

Implementing new ocular surface diagnostics and therapeutics: protocols for success

by Christopher Starr, MD



Christopher Starr, MD

Protocols help surgeons diagnose and treat ocular surface dysfunction before cataract surgery

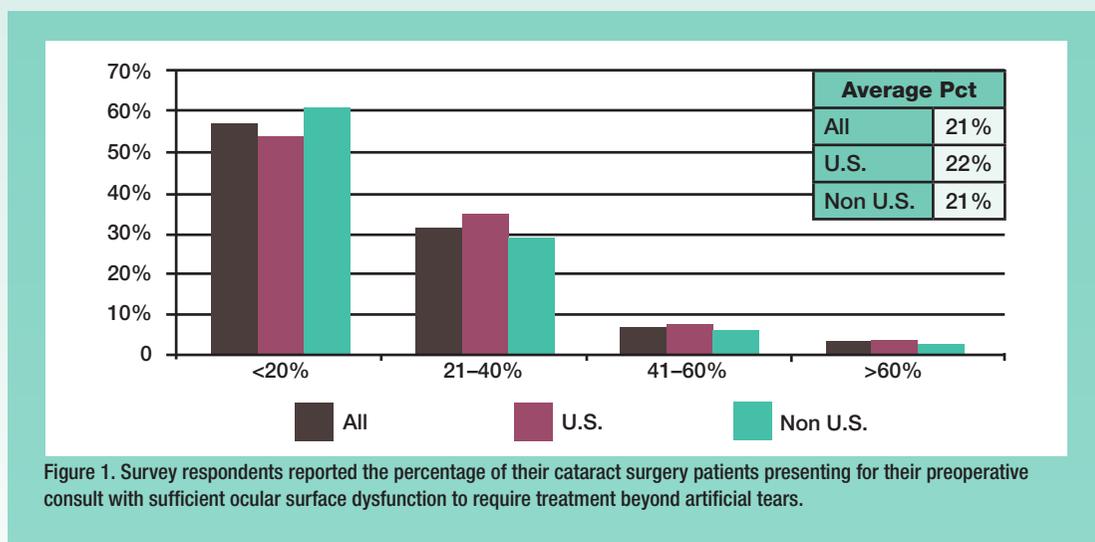


Figure 1. Survey respondents reported the percentage of their cataract surgery patients presenting for their preoperative consult with sufficient ocular surface dysfunction to require treatment beyond artificial tears.

During the last decade, surgeons have become increasingly aware of the role of the ocular surface after any type

of surgery in which patients have high expectations for postoperative vision—including cataract surgery with and without premium intraocular lenses (IOLs).

In light of the many new advances in ocular surface dysfunction (OSD) diagnostics, the ASCRS Cornea Clinical Committee is

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Educational Objectives

Ophthalmologists who participate in this activity will:

- Recognize symptoms and relate common ocular surface problems and their consequences for optical image quality to reduced outcomes in refractive cataract surgery;
- Identify strategies and processes to integrate new tools for evaluating ocular surface health into routine preoperative protocols, with the goal of making faster and more accurate diagnoses to guide treatment decisions; and
- Develop protocols and construct treatment plans that not only provide symptomatic relief, but also improve the health of the ocular surface and tear film sufficiently to result in accurate preoperative testing and optimize visual outcomes of surgery.

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developing a protocol to help clinicians manage patient flow and determine which tests to use.

Efficient protocols

Preoperative refractive measurements such as keratometry, topography, aberrometry, IOL calculations, and final refraction are all significantly affected by the tear film—probably the most important refractive surface in the eye. Therefore, it is essential to optimize the ocular surface and tear film before performing final presurgical measurements.

Each practice should train its technicians to identify dry eye disease (DED) and other common ocular surface disorders and then establish a protocol to maximize office efficiency and diagnostic reproducibility.

We recommend all laser vision correction and cataract surgical patients receive a standardized questionnaire (OSDI, SANDE, SPEED, to name only a few possibilities). When DED/OSD patients are identified, technicians then perform tear osmolarity testing first, before the tear lake is disrupted by bright lights, dilating drops, and anesthetics, followed by the MMP-9 tear test. The diagnostic sensitivity and specificity of this combination of tests is very high for identifying or ruling out DED. Optical coherence tomography of the tear film, tear lactoferrin, lipid interferometry, meibography, noninvasive tear break-up time, as well as traditional diagnostics like Schirmer's, lid expression, and staining, among others, also can be performed to help distinguish between aqueous deficient and evaporative forms of DED. Sjögren's syndrome, a potentially fatal autoimmune disease, should

be ruled out in any patient, especially young female patients, with suggestive symptoms.

Many of these novel point-of-care diagnostics can be performed by a trained physician extender long before the patient sees the ophthalmologist. This saves the clinician a significant amount of time.

A closer look

Despite these modern advances, many OSD cases still remain undetected. In the 2015 ASCRS Clinical Survey, the majority of respondents said less than 20% of their preoperative cataract surgery patients required treatment for DED beyond artificial tears (Figure 1). By contrast, in the multicenter Prospective Health Assessment of Cataract Patients' Ocular Surface (PHACO) Study by Trattler et al., only approximately 22% of patients scheduled for cataract surgery had a prior diagnosis of DED, despite about 80% having significant signs of DED.¹ More than 75% had corneal staining, and 50% had central corneal staining during their preoperative cataract surgical appointment. This is striking data since any corneal staining could lead to potential errors in IOL selection.

Ophthalmologists need to be on high alert for DED in this demographic since patients may not report symptoms and may not carry a DED diagnosis. Some patients with more advanced disease may not have significant symptoms because of the neurotrophic effect on the corneal nerves. Patients also need to know that if we do not postpone surgery to fully treat and reverse DED, it can adversely affect visual outcomes.

“Many of these novel point-of-care diagnostics can be performed by a trained physician extender long before the patient sees the ophthalmologist.”

—Christopher Starr, MD

Increasing patient satisfaction

To ensure patient satisfaction, the informed consent process should include information about their condition and recommended treatment options. We need to establish reasonable patient expectations, and patients need to understand that it is often important to continue DED treatments after surgery.

For patients with significant DED, I usually prescribe cyclosporine (often with other adjunctive treatments such as punctal plugs, topical steroids, antibiotics, and lubricants) before surgery and continue for at least 6 months after cataract surgery or laser vision correction. Corneal incisions and surgery itself can affect the corneal sensation for 6 months or longer.

As a result of gray areas in OSD and DED and the time required to diagnose and treat these disorders, some ophthalmologists

may be reluctant to manage these conditions. However, ophthalmologists will save time in the long run if they educate patients about their condition and treat it fully. If refractive surgery is performed without properly managing DED, more time will ultimately be spent managing dissatisfied patients postoperatively.

Reference

1. Trattler WB, et al. Cataract and dry eye: Prospective Health Assessment of Cataract Patients' Ocular Surface (PHACO) Study. San Diego: ASCRS•ASOA Symposium & Congress, March 2011.

Dr. Starr is associate professor of ophthalmology, director of the refractive surgery service, and director of the cornea, cataract, and refractive surgery fellowship, Weill Cornell Medical Center, New York-Presbyterian Hospital, New York.

New ocular surface therapeutics to optimize surgical outcomes

by Eric Donnenfeld, MD



Eric Donnenfeld, MD

Diagnostic technologies guide treatment of ocular surface dysfunction

The many advanced technologies we use to deliver increasingly better visual outcomes after cataract surgery, such as femtosecond lasers and aspheric, multifocal, and toric intraocular lenses (IOLs), fail to deliver optimal outcomes if patients have a compromised ocular surface. Our repeatability and accuracy in choosing the correct IOL decreases, as does patient satisfaction.

However, more than one-third of respondents to the 2015 ASCRS Clinical Survey reported that they are not familiar with the International Dry Eye WorkShop (DEWS)/Delphi guidelines for treatment of aqueous deficient dry eye and meibomian gland dysfunction, and roughly another third think they are following them but are not certain.

It is important to keep in mind that the key to success as a cataract surgeon is managing the ocular surface.

New diagnostic technologies

To treat dry eye disease (DED), we first must identify it. The future of dry eye diagnostics is evidence-based ophthalmology—point-of-care testing that allows us to diagnose DED seamlessly and accurately.

We begin with tear film questionnaires. If patients' responses indicate possible dry eye, the technician can order the appropriate tests to make the diagnosis.

We test all of our cataract patients with tear osmolarity and MMP-9 testing, which provide objective evidence of DED, leading to better therapeutic decisions. However, these tests are only a starting point, leading me to perform more diagnostic testing to confirm my diagnosis. If a patient has positive results, I perform tests such as lissamine green staining and tear break-up time, examine the ocular surface, and use dynamic meibomian gland imaging.

Negative results indicate that the patient does not have DED, but I need to look for conditions that mimic DED, such as ocular allergy or a lid disease such as conjunctivochalasis, entropion, ectropion, and floppy eyelid syndrome.

When these tests confirm my diagnosis, I can develop a targeted therapeutic plan.

Individualized treatment

If cataract surgery patients have mild DED, we treat them and schedule them for surgery.

When cataract surgery patients have keratitis and ocular surface damage evident on topography or fluorescein staining, we delay surgery, treat them, and perform presurgical testing later. Resolving the ocular surface also provides more accurate keratometry, which is often the limiting step in determining the correct IOL power.

Although patients with ocular surface dysfunction (OSD) may be surprised that surgery is postponed, they need to understand that we have their best interests at heart. Looking beyond the cataract and examining the ocular surface allows me to be a better clinician and a better surgeon. Patients understand this and embrace the fact that we are doing more than they anticipated.

Objective evidence-based point-of-care testing allows us to show patients exactly what we see so they understand the magnitude of the disease and how it needs to be treated.

Achieving satisfaction

There is a misconception that dry eye patients are our most unhappy patients after cataract surgery. Our patients who are marginally compensated and have borderline dry eye, with an increased blink rate or need to close their eyes more may shift to overt dry eye after cataract surgery, and these are our most unhappy patients.

More than one-third of respondents to the 2015 ASCRS Clinical Survey think that 21% or more of their patients have no OSD symptoms before surgery but they develop after surgery (Figure 1).

By preoperatively diagnosing the marginally compensated patient with tear osmolarity, for example, we can identify these patients. After we talk to patients about their disease and treat it, they are more likely to be satisfied with their outcomes.

Dr. Donnenfeld practices with Ophthalmic Consultants of Long Island and Connecticut and is clinical professor of ophthalmology, New York University, and trustee, Dartmouth Medical School.

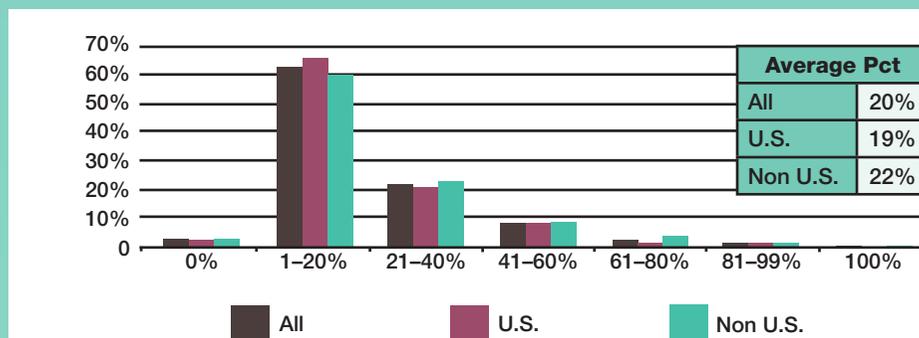


Figure 1. Respondents to the 2015 ASCRS Clinical Survey reported what percentage of their cataract patients present as asymptomatic of any ocular surface disease before surgery but develop symptoms after surgery.

Integration of new ocular surface testing and therapeutics into routine practice

by Edward Holland, MD



Edward Holland, MD

Undetected dry eye may negatively impact cataract surgery outcomes

When we evaluate patients for cataract surgery, a major component of that examination is the ocular surface. A healthy ocular surface is critical to successful outcomes—particularly in patients having refractive cataract surgery.

When patients are unhappy with their outcomes, it usually is not because we missed our refractive target. More commonly patients are dissatisfied with their vision because the ocular surface was not managed.

New ocular surface therapeutics can help us treat patients with aqueous tear deficiency and meibomian gland dysfunction (MGD) to deliver optimal outcomes.

Targeting ocular surface disease

Our first step in screening for ocular surface disease (OSD) is to ask all refractive and cataract surgery patients to complete a questionnaire regarding ocular surface symptoms.

Based on their responses, technicians know which point-of-care tests to perform. New point-of-care testing modalities make us faster, better, and more

efficient clinicians compared with old technologies, which were not very effective or efficient.

We begin ocular surface testing with tear osmolarity, which is helpful in diagnosing early signs of dry eye. Levels are elevated in both aqueous tear deficiency and MGD, indicating that patients have OSD even if they have no symptoms.

We also perform MMP-9 testing, which helps us to determine whether inflammation plays a key role and whether we should prescribe anti-inflammatories to manage dry eye.

I think that in the future we will have inflammatory markers that we can quantify, which also will allow us to monitor treatment response and help patients understand that their OSD is improving.

Asymptomatic patients may not realize they have OSD. When OSD becomes chronic, neurotrophic change occurs on the ocular surface so patients may not experience burning, pain, and discomfort. Vision fluctuation is a common symptom of OSD in an elderly patient, even in patients without the typical dry eye symptoms of pain or burning.

Another valuable new diagnostic technology is meibomography to detect MGD. Many patients do not understand the presence and function of the meibomian glands and the importance of the tear lipid layer. Meibomography allows patients to directly visualize their own meibomian glands and the pathology that is contributing to their dry eye.

Treating OSD

Because OSD is a progressive disease, we should discuss the diagnosis and available treatments with patients with findings of OSD.

If patients have OSD without corneal staining, we can perform topography and biometry and obtain good data. In these cases, we simultaneously plan cataract

surgery and treatment of their OSD, explaining to patients that this will provide better vision after surgery.

However, corneal staining indicates severe disease. We explain to patients that because of OSD, we may not be as accurate in selection of intraocular lenses (IOLs) or management of astigmatism. We recommend delaying surgery and treating OSD first to obtain a quality tear film and corneal epithelium and achieve better outcomes.

Patients may be disappointed to learn that we need to delay surgery. However, if we do not treat OSD before surgery, they often blame the surgeon for suboptimal results.

OSD and premium IOLs

We should not use toric IOLs or perform relaxing incisions in patients with corneal irregularities and irregular astigmatism that may be secondary to OSD. In these cases, it is best to manage OSD and obtain consistent preoperative data and possibly more regularity of astigmatism measurements. If we cannot get consistent readings, we sometimes choose to not manage the astigmatism. In the dry eye patient, a toric IOL is more desirable than relaxing incisions because

additional incisions in the cornea can increase neurotrophic trauma to the cornea.

Potential multifocal IOL candidates are even more challenging. Patients with a less than optimal tear film and corneal epithelium will have more complaints of decreased contrast sensitivity than a monofocal IOL patient.

With aggressive OSD treatment, the corneal epithelium can be improved, and in many patients with mild to moderate dry eye a multifocal IOL implantation will be successful. In potential multifocal IOL patients, I definitely manage OSD before surgery, and I must be confident that they have a healthy surface before I recommend this IOL option.

Conclusion

If we do not diagnose and treat OSD before cataract surgery, patients' visual outcomes will fall short of their expectations. They will believe the surgery failed, but the failure occurred in not diagnosing and treating OSD before surgery.

Dr. Holland is director of the cornea service, Cincinnati Eye Institute, and professor of clinical ophthalmology, University of Cincinnati, Ohio.

Practice pearls

- **Ocular surface disease is a very common disorder that is often ignored and underdiagnosed by clinicians.**
- **Ocular surface disease can have a significant impact on your patients' vision, comfort, and quality of life and your surgical outcomes.**
- **New technologies will improve the clinicians' ability to properly and efficiently diagnose ocular surface disease.**

Proactive ocular surface management: tools for success

by Marjan Farid, MD



Marjan Farid, MD

Surgeons need to aggressively seek out dry eye before cataract surgery

The most significant change in refractive index occurs between the air and tear film, and the tear film and ocular surface play a major role in higher-order aberrations and visual dysfunction.

Therefore, surgeons need to pay close attention to the ocular surface and particularly the tear film before cataract surgery.

Diagnostic tools

Ophthalmologists traditionally wait for patients to complain of dry eye symptoms before diagnosing ocular surface dysfunction (OSD); however, we will miss many cases using this approach. Symptoms and signs of dry eye disease do not always correlate.

Using patient questionnaires and testing, **William Trattler, MD**, found that more than 62% of patients scheduled for surgery had an abnormal tear break-up time of 5 seconds or less.¹

This highlights that we have a large population of patients with dry eye disease (DED) and visual dysfunction from OSD who have no symptoms. Therefore, we need to be very proactive, asking patients key questions and testing

them before refractive cataract surgery.

In our practice, we ask patients to complete the SPEED questionnaire, which helps identify patients at risk and guides diagnostic testing.

We perform tear film analysis on all patients with dry eye symptoms as well as all potential cataract and refractive patients. I use the test for MMP-9, a marker for inflammation, and osmolarity testing to identify tear film abnormalities.

To differentiate whether it is the cataract or the tear film that is affecting visual quality, I perform corneal topography on all cataract patients to identify corneal and tear film irregularities. If astigmatism on topography is very different from biometry measurements, for example, this is a clue that there is some variance and the tear film may be a problem.

Role of patient counseling

Patient education is essential in this process. We explain to patients that both the cataract and OSD may be blurring their vision. We tell patients that we need to postpone surgery to properly treat OSD and repeat preoperative measurements so we can achieve the best possible visual results from surgery. They are more willing to proceed with treatment if they

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Primary therapy: mild DED (Aqueous deficient or unspecified)

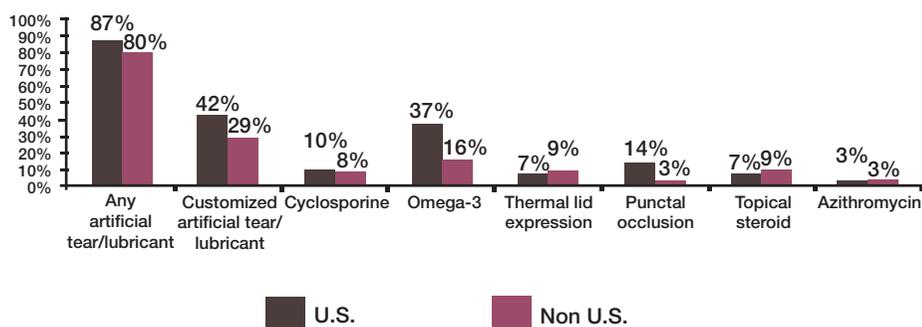


Figure 1. Respondents to the 2015 ASCRS Clinical Survey reported their primary therapies in treating mild dry eye.

Primary therapy: moderate DED (Aqueous deficient or unspecified)

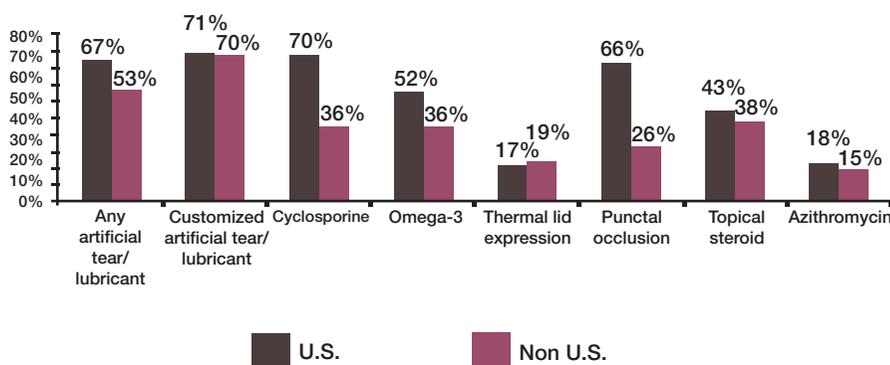


Figure 2. Survey respondents reported additional information on their treatment approaches for moderate DED.

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understand the disease and the reason for delay in surgery.

Point-of-care testing helps illustrate this point. For example, we show patients dynamic meibomian gland imaging and correlate that with the function of their oil glands.

It is particularly important to optimize the tear film before implanting premium intraocular lenses (IOLs). If a patient's tear film has not been optimized, I will not implant a multifocal IOL. Higher-order aberrations of the tear film can cause significant visual disturbances in patients with a multifocal IOL.

Tailored treatment

Our test results help us develop a treatment plan. Patients require an individualized cocktail of treatments to effectively normalize their tear film. We do not prescribe everything at once but work up their treatment.

Most patients have an evaporative component to their OSD, so all patients are treated with warm compresses and lid margin therapies. For many patients with meibomian gland dysfunction, I prescribe the thermal pulsation system to kick-start the function and quality of their meibum.

If we identify inflammatory cytokines by positive MMP-9 testing, I prescribe an anti-inflammatory agent, such as a short course of steroids like loteprednol with a longer-acting cyclosporine.

Omega-3 fatty acids have been shown to significantly improve lipid layers. The American diet lacks the essential omega-3 fatty acids needed for their anti-inflammatory properties.

I prescribe oral doxycycline in patients with staphylococcal marginal keratitis or significant inflammation, thick lids, and redness. The dual action of anti-inflammatory and antimicrobial effects can have a significant therapeutic effect in some patients.

Conclusion

To achieve the best outcomes in refractive cataract surgery, clinicians need to aggressively search for OSD using point-of-care diagnostics and treat this disorder before surgery.

Primary therapy: severe DED (Aqueous deficient or unspecified)

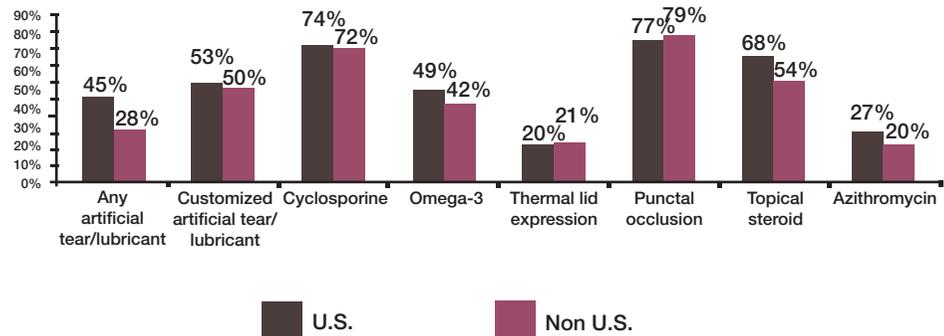


Figure 3. Respondents to the 2015 ASCRS Clinical Survey reported their primary therapies in treating severe dry eye.

Primary therapy: MGD

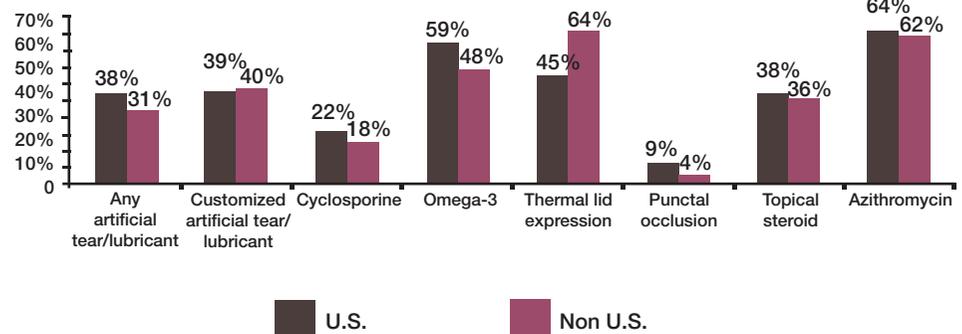


Figure 4. Survey respondents reported their primary therapies in treating MGD.

Reference

1. Trattler WB, et al. Cataract and dry eye: Prospective Health Assessment of Cataract Patients' Ocular Surface (PHACO) Study. San Diego: ASCRS•ASOA Symposium & Congress, March 2011.

Dr. Farid is associate professor of ophthalmology, director of cornea, cataract, and refractive surgery, and vice chair of ophthalmic faculty, Gavin Herbert Eye Institute, University of California, Irvine.

“Patients require an individualized cocktail of treatments to effectively normalize their tear film.”

—Marjan Farid, MD

Using next-generation therapeutics to manage dry eye and meibomian gland dysfunction

by Alice Epitropoulos, MD



Alice Epitropoulos, MD

Complaints after cataract surgery are often linked to meibomian gland dysfunction and aqueous deficient dry eye

Dry eye disease (DED) and meibomian gland dysfunction (MGD) are often the root of what causes many of our patients to be frustrated or dissatisfied with their cataract surgery outcomes.

If we do not treat dry eye and MGD prior to cataract surgery, an unstable tear film may adversely affect our biometry, delay healing, and cause suboptimal results postoperatively. A fail-proof method of identifying MGD and DED is to screen all patients for this condition, especially in our surgical patients.

Progressive disorder

MGD is the most common form of DED, affecting 85% of all dry eye patients.¹

Because it is a progressive disorder, patients need to understand that it can lead to irreversible damage if not treated.

Meibography is an excellent tool to examine the structure of

the meibomian glands, determine whether there is dilation or atrophy, and identify MGD early. We also can use it to show patients what their glands look like versus what they should look like (Figure 1).

If we explain that DED can affect their preoperative measurements and surgical outcomes, they are more likely to be compliant with their treatment even if they do not have symptoms.

Conventional treatments such as lid scrubs and warm compresses are minimally effective in MGD because they do not address meibomian gland obstruction. These are supplemental therapies that can be offered after the obstruction has been addressed. Thermal pulsation is the only treatment for evaporative dry eye cleared by the U.S. Food and Drug Administration and is a very safe and effective procedure.

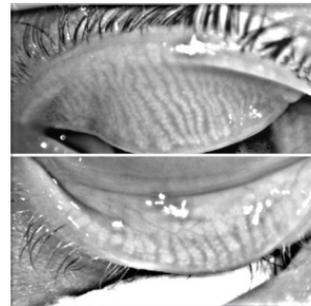
Our retrospective study showed that there was a statistically significant improvement in symptom scores, tear break-up time, and meibomian gland evaluation scores in patients treated with thermal pulsation.²

In addition, we recently completed a prospective, multicenter clinical trial showing that re-esterified omega-3 supplements significantly benefited patients with DED. Significant improvements were seen in symptom scores, tear osmolarity, MMP-9, and omega-3 index levels.³ We also demonstrated a more stable tear film as evidenced by a significant improvement in tear break-up time. These results support the recommendation that re-esterified omega-3s should be considered in patients with DED and MGD.

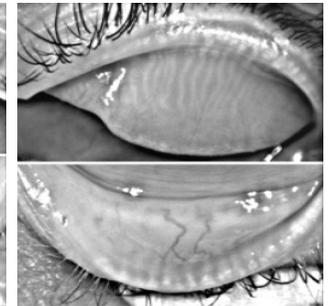
Aqueous deficiency DED

Topical cyclosporine is very effective in patients with aqueous deficiency DED, reducing inflammation and increasing goblet cell density. These patients are less likely to experience progression of their disease.⁴

Normal meibography



Advanced MGD



MGD progression → gland atrophy

Figure 1. MGD progression leads to gland atrophy.

Eric Donnenfeld, MD, has shown that topical cyclosporine also helps improve visual outcomes in patients with multifocal intraocular lenses (IOLs).⁵

Treatment of MGD and aqueous deficient DED

I see patients 4 to 6 weeks after initiating treatment for MGD and aqueous deficient DED. I remeasure their topography and biometry to make sure the measurements make sense. I don't hesitate to delay treatment until measurements are reliable.

Patients should be educated that DED is a chronic, progressive disease; it is often exacerbated after surgery; and treatment is usually continued after surgery.

Conclusion

Preoperative MGD and DED are extremely common and underdiagnosed and can adversely affect our surgical outcomes. It's important to maintain a high level of suspicion, even in asymptomatic patients. This requires that we screen and evaluate for these conditions preoperatively, which will allow for better quality of vision and overall improved outcomes for our patients.

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Dr. Epitropoulos is clinical assistant professor, the Ohio State University Wexner Medical Center, Columbus, Ohio, and co-founder, the Eye Center of Columbus.

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CME questions (circle the correct answer)

1. The multicenter Prospective Health Assessment of Cataract Patients' Ocular Surface (PHACO) Study by Trattler et al. reported that approximately 20% of patients scheduled for cataract surgery had a prior diagnosis of dry eye disease, but more than _____ had corneal staining.

- a. 50%
- b. 60%
- c. 75%
- d. 85%

2. According to Dr. Donnenfeld, the following condition may mimic dry eye disease:

- a. Ocular allergy
- b. Chalazion
- c. Bacterial conjunctivitis
- d. Viral conjunctivitis

3. According to Dr. Epitropoulos, which of the following is minimally effective as an initial treatment in patients with meibomian gland dysfunction:

- a. Warm compresses
- b. Thermal pulsation
- c. Re-esterified omega-3 supplements
- d. All of the above

4. Patients with chronic ocular surface disease may have _____ because of neurotropic changes on the ocular surface.

- a. Difficulty reading
- b. Fatigue
- c. Itching
- d. No typical symptoms

5. According to Dr. Farid, _____ may help patients understand why their cataract surgery is being delayed to treat ocular surface dysfunction.

- a. Peer-reviewed journal data
- b. Point-of-care testing results
- c. Follow-up appointments
- d. Patient education materials

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