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Articles adapted from the presentations at the November 11th, 2007, symposium.

Methicillin-Resistant *Staphylococci* in Cataract and Refractive Surgery

An outline of the problem, its implications, and preventive strategies.

BY ERIC D. DONNENFELD, MD

I am passionate about educating ophthalmic providers about the implications of methicillin-resistant *Staphylococcus aureus* (MRSA) and *epidermidis* (MRSE) for ocular surgery. Here, I share my experience with these organisms to illustrate the consequences of these difficult-to-treat bacterial infections and to highlight their growing threat to public health. Methicillin-resistant staphylococci are currently the most common cause of infection following LASIK, PRK, and cataract surgery.

CASE PRESENTATION

I recently performed PRK to correct moderate myopia on the right eye of a municipal employee who was in his 40s. I decided to treat him with PRK instead of LASIK because corneal topography with the Orbscan (Bausch & Lomb, Rochester, NY) showed an inferiorly decentered apex, inferior steepening, and corneal thinning that could have increased his risk of developing postoperative ectasia.

Immediately after surgery, I instilled Pred Forte (prednisolone acetate), Zymar (gatifloxacin 0.3%), and Acular LS (ketorolac tromethamine 0.4%) (all manufactured by Allergan, Inc., Irvine, CA), into the patient's right eye, and I fitted him with a bandage contact lens. The next day, the patient's endothelium appeared to have healed sufficiently, so I told him to discontinue his NSAID. On day 2, his eye had some pain; by accident, he had stopped using the antibiotic instead of the NSAID. He had a minor corneal infiltrate on his eye, but I saw no evidence of hypopyon or ulceration. I cultured the infiltrate and increased the fluoroquinolone dosing to every 2 hours. We arranged for him to be seen 16 hours later.

On postoperative day 3, I noted that the infiltrate had significantly enlarged, there was iritis, and we were clearly dealing with an infection. I started the patient on vancomycin every half hour and oral doxycycline to prevent collagenase release. I also continued him on Zymar and discontinued the prednisolone acetate. The culture came back 2 days later and revealed MRSA. However, the patient's eye did not improve. He returned on the seventh day with a dense central corneal infiltrate, and I knew he would likely need a corneal transplant. At this point, I thought his condition could not worsen, but I was wrong. When he came back the next day, his cornea had perforated (Figure 1), and I applied cyanoacrylate glue.

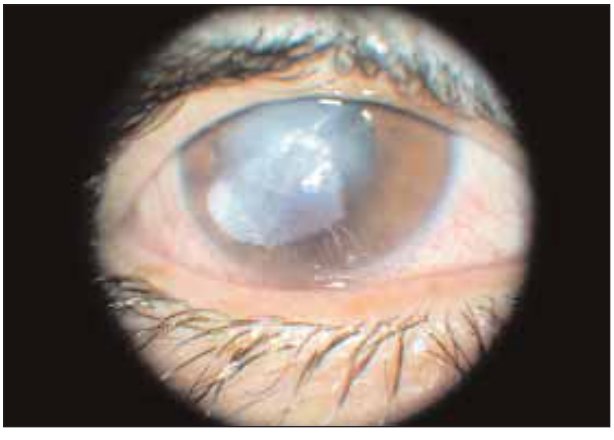

Figure 1. The perforated and MRSA-infected cornea of a PRK patient after he mistakenly discontinued his antibiotic.

A couple months later, I performed a corneal transplant, to which the eye responded very well. One year after the PRK surgery, I removed the transplant sutures, and the eye was -5.00 D with only 0.25 D of cylinder on refraction and 0.1 D of cylinder on aberrometry. The patient's left eye was plano. He was miserable due to the anisometropia and his inability to wear contact lenses.

I chose to perform thin-flap LASIK with the IntraLase FS laser (Advanced Medical Optics, Inc.) on his right eye to minimize the risk of infection (LASIK's risk of infection is five to eight times less than PRK's[1]). Also, in healthy eyes, the risk of infection is far greater than the risk of ectasia after PRK.[2] The patient's eye did very well after the LASIK surgery; the anisometropia resolved, and his UCVA reached 20/25 (Figure 2).

A PROBLEM GAINING ATTENTION

Unfortunately, the problem posed by MRSA is worse than the public realizes. I maintain that MRSA is the number-one health problem in the US today, and, as a study my colleagues and I published in the *American Journal of Ophthalmology* showed,[3] it may be particularly worrisome for ophthalmology. Of the 14 cases of MRSA we described in our study, 12 occurred in healthcare workers and four in physicians. Physicians and other healthcare workers are colonized by MRSA at an increased rate that puts us at a very high risk of developing infection. More than 50% of all infections in the ICU setting are due to MRSA.[4]

The incidence of MRSA infections is also increasing exponentially in the general population, and this trend is likely to continue, according to the literature.[5] Surgical candidates must understand this risk, as illustrated by a study of endophthalmitis among cataract patients at the University of Pittsburgh. From 1993 to 2004, the university's physicians found that 30% of postoperative infections were caused by MRSA. MRSE accounted for an additional 48% of cases of endophthalmitis. By 2006, MRSA appeared in 60% of their surgical cases, and MRSE—the greatest cause of endophthalmitis—was responsible for three quarters of the endophthalmitis outbreaks.[6]

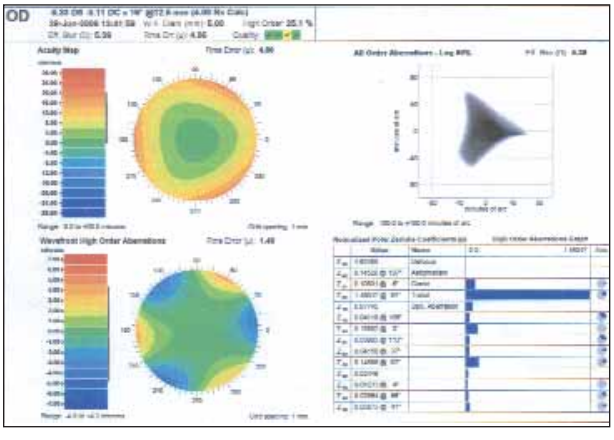

Figure 2. The patient's eye's topography after undergoing thin-flap LASIK 1 year after a corneal transplant.

> *"Well-constructed wounds and the use of a suture when necessary are critical for preventing late inoculation of organisms into the eye following surgery."*
>
> *—Eric D. Donnenfeld, MD*

Additionally, the ASCRS Clinical Committee Refractive Surgery Survey[7] cited MRSA as the number-one cause of infection following LASIK and PRK. A study presented at the 2006 ARVO meeting showed that 55% of patients who have endophthalmitis are resistant to the generic gatifloxacin and moxifloxacin molecules.[8] Thus, half of the cases of endophthalmitis are not going to respond effectively to the primary antibiotics in use today. With odds like these, our best strategy is to prevent infections before they occur.

CLINICAL IMPLICATIONS

Many clinicians wonder if clinical evidence favors one antibiotic over another for preventing postoperative infections. A study published by Moshirfar et al in *Ophthalmology* in 2007[9] gave the first clinical evidence that cataract patients' incidence of endophthalmitis was approximately 50% lower for those who received Zymar compared with Vigamox (moxifloxacin ophthalmic solution 0.5%; Alcon Laboratories, Inc., Fort Worth, TX). This study included 14 cases of endophthalmitis (an overall rate of 0.07%). Importantly, endophthalmitis' average time to presentation is 9.3 days, and the participants in this study were instructed to stop their antibiotics after 7 days. Six cases of endophthalmitis occurred after the drops were stopped and the eyes were left unprotected. When the investigators eliminated these cases, there was a fourfold increase of endophthalmitis with Vigamox versus Zymar. Until I see a human endophthalmitis study with different results, I will consider this one the best guide for choosing an antibiotic.

STRATEGIES FOR PREVENTION

Endophthalmitis prevention occurs mainly on the ocular surface. Well-constructed wounds and the use of

a suture when necessary are critical for preventing late inoculation of organisms into the eye following surgery, because again, most cases present later than 3 days.

Fortunately, MRSA and MRSE respond brilliantly to the benzalkonium chloride (BAK), a preservative that is added to many ophthalmic medications. A study by Blondeau et al[10] showed that BAK greatly increased an antibiotic's killing effect and reduces the minimal inhibitory concentrations (MICs) to manageable rates versus the generic moxifloxacin and gatifloxacin molecules that lack it. A European study showed a 78% reduction of endophthalmitis with intracameral cefuroxime.[11] Although the study had some flaws, the idea of using antibiotics intracamerally is valid and warrants more research. If you use an antibiotic intracamerally, mix and match: use a broad-spectrum fluoroquinolone on the ocular surface, and use an antibiotic that is specifically effective against MRSA inside the eye.

Also, sterilize the lid well with one of the advanced products available today. The TheraTears SteriLid eyelid cleanser (Advanced Vision Research, Inc., Woburn, MA) is very effective against MRSA. Additionally, the prescription nasal gel mupirocin (Bactroban; GlaxoSmithKline, Research Triangle Park, NC) is a super bacitracin with an FDA-approved indication of effectiveness against MRSA. I apply this to the lid margins of patients known to carry MRSA preoperatively.

CONCLUSION

In summary, we surgeons must do a better job of sterilizing the operative field against infectious organisms. Povidone iodine (Betadine; The Purdue Frederick Company, Stamford, CT) remains the gold standard for sterilizing the operative field. BAK works the same as Betadine, by destabilizing cell membranes and enhancing the speed of microbial kill. Also, reducing the size of our wounds will greatly minimize the risk of endophthalmitis. Finally, I suggest prescribing antibiotics postoperatively for 10 to 14 days instead of 7, as supported by the Moshirfar study.

MRSA is here to stay as a major health concern. Be aware of it, and remember that prevention is the key. ■

Eric D. Donnenfeld, MD, is a partner in Ophthalmic Consultants of Long Island, New York, and is a Trustee of Dartmouth Medical School. He is a paid consultant for Allergan, Inc., Advanced Medical Optics, Inc., Alcon Laboratories, Inc., and Inspire Pharmaceuticals, Inc. Dr. Donnenfeld may be reached at (516) 766-2519; eddoph@aol.com.

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Preventing Cataract Complications

A new pearl for preventing anterior capsular tears and a new device for managing IFIS.

BY DAVID F. CHANG, MD

The following three cataract cases highlight a new strategy for preventing errant anterior capsular tears. *(Watch video of this technique on the accompanying CD-ROM.)* Weak zonules are a frequent and unrecognized cause of radially escaping tears. If the peripheral capsule is not taut and immobilized, it is hard to control the direction of the advancing tear. I call this phenomenon *pseudoelasticity*, because the anterior capsule behaves as though it is elastic if it is not kept taut by the zonules.

TECHNIQUE FOR MANAGING AN ERRANT CAPSULAR TEAR

In the summer of 2006, Brian Little, MD, and his colleagues published a technique[1] for managing errant capsulorhexis tears that I feel every surgeon should know. He calls it the *capsulorhexis tear-out maneuver*. Normally, the surgeon folds the flap over in front of where the tear is occurring and pulls the flap ahead of the advancing tear. Dr. Little proposed that when you encounter a tear that wants to veer radially outward, you need to do just the

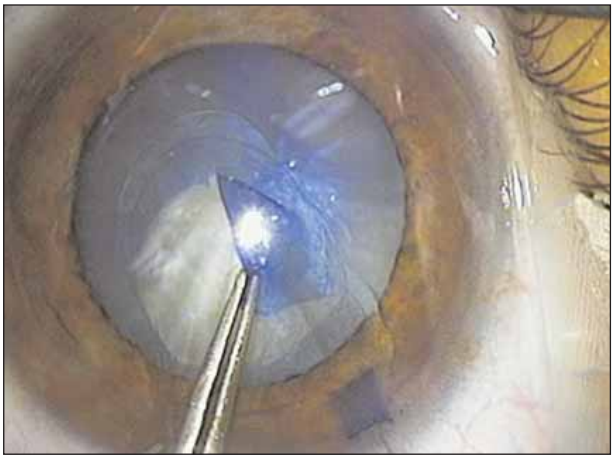

Figure 3. Pulling the tear away from the direction it is going helps to redirect it.

opposite. First, fold the flap back into its original position, where it was prior to being torn. Next, pull the flap backward in the opposite direction from where the tear needs to go, so as to put the flap under tension. Only when the flap is made taut in this way do you redirect the flap centrally so as to rescue the tear. The technique is somewhat counterintuitive, but by gripping the flap under such traction, it is much easier to control and redirect the advancing tear.

Case No. 1: Intumescent Lens

During this case of a young patient with a white intumescent lens, the capsulorhexis tear started to suddenly veer out to the periphery. The swollen cortical lens material creates increased intracapsular pressure such that when the liquefied milk suddenly escapes, it exerts centrifugal forces on the capsular tear, pushing it radially outward. Using the capsulorhexis tear-out maneuver, I pulled the flap backward, away from the direction in which it was going, and then turned it sharply toward the center. Once it was safely redirected, I folded the flap forward again to resume the capsulorhexis step in the conventional way. The tear again started to veer outward, so I had to repeat the maneuver to redirect it once more (Figure 3). The problem in this case was the elevated intralenticular osmotic pressure that repeatedly pushed the tear outward.

Case No. 2: Pediatric Eye

Controlling the capsulorhexis is also very difficult in the case of pediatric or teenaged cataract surgery, because these eyes have extremely elastic capsules. For example, in the eye of a 16-year-old patient, I became aware of significant capsular elasticity when the capsulotomy needle first dimpled the central capsule prior to penetrating it. One should target making a smaller-diameter capsulorhexis in young eyes to prevent the tear from spinning radially outward. In this case, if I had not started out with such a smaller tearing radius, I would have already lost control of it. When you tug on the anterior capsular flap and see the peripheral capsule move along with it in pediatric eyes, this is a sign of greater capsular elasticity. In this case, my strategy was to make the capsulorhexis diameter smaller than usual so as to improve control and to allow enough room to rescue an errant tear using the Little technique. After the IOL had been implanted, I secondarily enlarged the capsulorhexis' diameter by making a small oblique cut and using forceps to tear off a strip of excess capsule.

Case No. 3: Traumatic Cataract, Weak Zonules

Weak zonules give rise to what I have called *pseudoelasticity* of the anterior capsule. Again, as the flap is pulled, the peripheral capsule moves along with it (as in the younger eye's elastic capsule) because of insufficient zonular traction. This causes a tendency for the tear to slingshot out peripherally. When I anticipate that the zonules are weak, I also aim for a small capsulorhexis to provide a greater margin of error for controlling the tear. In this case of a traumatic cataract with weak zonules, I placed a capsular tension ring (Morcher GmbH, Stuttgart, Germany) into the intact capsular bag prior to inserting the IOL. Because of the greater risk of capsular contraction syndrome in the presence of weak zonules, I

THE WIDENING USE OF FLOMAX

BY DAVID F. CHANG, MD

Surgeons should be aware that they may encounter intraoperative floppy iris syndrome in women, in whom alpha blockers are also used to treat lower urinary tract obstruction. In addition, a study conducted in Italy and published in 2005 showed that Flomax (Boehringer-Ingelheim Pharmaceuticals, Inc., Ridgefield, CT) promoted the clearance of large renal stones after extracorporeal shock wave lithotripsy, as compared to lithotripsy alone.[1] The adjunctive treatment was given for up to 3 months in the study group. Since then, giving tamsulosin to people with kidney stones to help clear the ureters has become quite popular, although the treatment course is typically much shorter, in the order of several weeks.

1. Gravina GL, Costa AM, Ronchi P, et al. Tamsulosin treatment increases clinical success rate of single extracorporeal shock wave lithotripsy of renal stones. *Urology*. 2005;66:24-28.

use a hydrophobic acrylic IOL to minimize fibrosis and contracture of the anterior capsule. I prefer a three-piece lens, because I think the stiffer haptics supply more outward expansive force.

> *"My goal is to reduce capsulorhexis contraction, which in turn can lead to delayed bag-IOL subluxation and dislocation."*
>
> *—David F. Chang, MD*

Because I was worried about the sphincter-like effect of the capsulorhexis, I also secondarily enlarged it. In these cases of weak zonule, I actually try to tear the capsulorhexis beyond the optic. My goal is to reduce capsulorhexis contraction, which in turn can lead to delayed bag-IOL subluxation and dislocation. Dr. Little's capsule tear-out maneuver is again tremendously helpful in controlling the tear when there is capsular pseudoelasticity because of lax zonules. An alternative approach to preventing capsulorhexis contraction would be to make multiple radial relaxing cuts in the edge of the capsulotomy.

Summary

The capsulorhexis tear-out maneuver requires a little leap of faith, because the actions of forcefully pulling the flap backwards and then tearing it further while grasping it so far from the insertion point are counterintuitive. As these three cases illustrate, however, we can use this valuable surgical skill in a variety of challenging situations.

NEW PUPIL EXPANSION DEVICE FOR INTRAOPERATIVE FLOPPY IRIS SYNDROME

Boris Malyugin, MD, PhD, has developed a new pupil expansion ring for small pupils that is particularly effective for floppy irides due to systemic alpha-blocker therapy. MicroSurgical Technology (MST; Redmond, WA) manufactures the disposable Malyugin ring as well as a single-use injector system that I have found to be extremely easy to use. The square device has four scrolls that hook the pupil and hold it open (Figure 4). The iris drapes over each side of the device, leaving a round opening of 6 mm in diameter (Figure 5) (one caveat is that this ring is not useful in pupils larger than 6 mm). One component of the injector system is a platform that holds the unfolded, square, 5–0 Prolene device. The injector has a tiny "finger" that extends into the holding platform, snags the proximal scroll, and retracts and folds the expansion device into the injector shaft. The device is then inserted into the anterior chamber where it gently unfolds. The lead scroll catches the nasal iris edge, and a Lester hook positions each of the remaining three scrolls over the pupillary margin.

Unlike with other plastic expansion rings that are stiffer and have a higher vertical profile, there is no danger of this device bumping into the cornea, because it is thin and flexible. It is extremely gentle on the iris and will not overstretch it. Interestingly, with a severe case of IFIS, the iris is mobile enough to still prolapse to the incision. Initially using intracameral epinephrine to increase iris stromal rigidity can prevent this tendency.

To remove the device, first use a Lester hook to disengage the proximal scroll. I reintroduce the same injector, extend the finger-like projection, and retract the freed

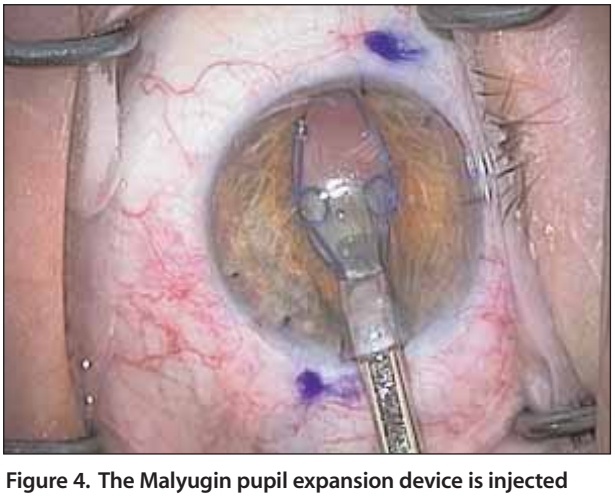

Figure 4. The Malyugin pupil expansion device is injected into the anterior chamber of a patient taking tamsulosin. The leading scroll has caught the edge of the pupil.

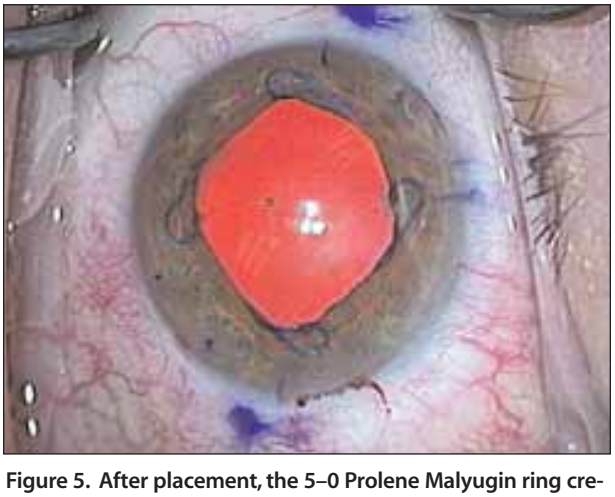

Figure 5. After placement, the 5–0 Prolene Malyugin ring creates a 6-mm–diameter pupil.

proximal scroll back into the injector. Although the device will not completely telescope into the injector system, it will fold into a linear configuration, making it easy to extract through the phaco incision.

Easy and Reliable

Although iris retractors work very effectively for severe IFIS, they take longer to insert and remove. The Malyugin pupil expansion device and injector are so easy to use that I would particularly recommend them for resident surgeons performing small-pupil phacoemulsification. The Malyugin device has none of the drawbacks of rigid PMMA expansion rings and even works for very small (3-mm) pupils. I have used Malyugin rings in a consecutive series of 30 tamsulosin eyes with excellent results, which will be published in the *Journal of Cataract and Refractive Surgery*. ■

David F. Chang, MD, is Clinical Professor at the University of California, San Francisco, and is in private practice in Los Altos, California. Dr. Chang is a consultant to Advanced Medical Optics, Inc., and Alcon Laboratories, Inc., and he donates these consulting fees to the Himalayan Cataract Project. Dr. Chang may be reached at (650) 948-9123; dceye@earthlink.net.

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Improving Quality of Vision

The prevention of cystoid macular edema.

BY MICHAEL B. RAIZMAN, MD

Nonsteroidal anti-inflammatory drugs (NSAIDs) are becoming more popular to use during cataract surgery. Ophthalmologists now seem to recognize the value of this class of drugs. There are four reasons why I advocate the use of topical NSAIDs during cataract surgery. First, these agents effectively reduce postoperative inflammation. Second, they probably prevent cystoid macular edema (CME).[1,2] The third reason is that NSAIDs maintain intraoperative meiosis (this was the first indication for these drugs during cataract surgery).[3] Finally, topical NSAIDs have been shown to improve comfort during and after surgery.[4-7] I routinely use topical anesthesia, and I believe that nonsteroidal drops assist in keeping my patients comfortable. This use of topical NSAIDs is equally important for comfort in refractive surgery.

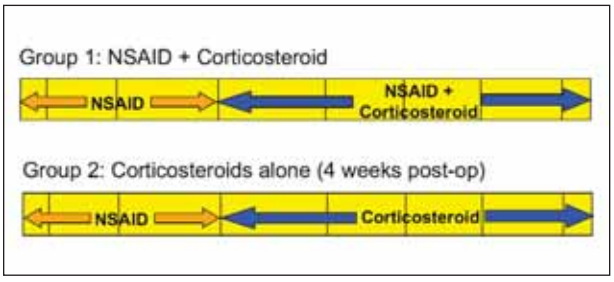

Figure 6. The efficacy comparison of topical NSAIDs and steroids in reducing the incidence of CME in patients undergoing cataract surgery (n = 60).

EXPERIENCE

Several patients in the mid-1990s prompted me to investigate the role of topical NSAIDs in preventing CME. At Tufts University School of Medicine, some of my associates, including Carmen Puliafito, MD, and Joel Schuman, MD, were collaborating with engineers from the Massachusetts Institute of Technology on the first prototype of the device that performed optical coherence tomography (OCT). Some of my patients were complaining of poor vision after cataract surgery despite what I considered to be a good outcome. One of my patients saw 20/20 but complained of metamorphopsia. The Amsler grid was described as having wavy lines centrally. OCT revealed significant parafoveal edema despite a normal foveal pit and normal foveal thickness.

Another patient complained of distorted vision in one eye. The first eye had 20/20 vision after cataract surgery with a normal OCT. The second eye had 20/25 visual acuity, but the patient was quite upset with the difference between the vision in the two eyes. Although the foveal pit appeared normal in the eye with 20/25 acuity, the macular thickness was 50 µm greater than in the eye with 20/20 vision. This patient was treated with topical NSAID drops, and after several weeks, the acuity and the OCT returned to normal.

We now realize that our patients are more demanding with cataract surgery. They expect excellent visual outcomes. We have learned from our refractive surgery patients that the quality of vision is critical. We no longer depend solely on the Snellen visual acuity. Contract sensitivity is also important. Our patients also demand a rapid recovery of vision and minimal discomfort.

PREVALENCE

We recognize that CME can occur with perfect cataract surgery. Although endophthalmitis is of great concern, postoperative macular edema is far more common. A variety of studies indicate that CME may occur

between 8% and 12% of the time in routine, uncomplicated clear cornea phaco surgery. Patients with diabetes may have a rate as high as 32%, even in the absence of diabetic retinopathy.[8] Patients with diabetic retinopathy may have an 80% chance of increased macular thickening with routine cataract surgery.

> *"I strongly recommend the use of topical NSAIDs routinely in cataract surgery."*
>
> *—Michael B. Raizman, MD*

Although it is possible to treat CME after it develops, not all patients will respond to therapy, and some macular edema is permanent and can cause significant reduction in visual acuity. In my view, it is better to do our best to prevent CME rather than wait for its development.

Risk Factors

There are a number of factors that increase the risk of CME. The presence of uveitis or other pre-existing inflammation is a strong risk factor. Macular edema after surgery in the contralateral eye is another risk factor. Any macular disorders including epiretinal membranes, traction on the macula, retinal vascular abnormalities, retinitis pigmentosa, and previous surgery can all increase the risk of CME.

Regimen

The optimal regimen for topical NSAIDs around cataract surgery is not known. Cal Roberts, MD, showed that providing 3 days of nonsteroidal therapy before surgery reduces the amount of postoperative inflammation compared to 1 or 2 days of therapy. We do not know whether 3 days of preoperative therapy are required to prevent postoperative CME.[9] A shorter course of preoperative therapy is adequate to reduce discomfort and maintain pupil dilation during surgery. I have my patients use NSAID drops for 3 days before surgery. In some high-risk cases, I may use these drops for 1 week before surgery.[10]

After surgery, I regularly prescribe NSAID drops for 4 weeks in routine cases and at least 6 weeks in patients with high risk factors. Patients with diabetic retinopathy routinely receive 6 to 12 weeks of therapy. In all cases, I use topical NSAIDs in combination with topical corticosteroids after cataract surgery. About 90% of patients may have complete control of inflammation with a NSAID drop alone. It is not possible to predict which patients fall into the 10% that are inadequately treated with topical NSAIDs. For this reason, I treat all patients with a combination of drops. I stop the steroid at 4 weeks and continue the NSAID drop if necessary.

In a small study that I performed in the late 1990s, I treated half of my patients with topical corticosteroids after routine cataract surgery.[1] The other half received topical corticosteroids in combination with topical NSAIDs for 4 weeks. The group that received the nonsteroid drops had no CME, as demonstrated on OCT. The group that received corticosteroids alone had a 12% rate of CME as demonstrated by OCT (Figure 6). Larger studies have corroborated my findings. Wittpenn and associates found a 12% rate of CME in patients who received prednisolone acetate alone.[11] In their study of patients who received prednisolone acetate and ketorolac, only 1% developed CME. Braunstein showed similar efficacy with nepefenac after routine cataract surgery.[12]

RECOMMENDATION

In summary, although CME may not be as devastating as endophthalmitis, it is far more common and deserves our attention. Even mild CME is clinically relevant, and our patients are demanding optimal outcomes. I strongly recommend the use of topical NSAIDs routinely in cataract surgery. ■

Michael B. Raizman, MD, is in private practice with Ophthalmic Consultants of Boston. He is the Director of the Cornea and Cataract Surgery at New England Eye Center and Associate Professor of Ophthalmology at Tufts University School of Medicine in Boston. He has received research funds, consulting fees, and/or travel expenses from Alcon Laboratories, Inc., Allergan, Inc., and Ista Pharmaceuticals, Inc. Dr. Raizman may be reached at (617) 367-4800.

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The Physician-Patient Partnership in the New Paradigm

Partnering with the patient to select presbyopia-correcting IOLs.

BY ROGER F. STEINERT, MD

I consider my patients partners in the process of planning surgery with presbyopia-correcting IOLs, starting with the initial consultation. Many providers new to premium refractive IOLs are primarily cataract surgeons who do not perform a lot of refractive procedures and are therefore not prepared to meet patients' high expectations. To give patients satisfactory outcomes with presbyopia-correcting IOLs, we need to understand their expectations and adapt our management style. The first step is opening a dialogue with patients.

GENERAL RULES

I immediately eliminate anyone who has a macular or vision-limiting pathology as a candidate for presbyopia-correcting IOLs. After this initial screening, I begin to assess interested patients by determining their goals for distance, intermediate, and near vision. Some of this information can be obtained with a formal questionnaire, but we can supplement patients' answers to these data by asking a few key questions. I specifically ask what activities they most want to perform without glasses, as well as the lighting conditions (ie, dim or bright light) under which they work most frequently.

Patients' personalities are another important aspect of managing presbyopia-correcting IOLs. Instead of trying to categorize candidates as type A or type B, I determine if they see the glass as half empty or half full. This gives me an indication of whether they will focus on the positives or negatives of their postoperative vision.

Biometry plays a key role in providing optimal outcomes with presbyopia-correcting IOLs. We must obtain accurate measurements of pupillary size under scotopic and mesopic conditions. This task can be delegated to appropriately trained staff members who can also perform corneal topography. The final refraction should have less than 1.00 D of cylinder. Because residual astigmatism can affect the performance of presbyopia-correcting IOLs, surgeons must also be willing to perform limbal relaxing incisions. Eventually, we will have access to toric lenses that also address presbyopia, but until then, we must be comfortable performing corneal corrections.

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> *—Roger F. Steinert, MD*

COMPLICATIONS

The best strategy for preventing postoperative complications with presbyopia-correcting IOLs is avoidance. Obviously, we must use the best and most meticulous surgical techniques, including eliminating cortex, making a correctly sized capsulorhexis, and implanting an optimally powered lens. Because no surgeon can guarantee every procedure will be free of complications, we need to prepare patients for potential problems and have a management strategy in place so that the patient is not confounded by a postoperative surprise. We must inform patients of a complication the day it happens.

SURGICAL POINTS

I have changed my operative strategy since I began implanting presbyopia-correcting IOLs. Recognizing that neuroadaptation influenced patients' vision with these lenses and that they generally saw better after receiving both lenses, many early adopters preferred to operate on both eyes within 1 week. I now wait at least 2 weeks (and sometimes 4 weeks) between the first and second eye so that I may judge how the patient functions from an optical standpoint and gauge the accuracy of my selected power. I explain this strategy to the patient before I implant the IOL in the first eye, and I make sure he understands that he will not experience the full visual benefit until the second eye is done. In the meantime, the patient

(Courtesy of George Beiko, MD.)

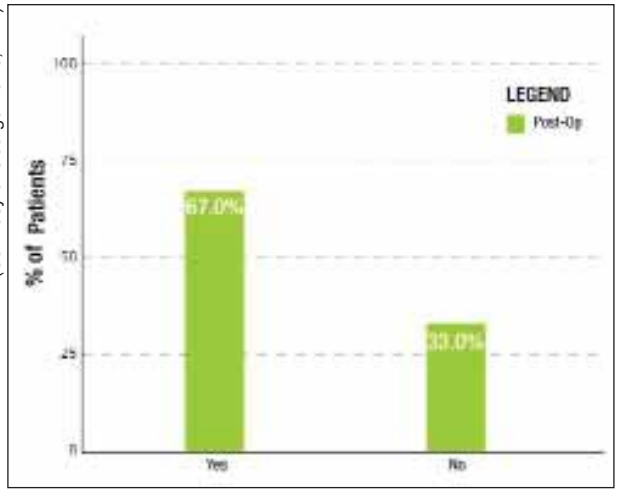

Figure 7. Improvement with halos between the 6-week and 6-month follow-ups (n = 98).

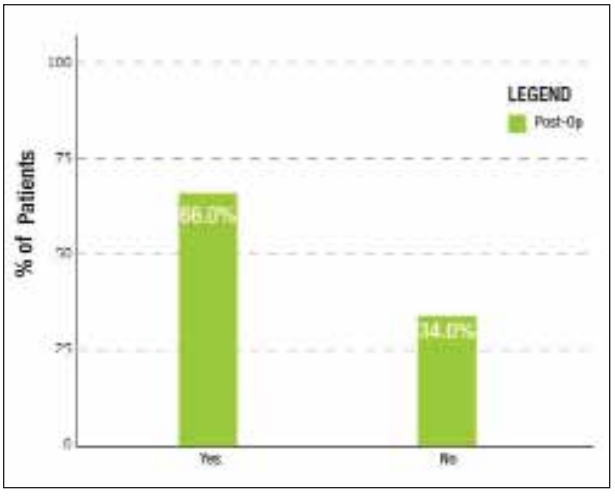

Figure 8. Improvement with glare between the 6-week and 6-month follow-ups (n = 98).

can decide if he wants the same correction for his second eye or a different lens that will improve his vision in a particular range. This waiting period also allows patients to determine if they are bothered by halos or glare. I like having a chance to fix the vision with the second eye through customized matching or by shifting powers. We must practice listening to patients' perception of their first eye so they feel that we are their partners with a shared goal of visual excellence. Patients who perceive they are not being taken seriously will quickly become unhappy.

Finally, it is important to educate patients preoperatively about neuroadaptation and the workings of the visual cortex. Neuroadaptation is real, and it improves edge definition and reduces the perception of out-of-focus aberrations. Neuroadaptation is the true reason why multifocal lenses work. Recently, George Beiko, MD, surveyed patients about their perception of halos and glare at their 6-week and 6-month follow-ups. The responses were 67% and 33%, respectively, for halos (Figure 7) and 66% and 34%, respectively, for glare (Figure 8). We do not understand why some people neuroadapt more readily than others, but the process takes at least 3 months and can last as long as 1 year. Therefore, the patient must know that he must be patient.

TAKE-HOME POINTS

1. Only people who prioritize functional vision without glasses are candidates for presbyopia-correcting implants. Do not force these lenses on patients; ask them about their visual needs, and evaluate their responses.

2. Presbyopic patients must understand that although presbyopia-correcting IOLs could provide a wider range of functional vision without glasses, they will still need glasses for some activities. Their vision may improve over the long term so they need less correction, but do not let them walk out the door thinking that they will be completely spectacle free.

3. Contraindications to presbyopia-correcting IOLs include significant macular disease, such as optic neuropathy, amblyopia, and advanced glaucoma. Conditions such as drusen with good visual potential, controlled glaucoma, and nonthreatening fixation are more challenging, but not contraindicated.

4. Patients should be aware of options for treating presbyopia. The quality of vision with an aspheric lens is becoming better accepted by patients and surgeons. Monovision or minimonovision are also options, particularly for people who previously used this technique with refractive surgery or contact lenses. Limbal relaxing incisions or toric implants can also improve quality of vision, particularly in patients with macular disease.

5. Remember that you are now a refractive cataract surgeon, not just a cataract surgeon, and this designation affects every step in your surgical process. You should underpromise and overdeliver. However, remember to celebrate successes, because patients do not always know how good their vision is compared with what it would have been with a standard lens. Help patients value the results you worked together to achieve. ■

Roger F. Steinert, MD, is Professor and Vice Chair at the University of California, Irvine. He is a consultant for Advanced Medical Optics, Inc. Dr. Steinert may be reached at (949) 824-0327; steinert@uci.edu.

Limbal Relaxing Incisions, Toric IOLs, and Astigmatism

A new paradigm to correct patients with more than 0.75 D of refractive cylinder.

BY R. BRUCE WALLACE III, MD

Success with presbyopia-correcting IOLs goes hand-in-hand with accurately calculating the power of IOLs preoperatively and effectively correcting astigmatism. The goal of inducing no more than 0.75 D of astigmatism in most eyes is a challenge; approximately 30% of refractive cataract patients need additional procedures to achieve this amount of refractive cylinder.[i] With most cataract surgeries using incisions of 3 mm or smaller, we must turn to limbal relaxing incisions (LRIs) and toric IOLs to arrive at the excellent visual results that we promise our patients.

TORIC IOLs

Toric IOL options include the STAAR toric IOL (STAAR Surgical Company, Monrovia, CA), available in two powers, and the AcrySof toric IOL (Alcon Laboratories, Inc., Fort Worth, TX), available in three powers. The AcrySof toric lens shows less propelloring or axis rotation (data on file with Alcon Laboratories, Inc.). With the success of the monofocal toric IOL, it is likely that Alcon will produce a toric version of the multifocal AcrySof Restor IOL in the future. The AcrySof toric lens combats corneal astigmatism, has a long safety record, provides rapid refractive stability, is available in non-blue-blocking options, and its refraction is able to be enhanced postoperatively.

Still, some surgeons are reluctant to use toric IOLs because they think they do not work, are difficult to implant, and require extra IOL manipulation. Once they understand the benefits of these lenses, however, the minimal extra effort involved in their implantation is a fair trade-off. I have found that the learning curve for toric IOL usage is minimal, and I have grown comfortable with the implantation technique.

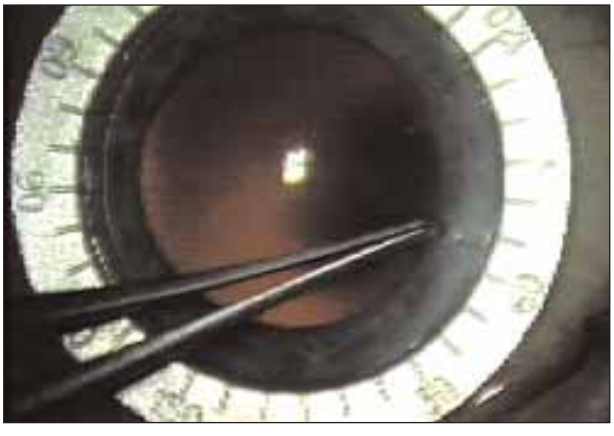

Figure 9. The author prefers using a Mendez marker, which has axis numbers to help orient astigmatic incisions.

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LRIs

What we now call LRIs are really peripheral corneal incisions (an incision that is 1.0 to 1.5 mm anterior to the limbus is not a limbal incision). Following the limbal curvature, we can make either single or paired incisions, but we should consider these peripheral corneal incisions.

Although LRIs are relatively safe and effective, they may fall short in comparison to toric IOLs. LRIs are somewhat less predictable with varied results with different techniques. They require additional instrumentation and can create postoperative foreign body sensation, and even infection and perforation in rare cases.

LRI PROCEDURE

Planning

Surgical planning for astigmatic correction can be difficult if a patient's refractive cylinder does not match his keratometric cylinder. In that case, it might be best to avoid performing LRIs until after lens surgery, when residual astigmatism can be measured more accurately.

Technique

I have developed a technique and accompanying surgical kit for correcting astigmatism that involves making one incision, a 60º arc, to eliminate approximately 1.50 D of cylinder in most eyes. The instrumentation that I helped developed and use is manufactured by Duckworth & Kent Ltd (Hertfordshire, UK) and Storz Instruments (Rochester, NY), although I have no financial interest in it. The entire package is called the *Wallace LRI Kit* (although it should be called the *PCI Kit*). It includes a preset 600-µm diamond knife, a Mendez Axis Marker, and 0.12 forceps. The Mendez Marker is valuable because it has axis numbers to help us orient the astigmatic incisions more accurately. The forceps in the kit is

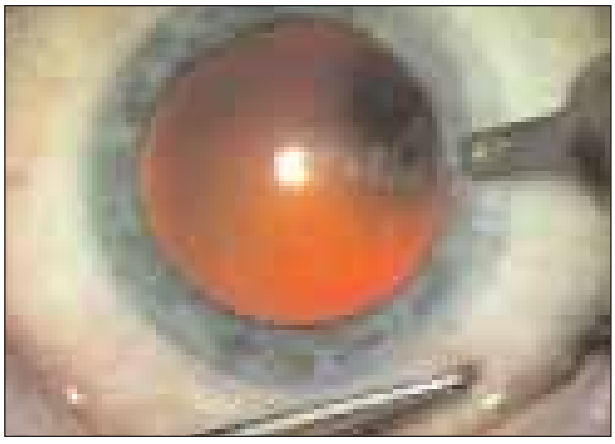

Figure 10. The author advances the diamond knife toward the fixation.

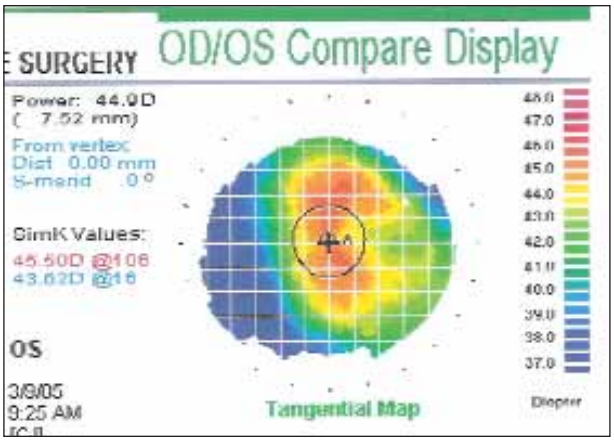

Figure 11. This topography shows an eye with 1.50 D of with-the-rule astigmatism.

used to mark the cornea and also fixate the globe. The blade is a titanium trifacet tip that does not dull easily and lasts a long time.

I perform my LRI procedures before phacoemulsification. First, I mark the axis (Figure 9), and then the incision's borders. I fixate the globe with 0.12 forceps and advance the knife toward the fixation (Figure 10).

Case Example

Figure 11 is an eye's topography showing 1.50 D of with-the-rule astigmatism. I chose the 106° access mark, which required twisting the instrument slightly to accommodate working under the lid speculum. If you do not use a locking lid speculum, you can ask the technician to hold the lid open or else just widen the speculum, although doing so can torque the eye downward. After I marked the axis, I shifted the 90° mark of the marker over, on top of the 106° mark, and then I counted three hash marks to each side for a total of 60° (30° on each side) and marked these. After drying the spots with a Weck cell sponge for better visibility, I fixated the globe with the same forceps that I used to mark the cornea, and I advanced the knife toward fixation, keeping it as perpendicular to the cornea as possible. I made a single superior incision to treat 1.50 D of astigmatism. The profile of the knife in the LRI kit is so thin that you can twirl it, which I do as I follow the template of the limbus. The technique is very reproducible, and the results are relatively immediate and stable.

POSTOPERATIVE MEDICATIONS

We have found topical nonsteroidal anti-inflammatory medications (such as Acular LS [Allergan, Inc., Irvine, CA]) to provide a safe anesthetic effect, and patients rarely complain of foreign body sensation after LRI. Due to its benefits in preventing CME, we now begin administering Acular LS 3 days prior to lens surgery.

POSTOPERATIVE ASTIGMATIC MEASUREMENT

Although there are many sophisticated programs available for measuring astigmatism after surgery, I suggest that surgeons first follow their results by measuring the amount of postoperative cylinder an eye has, regardless of the axis of its location. My staff and I are getting great results; we have routinely been in the 90th percentile for eyes with less than 1.00 D of astigmatism postoperatively. As postoperative corneal topography continues to improve, so will ophthalmologists' astigmatic corrections. Additionally, wavefront analysis will help us measure postoperative eyes in order to determine if our incisions need to be at different depths or optical zones.

CONCLUSION

In reducing astigmatism, consider the options you have available. Peripheral corneal incisions and toric IOLs are both effective. Our refractive cataract and refractive lens patients are increasingly expecting not to need postoperative tweaking with expensive modalities such as LASIK. ■

R. Bruce Wallace III, MD, is Medical Director of Wallace Eye Surgery in Alexandria, Louisiana, Clinical Professor of Ophthalmology at the LSU School of Medicine, and Assistant Clinical Professor of Ophthalmology at the Tulane School of Medicine in New Orleans. He is a consultant for Advanced Medical Optics, Inc., and Allergan, Inc. Dr. Wallace may be reached at (318) 448-4488; rbw123@aol.com.

1. Wallace RB. On-axis cataract incisions: where is the axis? The ASCRS Symposium of Cataract, IOL and Refractive Surgery Best Papers of Session. November 1995; 67-72.