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The Key to Effective MGD Management


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The Key to Effective MGD Management

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Content Source

This continuing education activity captures content from two live satellite symposia.

Activity Description

This supplement summarizes two presentations by well-known experts in meibomian gland dysfunction (MGD)–related dry eye disease (DED). The faculty reviews diagnostic and treatment approaches and shares additional insights through case discussions.

Target Audience

This certified CE/CME activity is designed for optometrists and ophthalmologists.

Learning Objectives

Upon completion of this activity, the participant should be able to:

- **Summarize** the clinical signs and symptoms of DED
- **Recognize** and explain MGD-related DED pathology
- **Discuss** the current and emerging methods in diagnosing MGD
- **Develop** individualized treatment plans for patients with DED
- **Describe** the mechanisms of action for current and emerging agents

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PRETEST QUESTIONS

Please complete prior to accessing the material and submit with Posttest/Activity Evaluation/Satisfaction Measures for credit.

1. Please rate your confidence in your ability to diagnose and treat meibomian gland dysfunction (MGD) (based on a scale of 1 to 5, with 1 being not at all confident and 5 being extremely confident).

a. 1
b. 2
c. 3
d. 4
e. 5

2. All of the following are predisposing factors to dry eye disease (DED) EXCEPT:

a. Older age
b. Female gender
c. Male gender
d. Contact lens wear

3. How do antibiotics help treat DED?

a. Alter fatty acid metabolism and reduce the expression of matrix metalloproteinases and inflammatory cytokines
b. Increase turnover of conjunctival goblet cells
c. Direct effect on aqueous layer secretion
d. Antibiotics are not effective in the treatment of DED

4. A 56-year-old woman presents to your office with DED. After hearing about her treatment options, she is most interested in thermal pulsation treatment. She asks how this treatment might impact her current vision, as she is currently spectacle independent. What is the best answer for this patient?

a. Your refraction will not be impacted by thermal pulsation treatment
b. You may have a change in the amount of astigmatism after thermal pulsation treatment
c. Your refraction will be impacted by thermal pulsation treatment, but you will still be spectacle independent
d. Thermal pulsation treatment will increase your astigmatism and you will be dependent on spectacles

5. A 52-year-old white man presents to your office for routine eye exam. He notes significant mid- to late-day eye discomfort, with itching, tearing, and burning. He is a contact lens wearer. On exam, you note 2+ punctate epithelial erosions in bilateral corneas, with no MGD noted. What is the next best step in treatment?

a. Intense pulsed light therapy
b. Microblepharoexfoliation
c. Contact lens holiday and frequent artificial tears treatment
d. Oral steroids course

6. A 55-year-old woman presents to your office for evaluation. She notes frequent itching and burning sensation, especially at the end of the day. She spends many hours on digital devices. Exam reveals decreased tear breakup time OU, with meibomian gland inspissation OU. All of the following represent reasonable treatments for this patient, EXCEPT:

a. Intense pulsed light therapy
b. Micro-blepharoexfoliation
c. Topical azithromycin or systemic doxycycline
d. Intravenous steroid treatment

7. All of the following are common dry eye complaints EXCEPT:

a. Eye fatigue
b. Spiderwebs/cobwebs in vision
c. Transient blurred vision
d. Burning/itching

8. Which of the following statements about the relationship between DED and age is TRUE?

a. Studies show increasing DED prevalence with age
b. Studies show decreasing DED prevalence with age
c. Studies show no correlation between DED prevalence and age
d. Studies show increasing DED prevalence with age, but only until age 49 years

9. A 56-year-old man with primary open-angle glaucoma presents to your office for evaluation. He's currently on latanoprost OU every night at bedtime and dorzolamide/timolol OU twice daily. He has a history of LASIK and currently wears contact lenses. He notes frequent eye fatigue and occasional burning and itching. On exam you note MGD, punctate epithelial erosions, and 1+ cortical cataracts in both eyes. All of the following likely contributed to this patient's dry eye EXCEPT:

a. Contact lens wear
b. LASIK surgery
c. Glaucoma medications
d. Cataracts

10. On average, what percentage of patients in a practice have signs of MGD?

a. ~10%
b. ~20%
c. ~30%
d. ~40%

11. A 76-year-old man presents to your office for cataract evaluation. He notes eye fatigue and itchy, burning eyes bilaterally. He also notes blurry vision. He has 2+ NS in both eyes and significant astigmatism. You implant a toric lens and complete an uneventful surgery. At his 1-week postoperative visit, he is very unhappy and complains of blurry vision and distortion in his operative eye. His exam reveals a clear cornea, with a well-centered posterior chamber intraocular lens. His autorefraction shows 2.00 D of cylinder. What might be a reason for this result?

a. Astigmatism induced from the cataract main incision leading to postoperative cylinder
b. Astigmatism induced from the side port incision leading to postoperative cylinder
c. Failure to diagnose DED prior to surgical lens calculations, leading to improper lens implanted
d. Edema from the corneal wounds inducing postoperative cylinder

12. A 45-year-old woman presents to your office for evaluation. She notes red, itchy eyes, blurry vision, and eye fatigue. On examination, you note meibomian gland inspissation in both eyes. Which of the following is a reasonable first treatment option for this patient?

a. Topical or systemic antibiotics
b. Oral steroid
c. Topical antihistamine
d. Oral antihistamine

13. Why might the signs and symptoms of DED not align?

a. Dry eye diagnostics are not sensitive enough to diagnose DED
b. Patients with late-stage disease may not be symptomatic but will have significant clinical signs
c. Patients with early stage dry eye will always have corneal staining but will be highly symptomatic
d. Patients are not forthcoming with reporting their dry eye symptoms

14. You are seeing a 15-year-old patient in your office for evaluation. He notes burning, itching, and eye fatigue after using his electronic device. He reports blurry vision frequently throughout the day that resolves upon blinking. His medical history is significant for asthma, allergic rhinitis, and acne. His current medications include a rescue inhaler for his asthma, a steroid nasal spray for his allergic rhinitis, and isotretinoin. He is also on a vegan diet. What is the most likely cause of this patient's complaints?

a. MGD secondary to inhaler use for asthma
b. MGD secondary to nasal spray use for allergic rhinitis
c. MGD secondary to isotretinoin
d. MGD secondary to vegan diet

THE KEY TO EFFECTIVE MGD MANAGEMENT

This supplement summarizes two live symposia for eye care practitioners focused on diagnosing and treating meibomian gland dysfunction (MGD). Key opinion leaders share clinical data as well as their individual tips and pearls for providing the best care for patients with dry eye-associated MGD.

THE TRUE PREVALENCE OF DRY EYE DISEASE

Dry eye is one of the most common disease presentations in ophthalmology and optometry, with a prevalence of up to 75% in some groups.[1] Yet it is frequently underdiagnosed, with as many as 3% of Americans with symptomatic dry eye disease (DED) not receiving treatment.[2]

"If we start to ask the proper questions, and if we truly become good listeners as eye care practitioners, a lot of our patients in our exam rooms have DED," said Cynthia Matossian, MD, FACS.

Identifying these patients is critical because they experience a range of symptoms that significantly affect well-being and negatively impact daily activities that will only worsen if left untreated.[3] Symptoms include stinging, burning, and fluctuations in vision that slow reading speed.[4]

Leslie O'Dell, OD, FAAO, recommends paying close attention to clues for fluctuating vision at the slit lamp, even if a patient hasn't complained of dry eye symptoms. "Patients will blink and comment that their vision is better, but I didn't change the refraction," she explained. "That isn't normal. When you blink your eyes, you should not have a significant change in vision. It should remain stable between blinks."

In a long-term retrospective study of 107 men and 154 women who reported a DED diagnosis, 46% experienced fluctuating vision, 75% reported symptoms of discomfort (which includes both dryness and irritation), and 90% reporting using artificial tears.[5]

"[DED] increases absenteeism from work, and people are not as productive," Dr. Matossian said. "If their eyes are hurting, they're constantly closing their eyes or rereading the same paragraph because they can't focus on it."

Many patients with DED don't realize they have symptoms. To find those patients, Dr. O'Dell asks patients if they think of their eyes during the mid to late workday or if they can feel them. "Usually they'll say they do; they feel tired," she said.

"You shouldn't be able to feel your eyes," Kelly K. Nichols, OD, MPH, PhD, FAAO, added. "They should be invisible to you in terms of feeling. If a patient can feel them, there is something wrong. There are all sorts of ways of garnering symptom information from patients that can be useful."

Men and women are equally affected by DED until around age 45 years, when dry eye becomes more prevalent in women at almost a 2:1 ratio.[2] In addition to sex and older age, other predisposing factors include the environment (eg, low humidity and air conditioning), systemic medications, topical ocular medication including preservatives, previous ocular surgery (eg, LASIK and cataract surgery), contact lens wear, systemic diseases (eg, lupus and rheumatoid arthritis), and cosmetics (eg, mascara and eyelash extensions).[6,7] Although older age is still a primary risk factor for DED, the age of the dry eye population is shifting to younger patients—including children.

"Dry eye is not an old person's disease anymore," Dr. Nichols said. "Therefore, standardizing how you do your routine exams across all ages is really important."

Dr. Nichols and colleagues recently looked at tear film and meibomian gland characteristics in 225 children age 8 to 17 years. Although 15% reported ocular discomfort, 39% of the upper and 39% of the lower eyelids had meibomian gland dropout across all patients.[8] Electronic device use did not correlate with meibomian gland dropout in this specific study, but other studies have found a link between excess "screen time" and the development of DED, which has only been exacerbated due to the COVID-19 pandemic.[9-11]

"On average, our blink rate significantly drops from about 22 to about 4 blinks per minute when we're staring at a monitor. That decrease and drop then interferes with the meibum coming out of the meibomian glands because they're not getting that muscular activity of the lids blinking. As a result, the meibum stagnates, alters its viscosity, and the glands become inspissated," Dr. Matossian explained.

Staring at a screen may also cause the eyes to open wider than normal, subjecting them to more evaporation, which can worsen dry eye symptoms.

"Kids do have dry eye," Dr. Nichols said. "When you think about the lifetime of their eyes, dry eye is really important to try to address because of their age. You want their vision and the comfort of their eyes to be good. It's really important to look for it in younger kids."

Another risk factor that clinicians may not think of is the use of CPAP machines for patients with sleep apnea. "No matter how good of a fit it has around the nose and mouth, there's always some level of retrograde air flow loss that escapes directly to the eye, affecting the tear film," Dr. Matossian explained.

THE LINK BETWEEN DED AND MGD

The vicious cycle of dry eye consists of many pathways.[12] The tear film consists of three layers: the lipid, aqueous, and mucus. Tears provide a smooth, refractive surface for optimal vision, help maintain ocular surface health, protect the cornea, and provide

lubrication. The lipid layer stabilizes the tear film and reduces tear evaporation. Meibomian gland function is a critical factor in maintaining ocular surface health and tear film stability.[13,14] Meibomian glands are in the upper and lower eyelids. With each complete blink, eyelid muscles release meibum, a protective lipid, from the glands. The upper lid then helps spread meibum across the ocular surface.

If the function of the meibomian glands is disrupted, the quality and quantity of meibum is compromised, which in turn affects ocular surface health, causing hyperosmolarity, apoptosis, and cell damage on the ocular surface. Known as meibomian gland dysfunction (MGD), obstruction of the meibomian glands is a primary cause of ocular surface disease, affecting about 40% of patients.[15,16]

"MGD-related changes in the tear lipid layer leads to tear film instability, tear hyperosmolarity, and death of conjunctival and corneal cells via apoptosis. As a compensatory response to tear hyperosmolarity, we get this chronic neural drive stimulating the lacrimal gland and accessory glands, and this leads to neurogenic inflammation," said Jay S. Pepose, MD, PhD. "Then, through the mitogen-activated protein kinase pathway, there is release of cytokines and activation of matrix metalloproteinases. We then we lose goblet cells, which leads to more tear film instability. You see how this becomes a self-perpetuating cycle."

Patients will have trouble getting a healthy oil layer if the glands are clogged and the lipid looks like toothpaste. "They're going to be chronically dry and evaporating," Kenneth A. Beckman, MD, said.

Diagnosing DED and MGD

Many patients don't realize their complaints are dry eye related, therefore clinicians should listen for subtle verbal clues.

"Some patients will say, 'I stop to close my eyes in the evening' or 'I need to take my contact lenses out, because I just can't see anymore,'" Dr. Nichols said. "That's because they're not surfacing that contact lenses with tears. If a patient says these things, that's a red flag."

MGD can be graded by the area of loss (Figure 1) or by classifying the disease as mild, moderate, or severe.[17]

"Sometimes the meibomian glands can look really healthy, but they could be dysfunctional," Dr. Matossian said. "Don't let the architecture fool you. They can be pristine in architecture, yet nonfunctional."

To properly assess the meibomian glands, clinicians should perform the "look, lift, push, and pull" technique during an exam: look at the lids, blink, lashes, and interpalpebral surface; lift the upper eyelid; push on the glands to assess the health of the meibum; and pull on the lids.

"Not only do you want to look at structure, you also want to examine the lid margin for capped glands, cicatricial changes, telangiectasias, and maybe the lid getting pulled posteriorly. Those are all tip-offs that something's not right with the meibomian glands," Dr. O'Dell said.

Before manually expressing the gland in the office, Dr. Nichols recommends that clinicians warm them up with a mask. Pressure on the glands should be gentle, but firm and consistent; the lid margin should not redden with pressure.

"When you do any kind of expression, you have to be patient," Dr. Nichols said. "If you use your finger, cotton swab, or expression tool, you have to hold it there for a little bit and wait. You should also do more than one pass to fully assess the quality of the secretion."

Corneal staining, tear breakup time, tear osmolarity, and matrix metalloproteinase-9 (MMP-9) testing should also be performed.[18] Dr. Matossian recommends that clinicians use meibography, which can tell you the percentage of gland loss in patients and track their progress over time.

"These diagnostic tools really help us as physicians cinch the diagnosis. It helps patients see their meibography, see that red strip on their MMP-9 test, or see the abnormal tear osmolarity numbers," she said. "We need diagnostics to monitor the effect of our treatment as well as help the patient and us make the proper diagnosis."

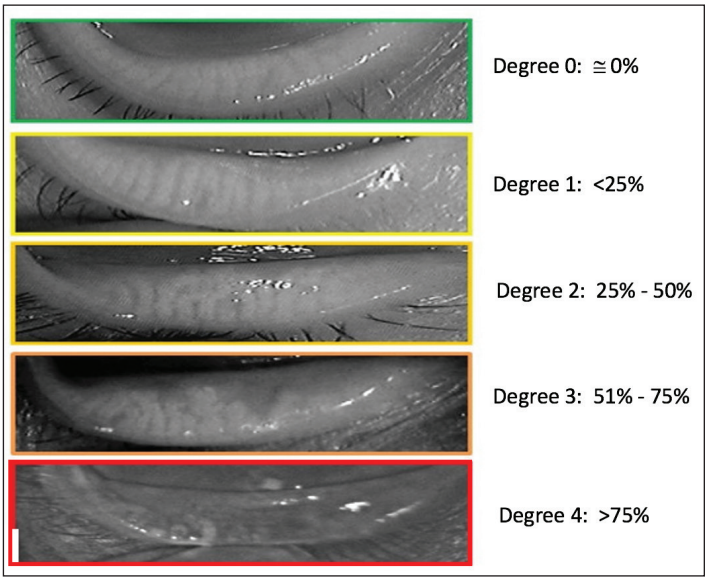

Figure 1. Staging of progressive loss of meibomian gland structure with meibography examples.[17]

Dr. Pepose agrees that meibography is an important diagnostic tool, especially for patient education to help motivate them to care for their chronic condition.

"The analogy that I give is going to the dentist," Dr. Pepose explained. "When you go to the dentist, they do a deep cleaning using ultrasound and equipment that you don't have at home. You undergo this office treatment periodically because you want to maintain the health of your gums and your teeth, but you still have to brush your teeth and floss at home as maintenance therapy. The message I give to patients is that MGD is a chronic condition, and they must do their part. Some of that will be done through home care, and some will be done in the office."

Grading with meibography is subjective, however, which may present challenges for clinicians due to a lack of consistency.

"There has been quite a bit of research looking at the repeatability of gradeability of meibography," Dr. Nichols said. "It's not great, one person (grader) compared to another. But if you practice and work on your consistency, you do improve."

For these reasons, there is great interest in using some artificial intelligence-based approaches to diagnose MGD.[19] Researchers have implemented deep learning algorithms into automated grading of meibomian glands, but these have yet to be employed in a clinical setting.[20,21]

"The end goal is to have a computer grade MGD or grade a meibomian gland image reliably so a clinician doesn't have to. That way the computer can give you a number that you can track over time," Dr. Nichols explained. "We're not that far off, but it doesn't exist right now. In the meantime, we need to practice being better within ourselves at grading so that you can be consistent between visits."

Because many patients, 20% or more,[22] are asymptomatic and may not believe they have MGD, Dr. Matossian recommends showing the patient an enlarged photo of their eyelid margin so they can see the clogged glands for themselves.

"If the patient doesn't believe that there's something wrong, do you think they're going to pay for medications out-of-pocket that they'll have to use chronically or agree to cash pay procedures to help their meibomian glands?" Dr. Matossian asked. "Absolutely not. It's a chronic disease. We already know compliance really goes downhill with most chronic diseases. If they don't see it, they're not going to buy into it."

CURRENT AND FUTURE TREATMENTS FOR MGD

The first step in determining a treatment regimen for MGD is addressing its underlying pathophysiology.[12]

"There are two forms of MGD," Dr. Pepose said. "We see patients who have inspissation of the meibomian glands and hyposecrete, and then there are patients with rosacea, for example, who hypersecrete. In both cases, the consistency of the meibum is changed."

Treatments for MGD are listed in the Table and include antibiotics (including macrolides and tetracyclines), steroids, cyclosporine, essential fatty acids, diquafosol, intraductal meibomian gland probing, electronic heating devices, intense pulsed light therapy, and electrotherapy.[19]

TABLE. TREATMENTS FOR MGD[19]

PHARMACEUTICALS	PROCEDURES	NUTRACEUTICALS
Immunomodulators	Heated masks	Omega-3
Pulse topical steroids	Manual gland expression	Tea tree oil
Topical and systemic antibiotics	Mechanical warming and evacuation (thermopulsation)	
Lid wipes and hypochlorite sprays	Intense pulsed light	
Lipid containing tears and sprays	Mechanical cleansing and micro-blepharo-exfoliation	

Topical or systemic antibiotics are useful because with inspissation, meibomian gland secretions convert from unsaturated lipids that melt at body temperature to saturated fats that further inspissate the meibomian glands and promote growth of bacteria. Commensal bacteria secrete esterases and lipases that changes meibum viscosity and break down lipids from soaps to fatty acids, leading to inflammation, hyperkeratinization, and a foamy tear film. Topical azithromycin or systemic doxycycline or azithromycin are useful in altering fatty acid metabolism and reduce the expression of matrix metalloproteinases and inflammatory cytokines.[23,24]

Prescription immunomodulators have been available for years, with more options on the horizon, and include cyclosporine ophthalmic emulsion 0.05%, lifitegrast ophthalmic solution 5%, cyclosporine ophthalmic solution 0.09% formulated with nanomicelle technology, and preservative-free compounded cyclosporine 0.1% ophthalmic emulsion in chondroitin sulfate.[25-29] Short-course topical corticosteroids may have a role, either as induction therapy along with cyclosporine or lifitegrast or as brief treatment with lid hygiene in moderate and severe MGD.[30]

Although generic immunomodulators are on the market, they have not been available long enough for clinicians to have a strong handle on any meaningful differences in terms of efficacy and tolerability.

"I know a few of my patients have actually been switched from branded to generic immunomodulators, but it's a very small number, smaller than I would've anticipated," Dr. O'Dell said. "My concern with branded versus generic is tolerance effectiveness. I think the generic would have more burning and stinging."

In-office procedures include thermal pulsation system (TPS), intense pulsed light (IPL), and micro-blepharo-exfoliation. The TPS delivers heat and pressure to the meibomian glands to liquify obstructed meibum and has been shown to improve meibomian gland score, tear breakup time, and OSDI scores.[31-33] Patients also find it comfortable, comparing it to getting a facial.

PANEL Q&A

Q: ***If a patient comes in for a cataract evaluation and you see staining, inflamed dry eye, or high osmolarity, how do you prepare their ocular surface for surgery?***

Jay S. Pepose, MD, PhD: I would pulse them with a topical steroid, but I would concomitantly put them on something that can be sustained long term. For example, I might put them on a steroid with lifitegrast or a steroid with a cyclosporine. Then I would bring them back and repeat biometry.

Cynthia Matossian, MD, FACS: I would treat very aggressively, perhaps do an in-office procedure, and get them on a steroid short term. I also explain that they have two diseases: cataract and dry eye. I tell them that I can cure the cataract but not the dry eye; they will need to treat the dry eye forever to control it. I don't hide these facts from my patients.

Q: ***Is it necessary to give every patient who comes in for cataract evaluation MMP-9 or test tear osmolarity or do you only test the patients who have staining?***

Kenneth A. Beckman, MD: You should start with a questionnaire. I do like to do staining and assess tear breakup time. I also get an osmolarity for my cataract evaluations. I don't routinely do InflammaDry MMP-9 testing right off the bat. However, if I find that I need to get them started on treatment, I may do that at the follow-up visit. To me, the most important test is the staining because that is what will throw off your K readings and topography resulting in inaccurate calculations.

Dr. Pepose: Particularly, central staining is going to have a major impact. I look not only at osmolarity, but at the difference between the two eyes with regard to osmolarity and if the difference is 8 mOsm/L or more, that is a red flag.

Dr. Beckman: That's an important point; you need to check osmolarity in both eyes, even if you're only operating on one. We talk about an abnormal osmolarity being high, but there's also an intra-eye difference. You can have two normal osmolarities, one could be 275 mOsm/L and the other 295 mOsm/L, but you shouldn't have that kind of variance between eyes.

Dr. Matossian: I agree; I check both eyes. I also do MMP-9 as well tear osmolarity and meibography. Those are my standard triad. Every cataract consult is a dry eye consult for me.

Dr. Beckman: We have to recognize that not all of these tests are available, and there's a cost to them. MMP-9 is not a requirement. To me, the requirement is thinking about dry eye and asking the questions. Staining and measuring tear breakup time are easy; the other tests are preference. Of course, I would like to do every test during a dry eye workup, but each one I do potentially interferes with something else. Once you do the osmolarity, you irritate. Is it going to trigger reflex tearing? You have to be practical.

Q: ***When do you switch the patient to a different contact lens versus push harder for dry eye solutions?***

Leslie O'Dell, OD, FAAO: I still am a big believer of daily wear contacts. If a patient is wearing a monthly lens or an extended-wear lens, I might make that jump to a daily wear while I'm improving the lipid. You can change two things at once.

Kelly Nichols, OD, MPH, PhD, FAAO: I agree that you can change two things at once. However, you shouldn't have the mindset of just changing the contact lens because that will not address the underlying conditions. Years ago in contact lens surveys, when asked what to do with dry eye patients, changing the lens was the first recommendation, followed by changing the contact solution. Third down the line was starting a dry eye therapeutic. Now that option is moving up the list. People are starting to think of moving to daily disposables, addressing the meibomian glands in their patients, or reducing inflammation by adding an immunomodulator at the same time. Going to a daily disposable modality is probably the easiest thing first, but you have to treat the underlying condition.

"I've had patients fall asleep while getting it," Dr. Beckman said. "Although it may not cure them, some patients will repeat the procedure in the same way that someone may go to the chiropractor or get a massage periodically. It feels good in the moment, and it lasts for a while."

Dr. Matossian recommends putting patients on a short-course topical steroid or NSAIDs after the TPS procedure to extend the anti-inflammatory effect. "We've just evacuated all this inflamed content out of the glands after pulsation," she said. "I like to cover it with 7 days of NSAIDs or steroids."

A recent study assessed the impact of the TPS on astigmatism management in patients with MGD undergoing cataract surgery,

finding that after a single treatment, the TPS reduced astigmatism in 24%. A little more than half of patients (52%) had more astigmatism, and 24% had no change in astigmatism.[34] These results underscore the importance of stabilizing the tear film before determining the astigmatism management method and toric IOL power and axis preoperatively.

"You need to address the ocular surface before surgery," Dr. Beckman said. "The PHACO study by Trattler et al looked at a number of preoperative cataract patients, all comers, without regard to their diagnosis of dry eyes. About 20% had a preexisting diagnosis of dry eyes, but about 75% had corneal staining. About half had central corneal staining, and a high percentage of them had a tear breakup time of less than 5 seconds.[35] You have to look for these problems, and you have to treat them aggressively before you go to surgery."

The IPL is a drug-free, drop-free, light-based treatment that targets inflammation, the root cause of MGD, by closing of abnormal blood vessels that perpetuate inflammation by leaking proinflammatory mediators.[36] The IPL is particularly effective in patients with severe MGD, but clinicians should be mindful of skin pigmentation.[37] The in-office micro-blepharo-exfoliation system uses a medical grade micro-sponge to remove debris from the eyelids while concurrently exfoliating the lash base. A tool containing an oscillating soft tip can be used at home as well to remove biofilm buildup from the lid margin.[38]

In recent years, there's been some discussion of the effectiveness of omega-3. The DREAM study found no statistically significant difference between patients taking omega-3 and placebo for DED at 6 and 12 months.[39]

"There were mixed interpretations of that study," Dr. Nichols explained. "The moral of that story has turned out to be, you can't just necessarily say that omegas don't work, but do you want to continue to prescribe them? Many clinicians continue to recommend them to their DED patients."

Dr. Nichols has found that her patients notice a difference in their dry eye symptoms when they stop taking omega-3.

"It's not necessarily just that their eyes feel different, it's their joints and everything else," Dr. Nichols said. "People do generally think they're beneficial otherwise than just for the eyes."

"DED is complex," Dr. Matossian said. "In my opinion, it's putting pieces of the puzzle in terms of different treatment modalities to attack these various arms that contribute to the entity. That's what I love about treating DED; it's not cookie-cutter. You really have to be cerebral about it and customize the treatment for each patient's level of disease and presentation of the disease."

Adding to its complexity is the fact that there may be more than one issue at play. "You need to find the underlying problem, and then approach each one individually," Dr. Beckman said. "The patient may be aqueous deficient, they may have MGD, they may have goblet cell issues on their conjunctiva, or they may have a totally normal surface but have a poor blink. You have to treat all of them."

Future Directions of MGD Treatment

Several agents are being studied for the treatment of MGD, including topical azithromycin, AZR-MD-001, CTB-006, and NOV03. Topical azithromycin is especially useful in cases of MGD in association with rosacea as it has an anti-inflammatory action and properties that help control bacterial flora. Although azithromycin is available in the United States, it's for the treatment of conjunctivitis and has not gone through a registration study for MGD specifically. A phase 4 study on azithromycin on tear film thickness in MGD is currently recruiting (NCT03162497).[40]

AZR-MD-001 is a novel formulation of selenium sulfide under development for MGD (NCT03652051).[41] A phase 2 study on AZR-MD-001 met its primary endpoints of improvements in signs and symptoms of MGD.[42]

"The mechanism of action makes sense," Dr. Pepose said. "It promotes the breakdown of disulfide bonds in keratin, slows the production of abnormal keratin, and stimulates meibum production.

"When you think of a patient who has keratin plaques plugging the meibomian gland orifices on the lid margin, and you just want to scrape it off and do a little lid debridement, that is the kind of patient AZR-MD-001 might benefit," Dr. Pepose continued. "You can imagine that the meibomian gland orifices, the central ducts, and the meibum matrix are getting blocked with keratin that's abnormal. If keratins are being upregulated, and you want to clear that out rather than scraping the plugs off, this treatment might hit that mark."

CBT-006 is a molecule under development that can dissolve cholesterol and lipids deposited in meibomian glands (NCT04884243).[43] If approved, the investigational drug NOV03 would be the first drug to treat both DED and MGD. NOV03 is 100% perfluorohexyloctane and is intended to stabilize the lipid layer and penetrate the meibomian glands. NOV03 uses water-free technology to prevent tear evaporation, restore tear film balance, and potentially dissolve thickened meibum (NCT04567329).[44]

"We have a lot to look forward to," Dr. Pepose said. "I think that we certainly all would agree that we need more in our armamentarium for MGD, particularly for chronic use to help maintain patients."

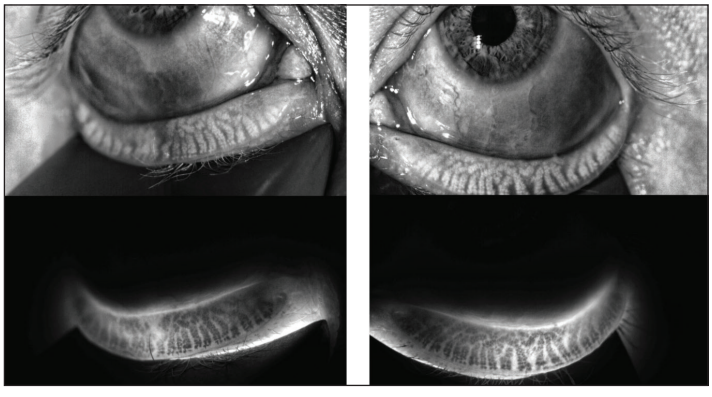

Figure 2. Meibography imaging in patient with contact lens discomfort.

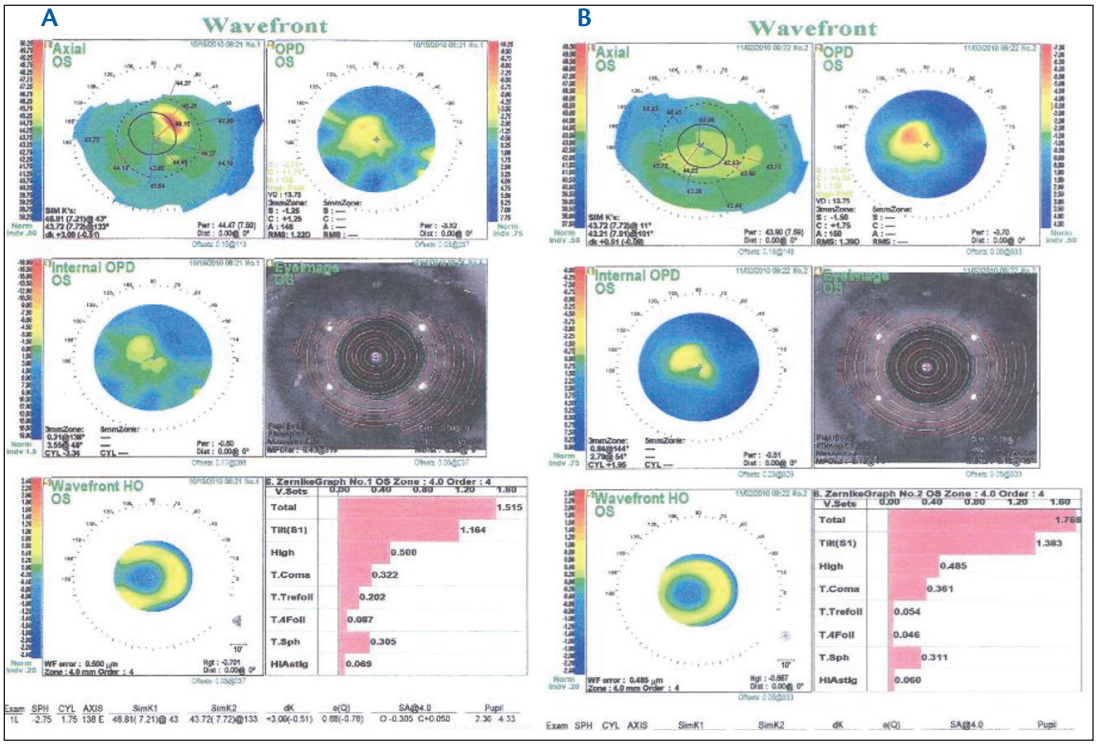

Figure 3. Topography in a patient with MGD referred for cataract surgery before (A) and after (B) treatment.

CASE DISCUSSION

Patient With Contact Lens Discomfort

A 51-year-old White man presents for a routine vision exam with increased mid- to late-day discomfort from his multifocal contact lenses. He is a sales executive who spends many hours a day on digital devices and driving on the highway. He is concerned about the comfort of his contact lenses and is considering moving to full-time use of his glasses. His vision is 20/20 OU, osmolarity is 311 mOsm/L OD and 325 mOsm/L OS, SPEED test score was 16 out of 28, and his tear breakup time was 5.8 OD and 3.8 OS. No MMP-9 was detected, but he does have meibomian gland drop out with 4 MGLYS OD and 2 MGLYS OS.

"In contact lens wearing patients, 10 to 12 glands should be active for that patient to feel comfortable in their lenses," Dr. O'Dell said.

Figure 2 shows meibography imaging, which Dr. O'Dell classified as "monochromic."

"I would call that thin lipid," she continued. "It's not perfect, but it's not horrific."

Dr. O'Dell treated the patient with LipiFlow, and his SPEED score improved to 0 out of 28. His contact lens comfort also improved.

"His signs and symptoms improved, and his MGLYS went from 4 to 10 OD and 2 to 6 OS. He may not be at the end of his DED journey and could have coexisting rosacea. I may decide to add treatments after continued follow-up," Dr. O'Dell said. "The take-home message is when you have a patient complaining about contact lens discomfort, evaluate their meibomian glands before switching their lenses."

Cataract Surgery for a Patient With MGD

A patient was referred to a cataract surgeon for surgery from the optometrist requesting a toric intraocular lens. The patient complains of decreased vision; difficulty reading, which is worse at the end of the day; dryness and irritation; and tearing and mattering in his lashes in the morning. The slit lamp exam reveals thickened meibomian secretions with plugging and debris in the tear film and lashes with rapid tear breakup time. Topography (Figure 3A) shows an irregular oblique astigmatism.

"If you look at the top left on the axial photo, there's a red hotspot," Dr. Beckman said. "That's not a classic bow-tie astigmatism. Then in the second picture on the right of the first topography, you see the Placido disc. If you look at the corresponding location, there's an indentation or a divot in the mires. This is a red flag and jumps out at me as something's wrong."

Dr. Pepose and Dr. Matossian agreed.

"If you move forward with cataract surgery, you're going to end up either overtreating or undertreating, but probably overtreating," Dr. Matossian said. "It could be as pseudo-astigmatism due to the dry spot."

The patient was treated with warm compresses, lid scrubs, preservative-free tears, and azithromycin for 2 weeks, which improved secretions, staining, and tear breakup time. Upon repeat topography, the hot spot disappeared and the astigmatism reduced from 3.00 D to .50 D.

"This patient had 2.50 D of pseudoastigmatism strictly from tear film instability," Dr. Matossian said.

The panel concluded that the patient was not a candidate for toric lenses, opting for a simple aspheric monofocal instead. Dr. Pepose also urged caution when considering this untreated patient for a presbyopia-correcting intraocular lens (IOL) "because in the setting of MGD and tear film instability it could result in fluctuating vision, scatter, and complaint of low contrast and ghosting of the image."

The panel stated that the take-home message of this case is to treat the ocular surface prior to cataract surgery. Not treating the ocular surface will result in inaccurate IOL calculations. "We would have been completely wrong with the IOL selection," Dr. Beckman said. ■

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THE KEY TO EFFECTIVE MGD MANAGEMENT

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DEMOGRAPHIC INFORMATION

Profession
___ MD/DO
___ OD
___ NP
___ Nurse/APN
___ PA
___ Other

Years in Practice
___ >20
___ 11-20
___ 6-10
___ 1-5
___ <1

Patients Seen Per Week
(with the disease targeted
in this educational activity)
___ 0
___ 1-15
___ 16-30
___ 31-50
____ >50

Region
___ Midwest
___ Northeast
___ Northwest
___ Southeast
___ Southwest

LEARNING OBJECTIVES

Did the program meet the following educational objectives?	Agree	Neutral	Disagree
Summarize the clinical signs and symptoms of dry eye disease (DED).	_____	_____	_____
Recognize and explain meibomian gland dysfunction (MGD)-related DED pathology	_____	_____	_____
Discuss the current and emerging methods in diagnosing MGD	_____	_____	_____
Develop individualized treatment plans for patients with DED	_____	_____	_____
Describe the mechanisms of action for current and emerging agents	_____	_____	_____

POSTTEST QUESTIONS

Please complete at the conclusion of the program.

1. Based on this activity, please rate your confidence in your ability to diagnose and treat meibomian gland dysfunction (MGD) (based on a scale of 1 to 5, with 1 being not at all confident and 5 being extremely confident).

a. 1
b. 2
c. 3
d. 4
e. 5

2. All of the following are predisposing factors to dry eye disease (DED) EXCEPT:

a. Older age
b. Female gender
c. Male gender
d. Contact lens wear

3. How do antibiotics help treat DED?

a. Alter fatty acid metabolism and reduce the expression of matrix metalloproteinases and inflammatory cytokines
b. Increase turnover of conjunctival goblet cells
c. Direct effect on aqueous layer secretion
d. Antibiotics are not effective in the treatment of DED

4. A 56-year-old woman presents to your office with DED. After hearing about her treatment options, she is most interested in thermal pulsation treatment. She asks how this treatment might impact her current vision, as she is currently spectacle independent. What is the best answer for this patient?

a. Your refraction will not be impacted by thermal pulsation treatment
b. You may have a change in the amount of astigmatism after thermal pulsation treatment
c. Your refraction will be impacted by thermal pulsation treatment, but you will still be spectacle independent
d. Thermal pulsation treatment will increase your astigmatism and you will be dependent on spectacles

5. A 52-year-old white man presents to your office for routine eye exam. He notes significant mid- to late-day eye discomfort, with itching, tearing, and burning. He is a contact lens wearer. On exam, you note 2+ punctate epithelial erosions in bilateral corneas, with no MGD noted. What is the next best step in treatment?

a. Intense pulsed light therapy
b. Microblepharoexfoliation
c. Contact lens holiday and frequent artificial tears treatment
d. Oral steroids course

6. A 55-year-old woman presents to your office for evaluation. She notes frequent itching and burning sensation, especially at the end of the day. She spends many hours on digital devices. Exam reveals decreased tear breakup time OU, with meibomian gland inspissation OU. All of the following represent reasonable treatments for this patient, EXCEPT:

a. Intense pulsed light therapy
b. Micro-blepharoexfoliation
c. Topical azithromycin or systemic doxycycline
d. Intravenous steroid treatment

7. All of the following are common dry eye complaints EXCEPT:

a. Eye fatigue
b. Spiderwebs/cobwebs in vision
c. Transient blurred vision
d. Burning/itching

8. Which of the following statements about the relationship between DED and age is TRUE?

a. Studies show increasing DED prevalence with age
b. Studies show decreasing DED prevalence with age
c. Studies show no correlation between DED prevalence and age
d. Studies show increasing DED prevalence with age, but only until age 49 years

9. A 56-year-old man with primary open-angle glaucoma presents to your office for evaluation. He's currently on latanoprost OU every night at bedtime and dorzolamide/timolol OU twice daily. He has a history of LASIK and currently wears contact lenses. He notes frequent eye fatigue and occasional burning and itching. On exam you note MGD, punctate epithelial erosions, and 1+ cortical cataracts in both eyes. All of the following likely contributed to this patient's dry eye EXCEPT:

a. Contact lens wear
b. LASIK surgery
c. Glaucoma medications
d. Cataracts

10. On average, what percentage of patients in a practice have signs of MGD?

a. ~10%
b. ~20%
c. ~30%
d. ~40%

11. A 76-year-old man presents to your office for cataract evaluation. He notes eye fatigue and itchy, burning eyes bilaterally. He also notes blurry vision. He has 2+ NS in both eyes and significant astigmatism. You implant a toric lens and complete an uneventful surgery. At his 1-week postoperative visit, he is very unhappy and complains of blurry vision and distortion in his operative eye. His exam reveals a clear cornea, with a well-centered posterior chamber intraocular lens. His autorefraction shows 2.00 D of cylinder. What might be a reason for this result?

a. Astigmatism induced from the cataract main incision leading to postoperative cylinder
b. Astigmatism induced from the side port incision leading to postoperative cylinder
c. Failure to diagnose DED prior to surgical lens calculations, leading to improper lens implanted
d. Edema from the corneal wounds inducing postoperative cylinder

12. A 45-year-old woman presents to your office for evaluation. She notes red, itchy eyes, blurry vision, and eye fatigue. On examination, you note meibomian gland inspissation in both eyes. Which of the following is a reasonable first treatment option for this patient?

a. Topical or systemic antibiotics
b. Oral steroid
c. Topical antihistamine
d. Oral antihistamine

13. Why might the signs and symptoms of DED not align?

a. Dry eye diagnostics are not sensitive enough to diagnose DED
b. Patients with late-stage disease may not be symptomatic but will have significant clinical signs
c. Patients with early stage dry eye will always have corneal staining but will be highly symptomatic
d. Patients are not forthcoming with reporting their dry eye symptoms

14. You are seeing a 15-year-old patient in your office for evaluation. He notes burning, itching, and eye fatigue after using his electronic device. He reports blurry vision frequently throughout the day that resolves upon blinking. His medical history is significant for asthma, allergic rhinitis, and acne. His current medications include a rescue inhaler for his asthma, a steroid nasal spray for his allergic rhinitis, and isotretinoin. He is also on a vegan diet. What is the most likely cause of this patient's complaints?

a. MGD secondary to inhaler use for asthma
b. MGD secondary to nasal spray use for allergic rhinitis
c. MGD secondary to isotretinoin
d. MGD secondary to vegan diet

ACTIVITY EVALUATION

Your responses to the questions below will help us evaluate this activity. They will provide us with evidence that improvements were made in patient care as a result of this activity.

Rate your knowledge/skill level prior to participating in this course: 5 = High, 1 = Low____

Rate your knowledge/skill level after participating in this course: 5 = High, 1 = Low____

This activity improved my competence in managing patients with this disease/condition/symptom. _____ Yes _____No

Probability of changing practice behavior based on this activity: _____High _____ Low _____No change needed

If you plan to change your practice behavior, what type of changes do you plan to implement? (check all that apply)

Change in pharmaceutical therapy _____
Change in nonpharmaceutical therapy _____
Change in diagnostic testing _____
Choice of treatment/management approach _____
Change in current practice for referral _____
Change in differential diagnosis _____
My practice has been reinforced _____
I do not plan to implement any new changes in practice _____

Please identify any barriers to change (check all that apply):

_____ Cost
_____ Lack of consensus or professional guidelines
_____ Lack of administrative support
_____ Lack of experience
_____ Lack of time to assess/counsel patients
_____ Lack of opportunity (patients)
_____ Reimbursement/insurance issues
_____ Lack of resources (equipment)
_____ Patient compliance issues
_____ No barriers
_____ Other. Please specify: _____

The design of the program was effective for the content conveyed	___ Yes	___ No
The content supported the identified learning objectives	___ Yes	___ No
The content was free of commercial bias	___ Yes	___ No
The content was relative to your practice	___ Yes	___ No
The faculty was effective	___ Yes	___ No
You were satisfied overall with the activity	___ Yes	___ No
You would recommend this program to your colleagues	___ Yes	___ No

Please check the Core Competencies (as defined by the Accreditation Council for Graduate Medical Education) that were enhanced through your participation in this activity:

_____ Patient Care
_____ Practice-Based Learning and Improvement
_____ Professionalism
_____ Medical Knowledge
_____ Interpersonal and Communication Skills
_____ System-Based Practice

Additional comments:

_____

_____ I certify that I have participated in this entire activity.

This information will help evaluate this activity; may we contact you by email in 3 months to inquire if you have made changes to your practice based on this activity? If so, please provide your email address below.

_____

_____

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