Undiagnosed dry eye can have far-reaching consequences in cataract patients

by William Trattler, MD

In our quest to improve cataract surgery outcomes, we use the latest formulas, IOLs, and surgical technologies. To make the most of the newest innovations, we need accurate preoperative measurements, but dry eye can interfere with these readings.

To help patients achieve the best refractive outcomes, surgeons need to enhance their dry eye assessment protocols to more accurately diagnose dry eye before surgery.

Dry eye impact
Many patients who are evaluated for cataract surgery do not have significant symptoms of dry eye. However, during an objective examination, which includes corneal staining, tear break-up time, and other tests, patients may have findings of ocular surface disease (OSD), which can impact preoperative imaging and IOL power calculations.

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―William Trattler, MD

OSD: Honing diagnostic protocols to pinpoint disease, enhance surgical outcomes
In the PHACO (Prospective Health Assessment of Cataract Patients’ Ocular Surface) study, my colleagues and I studied 136 patients who were 55 years of age or older and scheduled for cataract surgery. Dry eye was reported in 22.1% of the patients enrolled; most patients denied significant OSD symptoms. However, 76.8% had positive results on fluorescein corneal staining, with positive central staining in half. These findings point out that many patients presenting for cataract surgery may not report dry eye symptoms yet have significant dry eye that can impact cataract surgery testing.

Besides the standard tests for dry eyes like fluorescein staining and tear break-up time, other diagnostic tests for dry eye have been correlated with inaccurate cataract surgery keratometry readings. For example, Epitropoulos et al. reported that patients with osmolarity greater than 316 mOsm/L in at least one eye had significantly greater variability in their average K readings and corneal astigmatism compared with those with normal osmolarity (less than 308 in both eyes). Positive results for other diagnostic tests for OSD, such as MMP-9 testing and dynamic meibomian imaging, would also likely be associated with inaccurate preoperative keratometry readings.

In our practice, we have found that OSD needs to be identified on the preoperative examination of patients who are scheduled for cataract surgery. If OSD is present to a significant degree, it is likely that the topography and keratometry readings will be off (Figure 1). Therefore, we initiate treatment for OSD and have the patient return in 2 to 4 weeks for repeat topography and keratometry readings.

Because dry eye is very prevalent in this population, surgeons need to be aware of how it will impact the accuracy of our initial biometry measurements. If we do not optimize the ocular surface in patients with dry eye before repeating preoperative testing, patients may be under- or overcorrected. Furthermore, surgeons need to continue monitoring the ocular surface after surgery, which may induce or worsen dry eye. In addition, untreated dry eye affects visual quality, causing optical aberrations.

Optimal refractive outcomes and patient satisfaction are especially important for those who are paying out of pocket for multifocal or toric IOLs or laser vision correction.

**Mixed-mechanism OSD**

When isolating the cause of dry eye, surgeons may find abnormalities in more than one of the three tear film components—aqueous, mucin, or lipid.

The origin of dry eye directs our treatment strategies. For example, cyclosporine ophthalmic emulsion 0.05% increases aqueous production and goblet cell density. Other therapies for aqueous deficiency dry eye, such as topical steroids, punctal plugs, and lifitegrast, may play a role. In addition, patients with meibomian gland dysfunction may require treatments such as warm compresses, hypochlorous acid, topical azithromycin, or oral doxycycline. Therapy for each patient’s OSD can be individualized to improve the health of the ocular surface, which can result in improved preoperative testing results.

**Conclusion**

Patients have very high expectations of their cataract surgery outcomes, especially when investing in toric or multifocal IOLs. With advanced technologies, surgeons can deliver superior outcomes but only if they obtain accurate preoperative measurements. This often requires evaluation of the ocular surface, as well as treating dry eye and repeating topography and keratometry measurements at a later date, if necessary.

**References**


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Finding the root cause: Dry eye diagnostics

by Jessica Ciralsky, MD

The right diagnostics help pinpoint causes of dry eye and guide effective management

Although traditional testing modalities are still important for dry eye disease identification, newer point-of-care diagnostics can also be used to help clinicians differentiate between various conditions and guide treatment, particularly when signs and symptoms do not match.

Array of tests
Dry eye disease often remains undetected and untreated. However, Ding et al. reported that it affects an estimated 40 million Americans.1

To more effectively identify patients with dry eye, specific screening questions can be asked during initial history taking, or formal questionnaires such as the Ocular Surface Disease Index (OSDI) or Standard Patient Evaluation of Eye Dryness (SPEED) can be administered. Questionnaires and directed patient histories can help us pre-identify patients with symptoms indicative of dry eye who will need point-of-care testing.

Point-of-care diagnostics help us zero in on the correct diagnosis, develop targeted treatment strategies, and monitor treatment responses. When patients have positive results on either a validated questionnaire or on targeted history taking, we start testing for dry eye with a detailed examination and point-of-care testing for osmolarity and MMP-9, which, when abnormal, can also help us track patients’ response to treatment.2,3 Both increased osmolarity of the tear film and inflammation of the ocular surface are part of the definition of dry eye disease, as defined by the Dry Eye WorkShop (DEWS) report.4

Positive results for MMP-9 occur when the MMP-9 concentration is greater than 40 ng/ml and indicate the presence of inflammation. Elevated levels of MMP-9 have been seen in the tears of patients with dry eyes.

High osmolarity is also observed in patients with dry eye disease. We consider values greater than 308 mOsm/L or inter-eye variability greater than 8 points as indicative of dry eye. Inter-eye variability usually does not occur when the tear film is stable.

Tear osmolarity can be an important tool before cataract surgery, as demonstrated by Epitropoulos et al.5 Average K readings and corneal astigmatism were significantly more variable in hyperosmolar patients compared with those with normal osmolarity, which influenced power calculations for intraocular lenses.

A thorough slit lamp examination with fluorescein or lissamine green staining of the conjunctiva and cornea and examination of the lids with expression of the meibum continues to play a major role in the diagnosis of dry eye (Figure 1).

Meibomian glands and the lipid layer can be evaluated with meibography, ocular surface interferometry, and tear break-up time. Tear break-up time is a quick test that can indicate tear instability. If patients have blepharitis, abnormal meibum, or an abnormal tear break-up time, I will

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OSD: Honing diagnostic protocols to pinpoint disease, enhance surgical outcomes

Initiating and advancing ocular surface therapies and treatments

by Francis Mah, MD

Advanced diagnostic tools help us develop targeted strategies to more effectively initiate and advance dry eye treatment. However, clinicians also need to listen carefully as patients describe their symptoms, which will guide them in their approach.

Treatment progression
When patients first mention dry eye symptoms, I begin with the safest, least aggressive therapy. Eighty to 90% of patients with dry eye have a combination of meibomian gland dysfunction and aqueous dysfunction. Therefore, I utilize a multifaceted approach, which includes artificial tears 2 to 3 times per day.

In addition, I explain how to apply warm compresses for 5 to 10 minutes, once or twice a day. According to Bitton et al., patients should know that a warm facecloth does not retain heat as long as the warming masks they studied.

After removing the compress, patients should clean the base of the eyelashes with a clean facecloth and warm water, which massages the warmed meibomian glands, debrides thicker oils, and removes bacteria and Demodex.

I also advise patients to use a white petrolatum-based ointment at night, which will keep eyes moist if they have meibomian gland dysfunction or lagophthalmos. Furthermore, some think white petrolatum suffocates Demodex.

Finally, I advise omega-3 fatty acids, approximately 2,000 to 4,000 mg/day.

Considering subsequent steps
At the 6-week follow-up, if the patient has more meibomian gland dysfunction with blepharitis (Figure 1), I prescribe erythromycin or bacitracin ointment at night, or I prescribe oral minocycline 50 mg QD or doxycycline 50 mg BID.

In patients with more aqueous dysfunction, I

**“Dry eye disease is prevalent, and signs and symptoms do not always match.”**

—Jessica Ciralsky, MD

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**Conclusion**
Dry eye disease is prevalent, and signs and symptoms do not always match. Fortunately, clinicians now have many more tools to diagnose this condition so that therapy can be initiated earlier.

**References**


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prescribe topical lifitegrast or cyclosporine twice a day. I explain that cyclosporine can take as long as 4 to 6 months to work, and 17% of patients had burning or stinging. To minimize discomfort, I recommend refrigerating the cyclosporine. Lifitegrast may take up to 6 to 12 weeks to relieve symptoms and may cause burning and stinging, although possibly less frequently than with cyclosporine. Patients may experience dysgeusia. Punctal occlusion when instilling the drops, toothbrushing, or mouthwash may help reduce this.

If redness and inflammation are severe, I prescribe corticosteroids, even at the higher end of the therapeutic spectrum. If eye pain persists, I may treat with a high-potency corticosteroid.

In my experience, if blepharitis is exacerbated, we increase warm compresses and lid scrubs and use an ointment, in addition to the corticosteroid. With more of an aqueous deficiency, I prescribe cyclosporine or lifitegrast in addition to the corticosteroid. Sambursky reported on how inflammation as diagnosed by MMP-9 testing can help guide management.

After the initial therapies described previously, if we need additional therapy, I consider punctal plugs, and if necessary, I prescribe autologous serum. If blepharitis is the predominant concern, I may consider treatment with a microblepharoexfoliation device, thermal pulsation, or intense pulsed light (IPL) laser. The IPL laser reduces redness. Microblepharoexfoliation devices often provide a degree of relief if patients have keratinization of the top margin of the eyelid, but it can be irritating. Thermal pulsation can be a long-term solution (6 weeks to 2 years) for patients who prefer not to use warm compresses.

Future potential
I look forward to trying neurostimulation. The hand-held stimulator with disposable tips was developed to increase tear production in patients with dry eye. In an open-label, single-arm, nonrandomized pilot study of 40 patients with dry eye who used the device at least four times per day, symptoms and corneal and conjunctival staining decreased significantly by 180 days of treatment, and it was found to be safe. Two pivotal trials showed that it was effective, and a de novo application has been submitted to the U.S. Food and Drug Administration.

Conclusion
Point-of-care diagnostics guide us in the diagnosis and treatment of dry eye, but we cannot ignore symptoms. If patients still have symptoms after we begin treatment, we should not be afraid to progress through a sequence of therapies. Because symptoms without signs indicate stage 1 dry eye, we need to treat these patients a bit more aggressively than we have historically.

References

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Investigating the ocular surface in various types of patients

by Preeya Gupta, MD

Cases demonstrate the importance of preop dry eye assessments

It is crucial to pinpoint dry eye before cataract surgery, but the condition often remains undiagnosed. Based on data from numerous studies, it has been estimated that the prevalence of dry eye ranges from 5 to 30% among those older than 50.

The ocular surface is less stable in patients with dry eye, affecting the accuracy of preop measurements and, consequently, surgical outcomes. A thorough preop examination for dry eye is essential.

Preop assessments

During cataract evaluations, we administer patient questionnaires and I perform a full standard examination with staining. Point-of-care tests such as osmolarity and MMP-9 facilitate diagnosis and guide management; because technicians usually perform these tests, they are easy to integrate into a practice.

Foulks et al. described a sensitivity of 75% and specificity of 88% for osmolarity testing in mild to moderate cases, whereas sensitivity was 95% in severe cases. Sambursky et al. reported that MMP-9 testing had a sensitivity of 85% and specificity of 95% for dry eye.

I routinely use corneal topography during cataract evaluations, which provides information about the health of the ocular surface.

Patient complaints of blurred vision with specific activities trigger additional questioning. All blurry vision does not result from cataracts, so it is important to identify all distinct causes.

Case 1

A 55-year-old woman with glare and blurred vision while reading was evaluated for cataract surgery. She took amitriptyline and used artificial tears occasionally. She stated she did not want to wear glasses after surgery for distance vision.

On examination, she had a tear break-up time of 3 to 4 seconds; there was 2+ meibomian gland dysfunction (MGD), inferior corneal staining of 1+, osmolarity of 330 and 320 mOsm/L, and weakly positive results for MMP-9. Her biometry revealed 1.6 D of corneal astigmatism, which would require a toric implant to correct.

To treat dry eye initially, surgeons can use artificial tears, gels, compresses, lid scrubs, and oral omega-3 capsules. These treatments, while helpful, often take many weeks to improve the corneal surface. I generally prescribe a topical steroid to treat the inflammation more rapidly, especially in those with a positive MMP-9 test. Because we cannot continue steroids indefinitely, given the risk of glaucoma and cataracts, I pair the steroid with an anti-inflammatory medication, such as lifitegrast or cyclosporine.

Lifitegrast was approved in 2016, and my patients generally have tolerated it well. The most common side effects are burning, blurred vision, and dysgeusia. Patients have noticed improved symptoms as early as 2 to 3 weeks after initiating treatment. I now intervene earlier with this medication because of its rapid onset of action.

By starting patients on a topical steroid at the same time as lifitegrast or cyclosporine, patients not only get a rapid improvement but also may tolerate initial side effects of the medication better.

Disease-modifying therapies such as thermal pulsation or intense pulsed light therapy also can be useful. In patients who primarily have MGD, thermal pulsation restores the ocular surface fairly quickly so they don’t need to delay surgery for a prolonged time.

This patient’s initial calculation called for a T5 toric lens, but after thermal pulsation treatment was performed and remeasurement 3 to 4 weeks later, it was determined that the appropriate toric lens was a T3 implant (Figure 1). The decision was made to perform thermal pulsation treatment as the patient had a significant component of MGD.

If we had not optimized her ocular surface and repeated the measurements, we would have implanted a toric IOL with the incorrect power, significantly overcorrecting astigmatism.

Case 2

A 42-year-old woman had increasing ocular redness, irritation, and light sensitivity, which worsened later in the day (Figure 2). She used preservative-free artificial tears almost every 2 to 3 hours and ointment at night.

She had a family history of rheumatoid arthritis but had not received a diagnosis of the condition. She reported...
occasional dry mouth and periodic joint pain.

She had 2+ conjunctival staining with lissamine green and 2+ corneal fluorescein staining. Her tear break-up time was approximately 6 seconds, and she had a positive MMP-9 test and tear osmolarity of 318 and 328 mOsm/L.

In this patient I had a low threshold to perform meibomian gland imaging, which identified moderate meibomian gland atrophy. This technology is excellent in identifying gland atrophy and stratifying patients on the disease spectrum. Although clinicians can apply pressure to the meibomian glands to assess oil function, with meibography we can determine how much atrophy is present.

In young women with dry eye and dry mouth, clinicians should consider testing for Sjögren’s syndrome. Traditional laboratory tests identify Sjögren’s-specific antibody A and B. In contrast, the Sjö point-of-care test assesses for traditional markers and novel proprietary biomarkers (salivary protein-1, carbonic anhydrase-6, and parotid secretory protein), increasing sensitivity and specificity. Sensitivity was reported as 89.9% and specificity as 78.7% and 82.5% in age- and sex-matched controls and pediatric controls, respectively.

It is important to identify Sjögren’s syndrome because these patients later have systemic risks of lymphoma and other conditions.

In this patient I began treatment with lifitegrast as her MMP-9 levels were elevated and she had significant conjunctival and corneal staining. At her 6-week follow-up appointment, MMP-9 tests were negative and osmolarity decreased to 300 and 295 mOsm/L. She reported less irritation and redness, and conjunctival staining improved.

I referred her to rheumatology for a systemic evaluation because of her joint pain, and Sjögren’s syndrome was diagnosed.

**Conclusion**

These cases highlight the importance of screening for ocular surface disease to obtain a better surgical and refractive outcome as well as identify disease processes that require long-term treatment.

**References**


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CME questions (circle the correct answer)

1. A 65-year-old patient has 3+ cataracts OU. Preoperative topography demonstrates 0.6 D of astigmatism at axis 095, but biometry identifies 1.37 D of astigmatism at axis 78. What caused this discrepancy?
   a. Cataract density
   b. Corneal scarring
   c. Previous refractive surgery
   d. Ocular surface disease

2. A 60-year-old woman complains of a gritty sensation and fluctuating vision especially after working on a computer for longer than 20 minutes. Which of the following tests would be most helpful in confirming the diagnosis of dry eye?
   a. Normal topography
   b. Negative MMP-9 test
   c. High tear osmolarity
   d. Slit lamp examination without positive vital dye staining

3. A 74-year-old man presents for evaluation for fluctuating vision. A cataract was diagnosed previously. Which test combination would be least informative?
   a. Biometry and osmolarity
   b. Biometry and MMP-9
   c. Biometry and Schirmer’s
   d. Biometry and topography

4. A 33-year-old engineer is seeing his eyecare specialist for the first time with a chief complaint of fluctuation of vision, red eyes, and a burning sensation after a full day at work in front of a computer. He has never had any eye problems, does not wear contact lenses or glasses, and doesn’t use drops or medications in his eyes. He has a normal eye examination, including no corneal or conjunctival staining. At the 6-week follow-up after initial therapy, what should be considered before determining the next treatment steps?
   a. Origin of symptoms
   b. Corneal topography
   c. Fluorescein results
   d. Tear break-up time

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