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Your DED search-and-destroy mission

Detecting inflammation and tear hyperosmolarity is key.

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The DEWS report has withstood the test of time.

First published in 2007 — the second report is due out this summer — the International Dry Eye Workshop (DEWS) identified corneal surface inflammation and tear hyperosmolarity as two key components of dry eye disease (DED). The inflammation is understood to be progressive, leading to continued damage of the ocular surface if left unchecked. As for hyperosmolarity, it can negatively impact refractive outcomes due to marked variability in keratometry measurements.

Make no mistake: Dry eye is a real disease that is getting its time on the ophthalmic industry stage, and that stage is now worth about \$55 billion, just in the United States.

To detect and stop inflammation in its tracks, a comprehensive dry eye workup is essential. It's imperative to perform a workup on all patients who complain of dry eye-related symptoms including:

- Gritty, grainy feeling in eyes
- Inability to wear contact lenses for as long as they wish
- Fluctuating vision
- Difficulty with vision after a few hours of computer, monitor or tablet use
- Excessive tearing
- Tired eyes where forced blinking is required to maintain focus on the reading material.

The dry eye questionnaire

Our questionnaire is built into the history of the present illness (HPI) segment of our EMR. It requires our screening technicians to ask questions related to DED. If the patients answer affirmatively to any of the symptoms listed above, our technicians perform TearLab Osmolarity Testing (TearLab) and InflammADry (RPS, Inc.) testing — they must be performed before instilling any drops into the eye.

Beyond the questionnaire, some groups could use extra scrutiny in detecting inflammation. Look closely at the following:

- **Contact lens wearers.** Ask patients who wear contact lenses if they experience discomfort by day's end or cannot wear them for as long as they would like. These patients get MMP-9 ([see sidebar](#)) and tear osmolarity testing by our technicians before our optometrists see the patients. We also do LipiView (TearScience) imaging to assess the health of their meibomian glands.
- **Cataract consults.** All patients scheduled for a cataract consult get tear osmolarity and MMP-9 testing prior to seeing the surgeon. We take these test results plus the lissamine green and fluorescein staining patterns of the lid margin, the bulbar conjunctiva and the cornea. Then we outline a personalized treatment plan to optimize the patients' ocular surface. Several weeks later, we schedule patients for their pre-operative keratometry, topography and biometry testing. This allows time for the tear film and cornea to improve and ensures more reliable data for IOL power calculation.
- **Dissatisfied patients.** If patients visit your practice seeking a second opinion on their postoperative vision, where cataract surgery was performed elsewhere, you must look for ocular surface inflammation. Quelling the surface inflammation becomes a treatment option to ameliorate vision.
- **The silent group.** Symptoms do not always correlate well with DED; therefore, strictly adhering

to a symptom-based approach may not always be wise. The physician needs to evaluate the entire patient, including the medical history, for any connective tissue or other systemic diseases such as fibromyalgia, thyroid disease, Sjögren's syndrome, lupus or more. Previous eye surgery, such as LASIK or aggressive blepharoplasty with poor apposition of lid margins, could also be an underlying cause of ocular surface problems. A review of the patient's systemic medications could also be cause for concern — patients are often clueless about the ocular side effects of their anti-hypertension, anti-depression or anti-allergy medications.

The implementation process

Integrating diagnostic testing into a busy ophthalmology practice can be daunting. To succeed, prepare an organized approach with a timeline.

Include the following:

- **Physician education:** Start with educating your MDs and ODs. Without their support and comprehension of the importance to diagnose and treat ocular inflammation, the plan will not succeed.
- **Staff education:** The staff needs adequate training on how to perform the various tests and to ask the proper questions to elicit dry eye symptoms.
- **Set-up and calibration of equipment:** Determine the location of the testing equipment, the set-up for the mandated calibration of some equipment and the appropriate protocols for keeping the logs.

For a complete picture

Even with a perfect looking plan on paper, it will take some time to work out the details and overcome the unforeseen hurdles. In the evaluation, include:

- The answers to the dry eye questionnaire
- Patient's medical history for connective tissue or rheumatological disorders
- Systemic medications that may exacerbate DED
- The Tear Osmolarity and InflammDry test results
- The ocular surface stains, including fluorescein and lissamine green
- Slit lamp evaluation of the lid margin, the lashes, the meibomian glands and their secretions, the conjunctiva and the cornea
- LipiView images of meibomian glands
- Blink patterns and evaluation for complete blinks
- Tear break-up time
- Conjunctival chalasis or other ocular surface factors that could contribute to DED.

Meibomian glands' role

With each blink, the meibomian glands express a tiny amount of meibum, which contributes to the lipid layer of the tear film. Blockages in these glands result in insufficient oil to coat the tear film, thus leading to rapid tear evaporation and the subsequent cascade of DED. Blinking stimulates the meibomian glands to secrete oils and spread a thin protective lipid layer across the tear film. With a partial blink, the eyelids do not adequately touch. If partial blinks are greater than 40% of total blinks, this could contribute to dry eye conditions. An incomplete blink applies an inadequate amount of pressure at the meibomian gland orifices, thus releasing an inadequate quantity of meibum.

With stagnation, these oils become more viscous and lead to inspissated glands with a thick, toothpaste-

like material that does not readily flow in an olive oil consistency like healthy meibum should.

Meibomian gland structures are observed with the Dynamic Meibomian Imaging (DMI) feature from LipiView (TearScience). DMI produces three images to capture a comprehensive view of the meibomian gland structures: surface illumination, transillumination and merged images. Glands that are truncated, dilated or that have dropped out do not function optimally. Also, thermal pulsation and evacuation through either LipiFlow or intense pulsed light helps unclog these obstructed glands.

MMP-9 as a diagnostic in severe dry eye disease

Michelle K. Rhee, MD

A major challenge in the evaluation of our dry eye patients is the lack of correlation between symptoms and signs.

DED is a multifactorial disorder, and inflammation is one factor that plays an integral role. This disease of the tears and ocular surface results in symptoms of discomfort, visual disturbance and increased instability and osmolarity of the tear film, all of which can potentially damage the ocular surface.¹

As for important signs, matrix metalloproteinases (MMP) are molecules released during inflammation. These proteolytic enzymes are produced by the stressed ocular surface and glandular epithelial cells.² They participate in various pathologic processes, including extracellular matrix destruction in diseases such as arthritis, cancer and autoimmune disorders.³ MMP are zinc and calcium-dependent enzymes that play a role in initiating and sustaining ocular surface damage.

MMP-9 is the most important gelatinase on the ocular surface, and studies show increased MMP-9 levels in the tear film of DED patients. This damages the epithelial basement membrane, contributing to irregularity of the corneal surface.⁴

An important test

One impartial, reimbursable test is called InflammDry (RPS). This simple in-office MMP-9 test provides an objective biomarker to help diagnose and follow the response to topical steroid and cyclosporine treatment of dry eye.⁵

InflammDry is a disposable, single-use test that a technician can administer. Techs should perform the test before instilling other diagnostic eyedrops or conducting Schirmer testing, which manipulates the ocular surface.

The sample collector wicks away 10 ul of tears from the patient's tear lake by applying it to the inferior fornix, then places it in a buffer vial for 20 seconds. After 10 minutes, the test shows the presence or absence of a red line — a red line represents a MMP-9 level of 40 ng/ml or greater.

Why diagnose and treat DED?

Cataract and DED diagnoses increase as our population ages. Cataract surgery continues to evolve into refractive cataract surgery, with many patients seeking spectacle independence. In addition, LASIK and PRK continue to be popular methods to achieve spectacle independence for the general population.

Preoperative identification and treatment of DED is critical to achieving our best refractive endpoints, promoting optimal wound healing and reducing flap complications. MMP-9 has been implicated in poor epithelial healing and epithelial ingrowth after LASIK.⁶

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Manage expectations

DED is the most common cause of an unhealthy tear film and abnormal ocular surface in patients scheduled to undergo cataract surgery.

Since pre- and postoperative medications and/or incisional astigmatism management can exacerbate DED, it is critical to evaluate the cornea preoperatively and discuss the findings with the patient ahead of time. The patients must fully understand that they have pre-existing ocular surface disease (OSD), and that it is progressive in nature. This conversation will pre-empt any inaccurate association by patients that their cataract surgery was the sole cause of their postoperative dry eye syndrome. Moreover, hyperosmolar tear film can lead to unreliable keratometric and topographic data which, in turn, can lead to less accurate IOL calculations. Refractive surprises, even as small as 0.5 D in toric or multifocal IOLs, may lead to unhappy patients.

With consistent exceptional postoperative results, a practice benefits from happy patients who will act as their goodwill ambassadors promoting both the practice and its surgeons. But don't forget that the opposite is true as well. Poor surgical outcomes and refractive surprises due to inattention to the ocular surface and its importance in achieving the best refractive outcomes can lead to disgruntled patients and negative comments on the Web.

For the best ocular surgery results, diagnose OSD early and treat it aggressively. Make sure patients fully understand their pre-existing condition, and wait until the surface is optimized to take your pre-operative measurements so patients can enjoy the rewards of your hard work. **OM**

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