYE QUESTIONNAIRE — SPEED

Please answer the following questions by checking the box that best represents your answer. Select only one answer per question.

1. Report the type of SYMPTOMS you experience and when they occur:

SYMPTOMS	AT THIS VISIT		WITHIN PAST 72 HRS		WITHIN PAST 3 MONTHS	
	YES	NO	YES	NO	YES	NO
Dryness, Grittiness, or Scratchiness						
Soreness or Irritation						
Burning or Watering						
Eye Fatigue						

1. Report the FREQUENCY of your symptoms using the rating list below:

SYMPTOMS	0	1	2	3
Dryness, Grittiness, or Scratchiness				
Soreness or Irritation				
Burning or Watering				
Eye Fatigue				

0 = Never 1 = Sometimes 2 = Often 3 = Constant

3. Report the SEVERITY of your symptoms using the rating list below:

SYMPTOMS	0	1	2	3	4
Dryness, Grittiness, or Scratchiness					
Soreness or Irritation					
Burning or Watering					
Eye Fatigue					

0 = No problems
 1 = Tolerable — not perfect but not uncomfortable
 2 = Uncomfortable — irritating but does not interfere with my day
 3 = Bothersome — irritating and interferes with my day
 4 = Intolerable — unable to perform my daily tasks

4. Do you use eye drops for lubrication? YES NO If yes, how often? _____

Figure 1. SPEED questionnaire.

as osmolarity, MMP-9, and meibography to diagnose patients earlier when we're still able to have a bigger impact on their outcome. It's about alerting the patient that DED is chronic, progressive, and will continue to get worse unless treated. How have point-of-care tests helped identify patients with DED earlier before they become classically symptomatic?

PREEYA K. GUPTA, MD: There's been a paradigm shift in how we approach DED from a diagnostic perspective. We can't simply rely on the patient's symptoms. Many clinicians see a big disconnect between the signs of the disease and the patient's symptoms. Point-of-care testing allows us to identify patients earlier regardless of their symptoms.

In my clinical practice, I often test both osmolarity and MMP-9. I use those tests not only to help me identify DED, but to help me identify when it's not DED. We know that osmolarity has a very high specificity. If a patient has a normal osmolarity, there's a high likelihood that they have something other than DED. If a patient has normal osmolarity but high MMP-9, then I'm looking for an alternative diagnosis like epithelial basement membrane dystrophy with recurrent erosion, superior limbic keratoconjunctivitis, or conjunctivochalasis. Clinicians can tailor these tests to become better diagnosticians.

DR. YEU: In my practice, I test tear osmolarity as part of standard operating protocol for any dry eye evaluation. Knowing a patient has an abnormal tear osmolarity is useful, but the normal tear osmolarity in the setting of the patient's symptom questionnaire, history, and clinical exam is just as important. When a patient has a normal tear osmolarity you can clearly tell if there is turbid meibum, MGD, allergic conjunctivitis, or conjunctival chalasis that may be the larger player for their OSD.

The first thing that comes to my mind when I see normal tear osmolarity in a patient with dry eye symptoms is that I need to address the MGD and consider alternative mechanical issues or allergic conjunctivitis. In earlier MGD states, patients may have a relatively normal and balanced osmolarity between the two eyes because a hyper-reflexive mechanism is coming into play.

If I have a patient who is symptomatic even while on dry eye therapy, I test his or her MMP-9 levels. If that test is positive, then the patient may benefit from a second anti-inflammatory drug or a different one altogether. It gives you an objective measure to discuss with the patient.

DRY EYE QUESTIONNAIRES

Q | DR. KIM: We all are familiar with the Ocular Surface Disease Index (OSDI) questionnaire.¹⁶ Has anyone transitioned to a different questionnaire such as the Standardized Patient Evaluation of Eye Dryness (SPEED; Figure 1)¹⁷ or the Symptom Assessment in Dry Eye (SANDE)?¹⁸ How easy have these questionnaires been to implement into your practice, and how well have they functioned?

DR. GUPTA: From the Tear Film and Ocular Surface Society

(TFOS) Dry Eye Workshop (DEWS) II diagnostic algorithm,^{19,20} the two questionnaires that have been studied most in the literature are the Dry Eye Questionnaire 5 (DEQ-5) and the OSDI questionnaire.^{16,18,21} Those two are very easy questionnaires to use, but there's certainly a very long list of alternatives including SANDE, SPEED, and McMonnies.²² The important thing is that clinicians are using questionnaires to identify symptoms. It's an important part of identifying patients who you might not directly report dry eye symptoms in a standard examination, and it's also an important way to track patients over time. There's great value in questionnaires generally, regardless of which specific one you use.²³

DR. WHITLEY: In my practice, we use SPEED and a modified version of SPEED. We give it to all of our new patients regardless of what specialty they are visiting (cataract, LASIK, glaucoma, or retina) or which provider they are seeing. Depending on their score, we either evaluate and treat patients and/or refer them to our dry eye clinic.

The key is to implement some kind of questionnaire or some type of protocol. If you don't use a questionnaire, there are different questions that can be asked, and it's important to standardize them. For example, if a patient mentions blurred vision; does it fluctuate or change throughout the day? Does the patient feel the need to use eye drops? Are they bothered by red eyes? Making sure the questions are consistent between patients is important. If a patient answers yes to any of these questions, we need to evaluate for OSD and treat accordingly.

DR. MILNER: I agree with implementing any questionnaire to help identify dry eye patients, evaluate disease severity, and the patient's progress. I use SPEED as well. I like it because it's easy and quantifiable. Dry eye patients have what I called a "learned pattern of hopelessness." They are used to being unhappy and frustrated and often don't realize when they get better. I use the SPEED questionnaire to reinforce that they are improving with treatment, by showing them that their score improved from 32 to 18, for example. This becomes an "A-ha" moment for them when they realize that they aren't thinking about their eye discomfort as much, so maybe they are getting better.

It's also important to train staff to ask the right questions and to know what symptoms should trigger a dry eye workup. The staff is the front line and often critical in helping to diagnose and treat the dry eye patient. For example, I tell all my staff that patients should get a dry eye workup if they report fluctuating vision or blurry vision with extended reading, driving, or computer use. Patients may not be aware they have dry eye symptoms, so it's critical for staff to know what questions to ask and to recognize the warning signs so the physician can be alerted.

DR. GARG: When you give patients a questionnaire, they don't always know what symptoms are actually associated with dry eye. They may think they have another condition, and they may be scared because they don't know what it is. We also use the SPEED questionnaire on all new patients who come to our cornea or cataract clinics,

and then use that to help triage patients. The questionnaires give staff the ability to perform point-of-care testing before the patient sees the physician. The questionnaire results become the impetus to order the point-of-care tests.

ESSENTIAL TESTS FOR DRY EYE DIAGNOSIS

Q | DR. KIM: What are the essential tests needed to diagnose a patient with dry eye?

DR. WHITLEY: The first step is to look at the lids because if you don't address them the patient may still be symptomatic even after treatment. The next step is to evaluate their tear film for instability or stability through tear osmolarity or tear film break-up time. The third step is to use corneal staining and lissamine green staining to look for any cellular damage.

DR. YEU: Adding meibography has really been a game changer. Previously, when the clinical examination showed turbid meibum or difficult to compress meibum with some puckering or telangiectasis, I thought that always indicated architectural damage. However, I now know that you can't always connect function with meibomian gland architecture. In my experience, the benefit of the meibography in the setting of poor quality meibum is that patients with a healthier meibomian gland architecture may respond better to therapy, as compared to those with poor meibomian gland architecture. Thus, the meibography actually helps me prognostically as to how patients will respond to therapy. Specifically, a patient with MGD who demonstrates a healthier gland architecture on meibography will experience more symptomatic relief from the treatment. In contrast, a patient who has MGD with associated poor architecture may not necessarily "feel" a whole lot better, but would likely benefit from therapies like thermal pulsation in order to preserve the glands that exist.

DR. GARG: That's an excellent point. I saw a patient yesterday, and my fellow thought the meibography looked great. However, when I pushed on the lids, the quality of the meibum was horrible. The structure may look fine, but you have to examine the quality of what's coming out of it.

DR. GUPTA: I don't think we can look at the meibomian glands clinically without getting meibography. Diagnosing the degree of atrophy allows the doctor to set expectations for the patient. If a patient comes in with severe gland atrophy on imaging, you'll have more confidence to tell them they have severe disease that will be harder to treat. Or if they've only lost a few glands, you can tell them the recommended therapies have a higher chance of working because their anatomy is still intact.

DR. MILNER: I may be in the minority as fewer clinicians are performing Schirmer's, but still I find the Schirmer's test to be valuable in diagnosing aqueous deficiency versus other subtypes of dry eye. A low Schirmer's, especially without anesthesia, can help you determine

who has a lower tear production, which you would treat differently than a patient with MGD and a poor tear quality. I also press on the glands to assess the meibomian gland secretions and evaluate the patient's blinking and lid closure for lagophthalmos or exposure-related dry eye. The LipiView—an instrument with a built-in interferometer that captures images of meibomian glands—is helpful to evaluate blinking as well, as it tells you the number of partial blinks. I also do vital dye staining, like lissamine green or rose bengal, because they help you to not only diagnose dry eye but find those dry eye "coconspirators," diseases that masquerade as dry eye, by looking at the staining pattern. This approach can help clinicians separate patients into various dry eye categories, allowing them to then take a more directed approach to treatment.

DR. KIM: We've talked a little bit about how sometimes the signs of dry eye don't equal the symptoms and vice versa. Christopher Starr, MD, et al have published an interesting study that looked at a prospective group of 50 patients with dry eye symptoms, including redness, grittiness, and itching, who all had normal osmolarity.²⁴ The study group had a number of diagnoses such as allergic conjunctivitis (20%), anterior blepharitis (24%), epithelial basement membrane dystrophy (12%), keratoneuralgia (12%), contact lens intolerance (8%), and other (12%). I think we're all learning how to use these test results, whether they're positive or negative, and then using the combination of the findings to help sort out what condition the patient has.

NEW ALGORITHMS IN DRY EYE MANAGEMENT

Q | DR. KIM: There have been a number of initiatives and studies such as CEDARS and DEWS I and II that have tried to increase awareness of DED and provide some guidance to clinicians on diagnosis and treatment. How are these initiatives helping to guide clinicians in dry eye diagnosis and management?

DR. GUPTA: These algorithms have so much value. DEWS I came out in 2007,²⁵ and DEWS II was released in 2017.²⁶ TFOS DEWS II is an international collaboration that thoroughly evaluated all aspects of dry eye. It's an excellent resource for any clinician interested in dry eye. The diagnostic section, which goes through a series of steps of how to make a diagnosis of dry eye, will be the most helpful section to clinicians. The amount of studies that were cited between the 2007 and the 2017 reports doubled. Clearly there's a lot of interest and activity in DED.

DR. MILNER: I couldn't agree more. There's so much information in DEWS II. Anyone who wants to learn about dry eye should read it. Prior to DEWS, some treatment algorithms were a severity-based approach, meaning you treat mild dry eye differently than moderate or severe dry eye. The CEDARS algorithm²⁷ was designed to be a diagnostic-based approach: if you could separate patients into diagnostic subcategories, you could have a more directed treatment. The purpose of the CEDARS algorithm was to allow the clinician to separate patients into four categories that they could then use specific treatments to get better outcomes.

The first category is aqueous deficiency. The second category is evaporative dry eye based on goblet cell/mucin deficiency. Most patients with evaporative dry eye have MGD. However, there are patients who have goblet cell deficiency from chronic irritation as a result of multiple topical medications or chemical exposure or from cicatricial conjunctivitis, such as patients with Stevens-Johnson Syndrome, toxic epidermal necrolysis, or pemphigoid. These patients may not necessarily have blepharitis but still have a significant loss of goblet cells and mucin and still be evaporative. The third category is blepharitis. This is a separate category, because although a bulk of evaporative dry eye is a result of blepharitis/MGD, there are patients who have an inflammatory tear film from blepharitis and may not necessarily be evaporative. The fourth category is exposure. This category often gets overlooked. Some of these patients will feel dry because they aren't fully closing their lids from partial blinking or lagophthalmos. It won't matter how well you are treating those other categories, if you miss a nocturnal lagophthalmos, these patients will have persistent dry eye signs and symptoms. Finally, the last category, so to speak, are the dry eye coconspirators, the diseases that masquerade as or exacerbate dry eye, such as superior limbic keratoconjunctivitis, mucus fishing syndrome, conjunctivochalasis, and medicamentosa, to name a few. Think about these coconspirators when you are treating a patient with no success.

We felt if you could separate patients into these categories, you can have a directed treatment. For example, you can treat the aqueous deficiency with options such as plugs, ointments, cyclosporine, or lifitegrast. The CEDARS algorithm also provides some esoteric, innovative, off-label, and compounded treatments such as albumin, autologous serum, topical dapsone, to name a few. For evaporative dry eye based on goblet cell/mucin deficiency, treatments such as cyclosporine, lifitegrast, vitamin A ointment, and moist chamber goggles are used. For blepharitis, options include such treatments as cyclosporine (off-label), lifitegrast (off-label), topical metronidazole ointment (compounded), doxycycline drops (compounded), and thermal pulsation. The CEDARS algorithm provides clinicians with a roadmap based upon specific diagnostic categories of dry eye to get a more pointed, directed outcome.

DR. WHITLEY: One thing I noticed about the CEDARS algorithm is that it shows the important role of inflammation. Because we know with the TFOS DEWS II, anti-inflammatories typically aren't prescribed until step 2. But when we look at the CEDARS algorithm, we know that many patients have already tried several different artificial tears, and it recommends topical cyclosporine, lifitegrast, and steroids in the first-line setting. Inflammation is very common in OSD. It doesn't matter if it's aqueous deficient or evaporative dry eye, inflammation plays a role. It's very important that we get our peers to be more proactive and aggressive in using anti-inflammatories to address this condition.

DR. KIM: A recent American Society of Cataract and Refractive Surgery (ASCRS) clinical survey indicated that 60% of responders didn't know these guidelines existed or didn't use them.²⁸ Do you

think that's starting to change? Are these initiatives starting to help clinicians diagnose these patients better and institute treatment earlier?

DR. YEU: There are a plethora of manuscripts and algorithms addressing DED, and it has become overwhelming for the average clinician who may not know how to use diagnostics or who doesn't have the resources to create a dry eye center. What we need to impress upon people is that the algorithms provide a way to look at treatments from different approaches. DEWS uses a severity-based approach, while CEDARS uses etiology-based treatments. The diagnostics allow us to customize our treatments, where before that wasn't an option. I think this will become more relevant and better understood over time.

THE IMPACT OF DRY EYE ON CATARACT AND REFRACTIVE SURGERY OUTCOMES

Q | DR. KIM: Disease state awareness seems to be increasing in cataract and refractive surgeons. The PHACO study looked at patients who were scheduled for cataract surgery to see how prevalent dry eye was in that group.²⁹ The results were pretty telling with more than 60% having an abnormal tear break-up time. Nearly 50% had central staining with fluorescein, and 18.6% had a low Schirmer's score. How important is managing DED in cataract and refractive surgery patients?

DR. GUPTA: The PHACO study, which was first presented in part in 2011, was a great foundation to discuss the presence of DED in the cataract population.²⁹ Researchers looked at tear break-up time and corneal staining, which are both very easy to do in clinical practice. It was outstanding just how many patients had DED.

DR. MILNER: The PHACO study really showed how underdiagnosed DED is. Eighty percent (80%) of patients were determined to have level 2 dry eye or higher at their cataract preoperative visit with only 22% presenting with a diagnosis of dry eye.²⁹ The take-home message is clinicians need to be more proactive rather than reactive.

DR. GUPTA: Dr. Starr and I are in the process of putting together our work, looking at a more recent population of patients presenting for cataract surgery. We looked at point-of-care testing such as osmolarity and MMP-9 and found there is a large number of patients who have asymptomatic OSD. Nearly 80% of patients presenting had some level of OSD, and of those who were asymptomatic over 50% had an abnormal osmolarity and/or abnormal MMP-9. Point-of-care testing has allowed us to identify these patients earlier in the disease process, when patients may even be asymptomatic.

Literature has shown that tear break-up time decreases for the first 3 or 4 months after cataract surgery.^{30,31} Femtosecond laser-assisted surgery causes temporary dry eye for the first few months after surgery.⁸ Many cataract patients have high visual demands, and it's important to identify them before surgery so their OSD and dry eye can be managed side-by-side with the cataract. ASCRS has a clinical

algorithm that focuses on the high-risk, presurgical population, which was designed to help cataract and refractive surgeons identify these high-risk patients and treat them before surgery.

DR. YEU: The ASCRS Cornea Clinical Committee actually began the journey to create an algorithm on how to use advanced diagnostics. And after multiple iterations, they realized that OSD is so complex that the algorithm needed to be specific to certain populations, specifically cataract and refractive surgery patients. Hopefully, the ASCRS algorithm will be published in a few months.

DR. GARG: Many of us see cataract patients who don't need surgery right away. They're coming in with fluctuating vision, and their cataract surgery is a couple years out. I use my time with them to treat their DED or ocular surface because as time goes on, both will get worse. If we treat it proactively, the patient will be ready to go when it comes time for surgery. We'll get better measurements, which will result in a more accurate surgery. Our IOLs are continuing to evolve. Some lenses are a little more forgiving, but others are not. However, with any lens, the more precise we are with our preoperative evaluations, the biometry, keratometry, and topography, the more accurate we will be with our lens selection, which will improve outcomes overall.

DR. WHITLEY: Within our practice, we do a lot of collaborative care, whether it's internally with our ODs and MDs or within our referral network. We presented the PHACO data to all referring providers to bring awareness to the issue.²⁹ We encourage providers to go back to the dry eye questionnaires before they refer a patient and address any dry eye or ocular surface issues in advance of surgery. That way, by the time the patient is referred, they will be ready for surgery.

DR. KIM: Alice Epitropoulos, MD, published a study that showed how increased osmolarity can lead to errors in IOL calculations.³² We all have case examples of how an abnormal ocular surface has steered us toward abnormal keratometry. Many of our patients have high expectations. They are coming in wanting their LASIK or cataract surgery with a multifocal IOL. They're asymptomatic for dry eye, so they feel fine. How do you approach the asymptomatic patient and stress the importance of treating their dry eye first? What are your treatment approaches once you get the patient's buy-in?

DR. GUPTA: Many of my LASIK patients don't know they have dry eye, but they come in saying they can't wear their contacts anymore. When you ask them to elaborate on why they can't wear contacts, it turns out they have underlying DED. It's important to stress to the patient that this is not just about getting rid of glasses; it's about giving them good visual quality. The clinician's job is to make patients understand the importance of treating dry eye, and how dry eye negatively impacts their vision. That's what they are in your office for—they want good quality vision, and they need to understand what that means.

Once I've made a dry eye diagnosis, I divide patients into a few categories. If they have a little bit of punctate staining, I might put them on artificial tears. If they come back a couple of weeks later and there's no improvement, I put them on a topical steroid in addition to the tears. I have a low threshold for adding lifitegrast or cyclosporine. I tell these patients that we're going to push their surgery out a little bit and see them in a month. If there is still no improvement, I'll wait until their corneal staining and symptoms get better before proceeding. It's also important to lay out the roadmap for these patients and tell them what to expect, as well as the different treatment options. That goes a long way in this group.

MGD is also a big problem in the younger patient population. I like to use thermal pulsation therapy to treat MGD in these patients, because many of them don't want to take another eye drop. Thermal pulsation therapy works quickly, and it's something patients can have working in the background.

DR. YEU: I do a Schirmer's test without anesthesia for my LASIK evaluations. It's insightful because it allows me to understand what their level of reactive tearing is. Studies have demonstrated the connection between a low Schirmer's and a higher incidence of postoperative dryness.⁸ The meibography is also important here because I want to judge their response to therapy. If it looks like tears aren't enough and that they'll require further therapy like steroids or anti-inflammatory medications for longer periods of time, then it gives me a better sense of whether or not they are a true candidate for LASIK. If we decide to proceed with surgery because they do respond, then I give these patients oral omega-3 supplementation preoperatively. You can really see the positive effect of 6 to 8 weeks of omega-3s on their tear film.

DR. KIM: How important is having an optimal tear film in patients who are looking for a premium lens technology?

DR. GARG: You have to make the patient understand that the cornea and tear film make up two-thirds of the focusing power of the eyes, regardless of how fancy the lens is. Cornea and tear film are the most important things to manage. Not only does it help us decide which patients can be fitted for a premium lens, but more importantly, which patients aren't candidates. There are some patients whose surface you can't optimize no matter how hard you treat them. Those patients are monofocal candidates and can't have a premium lens.

However, there are some patients who get better. Thermal pulsation is great. I've been implementing more and more microblepharon exfoliation or the BlephEx. We now have lifitegrast, which has a quick onset. We also have topical steroids, and there are some in the pipeline that have better side effect profiles and may be the perfect solution for us to get our patients right over that hump. I'm pretty aggressive in prescribing these patients artificial tears, warm compresses, and omega-3s. Their surgery needs to be pushed out far enough so that you can see them again and reevaluate their dry eye. This can be difficult from a scheduling perspective because you have

CASE STUDY 1

Dr. Kim: We have a 65-year-old woman who was referred for a cataract evaluation. She's complaining of glare and blurry vision when reading. She's on artificial tears intermittently and amitriptyline at bedtime. She does not want to wear glasses for distance vision after her cataract surgery. Her exam reveals 2+ MGD. Her tear break-up time is 3 to 4 seconds. She has corneal staining, 1+ punctate epitheliopathy. She had a weakly positive MMP-9, and an elevated osmolarity of 328 in her right eye and 310 in her left eye.

Dr. Garg: There's clearly an irregular pattern on the topography (Figure 2), maybe an ectasia pattern. Her meibum looks quite turbid, which is reflected in the abnormal-appearing tear film, likely a rapid tear break-up time of 3 to 4 seconds. When you look at the topography, there are some irregular mires and areas of drop-out, which is suggestive of an irregular surface and irregular astigmatism.

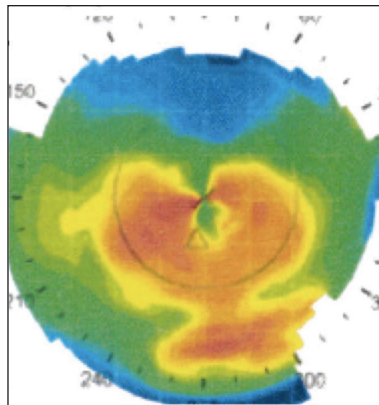


Figure 2. Topography of a 65-year-old woman referred for cataract surgery before dry eye treatment.

Dr. Kim: The keratometry showed about 1.57 D of astigmatism, but you can see the irregular pattern on that topography.

What are some treatment options for this patient prior to proceeding with her cataract surgery?

Dr. Gupta: The key here is that the patient has high expectations. She doesn't want to wear distance glasses, she has astigmatism, the surface is irregular, and she has some known dry eye. She's been using tears and is on a high-risk medication. The amitriptyline can definitely cause dry eye. I'd introduce some over-the-counter therapies for this patient and have a low threshold to start her on a topical steroid. Her MGD seems to be a major issue here with the abnormal tear break-up time. I'd also recommend thermal pulsation. If I thought she was at high risk for having chronic ocular surface inflammation, I might consider adding lifitegrast because it does have a rapid onset of action. Some patients have seen benefit in as little as 2 weeks.

Dr. Kim: How do you use steroids? Are you using both steroids and lifitegrast at the same time? How long do you treat the patient before you decide to proceed with surgery?

Dr. Gupta: There are times when I combine a steroid with the immunomodulators, and I think that sometimes helps with the tolerance of the medication. I typically use loteprednol four times a day for 1 week, followed by twice a day for 1 week; and I start that at the same time as the immunomodulator if I'm going to use it. Steroids give patients that boost in terms of rapidly addressing inflammation. However, many patients have chronic inflammation, and without a long-term therapy patients will cycle right back once you take them off the steroid.

Dr. Garg: It's also important to stress to patients that their dry eye may get worse after surgery. Therefore, they'll have to continue with many of these treatments postoperatively and for years to come to keep their ocular surface healthy.

Dr. Whitley: Education is definitely the key for the patient described in this case. If she wants to obtain the best vision possible, the dry eye has to be treated aggressively. Traditionally, I used steroids, but now that lifitegrast is out with a quick onset of action, I've been prescribing that more often due to the safety profile. I bring the patient back in 3 to 4 weeks to reassess and order a LipiScan, which is a meibomian gland imager. I then send the patient to our dry eye counselor to consider LipiFlow, a thermal pulsation system for MGD. I also prescribe omegas. It's important that we hit the inflammation both topically and systemically.

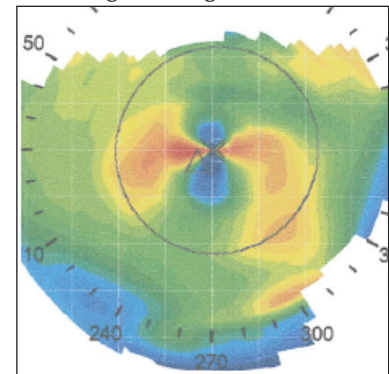


Figure 3. Topography of a 65-year-old woman referred for cataract surgery after dry eye treatment.

Dr. Kim: In this case, those therapies were done, and the patient came back 6 weeks later for another evaluation. The tear break-up time improved from

3 to 4 seconds to 9 seconds. Her MMP-9 was negative and her osmolarity normalized. The topography showed a much more regular pattern (Figure 3). Interestingly, her keratometry showed that her astigmatism not only decreased in terms of magnitude from about 1.60 D to about 1.00 D, but her axis also changed from 150 to 9. Her toric power actually changed considerably, which alters the IOL choice and surgical plan for this patient.

CASE STUDY 2

Dr. Kim: We have a 75-year-old man who has already had cataract surgery. He comes in complaining of an oily sensation with intermittent blurring, which has been going on for several months. The symptoms are worse in his right eye than his left eye (Figure 4 for right eye). He has a tear break-up time of 15 seconds, with some scurfing of his lid margin and some mild telangiectasia. He is 3/18 in terms of lissamine green staining of the nasal conjunctiva, the right greater than the left. His corneas are clear, and his osmolarity is normal (298 and 300). MMP-9, however, is positive. What is the diagnosis, and how do you treat this patient?

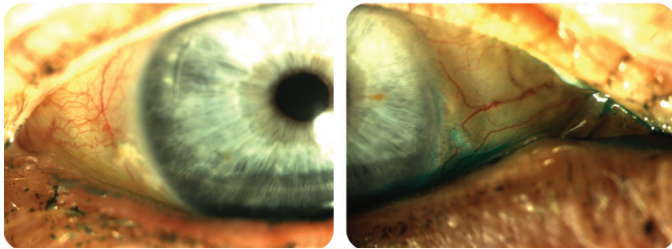


Figure 4. A 75-year-old man complains of intermittent blurring over a 6 to 8 month period after cataract surgery; right eye is more affected than left.

Dr. Yeu: When this patient walked into my office, he was 20/20 uncorrected after his cataract surgery, which was done by another surgeon in the practice almost a year prior. He said that prior to surgery he never had issues with blurring or the oily sensation. With that being said, he wears a contact lens in the right eye to provide monovision as needed.

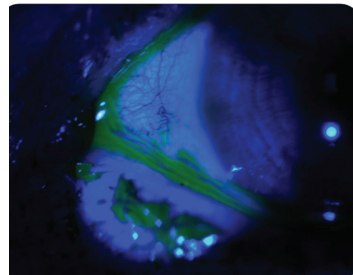


Figure 5. Same eye as in Figure 4; with conjunctivochalasis visible.

As you can see on the exam (Figure 5), there's a little bit of conjunctivochalasis. However, with the chalasis, the lissamine green stains above the chalasis within the internal palpebral fissure of the conjunctiva. There were a few issues going on, including blepharitis and the chalasis. I decided to quiet the acute issue and institute a steroid to help with the blepharitis. Topical azithromycin can be very useful.

Dr. Kim: A month after he's started those treatments, he feels 60% better. The sticky/oily sensation is gone but not the intermittent blurring, especially in the right eye. He still has some telangiectasia and MGD, but his conjunctiva and cornea are now clear. You've started azithromycin and some anti-inflammatory agent. Is there anything else you're going to do at this point?

Dr. Yeu: At this point, we still know that he is staining within the internal palpebral fissure. That's when we have to say we have to consider DED. We need the architecture to be as normal as possible. This is where topical therapy and intervention came together to create synergy. Conjunctival chalasis can mimic all sorts of symptoms and other forms of OSD. If I see a lot of redundancy within the fornix, then I know this is a patient that should be taken to the operating room for an extensive resection with amniotic membrane therapy. But you can take care of most of these patients in the clinic, either in the minor room or within the lane itself using forceps, numbing them topically, and using a disposable cautery where you bend the filament itself (Figure 6).

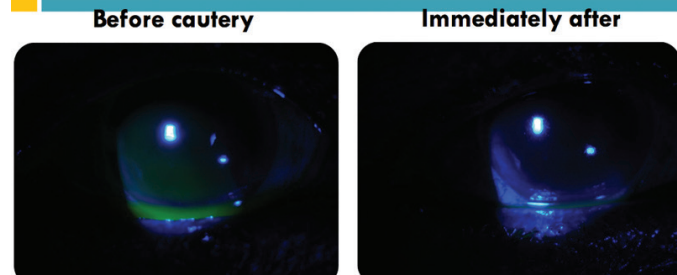


Figure 6. Same eye as in Figure 4, before and after cautery.

Dr. Kim: That's an excellent point. By pulling the eyelid away in a preanesthetized patient, you can determine whether this is actually causing his or her symptoms. When you pull back the eyelid, you temporarily reduce the redundant conjunctiva on the ocular surface so that the patient no longer feels the sensation from the excess conjunctiva. This patient reported that his intermittent blurring was resolved. It's a good case to show how you can have mixed disease.

to be willing to reschedule them again if you really want to give them that premium outcome.

DR. MILNER: I had a case that perfectly demonstrated the importance of addressing the tear film when taking care of premium IOL patients. I had a patient that came to me about 5 or 6 years ago, referred by another ophthalmologist who had implanted a ReSTOR lens. The patient was referred to me for a "touch up" PRK because she was 20/40 without correction after the cataract surgery. The

referring doctor asked me to perform PRK just to "tweak" her vision.

She presented with a refraction that was a -0.50 sphere and -0.50 D cylinder and no symptoms of dry eye. Her Schirmer's without anesthesia was 7 and 8. She had a rapid tear break-up time and a slightly abnormal tear osmolarity. She had no complaints of dry eye and no punctate staining. I told her that she had borderline findings of dry eye, and that I wanted to treat her tear film before we did the PRK because the outcomes would be better. I put her on cyclosporine, and she came back 6 weeks later with 20/25 vision without correction. She

was happy, and we never did the PRK.

This shows how critical the tear film is to vision. It is always better to treat the tear film prior to surgery, but if the outcomes are not what you expected, think about dry eye.

DR. WHITLEY: I completely agree. I see a lot of postoperative cataract patients at our practice. For the premium patient, oftentimes we're very aggressive anywhere between 3 and 4 weeks out because the patient is already on steroids and anti-inflammatories. The threshold's very low, so I put patients on lifitegrast, cyclosporine, or punctal occlusion because their ocular surface is very sensitive to their new lenses, and we want to give them clear, comfortable vision.

THE ROLE OF ANTI-INFLAMMATORY AGENTS IN OSD

Q | DR. KIM: Let's look at the role of anti-inflammatory agents in OSD. What defines an anti-inflammatory agent? Is it a steroid? Is it an immunomodulatory agent? Is it an omega-3? What role do anti-inflammatory agents play in treating acute versus chronic dry eye in these patients?

DR. YEU: I don't believe that all dry eye has an inflammatory component. With that being said, a very large part of it does. Whether or not you use an anti-inflammatory is going to depend on how you determine what medication you're going to start with. Oftentimes, topical steroids like loteprednol do a beautiful job in acute flare-ups, in eyes that are inflamed or hot, or in eyes having episodic flares. Sometimes you'll have a dry eye patient who is well controlled, and they will be on a plane for 8 hours and end up in an area that's very arid. Those conditions may tip that marginally compensated patient over and lead to an acute flare. In those situations, I'll prescribe a 4-week course of topical steroids.

DR. GARG: DED is episodic, and our job is to take this episodic disease and try to even it out as much as we can. However, despite our best intentions, you'll still get these episodic periods. Having a treatment for the episodic flare will be really helpful. Hopefully, we'll have one on the market soon.

DR. MILNER: I think most patients have inflammatory dry eye and need anti-inflammatory treatments. Steroids may be very helpful initially in the acute "hot eye," but they are not a great long-term solution for the chronic dry eye because of the risks associated with them. Patients with significant inflammation, such as those with graft versus host disease, often need topical steroids along with cyclosporine or lifitegrast at the start.

The current commercially available dry eye treatment options, such as cyclosporine and lifitegrast, are better long-term treatments for this chronic disease as they have a favorable safety profile. Most of my patients will be on cyclosporine or lifitegrast for at least 1 year, if not indefinitely. Some patients are on both because the drugs may be synergistic; as they have two different mechanisms of action. Both cyclosporine and lifitegrast are T-cell immunomodulators; they suppress the activation of T-cells, the

production of cytokines, and the recruitment of more T-cells.

Although there are no studies to support this, anecdotally, I have many patients who have partial success on one or the other drop, but have done even better on both treatments combined.

The difficulty is getting coverage for both. Eye care providers have to do a better job of going to the payers and advocating that DED often requires multitreatment, much like glaucoma.

Lastly, for blepharitis we know the macrolides, such as azithromycin, have an anti-inflammatory effect. Topical azithromycin doesn't just have good bacterial coverage, it has great tissue concentration and some anti-inflammatory activity. I like to use this, in addition to cyclosporine or lifitegrast (off label), to treat my posterior blepharitis/MGD patients.

DR. KIM: That wraps up our discussion. Thank you all for taking the time to have a thoughtful discussion with helpful information on how we can improve our diagnosis and management of dry eye patients. ■

- Lemp MA. Advances in understanding and managing dry eye disease. *Am J Ophthalmol.* 2008;146:350-356.
- Pritchard N, Fonn D, Brazeau D. Discontinuation of contact lens wear: a survey. *JCLC.* 1999;26:157-162.
- Farris RL. The dry eye: its mechanisms and therapy, with evidence that contact lens is a cause. *Ciao J.* 1986;12(4):234-246.
- Begley CG, Caffery B, Nichols KK, Chalmers R. Responses of contact lens wearers to a dry eye survey. *Optom Vis Sci.* 2000;77:40-46.
- Doughty MJ, Fonn D, Richter D, et al. A patient questionnaire approach to estimating the prevalence of dry eye symptoms in patients presenting to optometric practices across Canada. *Optom Vis Sci.* 1997;74:624-631.
- Rossi GC, Tinelli C, Pasinetti GM, et al. Dry eye syndrome-related quality of life in glaucoma patients. *Eur J Ophthalmol.* 2009;19:572-579.
- Rossi GC, Pasinetti GM, Scudeller L, et al. Risk factors to develop ocular surface disease in treated glaucoma or ocular hypertension patients. *Eur J Ophthalmol.* 2013;23:296-302.
- Shtein RM. Post-LASIK dry eye. *Expert Rev Ophthalmol.* 2011;6:575-582.
- Albietz J, Lenton L, McLennan S. The effect of tear film and ocular surface management on myopic LASIK outcomes. *Adv Exp Med Biol.* 2002;506:711-717.
- Moon JH, Kim KW, Moon NJ. Smartphone use is a risk factor for pediatric dry eye disease according to region and age: a case control study. *BMC Ophthalmol.* 2016;16:188.
- Beckman KA, Luchs J, Milner MS, Ambrus JL Jr. The potential role for early biomarker testing as part of a modern, multidisciplinary approach to Sjogren's Syndrome diagnosis. *Adv Ther.* 2017;34:799-812.
- Byun YS, Lee HJ, Shin S, Chung SH. Elevation of autophagy markers in Sjogren syndrome dry eye. *Sci Rep.* 2017;7(1):17280.
- Versura P, Giannaccare G, Vukatana G, et al. Predictive role of tear protein expression in the early diagnosis of Sjogren's syndrome. *Ann Clin Biochem.* 2018;4563217750679 (Epub ahead of print).
- Courtin R, Pereira B, Naughton G, et al. Prevalence of dry eye disease in visual display terminal workers: a systematic review and meta-analysis. *BMJ Open.* 2016;6(1):e009675.
- Hessen M, Akpek EK. Dry eye: an inflammatory ocular disease. *J Ophthalmic Vis Res.* 2014;9:240-250.
- Dougherty BE, Nichols JJ, Nichols KK. Rasch analysis of the Ocular Surface Disease Index (OSDI). *Invest Ophthalmol Vis Sci.* 2011;52:8630-8635.
- Asiedu K. Rasch analysis of the standard patient evaluation of eye dryness questionnaire. *Eye Contact Lens.* 2017;43:394-398.
- Amparo F, Schaumberg DA, Dana R. Comparison of two questionnaires for dry eye symptom assessment: the ocular surface disease index and the symptom assessment in dry eye. *Ophthalmology.* 2015;122:1498-1503.
- Craig JP, Nelson JD, Azar DT, et al. TFOS DEWS II Report Executive Summary. *Ocul Surf.* 2017;15:802-812.
- Jones L, Downie LE, Korb D, et al. TFOS DEWS II Management and Therapy Report. *Ocul Surf.* 2017;15:575-628.
- Chalmers RL, Begley CG, Caffery B. Validation of the 5-Item Dry Eye Questionnaire (DEQ-5): Discrimination across self-assessed severity and aqueous tear deficient dry eye diagnoses. *Cont Lens Anterior Eye.* 2010;33:55-60.
- Gothwal VK, Pesudovs K, Wright TA, McMonnies CW. McMonnies questionnaire: enhancing screening for dry eye syndromes with Rasch analysis. *Invest Ophthalmol Vis Sci.* 2010;51:1401-1407.
- Simpson TL, Situ P, Jones LW, Fonn D. Dry eye symptoms assessed by four questionnaires. *Optom Vis Sci.* 2008;85:692-699.
- Brisette AR, Bohm KJ, Starr CE. The utility of a normal tear osmolarity test in symptomatic patients. Poster presented at: The 8th International Conference on the Tear Film & Ocular Surface: Basic Science and Clinical Relevance; September 7-10, 2016; Montpellier, France.
- 2007 Report of the International Dry Eye Workshop (DEWS). *Ocul Surf.* 2007;5(2):65-204.
- Nelson JD, Craig JP, Akpek EK, et al. TFOS DEWS II Introduction. *Ocul Surf.* 2017;15:269-275.
- Milner MS, Beckman KA, Luchs J, et al. Dysfunctional tear syndrome: dry eye disease and associated tear film disorders - new strategies for diagnosis and treatment. *Curr Opin Ophthalmol.* 2017;27 Suppl 1:3-47.
- American Society of Cataract and Refractive Surgery. ASCRS Clinical Survey 2013: Executive Summary Review. Fairfax, VA: Global Trends in Ophthalmology, 2013.
- Trattler WB, Majumdar PA, Donnenfeld ED, et al. The Prospective Health Assessment of Cataract Patients' Ocular Surface (PHACOS) study: the effect of dry eye. *Clin Ophthalmol.* 2017;11:1423-1430.
- Li XM, Hu L, Hu J, Wang W. Investigation of dry eye disease and analysis of the pathogenic factors in patients after cataract surgery. *Cornea.* 2007;26:S16-20.
- Oh T, Jung Y, Chang D, et al. Changes in the tear film and ocular surface after cataract surgery. *Jpn J Ophthalmol.* 2012;56:113-118.
- Epitropoulos AT, Matossian C, Berdy GJ, et al. Effect of tear osmolarity on repeatability of keratometry for cataract surgery planning. *J Cataract Refract Surg.* 2015;41:1672-1677.

INSTRUCTIONS FOR CME CREDIT

To receive credit, you must complete the attached Post Test/Activity Evaluation/Satisfaction Measures Form and mail or fax to Evolve Medical Education LLC; 353 West Lancaster Avenue, Second Floor, Wayne, PA 19087; Fax: (215) 933-3950. To answer these questions online and receive real-time results, please visit evolvemeded.com and click "Online Courses." If you are experiencing problems with the online test, please email us at support@evolvemeded.com. Certificates are issued electronically; please be certain to provide your email address below.

Please type or print clearly, or we will be unable to issue your certificate.

Name _____ MD/DO participant OD non-MD participant

Phone (required) _____ Email (required) _____

Address _____

City _____ State _____ Zip _____

License Number _____ OE Tracker Number: _____

DEMOGRAPHIC INFORMATION

Profession	Years in Practice	Patients Seen Per Week (with the disease targeted in this activity)	Region	Setting	Models of Care
<input type="checkbox"/> MD/DO	<input type="checkbox"/> >20	<input type="checkbox"/> 0	<input type="checkbox"/> Northeast	<input type="checkbox"/> Solo Practice	<input type="checkbox"/> Fee for Service
<input type="checkbox"/> NP	<input type="checkbox"/> 11-20	<input type="checkbox"/> 1-5	<input type="checkbox"/> Northwest	<input type="checkbox"/> Community Hospital	<input type="checkbox"/> ACO
<input type="checkbox"/> Nurse/APN	<input type="checkbox"/> 6-10	<input type="checkbox"/> 6-10	<input type="checkbox"/> Mid-West	<input type="checkbox"/> Government or VA	<input type="checkbox"/> Patient-Centered Medical Home
<input type="checkbox"/> PA	<input type="checkbox"/> 1-5	<input type="checkbox"/> 11-15	<input type="checkbox"/> Southeast	<input type="checkbox"/> Group Practice	<input type="checkbox"/> Capitation
<input type="checkbox"/> Other	<input type="checkbox"/> <1	<input type="checkbox"/> 15-20	<input type="checkbox"/> Southwest	<input type="checkbox"/> Other	<input type="checkbox"/> Bundled Payments
		<input type="checkbox"/> 20+		<input type="checkbox"/> I do not actively practice	<input type="checkbox"/> Other

Training of Fellows Yes No

LEARNING OBJECTIVES

DID THE PROGRAM MEET THE FOLLOWING EDUCATIONAL OBJECTIVES?	AGREE	NEUTRAL	DISAGREE
Discuss the prevalence of dry eye disease and the related signs and symptoms of patients.	_____	_____	_____
Develop a differential diagnosis for patients with complaints of dry eye.	_____	_____	_____
Propose an individualized treatment plan for patients using current US Food and Drug Administration-approved therapies.	_____	_____	_____
Evaluate how dry eye disease can complicate surgical outcomes and how best to manage dry eye disease in these states.	_____	_____	_____
Differentiate the need for constant maintenance and ongoing ophthalmic care for the various dry eye disease treatments.	_____	_____	_____

POST TEST QUESTIONS

- PLEASE RATE YOUR CONFIDENCE ON YOUR ABILITY TO APPLY UPDATES IN DRY EYE DIAGNOSIS AND MANAGEMENT IN THE CLINIC BASED ON THIS ACTIVITY. (BASED ON A SCALE OF 1 TO 5, WITH 1 BEING NOT AT ALL CONFIDENT AND 5 BEING EXTREMELY CONFIDENT).**
 - 1
 - 2
 - 3
 - 4
 - 5
- PLEASE RATE HOW OFTEN YOU INTEND TO APPLY ADVANCES IN DRY EYE DIAGNOSIS AND MANAGEMENT TO "REAL-WORLD" PATIENT ASSESSMENT, TREATMENT, AND MANAGEMENT. (BASED ON A SCALE OF 1 TO 5, WITH 1 BEING NEVER AND 5 BEING ALWAYS).**
 - 1
 - 2
 - 3
 - 4
 - 5
- WITH THE CURRENT PREVALENCE OF DRY EYE DISEASE IN THE UNITED STATES APPROXIMATED AT 30 MILLION, ABOUT HOW MANY HAVE BEEN DIAGNOSED WITH THE DISEASE?**
 - 5 million
 - 10 million
 - 15 million
 - 25 million
- ALL OF THE FOLLOWING ARE NOVEL ANTIBODIES EXCEPT:**
 - SP-1 (salivary gland protein)
 - PSP (parotid secretory protein)
 - CA-6 (carbonic anhydrase VI)
 - RF (rheumatoid factor)
- THERE HAS BEEN AN INCREASE IN PEDIATRIC PATIENTS WITH DRY EYE DUE TO _____.**
 - Increases in Sjogren syndrome diagnosis
 - Increases in meibomian gland dysfunction
 - Increases in screen time
 - Contact lens overuse
- MS. SMITH PRESENTS IN YOUR OFFICE COMPLAINING OF DISCOMFORT AND RED EYES. SHE REPORTS OCCASIONAL FOREIGN BODY SENSATION. HER OSMOLARITY READING IS 290 mOsm/L, AND HER MMP-9 TEST IS POSITIVE. WHICH DIAGNOSIS IS LESS LIKELY?**
 - Epithelial basement membrane dystrophy
 - Dry eye
 - Superior limbic keratoconjunctivitis
 - Conjunctival chalasis
- ACCORDING TO THE TFOS DEWS II, WHICH OF THESE QUESTIONNAIRES ARE RECOMMENDED IN THEIR DIAGNOSTIC ALGORITHM?**
 - SANDE
 - SPEED
 - McMonnies
 - OSDI
 - There is no singular preferred option; the important thing is to implement a questionnaire
- THE SCHIRMER'S TEST IS VALUABLE IN DIAGNOSING _____. (SELECT ALL THAT APPLY).**
 - Aqueous deficiency
 - Sjogren syndrome
 - Meibomian gland dysfunction
 - Conjunctival chalasis
- WHICH ALGORITHM RECOMMENDS THERMAL PULSATION, CYCLOSPORINE, LIFITEGRAST (OFF-LABEL), AND DOXYCYCLINE DROPS FOR THE TREATMENT OF BLEPHARITIS?**
 - CEDARS
 - ASCRS
 - TFOS DEWS I
 - TFOS DEWS II
- WHAT PERCENTAGE OF PATIENTS IN THE PHACO STUDY HAD UNDIAGNOSED DRY EYE AT LEVEL 2 OR HIGHER?**
 - 80%
 - 70%
 - 60%
 - 50%
- INCREASED _____ CAN LEAD TO ERRORS IN IOL CALCULATIONS.**
 - MMP-9
 - Meibography
 - Osmolarity
 - Schirmer's
- LITERATURE HAS SHOWN THAT TEAR BREAK-UP TIME MAY DECREASE FOR HOW LONG AFTER CATARACT SURGERY?**
 - 1-2 months
 - 3-4 months
 - 5-6 months
 - 7-8 months

ACTIVITY EVALUATION/SATISFACTION MEASURES

Your responses to the questions below will help us evaluate this CME/CE activity. They will provide us with evidence that improvements were made in patient care as a result of this activity.

Rate your knowledge/skill level prior to participating in this course: 5 = High, 1 = Low _____

Rate your knowledge/skill level after participating in this course: 5 = High, 1 = Low _____

This activity improved my competence in managing patients with this disease/condition/symptom ____ Yes ____ No

I plan to make changes to my practice based on this activity? ____ Yes ____ No

Please identify any barriers to change (check all that apply):

- | | | |
|---|---|---|
| <input type="checkbox"/> Cost | <input type="checkbox"/> Lack of opportunity (patients) | <input type="checkbox"/> Other. Please specify: _____ |
| <input type="checkbox"/> Lack of consensus or professional guidelines | <input type="checkbox"/> Reimbursement/insurance issues | _____ |
| <input type="checkbox"/> Lack of administrative support | <input type="checkbox"/> Lack of resources (equipment) | _____ |
| <input type="checkbox"/> Lack of experience | <input type="checkbox"/> Patient compliance issues | |
| <input type="checkbox"/> Lack of time to assess/counsel patients | <input type="checkbox"/> No barriers | |

The design of the program was effective for the content conveyed. ____ Yes ____ No

The content was relative to your practice. ____ Yes ____ No

The content supported the identified learning objectives. ____ Yes ____ No

The faculty was effective. ____ Yes ____ No

The content was free of commercial bias. ____ Yes ____ No

You were satisfied overall with the activity. ____ Yes ____ No

Would you recommend this program to your colleagues? ____ Yes ____ No

Please check the Core Competencies (as defined by the Accreditation Council for Graduate Medical Education) that were enhanced through your participation in this activity:

Patient Care

Medical Knowledge

Practice-Based Learning and Improvement

Interpersonal and Communication Skills

Professionalism

System-Based Practice

Additional comments:

 I certify that I have participated in this entire activity.

This information will help evaluate this CME/CE activity; may we contact you by email in 3 months to see if you have made this change? If so, please provide your email address below.
