Updates in Ocular Surface Wellness

Part 2: Dry Eye

Proceedings From an Expert Roundtable Discussion

faculty

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Content Source
This continuing education (CE) activity captures content from a roundtable discussion.

Activity Description
Eye care providers face multiple challenges in managing ocular surface disorders, such as ocular allergy and dry eye. Recently, experts met to discuss new and practical approaches to improving the management of these patients. This CE activity brings you highlights from these discussions in a 2-part series: this is Part 2, Dry Eye; Part 1, Ocular Allergy, was published in March 2014 and is available on www.mededucicus.com.

Target Audience
This educational activity is intended for optometrists.

Learning Objectives
Upon completion of this activity, participants will be better able to:
• Make a differential diagnosis in patients with dry eye
• Select the therapy that is most appropriate for the patient’s diagnosis and severity of dry eye
• Incorporate current approaches to successfully manage more contact lens wearing patients who also have dry eye
• Counsel patients on proactive measures for managing dry eye

Accreditation Designation Statement
This course is COPE approved for 2 hours of CE credit for optometrists.
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Erratum: Table 2 in Updates in Ocular Surface Wellness, Part 1: Ocular Allergy. The dosing for alcaftadine incorrectly stated “4 times a day”; the correct dosing is “once a day”. The dosing for olopatadine should be clarified from “every day” to “once a day”.

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Dear Reader: This is the second part of a CE activity on Ocular Surface Wellness. Part 1, which can be found on www.mededicus.com, covered Ocular Allergy.

Introduction

Dry eye is a common ocular problem, with an estimated prevalence ranging from approximately 5% to more than 35%, according to various studies; it also is a common cause of visits for optometric care because it can be associated with bothersome ocular symptoms, fluctuating vision, and contact lens discomfort. Appropriate treatment can address these issues and is important because dry eye can be a chronic disease that can lead to abandonment of contact lens wear and progress to the degree that it becomes sight-threatening in some patients. Establishing the diagnosis is the first step in providing effective care for dry eye, but there are many challenges to making the diagnosis.

This continuing education program aims to increase the clinician’s ability to accurately detect dry eye and effectively manage it by taking into account both its etiology and severity in individual patients.

Diagnosis

Dry eye was defined by the International Dry Eye Workshop (DEWS) as “…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.” DEWS also identified 2 major classes of dry eye disease—aqueous-deficient and evaporative.

The DEWS definition and classification of dry eye disease provides a foundation for conducting a proper diagnostic evaluation that should include a detailed patient history to characterize symptomatology and to identify etiological causes, combined with a comprehensive evaluation of the periocular skin and lids, ocular surface, and tear film. A thorough examination will also lessen the potential for dry eye to be overlooked or overdiagnosed. Misdiagnosis of dry eye is a real possibility because its most common signs and symptoms—irritation, dryness, redness, burning, itching, tearing, and crusting—are nonspecific and overlap with those of other common ocular surface conditions, such as ocular allergy, contact lens-related discomfort, and infectious (kerato)conjunctivitis. A lack of concordance between dry eye signs and symptoms also contributes to the diagnostic dilemma. Patients with significant bother may have no to minimal clinical findings of dry eye on examination. Even individuals with confirmed Sjögren disease and an extremely low Schirmer test result may have minimal to no other objective evidence of dry eye, while some patients who have only mild complaints may have significant signs of dry eye on diagnostic testing. Therefore, attention to both subjective and objective measures of dry eye is critical for accurate diagnosis. It is particularly important to look for signs of dry eye in patients wearing contact lenses, even though they, too, have been found to be asymptomatic upon questioning.

History

“Symptoms of discomfort” is a defining feature of dry eye, and therefore the identification of symptoms should be part of the diagnostic evaluation. Although symptom severity may not correspond to the level of inflammation and ocular surface damage associated with dry eye disease, it is still important to gauge the intensity and effect of a patient’s symptoms because one of the goals of treatment is to provide relief of the associated bother.

The Ocular Surface Disease Index© (OSDI©) and the Standard Patient Evaluation of Eye Dryness™ (SPEED™) questionnaire represent 2 relatively quick, structured, validated questionnaires for assessing dry eye disease symptoms. OSDI also assesses effect on vision-related activities. The OSDI and SPEED documents can be downloaded from their respective Web sites: http://dryeyezone.com/encyclopedia/documents/OSDI.pdf; http://korbassociates.com/assets/SPEED_Questionnaire.pdf.

Alternatively, patients may be asked about the presence and severity of symptoms using informal questioning and simple grading scales. A history, however, should include specific queries to uncover functional or quality-of-life consequences of dry eye because this information can help guide the aggressiveness of treatment and provides a measure for assessing therapeutic response. Sometimes, patients who describe themselves as very symptomatic are found, through specific questioning, to suffer minimal to no effects. Other patients who complain little, if at all, may admit to having trouble when asked specifically about certain situations, for example, when performing vision-intensive tasks such as reading or working at the computer, or when in certain environments, such as in a room where there is a ceiling fan. Given that individual patients are affected in different ways by dry eye, depending on their usual activities and according to what they value, these types of questions provide a useful way to assess the severity of dry eye in order to establish individualized goals for intervention.

A history also should identify factors associated with dry eye (Table 1) because such information can reveal contributing causes of the condition and so lead the clinician to deduce appropriate patient management.

Clinical Examination

The clinical examination for dry eye should include assessments of lid morphology, the meibomian glands, meibum secretion, tear meniscus height, tear film break-up time (TBUT), and vital dye staining of the ocular surface. New diagnostic technologies also allow assessment of tear osmolarity, thickness of the tear film lipid layer, and an inflammatory marker of dry eye. Table 2 lists normal values for many of the tests performed to assess for dry eye disease.
External evaluation. Lid evaluation is a critical component of dry eye diagnosis because it is now recognized that most dry eye disease is evaporative and that meibomian gland dysfunction (MGD) is the most common cause of evaporative dry eye disease. Lid evaluation also allows for identification of other causes of the patient's complaints, such as eyelid contact dermatitis and comorbid conditions that can be contributing to MGD and dry eye, including anterior blepharitis and various dermatologic diseases. As part of the external examination, patients also should be checked for lagophthalmos and observed for blink rate; these issues can be etiological factors in dry eye.

The lid examination should check for missing eyelashes, debris or collarettes, redness, thickening, telangiectasia, and evidence of Demodex infestation (Figures 1 and 2).

![Figure 1](image1.png)

Figure 1. Cylindrical dandruff encircling the eyelash follicle in a patient with demodicosis. The debris represents scales that form clear cuffs collaring the lash root and have been shown to be prevalent in cases of Demodex infestation.

Image courtesy of Alan Kabat, OD

![Figure 2](image2.png)

Figure 2. Epilation of an eyelash with cylindrical dandruff reveals infestation by several Demodex mites at the lash root when examined under the microscope (magnification 100X).

Image courtesy of Alan Kabat, OD

Notably, telangiectasia may be found even in teenaged and young adults who have no signs or symptoms of dry eye. The presence of these small, irregular vessels at the lid margin is indicative of an inflammatory state and the likelihood that problems will develop in the future.

Evaluation of meibomian gland obstruction and meibum characteristics should be performed by gland expression through gentle pressure that is applied to the eyelid and lid margins. Gland expression can be done manually with the thumb or a cotton-tipped applicator, or using handheld instruments designed to apply a standardized level of light pressure. Normal meibum is a clear oily liquid. As the quality...
worsens, the meibum becomes increasingly opaque and thicker (Figure 3), so that expressibility necessitates increased pressure.

![Figure 3](image_url) Image taken during manual meibomian gland expression shows thick, turbid secretions indicative of MGD. Image courtesy of Alan Kabat, OD

The lid margin also can be assessed for meibomian gland dropout by using transillumination. This is done by flipping the skin side of the lid over a transilluminating light source and viewing the meibomian glands on the everted mucosal surface. Transillumination enables identification of gland architecture and also reveals inspissation of the orifices. Noncontact infrared meibography, which is commercially available from a number of sources, is another method for evaluating meibomian gland morphology.

Assessing the degree of meibomian gland atrophy is important for guiding treatment decisions. As more atrophied glands are noted, it is incumbent upon the clinician to appreciate that atrophied glands will be much more difficult and often impossible to rehabilitate with standard lid hygiene measures that are a mainstay for the management of obstructive MGD. It is critical, thus, to work to regain functionality to those glands that are still functioning.

**Ocular surface staining and TBUT.** Staining of the ocular surface can be done using fluorescein alone or both fluorescein and lissamine green to identify damage to the cornea and conjunctiva. Fluorescein also is used to fluoresce the tear film in order to measure TBUT and tear film meniscus height.

Proper technique and consistency in methodology is important when using the vital dyes in order to obtain accurate and reproducible results. In research studies, a pipette is used to precisely measure and instill a fixed volume of a preservative-free dye solution. In clinical practice, dye-impregnated strips are used instead. The strip should be completely wetted with a few drops of nonpreserved sterile saline and then shaken firmly to remove excess liquid. This technique will minimize variability in dye concentration and volume applied to the ocular surface, assuring that sufficient dye is transferred, but not in an excessive amount that will lead to quenching of fluorescence.

After pulling down the lower lid and directing the patient to gaze up, the strip can be applied to either the bulbar or palpebral conjunctiva. Clinical experience suggests that placement on the lower palpebral conjunctiva provides accurate TBUT measurements and is less likely to stimulate reflex tearing than placement of the strip on the bulbar conjunctiva. Tear film assessments should be performed prior to staining assessments and before expressing the meibomian glands. Because it can take some time for the tear film to stabilize, it might be helpful to measure TBUT 3 times, allowing patients to blink between measurements, and then to average the results. Alternatively, patients may be instructed to blink completely a few times before measuring TBUT. Since contact lens wear destabilizes TBUT, clinicians are advised to wait at least 5 minutes after lens removal before measuring TBUT.

In assessing TBUT, clinicians should determine the time for break-up as well as the position and pattern. For example, rapid tear break-up localized to the inferior cornea is a telltale sign of lagophthalmos (Figure 4).

![Figure 4](image_url) Rapid TBUT and fluorescein staining of the inferior cornea that corresponds to the area of exposure in a patient with lagophthalmos. Photo courtesy of Christine Sindt, OD

The interval between dye instillation and staining evaluation should be standardized, and a wait time of 2 minutes is generally recommended for lissamine green and fluorescein.9

The ocular surface staining pattern also provides diagnostic clues, and its severity should be recorded using the Oxford Scheme or some other type of grading scale. Interradial conjunctival lissamine green staining in the nasal and temporal regions is indicative of dry eye (Figure 5).10 A negative corneal staining pattern with a vague mosaic pattern is diagnostic of anterior basement membrane dystrophy, which is sometimes misdiagnosed as dry eye.

![Figure 5](image_url) Lissamine green staining of the nasal bulbar conjunctiva in a patient with dry eye. Photo courtesy of Milo Brujic, OD
When using vital dyes in contact lens wearers, conjunctival staining associated with dry eye should not be confused with the circumlimbal staining that is associated with indentation of the lens edge into the conjunctiva (Figure 6).

**Figure 6.** Staining on the superior limbus from indentation by a contact lens edge.

*Photo courtesy of Christine Sindt, OD*

**Lid wiper epitheliopathy.** The lid wiper is the area just posterior to the meibomian glands on the superior lid that wipes along the ocular surface during the blink. Dry eye patients often show lid wiper epitheliopathy (LWE), identified by staining of the lid wiper area using rose bengal, lissamine green, or fluorescein. The severity of LWE is graded according to both the length and the width of the area of staining.

**Tear volume.** The Schirmer test with anesthesia remains the standard method for evaluating aqueous tear production. It should be performed after TBUT and ocular surface dye staining—waiting for several minutes after the dye testing—because the Schirmer test can disrupt tear film stability. Excess fluid from instillation of topical anesthesia should be removed from the cul-de-sac prior to inserting the filter paper. The results are measured after 5 minutes.

Phenol red thread testing is a practical alternative to the Schirmer test because it takes only 15 seconds to complete. Phenol red thread testing also affords greater patient comfort and avoids reflex tearing. Measurement of tear meniscus height can be done using some optical coherence tomography platforms and is another method for estimating the volume of tears.

**Instrumental diagnostic measures.** Point-of-care diagnostic testing for dry eye has been emerging, and a device for measuring tear osmolarity was the first to become available. The test analyzes osmolarity in a 50-nL sample collected from the inferior tear meniscus; a result of >316 mOsm/L is considered indicative of dry eye disease. Some research supports tear osmolarity testing as superior to other diagnostic tests for identifying dry eye and grading its severity. Other studies, however, raise questions about its utility. It is unclear whether the latter results reflect limitations of the test itself or illustrate the fact that dry eye disease manifests with a complex and variable plethora of signs and symptoms. Therefore, clinicians may consider tear osmolarity testing to supplement other diagnostic testing, but should not rely on it as the sole measure for detecting and monitoring dry eye.

A semiquantitative immunoassay for detecting elevated levels of matrix metalloproteinase-9 (MMP-9) in the tears is a new point-of-care test for dry eye that was approved by the US Food and Drug Administration (FDA) in November 2013. MMP-9 is an inflammatory marker, and the test yields a positive result if the level of MMP-9 is >40 ng/mL. The role of this new assay in clinical practice for diagnosing and managing dry eye is yet to be determined.

An ocular surface interferometer provides information on the absolute thickness of the lipid layer of the tear film and allows clinicians to evaluate blinking frequency and completeness. Studies have shown that lipid layer thickness correlates with expressible meibomian glands and is lower in patients with obstructive MGD than in controls. However, further research is needed to determine the role of the ocular surface interferometer in screening for MGD.

**Sjögren disease evaluation.** Sjögren disease is a multisystem autoimmune disease that can lead to significant morbidity and even mortality. It is one of the most common autoimmune diseases, but its prevalence is underappreciated and the disease is underdiagnosed.

Given that dry eye is often one of the earliest manifestations of this condition, the possibility of Sjögren disease should be considered in any patient with clinically significant dry eye. Patients should be asked about dry mouth and about signs and symptoms of other tissue damage, particularly joint pain; they should be asked to provide family history of autoimmune disease because such findings further support the diagnosis of Sjögren disease and are an indication for confirmatory laboratory testing.

A relatively new laboratory blood test for Sjögren disease detects additional autoantibodies, thus improving the identification of patients with disease. Maintaining an index of suspicion for Sjögren disease, combined with use of this blood test, should increase early detection of affected patients and allow them to receive appropriate care through collaboration with a rheumatologist.

**Treatments**

Treatments for dry eye encompass a range of modalities that include medical therapies, surgical techniques, and a variety of other interventions. Specific strategies for use in patients wearing contact lenses will be discussed later.

Management decisions for patients with dry eye should take into account the severity of the disease and any modifiable contributing causes identified in a patient’s personal history. The goals of treatment are to provide relief from disease-related signs and symptoms and to prevent permanent tissue damage.

**Ocular lubricants/Tear supplements**

Artificial tears continue to be a mainstay in the management of dry eye, and there are a myriad of products from which to choose. Because MGD may be the cause or a contributing factor in as many as 85% of patients with dry eye, there is a role for
using a lipid-based artificial tear that will help supplement the deficient lipid component of the tears and stabilize the tear film. Studies evaluating lipid-based artificial tears show their efficacy in improving signs and symptoms of dry eye in patients with MGD, but also in those without lipid deficiency.23-25

Patients should understand why a lipid-based product is preferable to one of another formulation, thus reducing the possibility that they will decide to purchase a product solely on the basis of cost. Treatment of chapped lips provides a useful analogy for helping patients understand the difference between lipid-based and aqueous-based artificial tears. The explanation compares use of the aqueous-based artificial tear products for treatment of dry eye with licking the lips for treatment of chapped lips: the aqueous saliva evaporates quickly, and so it exacerbates the chapping rather than relieving it; in contrast, a wax- or ointment-based product specific for treating chapped lips has better retention and can cover and protect the surface.

There are several lipid-based artificial tear products available (Table 4). It is better to make a specific recommendation and to reinforce the underlying reason for that recommendation rather than to allow the patient to choose from among the various options. Giving a sample of the particular product being recommended, or a money-saving coupon, can help reinforce the recommendation, although it is not advisable to give patients samples of several different products, with a suggestion to try them all and select their preference, because this approach may leave patients with the perception that all the products are interchangeable.

Consumers will find an array of generic/store-brand artificial tear products on the shelves. Although the active ingredients in store-brand artificial tears may at times be similar to those in their brand-name counterparts, the inactive ingredients may be very different in the 2 formulations. In particular, with respect to preservative-containing formulations, the preservative in store-brand products is usually BAK (benzalkonium chloride), whereas the brand-name products are generally formulated with a preservative that is gentler to the ocular surface than is BAK.

Preservative-free artificial tears may be preferred when the required dosing frequency exceeds 4 times a day or in patients with more severe dry eye who have greater ocular surface damage, or who have sensitivities to any of the preservatives found in popular artificial tears. Gel or ointment formulations may be used in patients with severe dry eye.

### Anti-inflammatory Treatment

**Corticosteroids.** Topical corticosteroids alone provide an effective anti-inflammatory treatment for dry eye.26-28 But dry eye is a chronic disease, often requiring ongoing therapy, and the potential for cataract and IOP elevation with corticosteroid use is a limitation to the long-term use of these agents.

**Cyclosporine.** Cyclosporine, 0.05%, ophthalmic emulsion is the only prescription medication that has an FDA-approved specific indication for the treatment of dry eye. It acts to modulate inflammation, increase tear production, and has been shown to be safe and effective when used consecutively for up to 3 years.29 Time to onset of symptomatic relief with cyclosporine treatment is variable and may be delayed in some patients, especially those with more severe disease.30 Treatment benefit increases, however, with ongoing use and may continue to accrue over a period of at least 2 years.31 The most common side effects of cyclosporine use—and thus a common cause of premature treatment discontinuation32—are stinging and burning with instillation32.

Proper education is helpful for improving patient adherence to cyclosporine therapy32 (see Sidebar, next page). In addition, a short course of a topical corticosteroid started prior to or concurrent with cyclosporine therapy has been reported to

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**Table 3. Severity-based Treatments for Dry Eye**21

<table>
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<tr>
<th>Severe</th>
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<tr>
<td>Ocular lubricants/Tear supplements</td>
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<td>Eyelid therapy (for MGD)</td>
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**Table 4. Lipid-based Artificial Tears**

<table>
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<tr>
<th>Product Name</th>
<th>Active and Lipid Layer-supporting Ingredients</th>
<th>Preservatives</th>
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<tbody>
<tr>
<td>FreshKote&lt;sup&gt;a&lt;/sup&gt;</td>
<td>polyvinyl alcohol, polyvinyl pyroloidone, Amisol CLEAR (proprietary phospholipid)</td>
<td>Polixetolium</td>
</tr>
<tr>
<td>Refresh Optive Advanced&lt;sup&gt;b&lt;/sup&gt;</td>
<td>carboxymethylcellulose sodium, glycerin, polysorbate 80, castor oil</td>
<td>Purite (stabilized oxychloro complex); also available preservative-free in single-dose vials</td>
</tr>
<tr>
<td>Retaine MGD&lt;sup&gt;c&lt;/sup&gt;</td>
<td>light mineral oil, mineral oil</td>
<td>Preservative-free</td>
</tr>
<tr>
<td>Systane Balance&lt;sup&gt;d&lt;/sup&gt;</td>
<td>propylene glycol, dimyristoyl phosphatidylglycerol, mineral oil</td>
<td>Polyquaternium-1</td>
</tr>
</tbody>
</table>

<sup>a</sup>[http://www.freshkote.com/about-freshkote_5000_cl.aspx](http://www.freshkote.com/about-freshkote_5000_cl.aspx)


hasten control of inflammation and to minimize discomfort associated with cyclosporine. Loteprednol etabonate, which has been studied as an adjunct to cyclosporine, was found in a recent claims analysis to be the most often prescribed corticosteroid for patients with dry eye. Although loteprednol has a lower propensity to increase intraocular pressure (IOP) than do some other corticosteroids, IOP should be monitored in all patients receiving corticosteroid treatment.

Nutritional supplements. Evidence that essential fatty acids have anti-inflammatory activity provides a rationale for their use in the management of dry eye disease and MGD. In addition, there are an increasing number of reports from randomized, double-blind/double-masked controlled trials showing that treatment with nutritional supplements containing omega-3 and/or omega-6 fatty acids provides objective and subjective improvements in patients with aqueous-deficient, evaporative, and contact lens-associated dry eye.

Punctal Occlusion

The rationale for punctal occlusion using absorbable or nonabsorbable punctal plugs is to increase tear retention on the ocular surface. It should not be used, however, when there is acute inflammation, lest the ocular surface becomes exposed to an increased pool of inflammatory cytokines in the tear film. Currently there are no good measures for determining when it would be appropriate to occlude the puncta after initiating anti-inflammatory treatment for dry eye. In the future, measuring MMP-9 levels in the tear film may be helpful to better understand the inflammation present on the ocular surface. But, for now, clinicians should rely on subjective assessments of inflammation and might consider waiting 3 months after initiating anti-inflammatory treatment before punctal occlusion treatment.

Counseling for Cyclosporine Treatment Initiation

Make sure patients understand that dry eye is a chronic disease requiring long-term treatment.

Explain that cyclosporine reduces inflammation and increases natural tear production. While the time to onset of benefit is variable, the level of improvement increases with ongoing treatment.

Caution patients that they may experience stinging and burning with cyclosporine instillation, but that those side effects generally dissipate as treatment continues.

Suggest keeping the cyclosporine refrigerated to improve instillation comfort.

If prescribing a corticosteroid along with cyclosporine, instruct patients to wait 10 to 15 minutes between drop instillations.

Punctal plugs also may have a specific role in managing dry eye that is considered contact lens-induced, that is, noninflammatory cases in which the primary underlying cause of dry eye is believed to be absorption of tears into the lens. Patients who are likely to fit this description may be young, healthy contact lens wearers with a chief complaint of end-of-day dryness as opposed to older individuals in whom inflammation and MGD are more likely to be present. Nevertheless, while use of punctal plugs in patients with dry eye suspected to be related to contact lens wear would intuitively seem beneficial, it may temporarily decrease lacrimal function in patients with normal tear production, and there are conflicting reports in the literature regarding its efficacy.

Strategies for Severe Dry Eye

Patients with very severe dry eye disease may need intervention to rehabilitate the ocular surface. These modalities may include amniotic membrane, which helps reduce inflammation and facilitates regenerative healing; autologous serum, which has a composition similar to that of healthy tear film in terms of the protein components, growth factors, and pH; and 3% testosterone cream. Use of autologous serum and of 3% testosterone cream each calls for the optometrist to utilize a compounding pharmacy.

Meibomian Gland Dysfunction Management

Aside from the use of lipid-based artificial tears, there are specific interventions for patients with dry eye secondary to MGD that are designed to reduce inflammation, eliminate meibomian gland obstruction, and improve meibum quality.

Lid hygiene and measures for relieving meibomian gland obstruction. Traditionally, lid hygiene has involved application of heat and manual massage of the eyelids in order to soften and extrude thickened meibum. Forceful blinking exercises also can help keep the glands open, and commercially available lid scrubs can be used to clear debris from meibomian gland orifices and control bacterial overgrowth, which may be important, considering evidence suggesting that bacterial burden plays a role in dry eye even in the absence of frank blepharitis. According to the results of 1 study, bacterial colonization of the lid margin was significantly higher in patients with dry eye compared with unaffected controls. The tea tree oil-based lid scrub can eradicate Demodex mites and reduce inflammation. The tea tree oil-based lid scrub also has been shown to have activity against normal bacterial flora colonizing the lids.

Various products and techniques to facilitate meibomian gland expression and to relieve obstruction have been introduced for in-office use. Among these is thermal pulsation therapy that delivers heat and pulsatile pressure to the lids. Forceful expression also can be performed using a commercially available paddle and gland exprssor. And, Korb and Blackie have reported on their use of a golf club spud to mechanically debride the keratinized cells from the lid margin over the meibomian gland orifices in order to enable expression of meibum from the glands. Intraductal probing...
of obstructed meibomian glands and intense pulsed light therapy also have been reported to improve symptoms.50,51

**Topical antibiotics and tetracyclines.** Lid scrubs and topical antibiotics are more effective and safer than oral antibiotics for addressing excessive bacterial burden on the lid margin. Bacitracin has retained good activity against the gram-positive organisms found on the lids and has a low risk for causing allergic or contact dermatitis. Topical azithromycin provides both anti-inflammatory and antimicrobial activity and has been reported effective for treating anterior and posterior blepharitis.52 Treatment of MGD with azithromycin is off-label. One approach is to continue its use until the condition appears improved and then to maintain treatment using a pulse regimen of 1 week per month.

A fixed-combination topical antibiotic-corticosteroid can be used in patients with more significant evidence of lid margin inflammation, but should be prescribed for short-course use only because of safety concerns with the corticosteroid.

Tetracyclines have multiple actions that may be beneficial in treating MGD, including anti-inflammatory properties and effects on bacterial lipase production, the composition and quality of meibomian gland secretions, and MMP expression.53 A low, subantimicrobial dose provides anti-inflammatory action with good tolerability, and may be particularly indicated in patients with concurrent rosacea.

Results from a randomized study conducted by Korean investigators showed doxycycline 20 mg twice a day and 200 mg twice a day were similarly effective for treating patients with MGD refractory to conventional therapy.53

**Managing Dry Eye in Patients Wearing Contact Lenses**

Contact lens-related dry eye has been reported to affect as many as 50% of lens wearers and is a leading cause of contact lens intolerance and dropout.54 The presence of a contact lens on the eye can lead to dry eye via multiple possible mechanisms. The lens itself can absorb moisture from the tear film and alter the tear film, creating a prelens layer with reduced stability and a higher evaporation rate than normal. Deposits on the lens surface also can perturb the prelens tear film as well as reduce lens wettability and cause irritation to the palpebral tissues that are constantly wiping over its surface.

Evidence also is accumulating to support the idea that contact lens wear causes dry eye by adversely affecting meibomian gland function and the lid wiper area.55 However, it is believed that LWE in contact lens wearers and LWE in non-contact lens wearers are different conditions, and the clinical significance of the findings in relation to contact lens wear and the potential of LWE to affect management of dry eye in contact lens wearers has yet to be determined.

A thorough history and examination will help to sort out if a patient’s report of contact lens discomfort is due to dry eye or to contact lens-related issues (eg, improper fit, physical defects, surface deposits), or both. The information obtained will allow a targeted approach to intervention that will enable patients to continue with contact lens wear.

In patients who are generally able to maintain their usual wear schedule but are complaining of end-of-the-day dryness, it is worth probing whether there have been any changes in their environment that can cause dry eye. Another issue to consider is the patient using cosmetics or personal care products on the lids and skin around the eyes that can be adhering to the lens surface and causing problems with dry eye or irritation? MGD or Demodex infestation of the lash follicles also should be identified and treated because the problems associated with these conditions can be exacerbated by contact lens wear in that the lens provides a reservoir for adherence of foreign materials and antigens.

In addition, patients should be queried to determine their lens wear and care habits, including daily duration of wear, adherence to the recommended replacement schedule, and methods and specific products used for cleaning and disinfection.

If the patient has dry eye and is wearing a lens that has been functioning well optically, it may be reasonable to change care solutions. Multipurpose disinfecting solutions are formulated with various combinations of disinfectants, surfactants, moisturizing agents, and buffering agents. Contemporary care systems are unique in that they have been developed in the era of silicone hydrogel contact lenses and have been specifically formulated to optimize the comfort of both silicone hydrogel and hydrogel lenses (Table 5). Practitioners should query patients about their use of store-brand products that often do not contain the same ingredients as the innovator brand they aim to mimic. In particular, the store-brand product may be lacking in the optimal moisturizing agents that are found in recently developed multipurpose disinfecting solution products, agents that may be especially beneficial in patients with dry eye; also, store-brand products may change ingredients without any notification.

**Table 5. Contemporary Multipurpose Disinfecting Solutions**

<table>
<thead>
<tr>
<th>Product</th>
<th>Preservatives/Disinfectants</th>
<th>Surfactant, Lubricant, and Wetting Agents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biotreat™</td>
<td>polyquaternium, polyaminopropyl biguanide</td>
<td>hyaluronan; poloxamine</td>
</tr>
<tr>
<td>OPTI-FREE PureMoist®</td>
<td>polyquaternium-1, myristamidopropyl dimethylamine</td>
<td>TETRONIC 1304, HydraGlyde Moisture Matrix</td>
</tr>
<tr>
<td>RevitaLens OcuTec®</td>
<td>polyquaternium-1, alexidine dihydrochloride</td>
<td>TETRONIC 904</td>
</tr>
</tbody>
</table>

*http://www.healthyeyes.com/instructions-for-use/revitalens-ocutec-multi-purpose-disinfecting-solution/
In order to help patients reduce irritation from deposit build-up on the lens and to improve lens wetting in patients with dry eye, practitioners might also recommend use of a surfactant cleaner. For those patients who seem to present with preservative sensitivities, a hydrogen peroxide-based system would work well. Preservative sensitivity symptoms can be similar to dry eye symptoms, and removing this trigger can increase comfort in individuals so affected.

The next step would be to switch lenses in an attempt to optimize patient comfort. A daily disposable lens may be a logical choice if one is available that meets the patient’s optical needs, because it would minimize irritation and inflammation caused by deposits on the lens surface.56 There are a number of options in the realm of daily disposable lenses to offer patients. It is difficult to make definitive recommendations about preferences for specific lenses because the interactions of the lens with the tear film and with the ocular surface result in a complex issue mediated by a variety of factors (eg, surface treatment, propensity for build-up, water content), and because there are conflicting data in the literature from studies evaluating the potential benefits of switching to different lens materials. Certainly many patients have done well wearing daily disposable hydrogel lenses. Silicone hydrogel lenses are a newer introduction to the daily disposable armamentarium that provide higher oxygen permeability than the hydrogel materials.

A new water gradient contact lens made of delefilcon A is the latest addition to the technology available in daily disposable lenses. This lens has a high dK silicone hydrogel core, but its outer layer, which makes up approximately 10% of the lens thickness, is a non-silicone hydrophilic polymer. The silicone hydrogel core material has a water content of 33%, while the water content of the non-silicone hydrophilic polymer is >80%, on average, and approaches 100% at its outermost surface, thus providing exceptional lubricity.57 The delefilcon A lens has been shown to have less effect on the prelens tear film surface quality than does a daily disposable hydrogel lens made of nelficon A.58 On the basis of its surface characteristics, the water gradient technology lens might be a good option for patients with dry eye.

Scleral contact lenses can work extremely well in patients with severe dry eye because they provide an oxygenated fluid reservoir over the damaged ocular surface that protects the cornea and helps to improve vision.59-61

Topical Treatment Issues

Patients wearing soft contact lenses who are being treated with topical medications for dry eye need to be instructed not to instill the drops while wearing their contact lenses and to wait 10 to 15 minutes after dosing before lens insertion. Only a few specific artificial tears are approved for use while a contact lens is in the eye. Some practitioners are comfortable recommending such use with certain other products off-label.62 Considering the risks of IOP elevation, cataract formation, and secondary infection with corticosteroid treatment, it is best that patients abstain from contact lens wear while using a topical corticosteroid.

Gas permeable lens materials do not absorb medications, and any medication that does adhere to the lens surface can be effectively removed with proper cleaning. However, the importance of meticulous cleaning must be reinforced as well as instructions about not dosing the medication with the lens in the eye and waiting until after medication dosing to insert the lens. Topical cyclosporine should not be used in patients wearing scleral lenses because the emulsion vehicle accumulates underneath the lens and causes cloudy vision.

Conclusion

Dry eye is extremely common among patients seen in optometric practices and is a leading reason for dropout from contact lens wear. Dry eye is a multifactorial disease, and so a thorough history and examination are necessary not only for diagnosis, but also to identify its underlying causes. Successful management to restore the normal tear film, rehabilitate the ocular surface, and mitigate inflammation will provide symptomatic relief, improve visual function, and prevent permanent tissue damage. A clear understanding of techniques for diagnosing dry eye and of current treatment modalities will enable optometrists to optimize patient care and outcomes.

References


