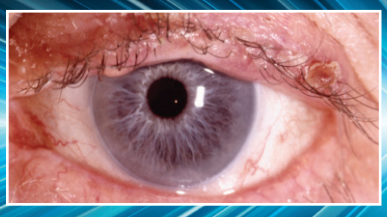
Supplement to

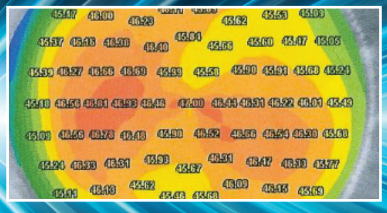
Advanced
OCULAR CARE

July/August 2011

CME ACTIVITY

Effectively Managing Dry Eye and Ocular Allergy





- New Perspectives on Ocular Surface Dysfunction
- Managing Concomitant Ocular Surface Disorders
- The Impact of Dry Eye on Cataract and Refractive Surgery Outcomes

Faculty:
Christopher E. Starr, MD, FACS
Michael B. Raizman, MD
William Trattler, MD

A CME activity jointly sponsored by the Dulaney Foundation and Advanced Ocular Care. *Supported by an unrestricted educational grant from Allergan, Inc.*

Effectively Managing Dry Eye and Ocular Allergy

Jointly sponsored by the Dulaney Foundation and *Advanced Ocular Care*

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This continuing medical education activity is supported by an unrestricted educational grant from Allergan, Inc.

STATEMENT OF NEED

The incidence of dry eye is estimated to be as high as 14.4%,[1-4] and dry eye is one of the most common reasons why people visit their eye care professionals.[5] Despite the high prevalence of this disorder, however, many people are not properly diagnosed and treated,[6] possibly owing to a lack of consensus in defining dry eye and lack of a single test or set of tests to confirm or rule out the diagnosis.[1] Current demographic changes and lifestyle factors suggest the incidence of dry eye will increase significantly, ensuring that eye care professionals will see more patients with dry eye symptoms.[6] In addition, evidence shows that inadequate perioperative management of dry eye can adversely affect outcomes in cataract and refractive surgery.[7,8] Greater awareness of emerging research, technologies, and therapies is crucial to ensure favorable outcomes. For example, reports from the International Dry Eye Workshop[9] and the Meibomian Gland Dysfunction Workshop[10] have redefined these conditions, providing a more definitive approach to diagnosis and treatment.

One of the challenges involved in recognizing and treating dry eye is that its symptoms often overlap with those of ocular allergy.[11] Being able to differentiate these conditions and treat each one appropriately will ensure relief for patients.

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TARGET AUDIENCE

This certified continuing medical education (CME) activity is designed for ophthalmologists and optometrists who manage patients who have dry eye and ocular allergy.

LEARNING OBJECTIVES

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

- recognize various forms of dry eye and related conditions and ocular allergy, using the latest information from the medical literature and new insights from case-based learning;
- differentiate signs and symptoms of dry eye and ocular allergy;
- prescribe appropriate therapies for dry eye and ocular allergy;
- manage inflammation associated with dry eye and ocular allergy.

METHOD OF INSTRUCTION

Participants should read the CME activity in its entirety. After reviewing the material, please complete the self-assessment test, which consists of a series of multiple-choice questions. To answer these questions online and receive real-time results, you may visit http://www.dulaneyfoundation.org and click "Online Courses."

Upon completing the activity and achieving a score of over 70% on the self-assessment test, you may print out a CME credit letter awarding *1 AMA PRA Category 1 Credit.*™ The estimated time to complete this activity is 1 hour.

ACCREDITATION AND DESIGNATION

This activity has been planned and implemented in accordance with the Essential Areas and policies of the Accreditation Council for Continuing Medical Education (ACCME) through the joint sponsorship of the Dulaney Foundation and *Advanced Ocular Care.* The Dulaney Foundation is accredited by the ACCME to provide continuing education for physicians. The Dulaney Foundation designates this print activity 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.

DISCLOSURE

In accordance with the disclosure policies of the Dulaney Foundation and to conform with ACCME and US Food and Drug Administration guidelines, anyone in a position to affect the content of a CME activity is required to disclose to the activity participants (1) the existence of any financial interest or other relationships with the manufacturers of any commercial products/devices or providers of commercial services and (2) identification of a commercial product/device that is unlabeled for use or an investigational use of a product/device not yet approved.

FACULTY CREDENTIALS

Michael B. Raizman, MD, practices at Ophthalmic Consultants of Boston and is director of the cornea service at Tufts University School of Medicine, New England Eye Center.

Christopher E. Starr, MD, is director of the refractive surgery service, the residency program, and the cornea, cataract, and refractive surgery fellowship at Weill Cornell Medical College, New York-Presbyterian Hospital in New York City.

William B. Trattler, MD, is director of cornea at the Center for Excellence in Eye Care in Miami.

FACULTY/STAFF DISCLOSURE DECLARATIONS

Dr. Raizman has received research support from Alcon Laboratories, Inc., and is a consultant to Alcon Laboratories, Inc., and Bausch + Lomb.

Dr. Starr is a speaker and/or researcher for Allergan, Inc., and Inspire Pharmaceuticals.

Dr. Trattler is a consultant, receives research support, and/or serves as a speaker for Allergan, Inc., Inspire Pharmaceuticals, Alcon Laboratories, Inc., and Bausch + Lomb.

All others involved in the planning, editing, and peer review of this educational activity have indicated they have no financial relationships to disclose.

CONTENTS

New Perspectives on Ocular Surface Dysfunction

We now know inflammation at the cellular level is a key pathophysiologic mechanism in most causes of ocular surface dysfunction, including dry eye, meibomian gland dysfunction, and ocular allergies.

BY CHRISTOPHER E. STARR, MD, FACS

We now have the benefit of two unbiased, evidence-based reports on dry eye and meibomian gland dysfunction (MGD), organized by large panels of recognized international experts, namely, the International Dry Eye Workshop (DEWS)[1-6] and the International Workshop on Meibomian Gland Dysfunction (MGDW).[7-14] These seminal publications have revolutionized and modernized our understanding of ocular surface dysfunction (OSD), providing new definitions and important new insights into the prevalence, classification, and etiology of dry eye and MGD.

THE DEWS REPORT

One of the most significant and compelling outcomes of the DEWS was a new definition of dry eye disease, which, for the first time, includes the terms "hyperosmolarity" and "inflammation," as follows:

Dry eye is a multifactorial disease of the tears and ocular surface that results in symptoms of discomfort, visual disturbance, and tear film instability with potential damage to the ocular surface. It is accompanied by increased osmolarity of the tear film and inflammation of the ocular surface.

According to the DEWS report, approximately 3.2 million women and 1.6 million men over the age of 50 have moderate to severe dry eye. Looking at the US population as a whole and including all severity levels, as many as 20 million people may have dry eye.[15]

Risk factors for dry eye include:

- increasing age
- female sex, especially women who are postmenopausal and taking estrogen
- deficiencies of omega-3 and omega-6 fatty acids and vitamin A
- oral medications, including antihistamines, beta-blockers, tricyclic antidepressants, and diuretics
- topical medications, especially those containing preservatives, such as benzalkonium chloride
- systemic diseases, namely autoimmune disease, including Sjögren syndrome and diabetes
- ocular surgery, in particular, laser vision correction and cataract surgery, especially when limbal-relaxing incisions are used
- stem cell transplantation, especially when graft versus host disease occurs

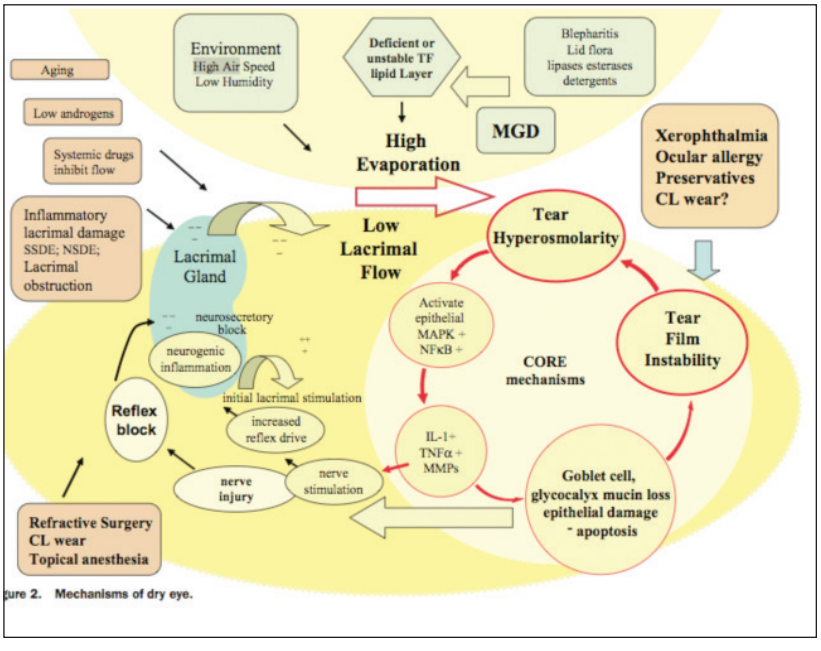

Figure 1. Mechanisms of dry eye. (DEWS 2007)

• infections, such as hepatitis C and HIV
• contact lens wear
• low humidity and windy environments
• eyelid abnormalities
• meibomian gland dysfunction.

Dry eye is categorized as either evaporative or aqueous deficient (Sjögren and non-Sjögren dry eye). Causes of evaporative dry eye are either intrinsic, such as MGD and lid abnormalities, or extrinsic, including allergy, topical drugs, and contact lens wear.

How do these various risk factors and associations lead to OSD? Figure 1 illustrates the cycle of ocular surface dysfunction. The core mechanisms of dry eye are driven by tear hyperosmolarity, which activates a cascade of inflammatory events that cause epithelial damage from apoptosis, loss of goblet cells, and a disturbance of mucin expression, all leading to tear film instability. This instability exacerbates ocular surface hyperosmolarity and, thus, completes the cycle.

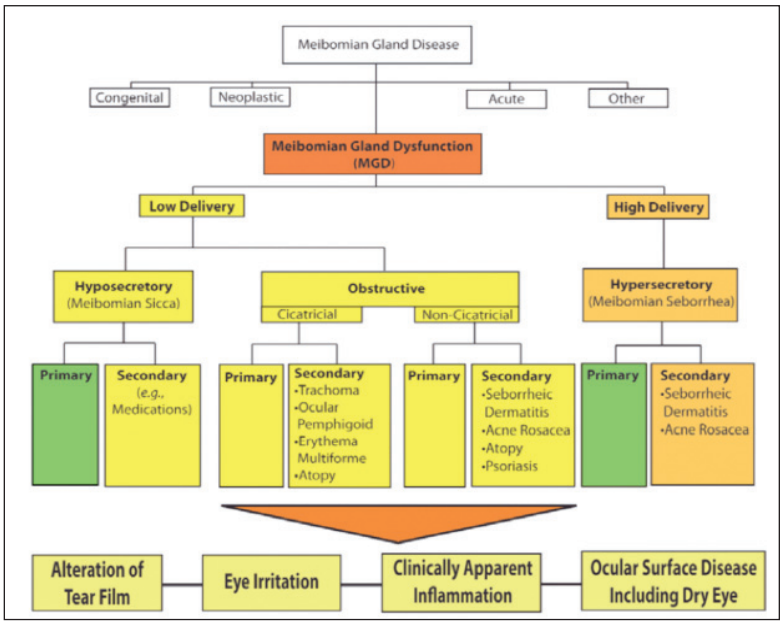

Figure 2. New classification of meibomian gland dysfunction. (MGDW 2011)

Epithelial injury caused by this cycle initially stimulates corneal nerve endings, leading to discomfort, increased blinking, and compensatory reflex tearing. Later, chronic nerve damage, lacrimal gland inflammation, and other factors cause a reduction in aqueous production, which leads to worsening hyperosmolarity, thus perpetuating the inflammatory cycle. This is likely why we tend to see poor correlation between symptoms and physical signs of dry eye, and why, if left untreated, this chronic disease will worsen over time.

THE MGDW REPORT

Meibomian gland dysfunction is one of the major causes of evaporative dry eye and tear hyperosmolarity. Without a unified definition and classification system, however, historical prevalence studies of MGD have varied widely, but some have shown rates as high as 70%.[16] Like the DEWS report, the MGDW report provides new evidence-based definitions of some common terms, namely:

• blepharitis: a general term that describes inflammation of the eyelid as a whole.

• anterior blepharitis: inflammation of the lid margin, anterior to the gray line.

• posterior blepharitis: inflammation posterior to the gray line. It is important to note that MGD is one of many potential causes of posterior blepharitis, and these terms should not be used interchangeably.

• MGD: This acronym stands for meibomian gland dysfunction not meibomian gland disease, which is a general term that can include congenital, neoplastic, and acute diseases of the meibomian glands. MGD is newly defined in the MGDW report as:

A chronic, diffuse abnormality of the meibomian glands, commonly characterized by terminal duct obstruction and/or qualitative and quantitative changes in glandular secretion. It may result in alteration of the tear film, eye irritation, clinically apparent inflammation, and ocular surface disease.

As in the new definition of dry eye, this new definition of MGD also includes the term "inflammation."

MGD is further divided into two categories based on meibomian gland secretions: low delivery and high delivery states (Figure 2). Low delivery is the more common of the two and is further subdivided into hyposecretory and obstructive forms of MGD. Of these, obstructive noncicatricial is the most common.

DIAGNOSING OSD AND MONITORING TREATMENT EFFICACY

Traditionally, we have relied on Schirmer testing, corneal and conjunctival staining, and tear breakup time to diagnose OSD. Although helpful, these tests are somewhat invasive, fairly subjective, and they often can be unreliable and poorly reproducible. As a result, we may be frustrated by poor correlation between our clinical findings and patients' subjective symptoms.[17]

Fortunately, in 2011, we have several newer, more reliable, less invasive diagnostic tools that more closely correlate

with patients' symptoms, enabling us to more accurately diagnose OSD and better assess treatment efficacy.

• Optical coherence tomography (OCT) objectively quantifies the tear meniscus height and volume. Studies have shown that tear meniscus height has greater than 90% sensitivity and specificity for dry eye.[18]

• Wavefront aberrometry measures the inter-blink change in higher-order aberrations and, thus, provides a quantitative assessment of tear-film quality and stability.

• Corneal topography (Placido) noninvasively measures tear breakup time. Some topographers can also measure tear meniscus height.

• Confocal microscopy can show inflammation at the cellular level. Researchers have used it to view the ductal changes that occur in MGD.[19]

As we learned from the DEWS report, tear hyperosmolarity and the resultant inflammation is a key mechanism in the OSD cycle. Studies have shown a strong, linear correlation between osmolarity and dry eye severity, as well as tight correlation with symptoms.[20] We now have a noninvasive, quick, simple, reimbursable, point-of-care tool for measuring tear osmolarity (TearLab Osmolarity System, TearLab Corp., San Diego, CA).

Matrix metalloproteinase-9 (MMP-9) is one of many inflammatory mediators that are increased in the tears of patients with OSD. Later this year a simple-to-use, noninvasive, point-of-care test (InflammaDry Detector, RPS, Inc., Sarasota, FL) will be available to measure elevations in tear MMP-9 levels.

Until recently, measuring lipid layer thickness with interferometry was cumbersome, time-consuming, and expensive, requiring a sophisticated laboratory. However, a new interferometer, currently awaiting FDA approval, will allow us to objectively quantify the tear film lipid layer quickly and noninvasively in our offices.

The modern approach to OSD diagnosis should include a standardized questionnaire, such as the Ocular Surface Disease Index, followed by noninvasive objective testing. These tests should be performed before disturbing the tear film and ocular surface with irritating dyes and anesthetics, Schirmer strips, and the bright lights of the slit lamp. Sequentially performing these objective tests at each visit after starting therapy can help us to assess and monitor treatment efficacy.

TREATMENT STRATEGIES FOR DRY EYE AND MGD

The dry eye treatment menu is extensive and varied and can include any combination of the following (listed alphabetically):

• anti-inflammatory medications
• artificial tears
• autologous serum tears
• bandage contact lenses
• environmental modifications (humidification, avoiding drafts)
• gels and ointments
• hydroxypropyl cellulose inserts
• moisture chamber spectacles and goggles
• punctal occlusion (plugs, cautery)
• secretogogues (cholinergic agonists, such as oral pilocarpine)
• surgery (amniotic membrane grafting, lid surgery, tarsorrhaphy, and salivary or mucus membrane grafting)
• systemic immunosuppressive agents
• thermal pulsation (LipiFlow Thermal Pulsation System, TearScience, Inc., Morrisville, NC).

Inflammation is a key etiologic factor in the pathogenesis of OSD. Thus, anti-inflammatory medications are critical to successful treatment. The following medications are currently being used for treating OSD (on- and off-label):

• topical cyclosporine-A, which is the only anti-inflammatory agent approved by the FDA for treating dry eye
• topical corticosteroids
• NSAIDs
• antibiotics with anti-inflammatory activity (tetracyclines, such as doxycycline and minocycline, and macrolides, such as azithromycin)
• omega-3 fatty acids

Table 1 shows dry eye treatment recommendations, stratified according to disease severity, from the DEWS report. The MGDW published a similar grid (Table 2) with treatment recommendations for MGD. A key away message from the DEWS treatment grid is that topical anti-inflammatory medications are recommended at stage two. Many practitioners still reserve anti-inflammatory agents, such as topical cyclosporine, as last resorts,[21] or they do not use them at all to treat OSD, but the overwhelming evidence argues against this approach.

Key take-aways from the MGDW is that topical azithromycin and/or oral tetracycline are recommended as early as stage two, and anti-inflammatory dry eye treatments are recommended adjunctively in stages three and four.

ALLERGIC CONJUNCTIVITIS

The Asthma and Allergy Foundation of America estimates that 50 million people in the United States have allergies, and the prevalence in the United States has been steadily rising since the 1980s.[22] About 50% of people with allergies have ocular allergy symptoms.[23]

The five main types of allergic eye disease are seasonal allergic conjunctivitis, perennial allergic conjunctivitis, vernal keratoconjunctivitis, atopic keratoconjunctivitis, and giant papillary conjunctivitis. Although the latter three conditions can be responsible for severe ocular morbidity, they are beyond the scope of this presentation.

TABLE 1. DRY EYE TREATMENT RECOMMENDATIONS*

Severity	Clinical Description	Treatment
Stage 1	Symptoms: mild to episodic, often the result of environmental stress Signs: none to mild TBUT and Schirmer results variable	Education and environmental/dietary/medical modifications Artificial tear substitutes, gels/ointments Eyelid therapy (compresses and hygiene)
Stage 2	Symptoms: moderate, episodic, or chronic; can be activity-limiting Signs: variable, mild debris, ↓meniscus TBUT <10s, Schirmer <10mm (5 min)	Anti-inflammatory agents Tetracyclines/macrolides (for MGD, rosacea) Punctal plugs (removable) Secretogogues Moisture-chamber spectacles
Stage 3	Symptoms: severe, frequent or constant, activity-limiting Signs: marked. Filamentary keratitis, mucus clumping, ↑ tear debris, frequent MGD, TBUT <5s & Schirmer < 5mm	Autologous serum tears Bandage contact lenses Permanent punctal occlusion
Stage 4	Symptoms: severe/disabling, constant Signs: marked, severe. Filamentary keratitis, mucus clumping, ↑ tear debris, ulceration, trichiasis, keratinization, symblepharon, TBUT Immediate, Schirmer <2	Systemic anti-inflammatory agents Surgery (lid surgery, tarsorrhaphy; mucus membrane and salivary gland grafting, amniotic membrane transplantation)

*International Dry Eye WorkShop 2007

Seasonal allergic conjunctivitis, the most common type, is most often triggered by pollen and typically spikes during the spring and summer months. Perennial allergic conjunctivitis is often caused by dust mites, pet dander, and mold; symptoms can last throughout the year.

Ocular surface inflammation plays a key role in the pathogenesis and symptomatology of allergic conjunctivitis. Both seasonal and perennial allergic conjunctivitis are type 1 hypersensitivity reactions that involve sensitization of the immune system upon first exposure of the antigen. After repeated exposure, the antigen-specific IgE binds to mast cells in the conjunctiva, triggering their degranulation which, in turn, releases intracellularly stored mediators, including histamine, tryptase, chymase, heparin, chondroitin sulfate, prostaglandins, thromboxanes, and leukotrienes.[24] This cascade represents the acute phase of the allergic response. In the late phase, the release of these mediators, together with multiple chemotactic factors, results in increased vascular permeability and the attraction and migration of eosinophils, neutrophils, and lymphocytes. This activity leads to the signs and symptoms of allergic conjunctivitis, which often overlap with other forms of OSD, including dry eye, MGD, and infectious conjunctivitis.

The key clinical signs of allergic conjunctivitis include:

- hyperemia of the conjunctiva and the eyelids
- clear, watery, scant discharge
- conjunctival chemosis and papillae
- eyelid edema

The key symptoms of allergic conjunctivitis include:

- itching. This is the hallmark symptom. If it is not present, the diagnosis of allergic conjunctivitis should be questioned. It is important to educate patients that vigorous eye rubbing will lead to mast-cell degranulation and worsening itch.
- tearing
- burning
- foreign-body sensation
- ocular dryness

Nonocular symptoms of allergic conjunctivitis often include sneezing, rhinorrhea, and nasal congestion. It is also important to note that antihistamine medications can cause or exacerbate dry eyes.

TREATING ALLERGIC CONJUNCTIVITIS

For all forms of allergic conjunctivitis, it is important to identify the offending allergen and avoid exposure to it. Pollen is ubiquitous, however, and avoidance is often

TABLE 2. MGD WORKSHOP TREATMENT RECOMMENDATIONS*

Severity	Clinical Description	Treatment Recommendations
Stage 1	Symptoms: minimal without discomfort, itching, or photophobia Signs: minimally altered secretions, no ocular surface staining.	Educate patient on diet, work and home environmental effects on tear evaporation Consider lid hygiene (warming/expression)
Stage 2	Symptoms: minimal to mild discomfort/itch Signs: scattered lid margin features, mildly altered meibomian secretions, limited ocular surface staining	Advise environmental changes (humidity) Lid hygiene: warming, firm massage, expression of meibomian secretions Preservative-free topical lubricants, azithromycin or oral tetracycline, ↑omega-3
Stage 3	Symptoms: moderate discomfort, itch, photophobia, mild decreased activities Signs: ↑ plugging, lid margin vascularity, moderately altered secretions, moderate conjunctival staining, early K staining	Above, plus Oral tetracycline Ointment at bedtime +/- Anti-inflammatory therapy for dry eye
Stage 4	Symptoms: Marked discomfort, definite reduction in activities Signs: ↑lid margin dropout and displacement, severely altered secretions, no expressible meibomian secretions, ↑corneal and conjunctival staining, ↑signs of inflammation (conj hyperemia)	Above, plus Anti-inflammatory therapy for dry eye

*Meibomian Gland Dysfunction Workshop 2011

impossible. Wearing wraparound protective eyewear and brimmed hats when outdoors, and frequently washing clothes, hands, and hair can reduce the antigenic load. Frequent instillation of artificial tears can also reduce the antigenic load by diluting the allergen and irrigating the ocular surface. Instilling chilled artificial tears and applying cold compresses to the eyelids can provide some soothing relief and help reduce hyperemia.

The foundation of allergic conjunctivitis treatment is blocking H1, H2, and, in some cases, H4 histamine receptors, which can be achieved with topical and oral medications. Antihistamines will quickly and effectively reduce itching, hyperemia, and edema of the ocular surface. Mast-cell stabilization, which is sometimes combined with topical antihistamine drops, can also reduce mast-cell degranulation upon further antigen exposure. In more severe cases, adjunctive anti-inflammatory medications are often indicated and can include topical steroids, topical NSAIDs, and topical cyclosporine A.

CONCLUSION

Recent international, collaborative, evidence-based reports by the DEWS and the MGDW have updated and increased our understanding, classification, and treatment of these common diseases. Modern, noninvasive, objective, diagnostic tools are improving the correlation between the patient's symptoms and the clinical signs of OSD, and improving our ability to diagnose and to measure treatment efficacy. Inflammation at the cellular level is a key pathophysiologic mechanism in most causes of OSD, including dry eye, MGD, and allergic conjunctivitis. If the inflammation is not treated, the recurring cycles will lead to chronic disease, worsening symptoms, and significant ocular surface damage. ■

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Managing Concomitant Ocular Surface Disorders

Addressing the full spectrum of a patient's symptoms, rather than focusing on the chief complaint, significantly improves outcomes.

BY MICHAEL B. RAIZMAN, MD

When managing patients who have ocular surface disease, it is important to consider the chief complaint—ocular allergy, for example—in the context of any related conditions, such as dry eye or meibomian gland dysfunction. Tailoring therapy to address the full spectrum of a patient's symptoms will significantly improve outcomes, as the following case illustrates.

CASE PRESENTATION

This 50-year-old man was evaluated for itchy, red, irritated, swollen eyes, caused by sensitivity to airborne pollen for many years. His symptoms usually occur in the spring and fall, but he can have occasional symptoms year-round. He has been using over-the-counter eye drops with a vasoconstrictor because he is uncomfortable going to work with red eyes. He says these drops helped briefly, but he is using them more frequently because the redness returns when the drops wear off. He has rhinorrhea, which can be severe, and he sneezes frequently. He does not have asthma or eczema. He uses metronidazole gel on his face for rosacea.

On examination, the patient has crusting and hypervascularity on the upper and lower lid margins and the lid skin, and hyperemia of the conjunctiva (Figure 1).

What is the best treatment for this patient who has concomitant ocular allergy and blepharitis? Some options include:

a) lid scrubs

b) lid scrubs and a topical antihistamine/mast cell stabilizer

c) oral doxycycline

d) oral doxycycline and a topical antihistamine/mast cell stabilizer

e) topical antihistamine/mast cell stabilizer

TREATMENT

The best approach for this patient is to treat his blepharitis and ocular allergy simultaneously. In this case, I would prescribe a combination of oral doxycycline, which I consider the most effective treatment for meibomian gland-type blepharitis, along with a potent anti-allergy eye drop, specifically an antihistamine/mast cell stabilizer combination.[1]

BLEPHARITIS

Although lid scrubs are often recommended for blepharitis, I avoid them when patients have concomitant ocular allergy because the scrubbing exacerbates their symptoms and can lead to eczema of the eyelids. Expressing the meibomian glands and applying dry heat to the eyelids may be helpful. At home, patients can place a hot washcloth inside a dry cloth or a plastic bag to use as a compress, or they can use a mask that can be heated in a microwave oven. I advise patients to avoid applying wet compresses directly to the skin because wetting the eyelid skin can dry it and lead to eczema.

For patients with severe blepharitis, I usually prescribe one of the tetracycline derivatives, either doxycycline or minocycline. Topical antibiotics can be helpful but must be used

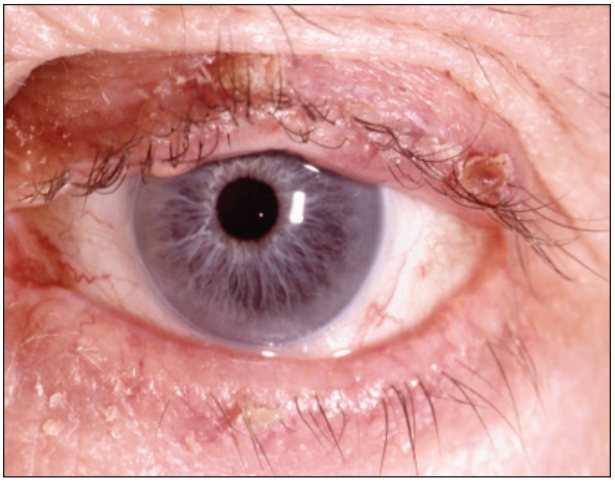

Figure 1. Note the crusting and hypervascularity of the lid margins and hyperemia of the conjunctiva.

AVOIDANCE STRATEGIES FOR PATIENTS WITH OCULAR ALLERGY

Safe, effective medicines are available to treat allergic conjunctivitis, but patients can also help themselves by following these simple suggestions to avoid flare-ups:

1. Do not touch or rub your eyes. Touching your eyes transfers airborne allergens, such as pollen and animal dander, from your hands to your eyes. Rubbing your eyes increases redness by dilating the blood vessels, and it also causes mast-cell degranulation, which triggers itching and tearing. If itching is troublesome, rub your eyebrow or your cheek but not your eyes. Place ice packs or cold compresses on the eyelids instead of rubbing. Chilled artificial tears may also reduce the urge to rub.

2. Roll up the windows while traveling by car.

3. Use air conditioning at home and in your car.

4. When you come in from the outdoors, change your clothes, brush or wash your hair, and wash your hands and face to remove pollen.

5. Keep pets out of the bedroom.

6. Use protective covers for pillows and mattresses as barriers against dust mites.

chronically. I reserve steroid or steroid/antibiotic combinations for acute flare-ups but not for chronic use.

ALLERGIC CONJUNCTIVITIS

Several potent eye drops are available for treating allergic conjunctivitis, but before prescribing any treatment, I educate my patients about what they can do to help themselves. See "Avoidance Strategies for Patients With Ocular Allergy," which outlines some specific do's and don'ts.

One factor that may influence whether or not a medication produces the desired result is convenience, which often drives a patient's adherence to a regimen. That is why I prefer an allergy drop approved for once-a-day dosing, such as alcaftadine and olopatadine. All of the allergy drops available to us are safe, so I tell patients they may use them as needed, even two or three times a day on very bad days. Also, for my patients' convenience, I prescribe refills for 1 year, as these drops are safe to use as needed over long periods.

In general, I advise patients to use their drops every day throughout the allergy season not just when their symptoms are at their worst. I recommend this approach because I believe they can achieve the most benefit from the mast-cell stabilizing effect by doing so, and they will have better overall comfort. They can add a drop when their symptoms seem to be flaring. I recommend they use a drop in the morning and then add a drop later in the day if needed. If patients know when their allergy season usually begins, I advise them to start using their drops approximately 2 weeks in advance.

RHINORRHEA

Returning to our patient, we have addressed his blepharitis and his allergic conjunctivitis, but we need to think about treating his nasal symptoms, as well. Most patients will use oral antihistamines for their nasal symptoms, and this may work well, but it is important to remember that all oral antihistamines—even the newer nonsedating agents—can cause dry eye, especially if a patient already has mild dry eye. I may advise those patients to switch to a steroid or an antihistamine nasal spray and use a topical antihistamine, as well. Even if patients are taking oral antihistamines, a topical antihistamine can be helpful, because it is more effective for the eyes than the oral antihistamine, in my experience.

Interestingly, some patients get relief of their nasal symptoms from their eye drops. This makes sense because the eye drop drains into the nose, and it can block histamine and stabilize mast cells in the nasal mucosa. This may also help alleviate sneezing and rhinorrhea from excess tears draining into the nose.

CONCLUSION

Allergy, dry eye, and blepharitis can be present in any combination in one patient. By recognizing and treating co-occurring components of ocular surface dysfunction and educating patients about their conditions, you will ensure their rapid relief. ■

1. Quarterman MJ, Johnson DW, Abele DC, Lesher JL Jr, Hull DS, Davis LS. Ocular rosacea. Signs, symptoms, and tear studies before and after treatment with doxycycline. *Arch Dermatol.* 1997;133:49-54.

A WORD ABOUT OTC DROPS

Many over-the-counter (OTC) eye drops for allergy contain vasoconstrictors, which I advise my patients to avoid because they can cause more redness over time. It is important to educate patients about this effect. In addition, the antihistamine in OTC vasoconstrictor combination drops is relatively weak, compared to antihistamines available by prescription, as evidenced by the need for more frequent dosing.

There are OTC antihistamine drops, such as ketotifen, that are safe and effective, and it is reasonable for patients to use these, but they are not always less expensive for the patient. In fact, when patients have prescription drug coverage, a prescription allergy drop may be more affordable for them, and they will receive an effective product that you have prescribed.

The Impact of Dry Eye on Cataract and Refractive Surgery Outcomes

Proactively evaluating patients for dry eye will improve patients' comfort and help optimize your surgical outcomes.

BY WILLIAM TRATTLER, MD

In this presentation, I will share some tips on diagnosing and treating dry eye. I will also discuss how dry eye influences corneal topography and optical biometry data and how that can affect our surgery outcomes.

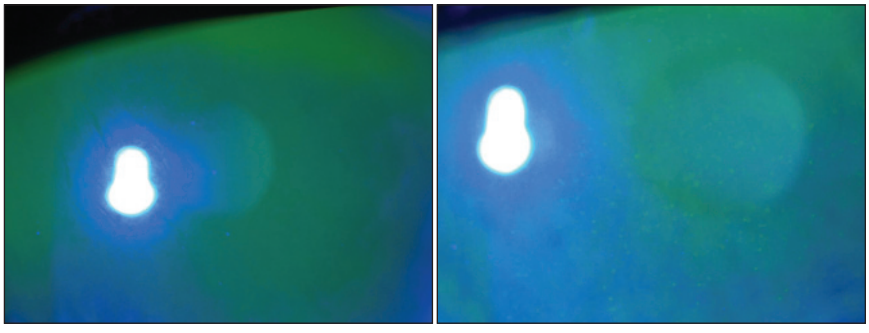

Figure 1. The same eye immediately after fluorescein was instilled (left) and 30 seconds later (right); optimal staining is seen in about 3 minutes.

CASE #1

A 42-year-old woman was evaluated for a chief complaint of fluctuating vision and occasional foreign-body sensation while working on the computer, which she does for about 6 hours a day. She has been using artificial tears four times a day. She is unable to comfortably wear soft contact lenses and is considering refractve surgery.

During the preoperative examination, I observed a very low tear-film lake and instilled fluorescein to evaluate the cornea. One frequently asked question is: How long should you wait after instilling fluorescein before assessing the degree of corneal staining? Although some staining may be visible immediately, maximal corneal staining will be seen in approximately 3 minutes. Figure 1 shows the same eye immediately after fluorescein was instilled (left) and 30 seconds later (right). The photo on the left shows some dye in the tear film but no corneal staining, while the photo on the right is starting to demonstrate corneal staining.

Another question we often hear is: What tear breakup time (TBUT) is considered abnormal? Traditionally, practitioners considered a TBUT of less than 10 seconds indicative of dry eye, but some research suggests 7 seconds may be a more accurate cutoff point.[1] Some practitioners use TBUT to determine the severity of dry eye. For example, when a patient's TBUT is less than 5 seconds, I consider that patient to have moderate to severe dry eye, which will influence my approach to treatment.

We now know this patient has central corneal staining, and her TBUT is less than 5 seconds, indicating moderate to severe dry eye. What would you do next?

a. Have the patient try a different brand of artificial tears.

b. Place punctal plugs.

c. Prescribe topical cyclosporine.

d. Prescribe topical cyclosporine plus a topical steroid.

I have found combining a steroid (four times a day for a week) and cyclosporine (twice a day) works well.[2] A short course of a steroid jump-starts the treatment, and the cyclosporine is an effective long-term strategy. As we know, the underlying cause of dry eye is inflammation, and that is what we are addressing in this patient.

At the 4-week follow-up visit, the patient's symptoms had improved. On examination, I observed reduced corneal staining and increased TBUT. The long-term

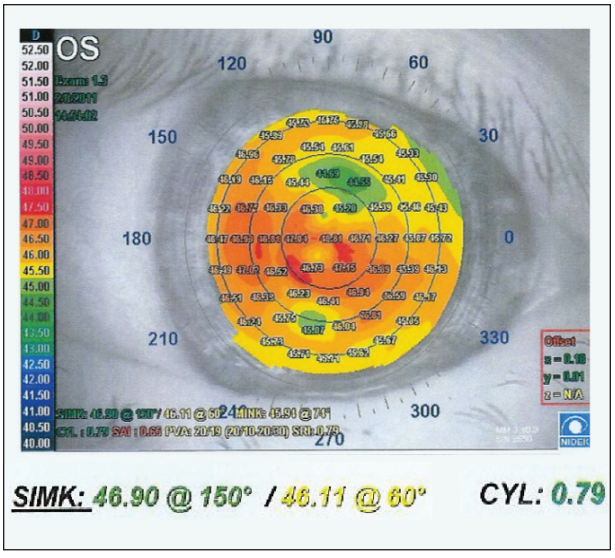

Figure 2. Topography shows corneal irregularity consistent with dry eye.

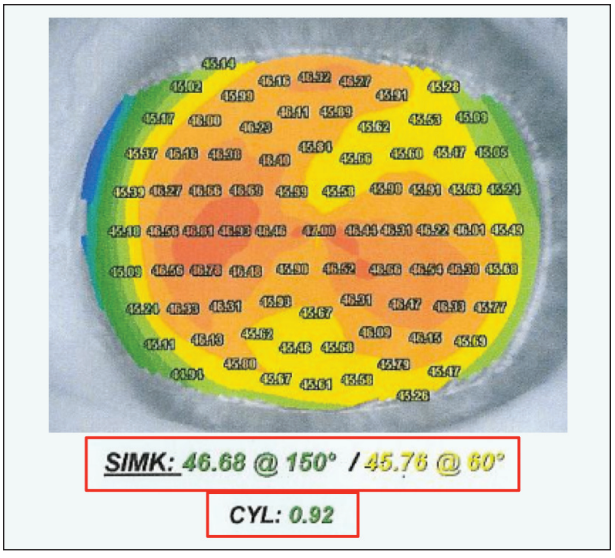

Figure 3. One week after therapy, the patient's corneal surface shows marked improvement.

treatment plan is to continue the topical cyclosporine twice a day, and possibly place punctal plugs to increase tear-film volume. The patient will undergo preoperative testing for laser vision correction, which may be an option for her now because of her improved tear film quality.

CASE #2

A 68-year-old woman is evaluated for blurry vision. On examination, she has 2+ nuclear sclerosis of both lenses. Her best corrected visual acuity is 20/60 with moderate corneal astigmatism. The patient says her eyes are comfortable, and she does not report symptoms of dry eye. Knowing she has astigmatism, the patient wants to optimize her distance vision, so she is interested in having limbal relaxing incisions (LRIs) or a toric intraocular lens (IOL). What is your next management step?

All patients over the age of 55 who will undergo cataract surgery should be routinely tested for dry eyes, whether or not they report symptoms. How common is dry eye in this patient population? My colleagues and I performed a multicenter study of patients 55 years and older at nine US sites, and we found that more than 60% of patients had TBUTs of less than 5 seconds.[3] We also found 45% had central corneal staining, and 47% had Schirmer scores of less than 10 mm.

Why is this important in patients scheduled for cataract surgery? Dry eye affects corneal topography and ocular biometry readings, and this will affect surgery outcomes. This patient, for example, had biometry readings with the IOL Master (Carl Zeiss Meditec, Dublin, CA) at her initial visit. In three measurements of her astigmatism, the power was different every time (1.79D, 1.47D, and 1.15D), making it impossible for us to select the appropriate power for a toric IOL.

This patient's corneal topography (Figure 2) also showed irregularity related to dry eye, but only 0.79D of astigmatism. Again, you would be puzzled as to what to do for this patient if you did not look for signs of dry eye. Patients should be evaluated for dry eye at the slit lamp examination, where corneal staining and TBUT can be assessed quickly.

To recap, this patient is 68 years old, she has a vision-significant cataract, and she has significant dry eye that is affecting her corneal topography and her keratometries.

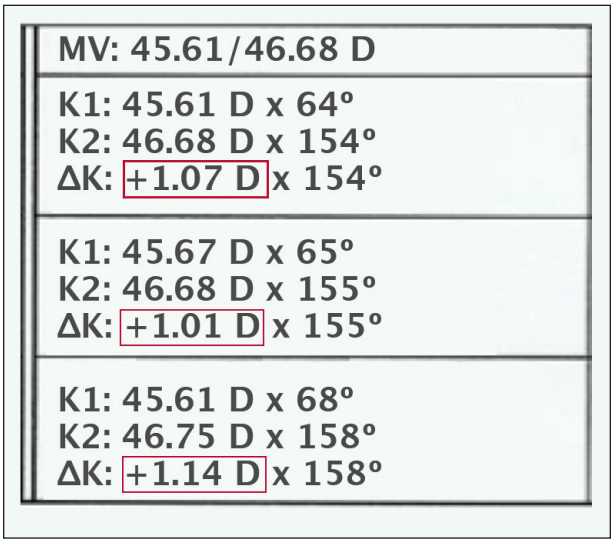

Figure 4. After treatment, all three biometry readings with the IOL Master are consistent with one another and also with corneal topography.

What interventions will help normalize her ocular surface?

Again, I prefer to combine topical steroids and topical cyclosporine to achieve rapid improvement in the ocular surface. As Figure 3 shows, improvement is evident 1 week after treatment. The astigmatism reading is now 0.92D, and on examination, there was improvement in corneal staining.

How did treatment affect the patient's biometry reading with the IOL Master? As Figure 4 illustrates, all three readings are consistent at about 1.00D of astigmatism, and the biometry readings are now consistent with the corneal topography. By treating this patient's dry eye with topical cyclosporine and topical steroids, we saw a significant improvement in the ocular surface and more accurate, consistent readings.

CONCLUSION

Identifying dry eye in our patients, especially prior to testing for cataract surgery, is critical to good outcomes. Dry eye affects keratometry readings, which can lead to placing a toric IOL on the wrong axis, and it can also influence how we place LRIs. So, spend the time, even when patients are asymptomatic, to look closely for dry eye and then treat properly to assure optimum outcomes. ■

1. Abelson MB, Ousler GW 3rd, Nally LA, Welch D, Krenzer K. Alternative reference values for tear-film breakup time in normal and dry eye populations. *Adv Exp Med Biol.* 2002;506:1121-1125.
2. Sheppard JD, Scoper SV, Samudre S. Topical loteprednol pretreatment reduces cyclosporine stinging in chronic dry eye disease. *J Ocul Pharmacol Ther.* 2011;27:23-27.
3. Trattler W, Reilly C, Goldberg D, et al. Prospective Health Assessment of Cataract Patients' Ocular Surface Study. Poster presented at: Annual meeting of the American Society of Cataract and Refractive Surgery; March 2011; San Diego CA.

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CME QUESTIONS

1. According to the Dry Eye Workshop (DEWS) report, which of the following drives the core mechanisms of dry eye?
a. apoptosis
b. inflammation
c. mucin expression
d. tear hyperosmolarity

2. As classified by the Meibomian Gland Dysfunction Workshop (MGDW), psoriasis is in which of the following categories?
a. hypersecretory
b. hyposecretory
c. obstructive cicatricial
d. obstructive noncicatricial

3. Which of the following diagnostic tools has greater than 90% sensitivity and specificity for dry eye?
a. confocal microscopy
b. corneal topography
c. optical coherence tomography
d. wavefront aberrometry

4. According to the DEWS report, what is the earliest stage of dry eye when a topical anti-inflammatory medication should be prescribed?
a. stage 1
b. stage 2
c. stage 3
d. stage 4

5. According to the MGDW report, a topical anti-inflammatory medication may be prescribed adjunctively as early as which stage of meibomian gland dysfunction?
a. stage 1
b. stage 2
c. stage 3
d. stage 4

6. Which of the following treatments for allergic conjunctivitis may cause or exacerbate dry eye?
a. antihistamines
b. anti-inflammatories
c. nonpreserved artificial tears
d. steroids

7. According to Michael B. Raizman, MD, which of the following is contraindicated in patients with co-occurring blepharitis and allergic conjunctivitis?
a. antihistamine/mast-cell stabilizer
b. lid scrubs
c. minocycline
d. oral doxycycline

8. According to William Trattler, MD, how long should you wait after instilling fluorescein before assessing the degree of corneal staining?
a. 10 seconds
b. 30 seconds
c. 1 minute
d. 3 minutes

9. For a patient with moderate to severe dry eye, what is Dr. Trattler's preferred initial treatment?
a. artificial tears as needed
b. punctal occlusion
c. topical cyclosporine
d. topical cyclosporine plus a topical steroid

10. In a recent study by Dr. Trattler and colleagues, what percentage of patients 55 years and older had tear breakup times of less than 5 seconds?
a. 15%
b. 30%
c. 45%
d. 60%

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