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Advanced diagnostics in action: Identifying ocular surface disease in cataract and refractive patients

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Implementing advanced diagnostic protocols to identify ocular surface disease and enhance refractive outcomes

by John Hovanesian, MD

John Hovanesian, MD

Whether patients seek laser vision correction or refractive cataract surgery, untreated dry eye can diminish visual outcomes

Nearly 80% of cataract-age patients have dry eye disease—a major contributor to inaccurate visual outcomes after refractive surgery.[1] Whether a patient is having LASIK or refractive cataract surgery, postoperative uncorrected visual acuity correlates strongly with patient satisfaction.

However, patients in their 70s or 80s with advanced dry eye may be asymptomatic because the dry cornea becomes desensitized over time. Consequently, ophthalmologists are less likely to treat conditions that do not cause complaints unless they threaten the patient's vision. However, this is a mistake because even in borderline cases with few signs or symptoms, surgery may tip the scales, triggering symptoms and affecting refractive outcomes.

> ***"When implementing new protocols, we cannot spend enough time educating and training staff."***
>
> ***–John Hovanesian, MD***

Establishing protocols

A detailed dry eye questionnaire is a good first step in understanding a patient's symptoms. I use the SPEED questionnaire: It's simple, questions are straightforward, and it is fairly sensitive to visual disruption and symptoms caused by dry eye.[2] We are moving toward routinely administering this questionnaire to patients with cataracts and performing objective diagnostic testing in those with positive scores. We also test asymptomatic patients with signs of dry eye on examination.

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Educational Objectives
Ophthalmologists who participate in this activity will:

- List cataract preoperative screening tests impacted by ocular surface disease
- Assess current and emerging OSD diagnostic tools
- Differentiate between the various therapeutic classes and treatments

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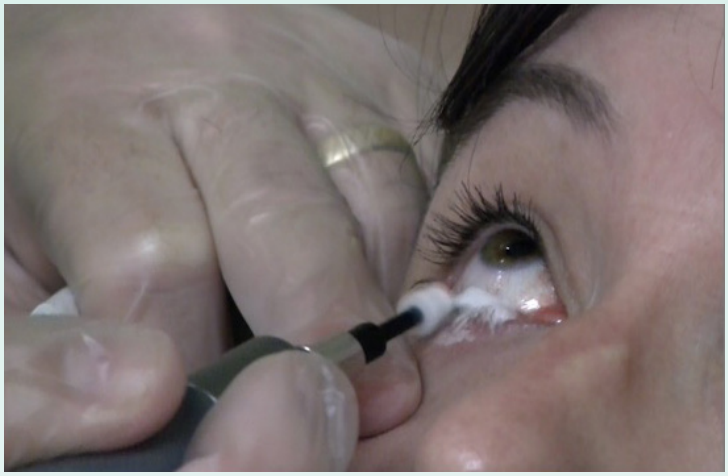

Figure 1. Microblepharoexfoliation removes from the eyelashes and eyelid margins the biofilms that contribute to chronic dry eye and a disrupted tear film.

Source: James Rynerson, MD

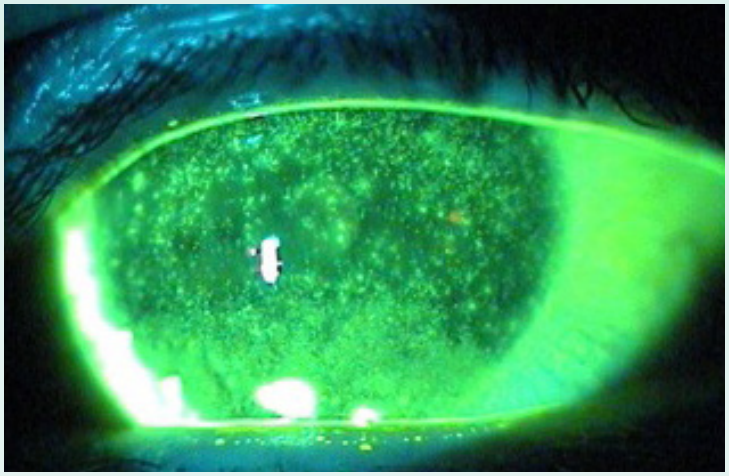

Figure 2. Dry eye can cause significant alteration of biometry measurements long before significant corneal staining appears.

Source: AAO image collection

Objective measures include tear film osmolarity, which generally indicates aqueous deficiency, and MMP-9 markers, which show inflammation that often correlates with blepharitis and meibomian gland disease.[3,4]

We also perform a comprehensive examination including classic tests such as tear breakup time and staining with lissamine green or fluorescein.

Patient education

One of my mentors taught that if you caution patients about a complication before surgery, you are a genius; if you tell them after surgery, you are making excuses. Therefore, it is important to educate patients before surgery.

When we diagnose dry eye, we explain to patients we cannot achieve their desired visual result without treating ocular surface disease first and that it is the patient's responsibility to treat dry eye with the tools we provide.

Patients also need to understand that surgery will not cure their dry eye; therefore, they need to continue dry eye treatment indefinitely to have good vision.

Treatment protocols

I prefer using loteprednol gel or lifitegrast to rehabilitate the ocular surface.[5,6] After surgery, clinicians may continue treatment with lifitegrast or cyclosporine drops.[7] In addition, microblepharoexfoliation using a rotary device with a disposable sponge tip helps remove biofilms from the eyelid surface (Figure 1).[8]

One month of dry eye treatment typically stabilizes the ocular surface so we can repeat tear osmolarity and MMP-9 testing along with the clinical examination to confirm that preoperative measurements will be accurate (Figure 2).

Introducing new protocols

When implementing new protocols, we cannot spend enough time educating and training staff. When we explain to staff why we are making these changes and how they will improve patient outcomes, they embrace them.

As part of this process, we need to help our staff incorporate new tests into the flow of their day. Although these diagnostic tests only take a minute or so, they will not become a permanent part of the process if they impede their work flow.

Conclusion

Because each case of dry eye is unique, it is important to make the most of available diagnostics to pinpoint and treat the cause of the disease. In this supplement, my colleagues will share how they use these diagnostics in specific cases.

References

1. Trattler W, et al. Cataract and dry eye: prospective health assessment of cataract patients' ocular surface study. ASCRS•ASOA Symposium & Congress, March 2011.
2. Asiedu K, et al. Ocular surface disease index (OSDI) versus the standard patient evaluation of eye dryness (SPEED): a study of a nonclinical sample. *Cornea.* 2016;35:175–180.
3. Epitropoulos AT, et al. Effect of tear osmolarity on repeatability of keratometry for cataract surgery planning. *J Cataract Refract Surg.* 2015;41:1672–1677.
4. Messmer EM, et al. Matrix metalloproteinase 9 testing in dry eye disease using a commercially available point-of-care immunoassay. *Ophthalmology.* 2016;123:2300–2308.
5. Sheppard JD. Effect of loteprednol etabonate 0.5% on initiation of dry eye treatment with topical cyclosporine 0.05%. *Eye Contact Lens.* 2014;40:289–296.
6. Holland EJ, et al. Lifitegrast clinical efficacy for treatment of signs and symptoms of dry eye disease across three randomized controlled trials. *Curr Med Res Opin.* 2016;1–7.
7. Salib GM, et al. Safety and efficacy of cyclosporine 0.05% drops versus unpreserved artificial tears in dry-eye patients having laser in situ keratomileusis. *J Cataract Refract Surg.* 2006;32:772–778.
8. Rynerson JM, et al. DEBS—a unification theory for dry eye and blepharitis. *Clin Ophthalmol.* 2016;10:2455–2467.

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Case report: Advanced diagnostics pinpoint severe MGD in cataract patient

by Cynthia Matossian, MD

Cynthia Matossian, MD

Diagnostic technologies help clinicians detect and treat source of dry eye to improve refractive surgery outcomes

To optimize vision with premium intraocular lenses, clinicians need to perform a comprehensive ocular surface examination to uncover conditions that may impact the accuracy of preoperative measurements. Unreliable measurements can lead to refractive surprises. Suboptimal visual results cause dissatisfaction, particularly if patients have paid out of pocket.

Case report

A man in his mid-50s came to our office for a cataract consultation because he had difficulty seeing. He worked in the financial market and explained that he was surrounded by multiple computer displays and his "whole world depended on decimal points."

As with all of our intake interviews, the technician began with a SPEED questionnaire that is incorporated into our electronic medical records as a drop-down menu that cannot be skipped.

The patient's responses triggered the next step, where the technician performed tear osmolarity and MMP-9 testing. These two procedures must be performed before drops are instilled in the eye.[1,2] Next, we imaged his meibomian glands while the patient's pupils were dilating.[3]

By the time I examined the patient, I had his questionnaire responses and test data. I proceeded with the fundus examination and a thorough slit lamp examination with both lissamine green and fluorescein staining, inspecting the lid margins, conjunctiva, and lens.

He had marked meibomian gland dysfunction with gland dropout, as well as a visually significant cataract. Figures 1 and 2 illustrate meibomian gland dropout in other cases.

I explained that we needed to optimize and treat his ocular surface before addressing the cataract. He was unhappy to hear that his cataract surgery had to be delayed; I explained to him that even with flawless surgery, we might not reach our intended refractive target if the ocular surface is not pretreated properly.

I custom-tailored his treatment protocol to include oral omega-3 supplements to stabilize his lipid layer, a heated microwavable mask to keep the meibum more liquefied and the orifices of the glands open, as well as preservative-free artificial tears.[4] He preferred to avoid prescription medications.

Repeat testing in 4 weeks showed that his ocular surface had improved, but not enough. Therefore, I offered him the option of prescription eye drops or thermal pulsation therapy. He chose the latter.[5] It was important to engage him in the decision-making process because he is accustomed to making important decisions all day long in his career.

I usually treat patients with oral omega-3 supplements for at least 4 weeks before thermal pulsation. This helps increase the lipid reserve before the mechanical expression of the impacted meibomian glands. I think having a healthy lipid reserve on hand has improved my success rate with this technology by minimizing the dry eye feeling that some patients experience 1 to 2 days post-procedure.

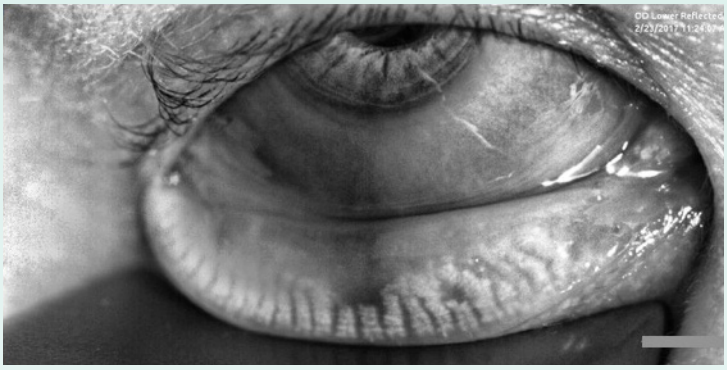

Figure 1. Meibomian imaging showing meibomian gland dropout in right eye

Figure 2. Meibomian imaging showing meibomian gland dropout in left eye

Thermal pulsation improved but did not eliminate his ocular symptoms. He was now motivated to continue with the omega-3 supplements and the microwaveable mask. At this point, I explained that his disease required prescription eye drops, which he finally accepted. I prescribed cyclosporine drops because lifitegrast had not yet been approved.[6]

Weeks later, when the ocular surface was optimized, we proceeded with preop measurements and cataract surgery with a multifocal implant in each eye.

Essential diagnostics

The most important diagnostic in this case was meibography. As the old adage says, a picture is worth a thousand words. Meibography images showed significant gland dropout, helping the patient understand that he required lifelong treatment.

Conclusion

I would not have suspected such advanced meibomian gland dropout in a patient in his mid-50s. Without meibography, I probably would not have treated him as

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Case report: Sensitive diagnostic protocols

by Eric Donnenfeld, MD

Eric Donnenfeld, MD

Precise diagnostics help detect ocular surface disease and guide treatment before surgery

Untreated ocular surface disease (OSD) can significantly impact visual outcomes after laser vision correction, dramatically deflating patients' high expectations. By developing a detailed diagnostic protocol for these patients, surgeons can identify specific causes of dry eye and customize strategies to optimize the ocular surface before LASIK to enhance postoperative results.

Case report

After 15 years of contact lens wear, a 34-year-old woman became contact lens intolerant. She requested LASIK to improve her uncorrected vision and reduce her dependence on glasses.

> ***"Irregular mires on corneal topography are a key sign of dry eye disease."***
>
> ***–Eric Donnenfeld, MD***

Her uncorrected vision was counting fingers in both eyes and she was –5.0 D, –0.75 D at 150 degrees in the right eye and –4.75 D, –1.0 D at 15 degrees in the left eye. Her best corrected vision was 20/20- OU. She reported that her vision fluctuated between blinks and at the computer.

On external disease evaluation, her lids revealed 2+ meibomian gland dysfunction with inspissated glands. Tear breakup time was 4 seconds in the right eye and 5 seconds in the left eye. Schirmer's scores with anesthesia were 18 mm in her right and 17 mm in her left eye. She had 1+ lissamine green staining of the interpalpebral bulbar conjunctiva in both eyes and trace superficial punctate keratitis with fluorescein on her cornea.

Point-of-service testing revealed tear film hyperosmolarity in both eyes (301 OD and 317 mOsm). Research has shown that patients with tear hyperosmolarity before LASIK have worse outcomes after LASIK.[1] MMP-9 testing was also positive OU.[2]

Most notably, her corneal topography demonstrated irregular mires with dropout (Figure 1).[3]

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> ***"Meibography images showed significant gland dropout, helping the patient understand that he required lifelong treatment."***
>
> ***–Cynthia Matossian, MD***

aggressively. The stepwise treatment algorithm helped stabilize his ocular surface for more reliable measurements to obtain optimal refractive results with his cataract surgery.

References

1. Epitropoulos AT, et al. Effect of tear osmolarity on repeatability of keratometry for cataract surgery planning. *J Cataract Refract Surg.* 2015;41:1672–1677.
2. Sambursky R. Presence or absence of ocular surface inflammation directs clinical and therapeutic management of dry eye. *Clin Ophthalmol.* 2016;10:2337–2343.
3. Arita R. Validity of noninvasive meibography systems: noncontact meibography equipped with a slit-lamp and a mobile pen-shaped meibograph. *Cornea.* 2013;32 Suppl 1:S65–70.
4. Epitropoulos AT, et al. Effect of oral re-esterified omega-3 nutritional supplementation on dry eyes. *Cornea.* 2016;35:1185–1191.
5. Blackie CA, et al. The sustained effect (12 months) of a single-dose vectored thermal pulsation procedure for meibomian gland dysfunction and evaporative dry eye. *Clin Ophthalmol.* 2016;10:1385–1396.
6. Stonecipher KG, et al. The IMPACT study: a prospective evaluation of the effects of cyclosporine ophthalmic emulsion 0.05% on ocular surface staining and visual performance in patients with dry eye. *Clin Ophthalmol.* 2016;10:887–895.

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Dynamic meibography of both eyes revealed moderately inspissated meibomian glands with dropout of one or two glands, as well as dilated meibomian glands (Figure 2).[4]

She had a very short tear breakup time as proven by the ocular scatter index evaluation. The remainder of the examination indicated a normal anterior segment with a normal posterior pole.

Based on her clinical examination and contact lens intolerance, we diagnosed dry eye disease most likely related to meibomian gland disease (MGD).

Treatment strategy

We recommended hot compresses and prescribed re-esterified omega-3 fish oil supplements.[5]

This patient wanted rapid improvement, so we performed thermal pulsation on both eyes and prescribed topical loteprednol gel three times a day and a T-cell immunomodulator.[6,7] The combination of loteprednol and lifitegrast ophthalmic solution 5% is useful in patients who want results quickly as lifitegrast has been reported to improve symptoms in as little as 2 weeks.[8]

Two weeks later, lissamine green staining had resolved and tear osmolarity improved to 298 and 307 mOsm, which was abnormal but significantly improved, and corneal topography showed significant normalization with more regular mires.

Because her ocular surface improved dramatically, we performed a thin flap, large-hinge LASIK with a small diameter of 8.5 mm to reduce the risk of postoperative dry eye.

Although her recovery was relatively uneventful, we prescribed non-preserved tears four times a day for the first month after surgery, as well as an omega-3 supplement and the topical immunomodulator. Loteprednol gel was tapered during a 1-month period.

The patient's vision improved to 20/20.

Valuable assessments

If we had not identified MGD as the source of this patient's dry eye and treated her aggressively, her refractive outcome would not have been as successful.

Tear osmolarity testing and corneal topography were essential. Irregular mires on corneal topography are a key sign of dry eye disease. Contact lens intolerance is almost pathognomonic of dry eye disease, so every LASIK candidate with such a history should be considered to have dry eye until proven otherwise.

However, the most important tests were the physical examination and inspection of the patient's lid margins, as well as documenting MGD with dynamic meibomian imaging. The shortened tear breakup time and ocular scatter index evaluation readings supported a diagnosis of MGD.

Conclusion

Before considering surgical intervention, surgeons must use objective testing to determine whether the patient's ocular surface is healthy. It also enables us to establish the cause of OSD and develop a more focused therapy.

Dry eye disease must be treated before surgery. If it is not, it significantly decreases the likelihood of achieving the desired refractive outcome.

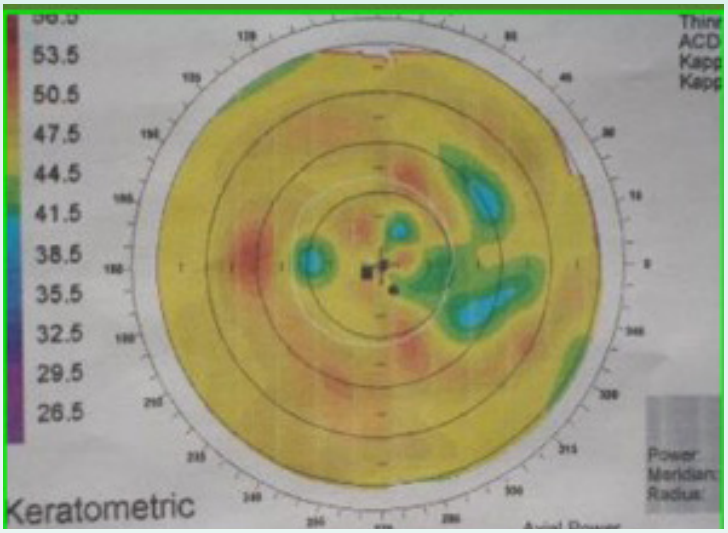

Figure 1. Corneal topography revealing irregular mires consistent with dry eye disease

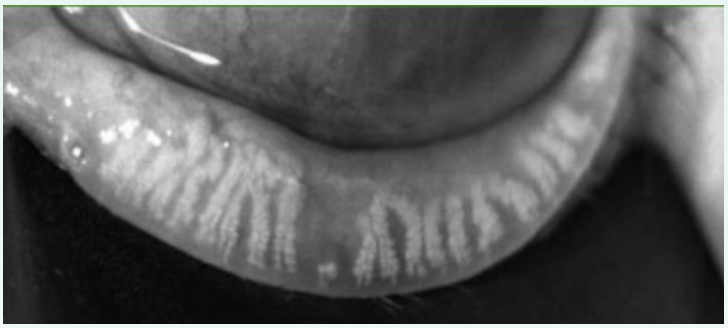

Figure 2. Dynamic meibography showing thickened, irregular meibomian glands with dropout

References

1. Donnenfeld D, et al. Measurement of refractive surgery induced dry eye using tear osmolarity testing. ESCRS Congress, September 2011.
2. Sambursky R. Presence or absence of ocular surface inflammation directs clinical and therapeutic management of dry eye. *Clin Ophthalmol.* 2016;10:2337–2343.
3. Torricelli AA, et al. Screening of refractive surgery candidates for LASIK and PRK. *Cornea.* 2014;33:1051–1055.
4. Geerling G, et al. Emerging strategies for the diagnosis and treatment of meibomian gland dysfunction: Proceedings of the OCEAN group meeting. *Ocul Surf.* 2017;15:179–192.
5. Epitropoulos AT, et al. Effect of oral re-esterified omega-3 nutritional supplementation on dry eyes. *Cornea.* 2016;35:1185–1191.
6. Blackie CA, et al. Treatment for meibomian gland dysfunction and dry eye symptoms with a single-dose vectored thermal pulsation: a review. *Curr Opin Ophthalmol.* 2015;26:306–313.
7. Boynton GE, et al. Prospective randomized trial comparing efficacy of topical loteprednol etabonate 0.5% versus cyclosporine-A 0.05% for treatment of dry eye syndrome following hematopoietic stem cell transplantation. *Cornea.* 2015;34:725–732.
8. Holland EJ, et al. Lifitegrast for the treatment of dry eye disease: Results of a Phase III, randomized, double-masked, placebo-controlled trial (OPUS-3). *Ophthalmology.* 2017;124:53–60.

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Case report: Using advanced diagnostics to distinguish mixed causes of dry eye before cataract surgery

by Alice Epitropoulos, MD

Alice Epitropoulos, MD

By differentiating aqueous deficient and evaporative dry eye, diagnostic tools help clinicians customize treatment strategies

Eighty-six percent of patients with dry eye have evaporative dry eye (EDE), but all patients should be screened for both EDE and aqueous deficient dry eye (ADDE) or mixed EDE/ADDE.[1]

Once the diagnosis is made, we can determine the subtype or subtypes and severity. Typically, ADDE can be diagnosed by low tear volume and production and hyperosmolarity.

Tear hyperosmolarity in ADDE results from reduced tear production by the lacrimal glands with a normal evaporation rate. Increased tear osmolarity has been shown to be the principal factor causing damage to the epithelial cells, triggering the release of inflammatory cytokines and subsequent apoptotic cell death.[2] Although tear osmolarity does not differentiate between ADDE and EDE, it is an excellent measure of disease severity and treatment response.

Diagnostic steps

In our practice, all patients complete a dry eye questionnaire, which can be used to evaluate and document their response to treatment over time.

If the SPEED score is 6 or higher, our technicians perform tear osmolarity, MMP-9 testing, and corneal topography before drops are instilled.[3,4] However, because many patients with dry eye do not have symptoms, we need to actively search for dry eye in everyone.

We can examine the meibomian gland structure by transilluminating the glands or with gland imaging, but meibography provides quality high-definition images.[5]

We also assess the number of partial and incomplete blinks and look for an adequate lid seal.

The hallmarks for accurate diagnosis remain a careful history and clinical examination. Lid and lid margin evaluation should be part of every examination.

Traditional diagnostics such as tear breakup time, lid expression, and staining also should be performed to help distinguish ADDE and EDE. Figure 1 shows an example of corneal staining in a case of mixed ADDE/EDE.

Case report

To illustrate a diagnostic protocol for mixed ADDE and EDE, I will present a case of a 47-year-old woman with a cataract as well as dry eye, dry mouth, dry nose, and arthritic discomfort. Her complaints included ocular burning, foreign body sensation, and intermittent blurred vision with prolonged reading.

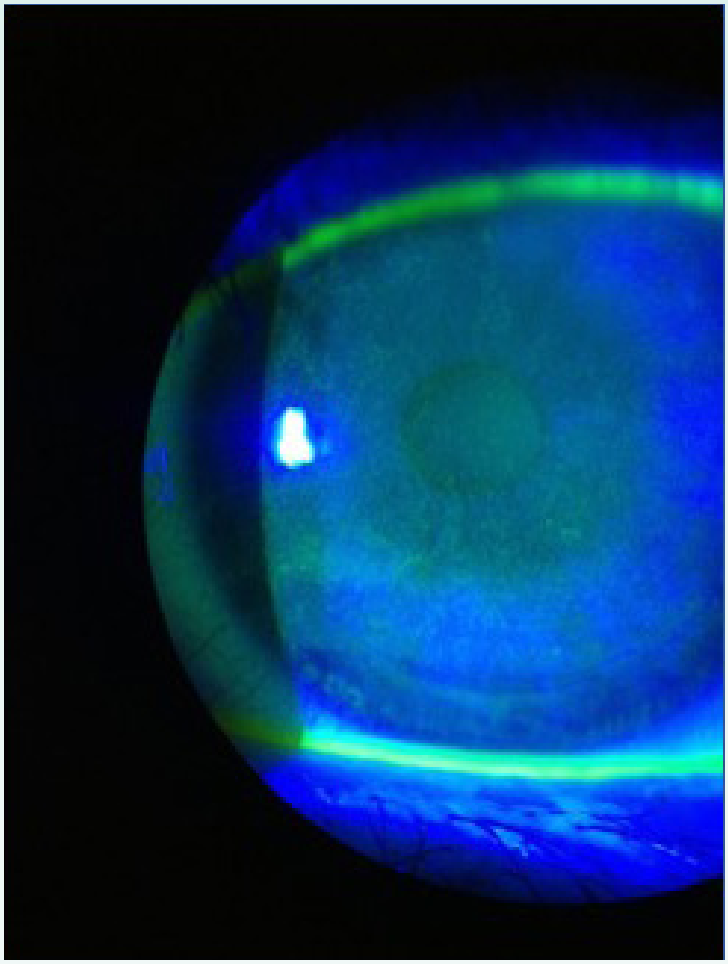

Figure 1. Corneal staining due to mixed ADDE/EDE

Source: William Trattler, MD

This patient's Schirmer's score was 3 in the right eye and 7 in the left eye. Tear osmolarity was abnormal: 310 mOsm in the right and 318 mOsm in the left eye. MMP-9 results were positive. Meibography showed mild atrophy of the meibomian glands.

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The ocular surface interferometer showed 6/10 partial blinks.

At the slit lamp, the patient had a reduced tear meniscus, reduced tear breakup time, and some inferior corneal staining. It is important to evaluate the lids and examine how the meibomian glands are functioning along with the quality of secreted meibum. If less than 6 glands are functioning, dry eye symptoms typically begin to emerge.

Based on her symptoms, we screened her for Sjögren's disease.[6] If this test is positive, I refer patients to a rheumatologist for additional evaluation and treatment.

All of these tests are important in such a patient, but corneal staining, tear meniscus, and tear osmolarity are particularly essential in diagnosing ADDE.

Treatment guidance

The tear film is the most important refracting surface of the eye. An unhealthy ocular surface can affect the accuracy of biometry before refractive cataract surgery and result in choosing an inaccurate power implant, delay postoperative healing, and impact visual outcomes.[3]

It is essential to treat dry eye in a timely fashion to avoid disease progression. ADDE typically can be managed with artificial tears, an immunomodulator, and punctal occlusion. I use a combination of treatments, but in a case of mixed ADDE and EDE such as described above, I would prescribe a topical steroid and either cyclosporine or lifitegrast and a good-quality omega-3 supplement to reduce inflammation and increase the natural quality tear production, as well as thermal pulsation treatment to treat MGD.[7,8,9]

Research has shown that re-esterified omega-3 supplements significantly improve tear osmolarity, symptom scores, MMP-9 positivity, and tear film stability.[10]

When considering punctal occlusion, performing the MMP-9 test provides helpful information to ensure inflammation has been eliminated; otherwise patient symptoms may worsen with this therapy.

In a patient like this, traditional treatments such as warm compresses, manual meibomian gland expression, artificial tears, or antibiotics are not very effective because they do not address the root of the problem. Treatment must facilitate evacuation of the gland contents to restore gland function. This is accomplished using thermal pulsation in combination with microblepharoexfoliation, a lid cleanser with pure hypochlorous acid, and continuing omega-3 supplementation.

If a patient's autoimmune disease is systemic, a rheumatologist or other specialist may prescribe systemic treatment that would potentially improve ADDE.

Conclusion

In the digital era that we live in today, dry eye is becoming more prevalent. Many daily tasks reduce our blink rate, impeding the natural mechanism by which the meibomian glands release oil into the tear film. Therefore, the tear film is replenished less frequently and evaporates more quickly, compromising the lipid layer, tear film, and tear meniscus.

Therefore, ophthalmologists need to assess all patients carefully for EDE and ADDE, even if they do not report symptoms suggesting dry eye.

> ***"It is essential to treat dry eye in a timely fashion to avoid disease progression."***
>
> ***–Alice Epitropoulos, MD***

References

1. Lemp MA, et al. Distribution of aqueous-deficient and evaporative dry eye in a clinic-based patient cohort: a retrospective study. *Cornea.* 2012;31:472–478.
2. 2007 Report of the Dry Eye Workshop. *Ocul Surf.* 2007;5:65–204.
3. Epitropoulos AT, et al. Effect of tear osmolarity on repeatability of keratometry for cataract surgery planning. *J Cataract Refract Surg.* 2015;41:1672–1677.
4. Messmer EM, et al. Matrix metalloproteinase 9 testing in dry eye disease using a commercially available point-of-care immunoassay. *Ophthalmology.* 2016;123:2300–2308.
5. Arita R. Validity of noninvasive meibography systems: noncontact meibography equipped with a slit-lamp and a mobile pen-shaped meibograph. *Cornea.* 2013;32 Suppl 1:S65–70.
6. Beckman KA, et al. Making the diagnosis of Sjögren's syndrome in patients with dry eye. *Clin Ophthalmol.* 2015;10:43–53.
7. Rao SN. Topical cyclosporine 0.05% for the prevention of dry eye disease progression. *J Ocul Pharmacol Ther.* 2010;26:157–164.
8. Donnenfeld ED, et al. Safety of lifitegrast ophthalmic solution 5.0% in patients with dry eye disease: a 1-year, multicenter, randomized, placebo-controlled study. *Cornea.* 2016;35:741–748.
9. Epitropoulos AT. Evaluation of single thermal pulsation treatment for meibomian gland dysfunction and dry eye. ASCRS• ASOA Symposium & Congress, April 2015.
10. Epitropoulos AT, et al. Effect of oral re-esterified omega-3 nutritional supplementation on dry eyes. *Cornea.* 2016;35:1185–1191.

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Advanced diagnostics in action:
Identifying ocular surface disease in cataract and refractive patients

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CME questions (circle the correct answer)

1. In dry eye disease, the corneal topography will most often demonstrate:
a. Flatter keratometry
b. Steeper keratometry
c. Irregular mires
d. Inferior corneal steepening

2. In a 34-year-old woman seeking LASIK, which tear osmolarity measurement is most indicative of dry eye?
a. Tear osmolarity less than 300
b. Tear osmolarity of 304 OD and 305 OS
c. A disparity of 7 mOsm or less between the two eyes
d. Tear osmolarity greater than 308

3. A 64-year-old patient preparing for cataract surgery is using a regimen of warm compresses, lid hygiene, artificial tears, and lifitegrast. What would be an appropriate time frame to expect stable biometry measurements?
a. 1 week
b. 1 month
c. 3 months
d. 6 months

4. A man in his mid-50s is complaining about fluctuating vision. If the patient questionnaire indicates additional testing is necessary, which sequence would be INCORRECT?
a. MMP-9, tear osmolarity, and meibography
b. Tear osmolarity, MMP-9, and meibography
c. Pupil dilation, tear osmolarity, and MMP-9
d. Non-contact applanation, tear osmolarity, and MMP-9

5. In a 47-year-old woman with dry eye and arthritic symptoms, which method CANNOT be used to diagnose aqueous deficient dry eye?
a. Tear meniscus
b. Tear osmolarity
c. Corneal staining
d. Meibography

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