

Optimizing Vision Across Generations



Highlights of a CME Symposium

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This continuing medical education (CME) activity captures content from a symposium held on October 18, 2014, in Chicago, Illinois.

ACTIVITY DESCRIPTION

Advances in contact lens technology, laser vision correction, and cataract surgery have allowed for increased opportunities for addressing the vision needs of patients of all ages and particularly for individuals seeking reduced spectacle dependence. This monograph uses the case histories from multiple generations within a single family as a framework for an expert panel discussion, covering strategies for optimizing success and patient satisfaction with contact lens wear, LASIK, and cataract refractive surgery.

TARGET AUDIENCE

This activity is intended for ophthalmologists.

LEARNING OBJECTIVES

Upon completion of this activity, participants will be better able to:

- Discuss strategies for managing contact lens wear in patients with ocular surface disorders
- Assess and treat ocular surface disorders prior to refractive and cataract surgery, and counsel patients about the need for ocular surface rehabilitation
- Select best practice anti-inflammatory and anti-infective regimens to prevent postoperative complications
- Counsel patients effectively on intraocular lens options
- Evaluate newer surgical devices and technologies on efficacy, safety, and clinical utility

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Optimizing Vision Across Generations

INTRODUCTION

Advances in contact lens technology, laser vision correction, and cataract surgery have allowed for increased opportunities for addressing the vision needs of patients of all ages and particularly for individuals seeking reduced spectacle dependence. However, multiple issues have an influence on patient outcomes and satisfaction.

Using the case histories from multiple generations within a single family as a framework for an expert panel discussion, strategies for optimizing success with contact lens wear, LASIK (laser-assisted in situ keratomileusis), and cataract refractive surgery are highlighted.

OPTIMIZING VISION WITH CONTACT LENSES

A 15-year-old girl presents to her ophthalmologist complaining of difficulty with reading and difficulty seeing the blackboard in school. She also has headaches at the end of the day. Her manifest refraction is +1.00 D in both eyes.

Dr Donnenfeld: Which additional tests should be performed on this patient?

Dr Henderson: It is always important to do a cycloplegic refraction in children, especially those with hyperopia. It is also important to examine for strabismus, because there can be an esophoria with uncorrected large hyperopic errors.

On cycloplegic examination, her refraction is +3.50 D OU, and she has 10 prism diopters esophoria without correction. The patient says she does not want to wear plus glasses.

Dr Donnenfeld: What power contact lens would you prescribe?

Dr Henderson: You would want to prescribe as much plus power as possible. I might start with +1.00 D and then incrementally add +0.25 D to see if the patient will tolerate the additional plus power, especially for reading.

Dr Donnenfeld: When recommending contact lenses or glasses to a patient who is accommodating significantly, I generally push plus lenses as far as the patient will accept the refraction. I then add an additional +0.25 D or +0.50 D more plus, and the patient will accept that over a few days.

I also like to prescribe a drop of cyclopentolate 1% at bedtime to produce cycloplegia and help break the accommodative spasm when the patient wakes up in the morning.

*The patient is fitted with extended-wear contact lenses. Five years later she presents with contact lens intolerance, complaining of ocular irritation, persistent itching, and foreign body sensation. Findings on examination are best-corrected visual acuity (BCVA) 20/20 OU, clear corneas, 1+ conjunctival injection, debris and stringy mucus in the tear film, and 1+ meibomian gland dysfunction. The image from her slit-lamp photograph appears in **Figure 1**.*

Dr Donnenfeld: What is your diagnosis?

Dr Kim: I suspect giant papillary conjunctivitis (GPC), based on her symptoms, the presence of stringy mucus, and the likelihood, considering her age, that she may not be adhering to the recommended regimen for contact lens wear. GPC is an immune-mediated inflammatory condition that develops when a foreign body in the eye causes chronic mechanical irritation. In this case,

the foreign body is the contact lens. Other possible etiologies include an exposed suture or an ocular prosthetic. To confirm the diagnosis of GPC, I would flip the superior lid to check for cobblestone papillae on the upper tarsal conjunctiva (**Figure 2**).

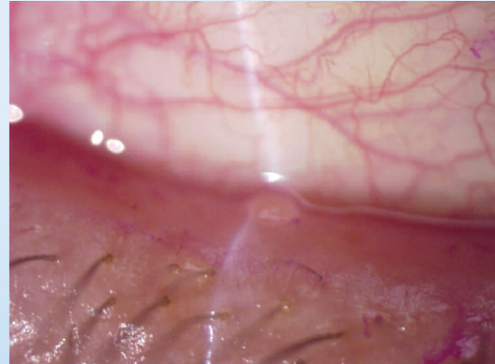


Figure 1. This slit-lamp image shows evidence of meibomian gland dysfunction and findings consistent with giant papillary conjunctivitis. Note the meibomian cyst and conjunctival injection, along with debris and stringy mucus in the tear film.

Photograph Courtesy of Terry Kim, MD

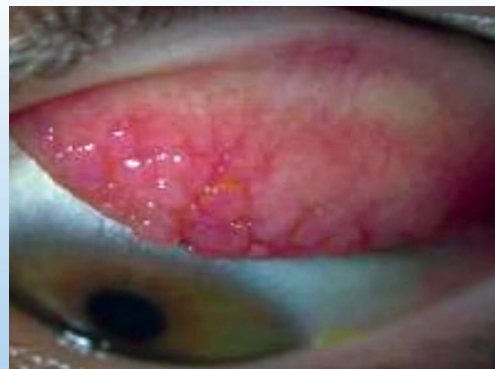


Figure 2. Eversion of the superior lid reveals giant cobblestone papillae on the tarsal conjunctiva, which is diagnostic of giant papillary conjunctivitis.

Photograph Courtesy of Terry Kim, MD

The upper tarsal conjunctiva shows large cobblestone papillae. Further evaluation shows a Schirmer test result of 4/5 OD/OS and 1+ lissamine green conjunctival staining nasally, indicating the patient also has dry eye disease.

Dr Weinstock: Dry eye is common in contact lens wearers and may coexist with ocular allergy; the 2 conditions can exacerbate each other. Because they share some overlapping, nonspecific features, it is important to conduct a comprehensive evaluation to make an accurate diagnosis that will determine the best treatment. In addition to the usual clinical examination and history, a noninvasive skin test for diagnosing allergy recently became available. It is an easy test that ophthalmologists can perform in the office to determine if the patient is allergic and to identify the specific cause of the allergy. The test includes positive and negative controls and uses panels of allergens that are specific to geographic regions.

Dr Donnenfeld: The ability to do allergy testing and the availability of new objective tests for dry eye, including tear osmolarity and detection of matrix metalloproteinase-9 (MMP-9), are great advances for improving our diagnostic capabilities. There are also new techniques for imaging the meibomian glands.

We will now talk about the management of GPC. The easiest solution for the eye care professional is to have the patient stop wearing contact lenses. This is often not an option for many patients, and so I change the patient to daily wear soft contact lenses or even gas permeable lenses that have the least risk for GPC.¹

For medical management, I use a dual-acting antihistamine/mast cell stabilizer. There are several good prescription options, including bepotastine, olopatadine, and alcaftadine. I prefer bepotastine because it seems to have low potential for causing ocular dryness because of its higher H1 antihistamine potency and lower antimuscarinic activity.²

I also believe judicious use of a topical corticosteroid is important for managing GPC, and I consider loteprednol, 0.2%, a good choice because of its low propensity for increasing intraocular pressure (IOP).³

Dr Kim, how would you manage a patient who has GPC and dry eye?

Dr Kim: The first step is to have the patient stop contact lens wear. Then, I typically start medical treatment with an antihistamine/mast cell stabilizer and add a corticosteroid only if the GPC is very severe or if the patient has an insufficient response to the antihistamine/mast cell stabilizer alone. I agree that there is an advantage for using loteprednol to minimize the risk for IOP elevation, but I might prescribe the 0.5% concentration rather than the 0.2%, depending on disease severity. I think patients who have dry eye also would benefit from topical cyclosporine, and typically that is much better tolerated when the patient is already using a topical corticosteroid.^{4,5}

Dr Donnenfeld: I think there are many ophthalmologists who do not realize that cyclosporine also can be very useful for managing severe ocular allergy.^{6,7}

Dr Henderson, how would you treat this patient?

Dr Henderson: I am more cautious about prescribing a corticosteroid in younger patients than I am in adults. So, I probably also would start with an antihistamine/mast cell stabilizer and add a corticosteroid if needed.

Dr Weinstock: When a patient presents with a red, painful eye associated with a severe allergic or inflammatory reaction and is very uncomfortable, I think it is important to treat that patient, even a pediatric patient, with a corticosteroid to shut down the inflammation quickly. I use a short pulse regimen of loteprednol or even prednisolone. Once the reaction quiets down, I quickly taper the corticosteroid and have the patient continue on an antihistamine/mast cell stabilizer.

Dr Donnenfeld: I believe that some clinicians are not aggressive enough in their use of corticosteroids to manage allergy as well as dry eye. For GPC, treatment with 2 medications that work via different mechanisms can accelerate the response, so a 2-week course of the corticosteroid may be sufficient.

Dr Henderson: We often talk about synergy from using a corticosteroid with a nonsteroidal anti-inflammatory drug (NSAID) to control inflammation after cataract surgery, so we probably can think about the combination of a corticosteroid with an antihistamine/mast cell stabilizer in the same way for managing severe ocular allergy. On that basis, I am changing my mind and would not wait to start a topical corticosteroid in the patient we are discussing.

Dr Donnenfeld: The patient was started on a topical antihistamine/mast cell stabilizer and topical cyclosporine. She was bothered by burning and irritation with cyclosporine. Dr Kim mentioned earlier that a corticosteroid can improve tolerance to cyclosporine, and there is also synergism with the 2 medications. Results from a multicenter, randomized controlled study we conducted showed that the combination of loteprednol, 0.5%, and cyclosporine worked faster and better than cyclosporine plus artificial tears for treating dry eye.⁴ Similar benefits have been reported for adding methylprednisolone, 1%, to cyclosporine.⁵

Many patients discontinue cyclosporine because of its burning and stinging. In addition, it can take up to 3 months to see a benefit from cyclosporine.⁸ Induction therapy with a corticosteroid will help with cyclosporine adherence so that patients will derive efficacy from its use.

The patient's GPC resolves. She is switched to a daily disposable contact lens, and she is maintained on a topical antihistamine/mast cell stabilizer alone.

OPTIMIZING VISION WITH LASIK

The first patient's 39-year-old father presents because he is interested in LASIK. He is an ophthalmologist who has worn contact lenses for many years. His visual acuity has been stable, but he recently began to wear reading glasses, and he has decided that he would like to get rid of his contacts.

Dr Donnenfeld: Dry eye is the most common complication of LASIK,⁹ and evaluation for dry eye and its management are important components of the preoperative assessment for patients seeking LASIK. There are multiple reasons for that. Dry eye limits the ability to obtain accurate measurements preoperatively and, therefore, compromises the predictability of the surgical outcome. In addition, LASIK can worsen preexisting dry eye, and dry eye that is present postoperatively can degrade vision. Therefore, LASIK should not be performed until a healthy ocular surface is restored.

To assess for ocular surface disease in patients seeking LASIK, I routinely measure tear osmolarity, examine the lid margins for meibomian gland dysfunction (MGD), assess corneal sensation, and do supravital dye conjunctival/corneal staining. I also test for MMP-9 if the tear osmolarity is high. I do a Schirmer test only in patients with rheumatoid disease, for whom I am concerned that tear production is absent or very low. I find the Schirmer test to be an unreliable predictor of dry eye disease.

Dr Henderson: I find I am doing a Schirmer test less often now that I am using the new objective diagnostic tests for dry eye.

Results of the Schirmer test are not consistently accurate, which makes them hard to interpret.

Dr Donnenfeld: Lemp and colleagues evaluated 6 tests for dry eye—tear osmolarity, tear film break-up time, corneal staining, conjunctival staining, Schirmer test, and meibomian gland grading—and found tear osmolarity performed the best for diagnosing disease and classifying severity.¹⁰ A study that I conducted showed that tear film hyperosmolarity prior to LASIK predicted a worse refractive outcome and worse vision if the patient did not receive treatment to manage the ocular surface disease.¹¹ As a corollary to that, we know that the accuracy of keratometry measurements before cataract surgery affects the accuracy of the refractive outcome, and a study that evaluated 67 patients at 2 visits prior to cataract surgery found greater between-visit variation in keratometry readings among patients with a hyperosmolar tear film compared with those having normal tear film osmolarity.¹²

In addition to the point-of-care tests for tear film osmolarity and MMP-9, there is a new diagnostic blood test for Sjögren syndrome that evaluates novel biomarkers. Does anyone have experience using that?

Dr Henderson: Last week I saw 2 patients who were referred to me by a rheumatologist to be tested for Sjögren syndrome. The test is easily done in the office, as it requires collecting blood from a finger prick onto a specimen card that is sent to the testing laboratory. Ophthalmologists who prefer not to draw blood in their office can give patients a laboratory order form, and, in some areas, an independent laboratory will perform the phlebotomy and send the test to be evaluated.

Dr Weinstock: I have also been using the Sjögren test and already found that it is a real game changer, especially for middle-aged women who are experiencing dry eye as an early symptom of their disease. These patients need to be started on topical cyclosporine for their ocular disease. However, Sjögren syndrome is a systemic disorder that can have an impact on function and quality of life. Early diagnosis when the patient is minimally symptomatic allows for early referral to a rheumatologist who can initiate effective systemic treatment to limit disease progression and prevent the development of permanent tissue damage.

Dr Donnenfeld: Older age and female sex are risk factors for dry eye,¹³ and I think the new blood test for Sjögren syndrome is something that should be considered particularly in women aged younger than 45 years who present with superficial punctate keratitis and perhaps a low Schirmer score, under 5 mm. Although Sjögren syndrome is much more common in women than in men, testing also should be considered in men who have unexplained low tear production. When patients are given the diagnosis of Sjögren syndrome, they are told they have a progressive vision-threatening disease that needs ongoing treatment. They are started immediately on cyclosporine and warned that it needs to be used as directed.

Topography is also an important screening test for LASIK candidates because it can identify keratoconus, irregular astigmatism, or corneal warpage from contact lenses. How long do you wait after patients discontinue contact lens wear before performing topography?

Dr Weinstock: For patients using soft contacts who have been compliant with their recommended wearing schedule, we typically wait approximately 2 weeks, but check the refraction to make sure it is stable. It is necessary to wait longer for someone who has been using a rigid gas permeable lens that is more likely to cause corneal warpage.

Dr Donnenfeld: Our rule is to wait 2 weeks for those patients wearing soft contact lenses and 1 month for every decade of rigid gas permeable contact lens wear.

*The clinical examination findings are as follows: MRSE +3.50 D OU, BCVA 20/25 OU, mild conjunctival injection and superior corneal neovascularization, 2+ lissamine green conjunctival staining, and 2+ central corneal fluorescein staining. Central corneal thickness is 590 μ OD and 595 μ OS. The patient has normal pachymetry OU by Scheimpflug imaging and a normal dilated fundus examination. The findings from corneal topography are shown in **Figure 3**.*

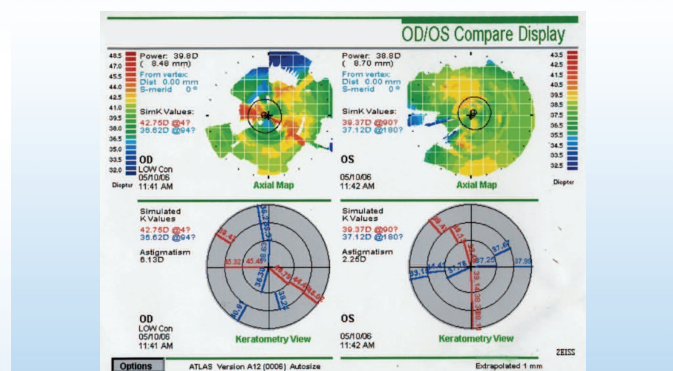


Figure 3. OD/OS Comparison—Irregular corneal topography with dropout (OU) that is consistent with dry eye disease.

Image Courtesy of Terry Kim, MD

Dr Donnenfeld: Dr Kim, what are your thoughts about the images?

Dr Kim: The map shows a lot of irregularity and moderate dropout of the mires that is fairly scattered. Findings such as these should raise a red flag to look closely for an ocular surface abnormality. This abnormality is often dry eye, but other possibilities include anterior basement membrane dystrophy or Salzmann nodular degeneration.

The patient in this case has grade 2/3 dry eye disease with contact lens overwear, and the Sjögren test is negative.

Dr Donnenfeld: Dr Henderson, how would you manage this patient?

Dr Henderson: I would do a superficial keratectomy and let the cornea stabilize before remeasuring the keratometry. I would wait at least 3 months, or even longer, depending on how well the patient is doing.

Dr Kim: I typically initiate a topical corticosteroid and topical cyclosporine simultaneously to manage ocular surface disease in LASIK patients. My preference for the steroid is loteprednol, 0.5%, gel, and I would prescribe it 4 times a day along with cyclosporine 2 times a day. Although it depends on disease severity, I typically taper the steroid weekly so that it is stopped after 4 weeks. I continue cyclosporine as needed. I also feel strongly that any patient with Sjögren syndrome should be on topical cyclosporine for life.

Dr Donnenfeld: I also like the gel formulation of loteprednol, because it stays on the ocular surface. I generally prescribe cyclosporine if patients have a positive MMP-9 test, because that enzyme is a marker of ocular surface inflammation. I may still prescribe cyclosporine if the MMP-9 test is negative and I suspect the patient has dry eye.

It is also important to address MGD, if it is present.

The patient receives management for his dry eye and follow-up shows the treatment was effective for resolving the ocular surface problems. The patient is ready to undergo LASIK. However, he is worried about infection after surgery.

Dr Donnenfeld: Dr Kim, what is the most common nonviral cause of early-onset infectious keratitis after LASIK?

Dr Kim: Results of an American Society of Cataract and Refractive Surgery (ASCRS) survey conducted in 2001 showed that atypical mycobacteria were the leading pathogens.¹⁴ In the 2008 ASCRS survey, methicillin-resistant *Staphylococcus aureus* (MRSA) was the most common cause of post-LASIK infectious keratitis.¹⁵ A multicenter review of cases of MRSA keratitis after refractive surgery found 9 of the 12 patients were health care workers.¹⁶

Dr Donnenfeld: Staphylococcal organisms are also the most common cause of endophthalmitis after cataract surgery.¹⁷ That includes MRSA, but *Staphylococcus epidermidis* is most common, and those isolates are often methicillin resistant.^{18,19}

According to the most recent data from the Antibiotic Resistance Monitoring in Ocular microorganisms (ARMOR) surveillance study published in the peer-reviewed literature, besifloxacin has the greatest activity against MRSA compared with other fluoroquinolones and other topical ophthalmic antibiotics (**Table 1**).²⁰ Therefore, I consider besifloxacin a great choice for prophylaxis in patients who are at risk for MRSA infections.

However, it is not just health care workers who are likely to be carriers of MRSA. In a study in which we obtained cultures from the lid margin and conjunctiva in patients undergoing cataract surgery, approximately 40% were colonized with MRSA, and almost 90% of those patients were not health care workers.¹⁹ The likelihood of MRSA colonization increased with age. Approximately 50% of patients aged 80 years and older had positive cultures for MRSA.

Table 1. Minimum Inhibitory Concentration Values ($\mu\text{g}/\text{mL}$) for 200 *S aureus* Ocular Isolates in the ARMOR 2009 Study*

Antibiotic	MIC Range	MIC50	MIC90
Vancomycin	0.25–2	0.5	1
Besifloxacin	≤ 0.008 –4	0.03	1
Moxifloxacin	≤ 0.008 –64	0.06	8
Ciprofloxacin	≤ 0.06 –256	0.5	256
Tobramycin	≤ 0.06 –>256	0.5	256
Azithromycin	≤ 0.25 –>512	128	>512

*Thirty-nine percent of *S aureus* ocular isolates were MRSA. MIC, minimum inhibitory concentration.

Dr Weinstock: The ARMOR in vitro susceptibility data also showed vancomycin's potent activity against MRSA.²⁰ For that reason, I use vancomycin intracamerally at the end of all my cataract surgeries.

Dr Donnenfeld: I do the same, and because MRSA is the organism I am most worried about, I also have patients use topical besifloxacin postoperatively.

While we are on the topic of cataract surgery, considering our patient who is having hyperopic LASIK, what type of intraocular lens (IOL) would you recommend if he needs cataract surgery in the future? Would you consider an aspheric monofocal IOL with negative spherical aberration, an aspheric monofocal IOL with zero spherical aberration, a standard spherical monofocal IOL, a multifocal IOL, or an accommodating IOL?

Dr Henderson: We know minimizing spherical aberration improves quality of vision, and because the posthyperopic LASIK cornea is likely to have negative spherical aberration, I would typically choose an implant with zero spherical aberration or a spherical IOL. Wavefront aberrometry to measure corneal spherical aberration in each patient is useful to individualize the IOL decision. It also important to consider pupil size, because the effects of corneal aberrations on vision are greater when the pupil is larger.

Dr Weinstock: I agree that, in general, a lens with zero spherical aberration is the best choice for avoiding aberration-related visual quality issues in a posthyperopic LASIK patient. The accommodating IOL available in the United States also has zero spherical aberration and could be an option if the patient is interested in a presbyopia-correcting implant.

I would not use a multifocal IOL in a patient who had keratorefractive surgery, whose cornea will have a slightly irregular, nonphysiologic shape. Others may differ in their opinions, and there may be certain situations in which I would consider a monofocal IOL.

Dr Donnenfeld: I might consider a multifocal IOL for a patient who had LASIK to correct +1.0 D, but not for this patient, who had LASIK for +3.50 D.

I agree that the accommodating IOL is a good choice for posthyperopic LASIK patients because it has zero aberration. I also find that the best results with the accommodating IOL in terms of reading vision are in posthyperopic LASIK patients, because they get more depth of field.

I consider zero aberration IOLs to be “do no harm” implants, because they do not create any problems if they are not perfectly centered. For that reason, they are a good choice in patients with poor zonules or other issues that can affect postoperative stability.

OPTIMIZING VISION WITH CATARACT SURGERY

The 63-year-old grandmother presents seeking visual rehabilitation, with a chief complaint about trouble driving at night. Her current glasses are +4.25 D OU, but she is wearing contact lens monovision and likes it. Her manifest refraction is +3.50 D OU, BCVA is 20/20- OU, and her dilated slit-lamp examination shows mild nuclear sclerosis.

Dr Donnenfeld: In the past, I routinely performed LASIK for presbyopic hyperopic patients. I am less enthusiastic about those

procedures now, because clinical experience shows that patients in this age group are more likely to develop regression, have progressive hyperopia, and have visual complaints. Therefore, I now recommend lens-based surgery for hyperopes aged approximately 45 years or older who are seeking refractive correction.

What age would you use as a cutoff for choosing between LASIK and clear lens extraction in a patient with +2.50 D of hyperopia?

Dr Kim: I would recommend lens surgery beginning at age 50 to 55 years, when some amount of nuclear sclerosis is most likely present to justify cataract surgery.

Dr Weinstock: I use a much lower cutoff. I do a lens exchange and implant accommodating IOLs or monofocal IOLs with monovision in any patient who is hyperopic and presbyopic, which is basically anyone older than age 40 to 42 years. The patient we are discussing is a perfect candidate for IOL monovision. She did well with contact lens monovision before, and lens exchange is a perfect opportunity to get her out of her contacts. Another good reason to choose monovision over a multifocal IOL in this patient is that her complaints about night vision might persist with a multifocal IOL. With monovision, she can be given glasses to wear for nighttime driving that would correct the near eye for distance and reduce glare.

Dr Donnenfeld: I agree that monovision is an obvious choice for a patient who has used it and liked it, although I also would consider monovision using the accommodating IOL.

Would anyone perform glare testing, light scatter, Scheimpflug imaging to determine lens density, a wavefront scan, or direct ophthalmoscopy with retroillumination preoperatively in this patient?

Dr Kim: We sometimes use the brightness acuity test to determine glare disability. In general, hyperopic patients, and especially high hyperopes, are more motivated than myopic patients to have early lens exchange surgery because they are frustrated with their distance vision and their lack of good intermediate or near vision without correction.

Dr Donnenfeld: I like to do glare testing, because we are able to bill insurance for the surgery if the patient has glare disability.

Dr Henderson: I like to do a wavefront scan to look at the higher order aberrations using a platform that differentiates aberration in the cornea vs in the whole eye, which lets me determine if patients are at increased risk for photic symptoms with a multifocal IOL. As a general rule, I would exclude patients if their level of coma and trefoil exceeds 0.33μ . They can, however, still be considered for an accommodating IOL.

Dr Donnenfeld: We already mentioned the importance of assessing the condition of the ocular surface prior to cataract surgery. Dr Kim, what do you include in your ocular surface workup for these patients?

Dr Kim: I measure tear break-up time, use fluorescein staining, and sometimes use lissamine green. All 3 of those tests can be done at the slit lamp in just a few minutes. I also measure tear osmolarity, assess the meibomian glands, and press on the lid margin to evaluate the quantity and quality of the gland secretions. We also have tear film interferometry, and I tend to use that in older patients because of the high likelihood that they will have MGD.

Dr Donnenfeld: Gland expression is an important but often omitted component of the preoperative examination. Some patients who do not have obvious MGD on visual examination are found to have obstructed glands or thick toothpaste-like secretions on gland expression.

What about performing optical coherence tomography (OCT) to evaluate the macula?

Dr Henderson: I obtain macular OCT on all patients regardless of what type of IOL they are choosing. I started doing that after an experience I had with a patient in his 50s who chose a toric IOL. He had no remarkable findings on clinical evaluation, but he had vitreomacular traction and developed a macular hole after uncomplicated cataract surgery. Now, using macular OCT routinely, we pick up clinically unrecognized retinal pathology in 2 to 3 patients a year.

Dr Weinstock: I also get an OCT for everybody so that I can pick up any subtle pathology that may not be seen on clinical examination. It is surprising what you find. If you diagnose a retinal problem after cataract surgery, it is considered a complication from the cataract surgery, whereas if you diagnose it before surgery, you are a hero.

The patient undergoes OCT, and it reveals a mild epiretinal membrane (ERM) (Figure 4). She says she wants to minimize her need for glasses. She also has 1.25 D of cylinder.

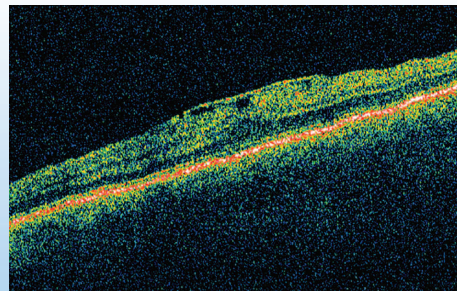


Figure 4. Optical coherence tomography image of an ERM in a patient undergoing cataract surgery.

Image Courtesy of Eric D. Donnenfeld, MD

Dr Donnenfeld: In a recent study, the incidence of ERM was 13.9% in patients undergoing cataract surgery.²¹ In general, if the ERM is mild and the vision does not seem disproportionately reduced by the retina pathology, I inform the patient of the finding and give an informed consent that lets the patient know about the risk for reduced postoperative visual acuity. If the ERM appears to be significant or if there is vitreous traction to the macula, I refer the patient for a preoperative vitreoretinal evaluation.

Considering her mild ERM, is this patient a candidate for a multifocal IOL?

Dr Kim: Definitely not, because an ERM exacerbates the reduction in contrast sensitivity associated with multifocal IOLs and is also a risk factor for postoperative cystoid macular edema.²² An ERM is not a contraindication to a toric IOL because the toric IOL should not reduce the quality of vision as can occur with a multifocal IOL. Given this patient's history of wearing contact lens monovision successfully and because of her cylinder, I think she is a great candidate for the toric accommodating IOL.

I have had very good outcomes using that lens in exactly this scenario, in which the patient is hyperopic, has astigmatism, and wants to reduce dependence on glasses. That lens also has excellent rotational stability, which makes it very effective for reliably correcting astigmatism.

Dr Weinstock: I agree with choosing the toric accommodating IOL. Other alternatives are monovision with monofocal IOLs or to implant the accommodating IOL and correct the astigmatism with LRI (limbal relaxing incisions) done either manually or with a femtosecond laser, which works well for treating approximately 1 D of astigmatism. This patient may be right at the cutoff for a laser procedure, depending on the axis of her astigmatism. If it is against the rule, some of the astigmatism can be reduced with the cataract incision, and she may only need a small arcuate incision on the opposite side. So, there are several choices here, and there is something of an art involved in making a decision.

Dr Donnenfeld: Considering that patients implanted with a presbyopia-correcting IOL should have no more than 0.5 D of residual astigmatism, the toric accommodating IOL would be a reasonable choice for her, as it is the only implant available in the United States that can address both cylinder and a desire for presbyopic correction. I think it is a “do no harm” lens and a better option for this patient than implanting another presbyopia-correcting lens and using LRIs to reduce her astigmatism.

Dr Henderson: I have been very happy using the monofocal toric IOLs for astigmatism management, and I recently started using the toric accommodating IOL in patients with astigmatism who also want an extended range of vision. I have been very impressed by its rotational stability, which I think is explained by its relative bulk and haptic design. The toric accommodating IOL is also very easy to implant and rotate in the eye.

One thing I like to do when implanting a presbyopia-correcting or toric IOL is to polish the anterior and posterior capsule prior to

inserting the lens. I think that step decreases the potential for postoperative capsule contracture and fibrosis.

Patients considering the toric accommodating IOL should be counseled preoperatively that they may need glasses for reading tiny print. I never promise total spectacle independence when I am implanting a presbyopia-correcting IOL.

Dr Donnenfeld: Another issue to discuss with cataract surgery patients is the possibility of surgery with a femtosecond laser. Dr Weinstock, you do a lot of femtosecond laser-assisted cataract surgery (FLACS) and have 3 of the 4 platforms that are currently available in the United States (**Table 2**). You also continue to do conventional cataract surgery. What is your conversation with patients when you discuss these 2 options?

Dr Weinstock: Although patients generally do not understand what astigmatism is, what a toric IOL is, or what accommodating means, they do know what a laser is, and that makes the discussion about laser surgery easy. I tell patients that we use a laser for cataract surgery because, in my opinion, it adds precision so that the outcomes are more predictable.

Dr Donnenfeld: I also find the discussion of FLACS is a fairly simple conversation, and there is no attempt to oversell it. In the past 6 months, I have had approximately 30 ophthalmologists and their family members come in for cataract surgery, and every one of them said that they want the laser.

What do you consider the advantages of using the femtosecond laser?

Dr Weinstock: The laser can be used for 4 steps: the capsulorhexis, pretreating the lens, creating the primary cornea incision and the paracentesis, and to make LRIs for astigmatism management. There are potential benefits for using the laser in each of these areas, and some studies show evidence of better clinical outcomes.²³ The laser improves the consistency of

Table 2. Approved Laser Cataract Surgery Systems in the United States

System Name	Manufacturer	Interface Design	Ocular Surface Identification	FDA Indications	Imaging Type
Catalys	Abbott/OptiMedica	Liquid optics (immersion lens)	Automatic or user/adjustable	Single-plane and multiplane arc cuts/incisions in the cornea; lens fragmentation; capsulotomy	3D SD-OCT
LenSx	Alcon	Curved lens	Manual	Anterior capsulotomy in cataract surgery; phacofragmentation; primary, secondary, and arcuate corneal incisions	3D OCT
LensAR	LensAR Inc.	Robocone (immersion lens)	Automatic	Anterior capsulotomy; laser phacofragmentation; full and partial thickness single-plane and multiplane arc cuts/incisions to the cornea	3D-CSI (confocal structured illumination)
Victus	Technolas/Bausch + Lomb	Curved lens	Manual	Creation of corneal flap in patients undergoing LASIK or other treatment requiring initial lamellar resection of cornea; anterior capsulotomy during cataract surgery; creation of penetrating arcuate cuts/incisions in the cornea; lens fragmentation	Online OCT

FDA, US Food and Drug Administration; LASIK, laser-assisted in situ keratomileusis; OCT, optical coherence tomography; SD, spectral domain. Adapted and updated from Jonathan Talamo, MD. [ASCRS] *EyeWorld*, March 2013.

capsulorhexis size, shape, and centration, and thereby results in better IOL position, and refractive and quality of vision outcomes. Laser pretreatment of the lens has been shown to reduce treatment time and ultrasound energy use, which has been used to explain findings of less anterior chamber flare, corneal edema, and retinal thickening. Increased reproducibility of incisions made with the laser can result in better postoperative incision integrity and also may increase the predictability of outcomes with astigmatic correction.

Dr Donnenfeld: There is still a lot of discussion about the benefits of the laser, and more data are needed to show improvements in clinical outcomes. However, my perspective is that the laser procedure is superior, and it will only get better in the future.

There are also a number of articles being published that show the advantages of using the laser in difficult cases.²⁴⁻²⁶ I have used it in eyes with small pupils, traumatic cataract, and intumescent lenses. I find it is particularly helpful in the latter cases, for which it can prevent the Argentinian flag sign, the situation in which the anterior capsule tears out to the equator, resulting in vitreous loss and a possible dropped nucleus.

There are reports of complications using the laser, particularly anterior capsular tears.²⁷ However, I never encountered that problem. It seems the pressure in the eye is maintained, so that when the capsulotomy is created, the lens does not fall forward and tear the capsule.

Dr Weinstock: I recently used the laser in a challenging case involving a patient with a small pupil, a very dense cataract, and Fuchs dystrophy. I thought it would be a real advantage to use the laser to fragment the lens, to lessen the phacoemulsification time and phacoemulsification energy use. First, I had to insert a Malyugin ring to open the pupil.

One suggestion that I have for surgeons who are just starting out with the laser is to use a divide-and-conquer technique. This is familiar to almost all surgeons, and if they have made a small capsulotomy, they might encounter problems trying to flip the lens.

To enable cortex removal after laser lens fragmentation, I recommend performing hydrodissection and hydrodelineation in more than 1 quadrant and using a bimanual approach to irrigation/aspiration (I/A), which especially facilitates access to the subincisional cortex. Using a soft, silicone I/A tip will allow surgeons to be more aggressive if they encounter a difficult area.

Dr Donnenfeld: Now we will discuss pain and inflammation control in cataract surgery. Considering the NSAIDs with an indication for treating pain and inflammation associated with cataract surgery, the products labeled for once or twice daily dosing are recommended to be started on the day before surgery and continued for 14 days after surgery.²⁸⁻³¹ When do you start an NSAID in patients having cataract surgery?

Dr Weinstock: I start it a few days preoperatively along with the antibiotic.

Dr Kim: At our institution, the NSAID is started just 1 hour before the procedure.

Dr Henderson: I think this is a controversial topic that does not have a clear-cut answer. However, a randomized, controlled study from Donnenfeld and colleagues showed significantly less

anterior chamber inflammation on the first day after surgery when patients were treated with an NSAID beginning 3 days preoperatively compared with 1 hour before.³²

Dr Donnenfeld: How long do you continue the NSAID after surgery?

Dr Kim: I tell patients to use the NSAID until it runs out, which is typically at approximately 1 month.

Dr Weinstock: I prescribe the NSAID for 6 weeks after surgery.

Dr Donnenfeld: I think 4 to 6 weeks is appropriate for routine cases, and I generally continue it for 1 month. Longer treatment is needed, however, for a patient at risk for macular edema, which would include patients with diabetes or those with a history of macular edema. In high-risk cases, I prescribe the NSAID for 3 months postoperatively. We have a number of excellent NSAIDs. The 2 newest options, 0.07% bromfenac and 0.3% nepafenac, are dosed once daily, while some of the other options are dosed 4 times a day. Reducing the number of daily doses may result in enhanced compliance and reduced ocular toxicity.

I recently saw a patient who came in 2 weeks after cataract surgery complaining about decreased visual acuity. On examination, she had central superficial punctate keratitis (**Figure 5**), which can affect the refractive outcome. I found that she was dispensed generic ketorolac, 0.5%, when she filled her prescription at the pharmacy. That medication needs to be used 4 times a day, and the generic NSAIDs have been associated with corneal toxicity.

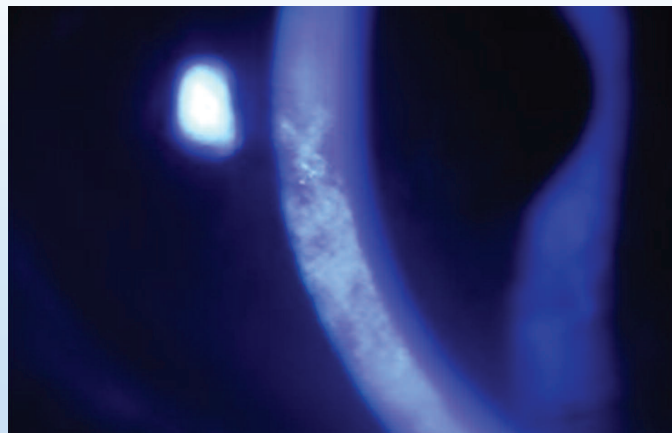


Figure 5. Superficial punctate keratitis due to generic nonsteroidal anti-inflammatory drug toxicity.

Photograph Courtesy of Eric D. Donnenfeld, MD

We also have several good options for steroid treatment (**Table 3**), but the results of a retrospective chart review conducted by Chang and colleagues indicate the need for more careful consideration in choosing a steroid when treating younger patients with high myopia.³³

Dr Henderson: Looking at the age and axial length of patients who had a steroid IOP response, Chang and colleagues found that the risk was particularly elevated in patients aged younger than 65 years with an axial length of at least 29.0 mm. Among patients aged 40 to 54 years with an axial length ≥ 27 mm, 17% were steroid responders, and the rate was almost 36% among patients with an axial length ≥ 29 mm in the same age bracket.

Table 3. Topical Ophthalmic Corticosteroid Options*

Generic (trade name)	Dosage Form/Strength
Dexamethasone (Decadron, Maxidex)	0.1% solution 0.1% suspension
Difluprednate (Durezol)	0.05% emulsion
Fluorometholone (Flarex, Fluor-Op, FML, FML Liquifilm, FML Forte)	0.1% ointment 0.1% suspension 0.25% suspension
Loteprednol etabonate (Alrex, Lotemax)	0.2% suspension 0.5% gel, ointment, and suspension
Prednisolone acetate (Omnipred, Pred Forte, Pred Mild)	0.12% suspension 1% solution 1% suspension
Prednisolone sodium phosphate	1% solution
Rimexolone (Vexol)	1% suspension

*University of Massachusetts Medical School. Therapeutic Class Overview: Ophthalmic Steroids. <http://www.medicaid.nv.gov/Downloads/provider/Ophthalmic%20Steroids%202013-0206.pdf>. Accessed September 30, 2014.

Dr Donnenfeld: For these high-risk patients, the authors recommended using an NSAID alone; using loteprednol or fluorometholone, which are less likely to affect IOP than other steroids; or shortening the duration of steroid treatment.

SUMMARY

New technologies have improved the safety and efficacy of contact lens wear, laser vision correction, and cataract surgery, and are allowing patients of all ages to enjoy reduced spectacle dependence. Familiarity with the expanding number of available options allows practitioners to make recommendations that best address the individual vision concerns and goals of each patient.

Achieving success and patient satisfaction also depends on conducting a thorough examination to identify disorders that can influence clinical outcomes and implementation of appropriate strategies to manage those issues and to prevent complications. As highlighted in this program, attention to the ocular surface is critical for optimizing vision, new diagnostic tools are enabling disease detection, and the use of appropriate medication regimens for addressing infection and inflammatory reactions will improve results in all patients.

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Post Test

To obtain *AMA PRA Category 1 Credit™* for this activity, complete the CME Post Test by writing the best answer to each question in the Answer Box located on the Activity Evaluation/Credit Request form on the following page. Alternatively, you can complete the CME Post Test online at <http://tinyurl.com/optimizingvision>.

See detailed instructions at **To Obtain AMA PRA Category 1 Credit™** on page 2.

- All of the following might be considered for the management of GPC, except:
 - Alcaftadine
 - Bepotastine
 - Naphazoline
 - Olopatadine
- A 31-year-old woman is interested in LASIK for correction of myopic astigmatism. She reports that she began wearing glasses at age 8 years and switched to rigid gas permeable contact lenses at age 11 years. Her prescription has been stable for the past 5 years. How long would you wait before performing topography?
 - 2 weeks
 - 4 weeks
 - 6 weeks
 - 8 weeks
- According to a published study by Lemp and colleagues, which test performed best for diagnosing dry eye disease?
 - MMP-9
 - Meibomian gland expression
 - Tear break-up time
 - Tear osmolarity
- Studies show that combining _____ with topical cyclosporine hastens inflammation control and reduces burning with cyclosporine use.
 - Bromfenac, 0.07%
 - Bromfenac, 0.09%
 - Loteprednol, 0.5%
 - Nepafenac, 0.3%
- MRSA colonization of the conjunctiva and lid margins in cataract surgery patients is:
 - A concern only in health care workers
 - A concern only in patients with a history of recent hospitalization
 - An indication for use of intracameral cefuroxime
 - Related to patient age
- According to current prescribing information, NSAIDs for treatment of pain and inflammation associated with cataract surgery should be:
 - Initiated 3 days before surgery
 - Initiated 2 days before surgery
 - Continued for 14 days after surgery
 - Continued for 4 to 6 weeks after surgery
- A 45-year-old man with early nuclear sclerosis chooses to undergo cataract surgery with implantation of an accommodating IOL to reduce spectacle dependence. He is a -8.0 D myope with an axial length of 27.5 mm in both eyes. Based on the study by Chang and colleagues investigating steroid-induced IOP response risk, what corticosteroid options would you consider?
 - Dexamethasone or difluprednate
 - Difluprednate or fluorometholone
 - Loteprednol or fluorometholone
 - Loteprednol or prednisolone acetate
- A 65-year-old man with binocular BCVA of 20/50 and problems with night vision is diagnosed with bilateral cataracts. His refractions are +2.00 +1.75 x 90 OD/+2.25 +1.85 x 85 OS. He has epiretinal membranes in both eyes and has never used contact lenses. He is an avid downhill skier and tennis player. He expresses interest in reducing spectacle dependence for those activities. What option would you recommend to this patient in order to match his goal?
 - Bilateral implantation of the toric accommodating IOL
 - Bilateral implantation of a diffractive multifocal IOL and femtosecond laser-created LRI to reduce his astigmatism
 - Monovision with toric IOLs
 - Monovision with aspheric IOLs and manual LRIs
- A 67-year-old retired art teacher presents with bilateral cataracts. She is a low myope with -1.50 D of astigmatism and indicates a desire to minimize spectacle dependence for all vision tasks. She indicates her cousin recently had cataract surgery and does not wear glasses at all after receiving the toric accommodating IOL. Which of the following findings would lead you to counsel your patient against receiving the same IOL?
 - Epiretinal membrane
 - Negative corneal spherical aberration
 - Positive corneal spherical aberration
 - The patient hand paints and sells miniature figurines
- Studies comparing femtosecond laser-assisted and conventional cataract surgery report that the laser procedure has all the following benefits, except:
 - Reduced ultrasound energy usage
 - Easier cortex removal
 - Increased consistency in incision architecture
 - Increased uniformity of capsulorhexis shape

Activity Evaluation/Credit Request

Original Release: March 1, 2015

Last Review: February 5, 2015

Expiration: March 31, 2016

Optimizing Vision Across Generations

To receive *AMA PRA Category 1 Credit™*, you must complete this **Evaluation** form and the **Post Test**. Record your answers to the **Post Test** in the **Answer Box** located below. Mail or Fax this completed page to **New York Eye and Ear Infirmary of Mount Sinai-ICME**, 310 East 14th Street, New York, NY 10003 (Fax: 212-353-5703). Your comments help us to determine the extent to which this educational activity has met its stated objectives, assess future educational needs, and create timely and pertinent future activities. Please provide all the requested information below. This ensures that your certificate is filled out correctly and is mailed to the proper address. It also enables us to contact you about future CME activities. Please print clearly or type. Illegible submissions cannot be processed.

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Signature Required _____ Date Completed _____

OUTCOMES MEASUREMENT

Yes No **Did you perceive any commercial bias in any part of this activity? IMPORTANT! If you answered "Yes," we urge you to be specific about where the bias occurred so we can address the perceived bias with the contributor and/or in the subject matter in future activities.**

Circle the number that best reflects your opinion on the degree to which the following learning objectives were met:

5 = Strongly Agree 4 = Agree 3 = Neutral 2 = Disagree 1 = Strongly Disagree

Upon completion of this activity, I am better able to:

• Discuss strategies for managing contact lens wear in patients with ocular surface disorders	5	4	3	2	1
• Assess and treat ocular surface disorders prior to refractive and cataract surgery, and counsel patients about the need for ocular surface rehabilitation	5	4	3	2	1
• Select best practice anti-inflammatory and anti-infective regimens to prevent postoperative complications	5	4	3	2	1
• Counsel patients effectively on intraocular lens options	5	4	3	2	1
• Evaluate newer surgical devices and technologies on efficacy, safety, and clinical utility	5	4	3	2	1

1. Please list one or more things, if any, you learned from participating in this educational activity that you did not already know. _____

2. As a result of the knowledge gained in this educational activity, how likely are you to implement changes in your practice?

4=definitely will implement changes 3=likely will implement changes 2=likely will not implement any changes 1=definitely will not make any changes

4 3 2 1

Please describe the change(s) you plan to make: _____

3. Related to what you learned in this activity, what barriers to implementing these changes or achieving better patient outcomes do you face?

4. Please check the Core Competencies (as defined by the Accreditation Council for Graduate Medical Education) that were enhanced for you through participation in this activity. Patient Care Practice-Based Learning and Improvement Professionalism
 Medical Knowledge Interpersonal and Communication Skills Systems-Based Practice

5. What other topics would you like to see covered in future CME programs? _____

ADDITIONAL COMMENTS _____

POST TEST ANSWER BOX

1	2	3	4	5	6	7	8	9	10

