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Cataract & Refractive Surgery TODAY

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Troubleshooting With Presbyopia-Correcting IOLs

Featured material from PRIME SYMPOSIA
Premium Refractive IOL Management and Education

Phacodynamics to Help Minimize Complications
By Barry S. Seibel, MD

What Happens When You Miss Your Target?
By Mitchell A. Jackson, MD

Pharmaceutical Strategies To Minimize Cataract Complications
By Roger F. Steinert, MD

Jointly sponsored by the Dulaney Foundation and *Cataract & Refractive Surgery Today*.

Release date: February 2010. Expiration date: February 2011.

This continuing medical education activity is supported by an unrestricted educational grant from Allergan, Inc.

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STATEMENT OF NEED

Presbyopia-correcting IOLs continue to gain market share in ophthalmology,[1] and ophthalmic surgeons who adopt these lenses must develop a skill set for implanting them as well as managing postoperative refractive error. Due to the multifocal and/or aspheric nature of presbyopia-correcting IOLs, optimal UCVA depends upon several criteria. First, the ocular surface must be healthy.[2,3] Second, surgical outcomes must be within 0.50 D of the intended refraction.[4,5] Third, the patient population for which these lenses are designed has a significant incidence of preoperative astigmatism (unpublished data from Warren E. Hill, MD, of 6,000 cataract patients), which must be reduced to allow these lenses to perform optimally.[6]

The sensitivity of presbyopia-correcting IOLs also demands highly skilled cataract surgery. In particular, surgeons should optimize the phacoemulsification step via up-to-date techniques and devices to prevent intraoperative complications and ensure a clear cornea postoperatively.[7]

As with any form of cataract surgery, protecting the eye from infection and surgically induced pathology is an important component of ensuring positive outcomes and reducing the time and expense of managing postoperative complications. Surgeons must be able to prevent and manage macular edema, inflammation, and pain in patients who receive elective IOLs.

This CME activity is designed to provide evidence-based knowledge regarding the prevention and management of complications with elective presbyopia-correcting IOLs. Experts will address the standard of care required of practicing ophthalmologists for the implantation of these lenses.

1. Market Scope Quarterly Cataract Surgeon Survey St. Louis, MO: Market Scope LLC.
2. Behrens A, Doyle JJ, Stern L, et al. Dysfunctional tear syndrome. A Delphi approach to treatment recommendations. *Cornea* 2006;25:900-907.
3. Woodward MA, Randleman JB, Stulting RD. Dissatisfaction after multifocal intraocular lens implantation. *J Cataract Refract Surg*. 2009;35(6):992-997.
4. Lindstrom RL. Refractive outcome of toric IOLs determines patient satisfaction. *Ocular Surgery News*. August 10, 2009. http://www.osnsupersite.com/view.aspx?rid=42062. Accessed February 5, 2010.
5. Kezirian GM. Refractive comanagement for the presbyopia-correcting IOL surgeon. *Cataract & Refractive Surgery Today*. 2009;9(11):57-59.
6. *Mastering Refractive IOLs: The Art and Science*. Ed. Chang DF. Thorofare, NJ: Slack, Inc.; 2008.
7. Seibel BS. *Phacodynamics: Mastering the Tools and Techniques of Phacoemulsification Surgery*. 4th ed. Thoroughfare, NJ: Slack, Inc.; 2005.

TARGET AUDIENCE

This certified CME activity is designed for general ophthalmologists and anterior segment surgeons specializing in cornea, refractive, and cataract surgery.

LEARNING OBJECTIVES

Upon completing this activity, the participant should be able to:

- effectively manage and prevent complications with presbyopia-correcting IOLs;
- optimize phacoemulsification to prevent complications and improve outcomes; and
- employ effective pharmaceutical protocols for cataract surgery.

METHOD OF INSTRUCTION

Participants should read the continuing medical education (CME) activity in its entirety. After reviewing the material, please complete the self-assessment test, which consists of a series of multiple-choice questions. To answer these questions online and receive real-time results, please visit http://www.dulaneyfoundation.org and click "Online Courses."

Upon completing the activity and achieving a passing score of over 70% on the self-assessment test, you may print out a CME credit letter awarding 1 *AMA PRA Category 1 Credit.*™ The estimated time to complete this activity is 1 hour.

ACCREDITATION AND DESIGNATION

This activity has been planned and implemented in accordance with the Essential Areas and policies of the Accreditation Council for Continuing Medical Education (ACCME) through the joint sponsorship of the Dulaney Foundation and *Cataract & Refractive Surgery Today*. The Dulaney Foundation is accredited by the ACCME to provide continuing education for physicians. The Dulaney Foundation designates this educational activity for a maximum of 1 *AMA PRA Category 1 Credit.*™ Physicians should claim credit only commensurate with the extent of their participation in the activity.

DISCLOSURE

In accordance with the disclosure policies of the Dulaney Foundation and to conform with ACCME and US Food and Drug Administration guidelines, anyone in a position to affect the content of a CME activity is required to disclose to the activity participants: (1) the existence of any financial interest or other relationships with the manufacturers of any commercial products/devices or providers of commercial services; and (2) identification of a commercial product/device that is unlabeled for use or an investigational use of a product/device not yet approved.

FACULTY CREDENTIALS

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FACULTY/STAFF DISCLOSURE DECLARATIONS

Dr. Jackson is on the speakers' bureaus of Abbott Medical Optics Inc., Bausch + Lomb, Allergan, Inc., ISTA Pharmaceuticals, Inc., and Technolas Perfect Vision. He describes off-label uses of three ophthalmic devices.

Dr. Seibel is a consultant to Optimedica Corp.

Dr. Steinert is a consultant to Abbott Medical Optics Inc., Allergan, Inc., ReVision Optics, Rhein Medical, ISTA Pharmaceuticals, Inc., and LenSx Lasers, Inc.

All those involved in the planning, editing, and peer review of this educational activity have indicated that they have no financial relationships to disclose.

Phacodynamics to Help Minimize Complications

How to prevent bad things from happening to good operations.

BY BARRY S. SEIBEL, MD

Every cataract surgeon wants to minimize complications during phacoemulsification. I have found that maximizing our understanding of both the phaco machine's operating principles as well as the fundamental physics behind microsurgical maneuvers can effectively help us manage intraoperative complications.

Traditionally, we learn phacoemulsification by memorizing large tables that describe the various permutations of flow, vacuum, equipment, stage of the procedure, etc. I propose a proactive method of using reason to intuit how and when we should adjust the machine's parameters based on what we see through the microscope.

THE CLINICAL MEANING OF PHACO PARAMETERS

I think it is most important to understand what phaco parameters mean clinically. We should approach phacoemulsification by asking ourselves what our clinical goals are and how can we best adjust the machine to accomplish them. In basic terms, *flow* is the current that moves nuclear material to the port of the phaco needle. *Vacuum* is the force that allows the port to grip material that is brought there by flow. *Bottle height* keeps the anterior chamber formed, not only in the steady state, but also and most importantly in high-vacuum maneuvers like chopping. *Ultrasound* disrupts and destabilizes the nucleus so the vacuum forces can deform and aspirate material that would otherwise be too rigid for fluidics alone. It also allows us to embed the phaco tip into the body of the nucleus so that vacuum from the pump can grip the material, allowing us to chop the nucleus with a second instrument.

Attracting Material to the Tip

We surgeons must be aware of the differences between flow pumps and vacuum pumps (Figure 1). Vacuum power is set differently between the two pumps. Also, adjusting the vacuum will produce a different clinical outcome depending on whether the aspiration port is occluded or not. Figure 2 shows the effect of trying to attract a chopped fragment to the phaco tip. The green bar on the side represents the vacuum preset level for using a flow pump and the vacuum level in the cassette if using a Venturi pump. The red bar at the bottom represents the amount of vacuum inside of the phaco tip, which is nowhere near the preset level, because there is not much resistance to flow while aqueous is being drawn into the unoccluded aspiration port, so the vacuum does not rise significantly. In this scenario, adjusting the vacuum preset limit on a peristaltic phaco machine would have no clinical effect, nor would increasing the ultrasound or bottle height. If we wanted to get the fragment to the tip faster, we would raise the flow rate.

parameter	aspiration port occlusion	effect
flow pump		
commanded flow rate (cc/min)	no	attracts material to aspiration port
	yes	rise time
vacuum limit (mm Hg)	no	none
	yes	grips material at aspiration port
vacuum pump		
commanded vacuum (mm Hg)	no	controls flow rate; attracts material to aspiration port
	yes	grips material at aspiration port

Figure 1. Fluidic differences between flow pumps and vacuum pumps.*

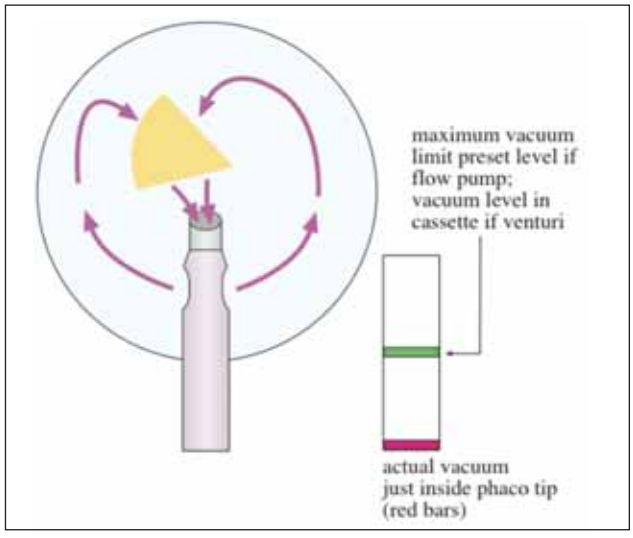

Figure 2. Raising the flow rate will attract a chopped fragment to the phaco tip faster.*

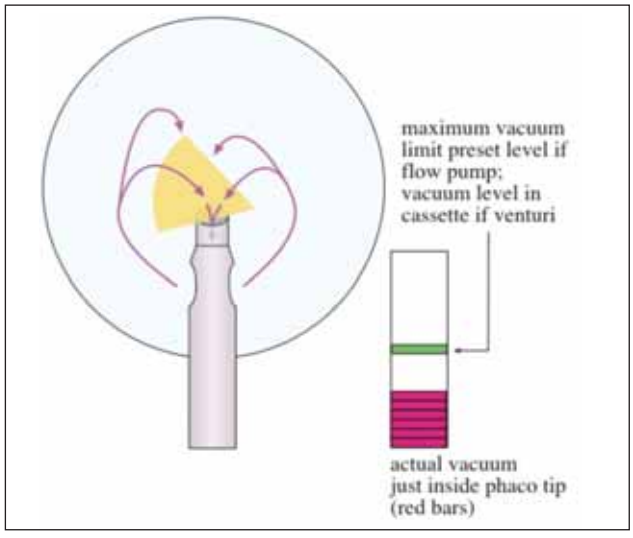

Figure 3. Vacuum inside the phaco tip rises as the tip becomes occluded by the nuclear fragment.*

Partial Occlusion

Figure 3 shows a nuclear fragment partially occluding the phaco tip. Vacuum is relevant to the extent that the fragment is occluding the tip. Flow is relevant to the extent that some of the tip's surface area is still open. Both vacuum and flow are attractive fluidic parameters that will counteract the axial vibration of the phaco tip (under traditional ultrasound) that can cause chatter that will knock the fragment away. The vacuum inside the phaco tip has risen (the red bars) because of the partial occlusion at the tip. We will not hear the occlusion indicator until the vacuum reaches the preset level. The resistance and vacuum forces are higher because the flow is trying to draw fluid and nuclear material through the smaller opening. If we were trying to phacoaspirate this particle, the vacuum and flow would be counteracting the ultrasound to draw the fragment into the tip. If there is lens chatter, we either increase the attractive parameters of vacuum and flow or decrease the repulsive action of the traditional longitudinal ultrasound.

CHOPPING

Let's say that we are trying to chop a nuclear fragment into two smaller pieces. We may lose the phaco needle's grip as we maneuver the phaco chopper around the fragment (Figure 4). Because vacuum equates to grip, we might try to raise the vacuum level. However, nothing will happen at the phaco tip, because it is not completely occluded. We must first optimize our technique by completely embedding the aspiration port into the nuclear fragment. No matter what kind of pump we are using, we must completely occlude the aspiration port to cut off all aspiration outflow. Vacuum has to rise up to the preset level so that we hear the occlusion indicator (if using a flow pump). Now we can begin chopping, and if we again lose control or grip, it will then make sense to increase the vacuum level.

TIP OCCLUSION

When trying to occlude the phaco needle in nuclear material, we must make sure the bevel is turned correctly. If the bevel of the tip is not parallel to the material, it will not embed all the way because of resistance from the silicone sleeve, and when we try to pull the heminucleus out for a stop-and-chop maneuver, the tip will simply pull out of the

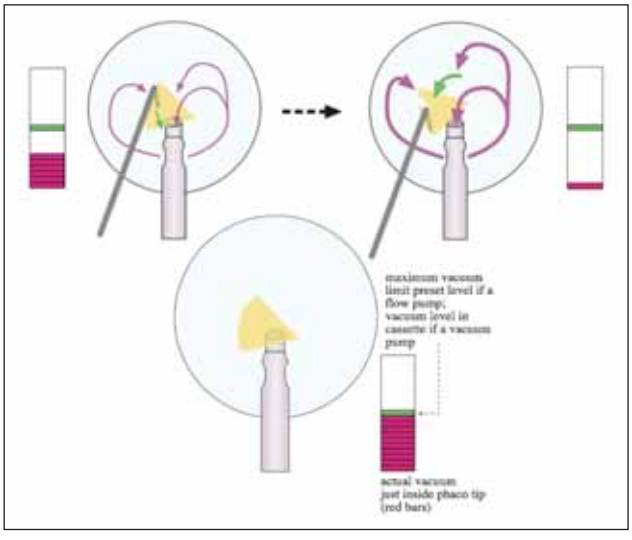

Figure 4. The aspiration port must be fully embedded into the nuclear fragment in order to achieve purchase.*

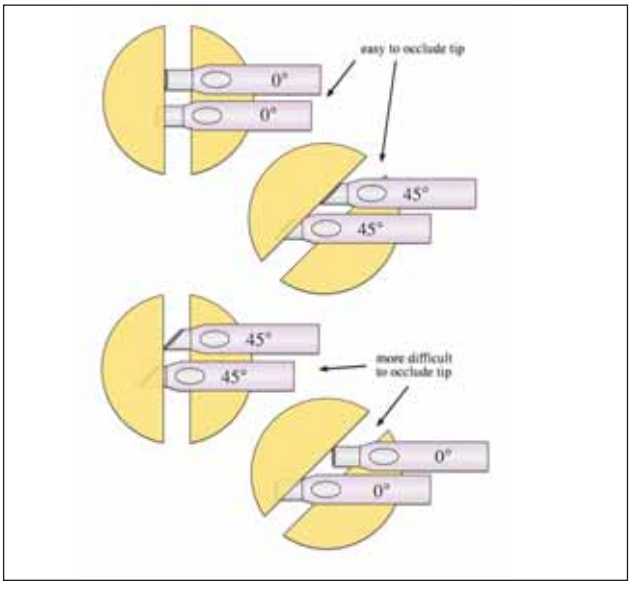

Figure 5. The bevel of the phaco tip must be parallel to the surface of the material being occluded.*

heminucleus instead of gripping it. The bevel of the tip must be parallel to the surface we want to occlude (Figure 5). The flow will be zero, but the vacuum will have reached the full preset level. At this point, we can pull the large heminucleus out distally and achieve strong grip and control while engaging the phaco chopper. Again, we can produce a completely different clinical outcome without changing our parameters, but by slightly adjusting our surgical technique.

POSTOCCLUSION SURGE

When using high-vacuum techniques, especially in chopping, we have to be concerned about postocclusion surge. As vacuum builds between the occluded particle and the pump, the tubing can start to collapse, air bubbles may be pulled out of the solution (Figure 6), and all of these forces will combine to exceed the steady state in the anterior chamber that we set at the beginning of the procedure with an open aspiration port. As the nuclear material breaks down, there can be a sudden inrush of fluid as the tubing expands and the air rushes back into the solution, and this causes postocclusion surge or shallowing of the chamber (Figure 7). Essentially, there will be too much fluid going out and not enough coming in. We want to create a high-pressure head of fluid that will keep the chamber stable, so we increase the bottle height. If the bottle height is at its maximum, but postocclusion surge still occurs, then we must decrease the vacuum level. All brands of phaco machines have options for countering this effect, such as more resistive tubing, which is found on the Infiniti Vision System with Intrepid FMS (Alcon Laboratories, Inc., Fort Worth, TX). Dual-linear foot pedal

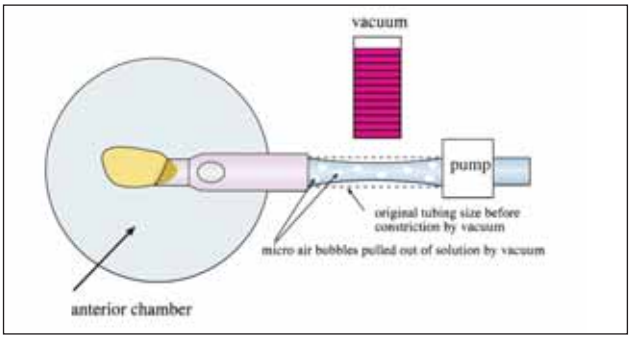

Figure 6. When the phaco tip is occluded, rising vacuum pulls micro air bubbles out of the solution in the phaco handpiece.*

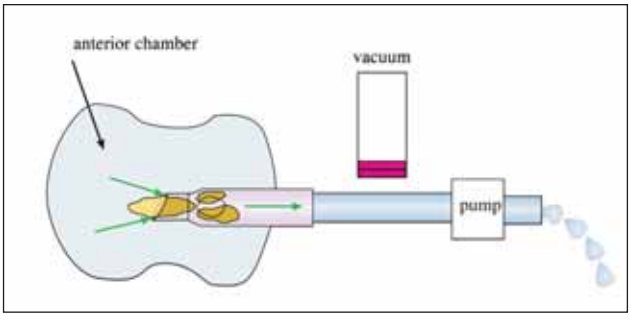

Figure 7. As material is drawn into the phaco tip, fluid rushes in with it, shallowing the anterior chamber.*

control, which is available on the Stellaris Vision Enhancement System (Bausch + Lomb, Rochester, NY) and is forthcoming on the WhiteStar Signature platform (Abbott Medical Optics Inc., Santa Ana, CA), allows even further capability to reduce vacuum when it is not critical.

SUMMARY

We should always optimize our technique before optimizing our technology. It is preferable to use vacuum for gripping nuclear material. With various nuclear densities, we may have to modify our technique to optimize the vacuum seal. The bevel of the phaco needle must be parallel to the surface to achieve full occlusion. When we notice any dimpling or instability in the anterior chamber, we need to control surge by checking the bottle height first and lowering the vacuum level second, and we must remember to take advantage of the surge-control options from the various manufacturers. All of these strategies can increase the odds of complications-free cataract operations, particularly in this era of premium IOLs. ●

**Figures reprinted with permission from SLACK Incorporated: Seibel BS.* Phacodynamics: Mastering the Tools and Techniques of Phacoemulsification Surgery. *4th ed. Thorofare, NJ: SLACK Incorporated; 2005.*

What Happens When You Miss Your Target?

Managing residual refractive error in presbyopia-correcting lenses.

BY MITCHELL A. JACKSON, MD

Most of my experience is refractive, although I have been performing cataract surgery in private practice for 16 years. During the past few years, I have increased my volume of presbyopia-correcting IOLs and learned several strategies for optimizing my results. Primarily, surgeons who wish to implant these lenses must remember that refractive IOL patients will not tolerate even small refractive errors.[1] Because these patients are incredibly sensitive to the slightest aberrations, surgeons must be willing to treat postoperative refractive errors. Here, I share my own strategies for managing residual refractive error with these implants.

EMMETROPIA IS THE GOAL

Richard Lindstrom, MD, has studied the correlation between refractive cataract patients' postoperative satisfaction and their outcomes. Dr. Lindstrom has concluded that, "A good outcome is a complication-free procedure that generates a refractive outcome within 0.50 D of emmetropia."[2] Although preoperative counseling and managing patients' expectations are still important, achieving our refractive targets is critical for pleasing patients. Modern-day cataract surgery is refractive surgery. Even patients who receive monofocal IOLs now expect perfect vision after surgery. Therefore, our goal must be emmetropia.

Preoperative Evaluation

The Centers for Medicare and Medicaid Services' ruling 05-01 (May, 2005) states that the additional fee we are allowed to collect for premium IOLs is not for the lens, but for the work-up and chair time for providing the premium technology.[3] Patient's out-of-pocket expenses are for the extra diagnostic tests to make sure we achieve the right outcome.

" 'A good outcome is a complication-free procedure that generates a refractive outcome within 0.50 D of emmetropia.' "

My formal preoperative evaluation for premium refractive IOL patients includes pupillometry and corneal topography. Pupillometry can pinpoint the reason for a patient's complaints postoperatively. This test also helps me select the right implant for a patient. For example, patients with different pupil sizes may benefit from different multifocal IOL designs.[4,5]

Corneal topography rules out pathology such as keratoconus, and it also reveals whether the patient's cornea is thick enough to withstand a postoperative enhancement with LASIK, or if PRK is better indicated. Topography can also help us determine the visual axis if we decide to use limbal relaxing incisions (LRIs) postoperatively. Make sure your patients are out of their contact lenses long enough to get an accurate topographic map of their cornea and prevent false-positive readings. If you do see an abnormal topographic pattern, whether forme fruste keratoconus, frank keratoconus, or pellucid marginal degeneration, do not implant a multifocal IOL, because irregular corneal surfaces can potentially lead to an additional loss of BCVA and other visual distortions. These patients will be happier with a monofocal lens.

Figure 1 illustrates the importance of conducting topographic mapping on every premium refractive IOL patient preoperatively. An individual with a multifocal IOL was referred to me. He had not received topography before his implantation surgery. When my staff and I mapped his eye topographically, we found frank keratoconus. We had to

exchange the implant (thankfully, his previous surgeon had not yet performed an Nd:YAG capsulotomy).

I also use the latest version (5.4) of the IOLMaster (Carl Zeiss Meditec, Inc., Dublin, CA) to perform keratometry. The system's keratometric readings are spot-on, especially with toric IOLs and post-LASIK cataracts.[6] Performing retinal optical coherence tomography (OCT) is also critical. OCT has allowed me to detect epiretinal membranes, which are a contraindication for multifocal IOLs. Therefore, my staff and I have begun to perform this test preoperatively on patients in whom we suspect macular disease of any type.

DRY EYE

Cataract patients have many risk factors for dry eye.[7,8] Because of their age, the majority of cataract patients have dry eye syndrome, meibomian gland dysfunction, and/or blepharitis, which can compromise a patient's visual acuity by affecting the ocular surface. These conditions can be caused by age, menopause, and medications. It is important to take a careful history of all medications. I include over-the-counter medications, such as antihistamines, antidepressants, diuretics, birth control pills, hormone replacement therapy, and various headache medicines—all these drugs can affect the tear film.[9]

Intraoperatively, cataract surgery can destabilize tear production,[10] phacoemulsification can alter the tear breakup time,[11,12] and LRIs can denervate the cornea.[13] The latest terminology for dry eye is *dysfunctional tear syndrome* and *tear film composition abnormality*.[14] In simple terms, eyes with dysfunctional tear syndrome have a greater presence of cytokines, which cause inflammation.[15] The easiest way to assess tear film abnormality pre- and postoperatively is to stain the cornea with lissamine green dye.

Because the health of the ocular surface is so important in refractive cataract surgery, I treat ocular dryness aggressively pre-, intra-, and postoperatively. I prescribe my patients oral omega-3 fatty acids,[16] azithromycin if they have lid margin disease, and cyclosporine A to counter the inflammatory cytokines.[17,18] I use these treatments preoperatively to optimize the diagnostic testing and have patients continue them postoperatively to maximize outcomes. Although the use of azithromycin ophthalmic solution 1% (AzaSite; Inspire Pharmaceuticals, Inc., Durham, NC) for anti-inflammatory measures is off-label, there are several studies that show it has anti-inflammatory effects when used preoperatively for lid margin disease.[19,20] I feel that using it preoperatively lessens patients' complaints about dry eye and improves their visual outcomes postoperatively.[21-23]

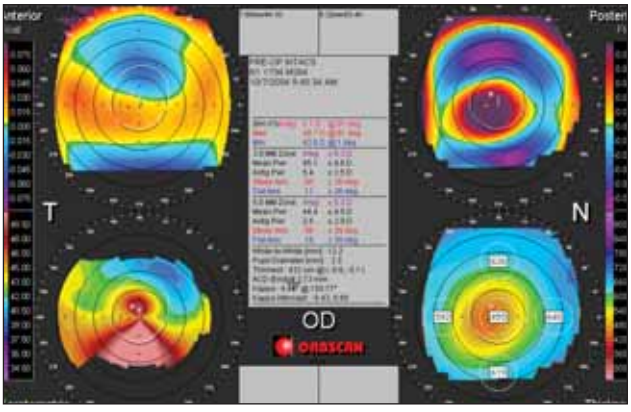

Figure 1. Keratoconus that could have been detected preoperatively with topography.

ASTIGMATISM

Currently, there are no FDA-approved presbyopia-correcting IOLs that address astigmatism. Depending on the patient's needs and ocular pathology, you may decide to recommend a toric IOL versus a premium presbyopia-correcting lens to correct the astigmatism. You may also consider LRIs. I use LRIs if the corneal astigmatism is less than 1.50 D. If the astigmatism is greater than 3.00 D, I may consider debulking it intraoperatively with LRIs and then treating the rest with a laser vision correction enhancement postoperatively. Although laser vision correction might be more precise than LRIs, it cannot be done immediately postoperatively, and so the patient loses the "wow" factor with his presbyopia-correcting IOL.

Some of the nomograms I use are the NAPA by Louis "Skip" Nichamin, MD (www.mastel.com/pdf/napa.pdf), and the DONO by Eric D. Donnenfeld, MD (http://www.lricalculator.com). The LRI calculator is also very helpful; it uses vector analysis based on the placement of the incision. It is very easy to use for LRIs and allows you to personalize your own nomogram.

CHALLENGING EYES

Have an appropriate plan for managing eyes with pseudoexfoliation[24] and intraoperative floppy iris syndrome.[25] If these patients desire a multifocal IOL, you must warn them that theirs is a more challenging case and you may only be able to give them a monofocal lens (of all the current premium/toric IOLs, only the Tecnis three-piece multifocal IOL [Abbott Medical Optics Inc., Santa Ana, CA] can be placed in the sulcus).

POSTOPERATIVE CONSIDERATIONS

I do not often piggyback lenses, but I will occasionally do this with the STAAR AQ 5010 (Monrovia, CA), because

it has a larger diameter. This lens does not address astigmatism, however, which is the most common reason for postoperative dissatisfaction. I still find laser vision correction to be the most predictable, reliable, and comprehensive method for correcting residual refractive error. I choose between LASIK and PRK based on the patient's preoperative topography, and I inform the patient of my plan so there are no surprises. Additionally, some surgeons are experimenting with using the IntraLase FS femtosecond laser (Abbott Medical Optics Inc., Santa Ana, CA) off-label to correct refractive error. The surgeon creates a smaller flap (6 mm, compared with the usual 8.5-mm LASIK flap), which should reduce some of the neurogenic dry eye complaints associated with the flap. Another off-label technique that I use to treat residual spherical aberration is the CustomVue card on the STAR S4 excimer laser (Abbott Medical Optics Inc., Santa Ana, CA). The laser is only approved for primary LASIK, but you can use it off-label to treat very small residual refractive errors without incurring any extra cost for you or your patient.

TIMING POSTOPERATIVE TREATMENTS

If you have not performed LRIs at the time of the surgery, you may want to wait longer postoperatively to correct residual refractive error, especially with the Crystalens—I tend to perform an Nd:YAG capsulotomy in those eyes a little sooner than with other implants. With the Crystalens, symptoms of glare and halo are not caused by multifocal rings and must be the result of another problem. Be aware, however, that an Nd:YAG capsulotomy may cause Z-syndrome (capsular contraction), which may change the position of the lens and shift the refractive error. Therefore, I will perform laser vision correction in these eyes after I use the Nd:YAG laser.[26,27]

Because of the nature of their optics, multifocal IOLs require that we correct any residual astigmatism, even if it is 0.50 D, to optimize these patients' vision. I perform enhancements on these eyes as early as 1 month if the refraction is stable. I only perform an Nd:YAG capsulotomy on these eyes if it is absolutely necessary, because once this is done, exchanging multifocal IOLs is much more difficult.

FINAL CONSIDERATIONS

Continue treating your patients' ocular surface after refractive cataract surgery to ensure the best outcomes. My staff and I always measure these patients' distance, intermediate, and near vision with both eyes together before testing their acuities separately, because that is how they function optimally.

I think it is useful to demonstrate to premium patients the value of their IOL implants. On the first postoperative day, I ask my patients to put on -2.50 D glasses made by Alcon Laboratories, Inc. (Fort Worth, TX), to show them the vision they would have had with a standard monofocal IOL. This exercise makes satisfied patients even happier and dissatisfied patients less so. ●

This article describes the off-label use of azithromycin ophthalmic solution 1% (AzaSite; Inspire Pharmaceuticals, Inc., Durham, NC), *the IntraLase FS femtosecond laser (Abbott Medical Optics Inc., Santa Ana, CA), and the CustomVue card on the STAR S4 excimer laser (Abbott Medical Optics Inc.).*

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Pharmaceutical Strategies To Minimize Cataract Complications

A review of the recent literature.

BY ROGER F. STEINERT, MD

Although the exact incidence of cystoid macular edema (CME) is still unclear, experts agree that CME is a frequent cause of visual loss following even uncomplicated cataract surgery. Studies suggest that the rate of clinical CME ranges from 1% to 12%,[1-4] while the incidence of angiographic CME ranges from 9.1% to 39%.[3,5-7] This broad category of subclinical CME may explain the reason some patients who have excellent visual acuity after cataract surgery still complain about seeing poorly.

The risk factors for CME are many.[8-10] CME is most common following intraocular surgery, although it can develop after surgeries with no obvious complications and in patients with no apparent risk factors. Elderly patients may have risk factors that are undiagnosed at the time of surgery, putting them at an increased risk for CME.

Although cataract surgeons may hesitate to add an additional prescription to the postoperative regimen, a study showed that treating CME (as opposed to preventing the condition) has a negative economic impact.[11] The study found that the cost of ophthalmic care among Medicare patients who developed CME was significantly higher than among those who did not.

CHOOSING AND USING NSAIDs FOR OCULAR SURGERY

The clinical benefits of NSAIDs include analgesic and anti-inflammatory activity. In addition, NSAIDs such as ketorolac, diclofenac, nepafenac, and bromfenac have been shown to be effective in preventing and treating CME. NSAIDs do not cause significant side effects, such as IOP elevation and cataract formation, which may be seen with corticosteroids.

"[A] study found that the cost of ophthalmic care among Medicare patients who developed CME was significantly higher than among those who did not."

A study by Donnenfeld et al assessed the clinical benefit, relative efficacy, and pharmacokinetic-response curve of pre- and postoperative dosing of ketorolac tromethamine 0.4% to improve outcomes during and after cataract surgery.[12] It showed that starting NSAID therapy at least 24 hours before cataract surgery significantly reduced patients' discomfort during and after surgery. In the same dose-ranging study of ketorolac 0.4%, the investigators found that only the regimen of 3 days of ketorolac 0.4% maintained the pupil's size at its pre-incision diameter (P =.110), which is important for allowing surgeons to extract the diseased lens and implant an IOL.

PREVENTING CME, RETINAL THICKENING

NSAIDs have also been demonstrated to reduce CME and retinal thickening in cataract surgery. Retinal thickening appears to be related to the incidence of CME and less-than-optimal visual outcomes after cataract surgery. In a prospective, randomized, investigator-masked, multicenter clinical trial, Wittpenn et al[1] randomized cataract surgery patients (n = 546) into two groups. Group 1 received ketorolac 0.4% q.i.d. for 3 days preoperatively and four doses during dilation immediately before the procedure. These patients continued the q.i.d. regimen until they exited

the study and also instilled prednisolone acetate ophthalmic suspension USP 1% q.i.d. Group 2 received an artificial tear solution for 3 days prior to surgery and received only four doses of ketorolac 0.4% during dilation immediately before the procedure. Postoperatively, these patients continued to use the artificial tear solution q.i.d. and instilled a steroid q.i.d. until they exited the study.

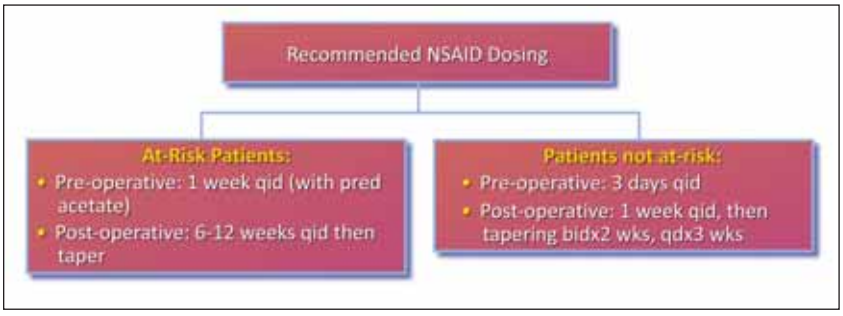

Figure 1. The author's pre- and postoperative NSAID dosing regimen.

The results of the ACME study demonstrated an association between small amounts of retinal thickening (>10 µm) and reduced contrast sensitivity after phacoemulsification, even in healthy patients with a low risk of CME. Mean visual acuity in patients with < 10 µm of retinal thickening was approximately 20/22, but visual acuity worsened to a mean of 20/25 in patients with ≥ 40 µm of thickening. Similarly, increased retinal thickening was associated with impaired contrast sensitivity. This was true no matter what lighting condition was applied.

IMPROVED VISUAL OUTCOMES

NSAIDs provide more subtle improvement in post-cataract visual outcomes. A prospective, randomized, case-controlled study found that adding perioperative ketorolac 0.4% to a postoperative steroid regimen resulted in fewer reductions in contrast sensitivity and improved fluorescein clearance test results.[13]

In the Donnenfeld study, preoperative treatment with ketorolac 0.4% for 1 or 3 days provided significantly better visual outcomes than did 1-hour dosing of ketorolac or placebo in the immediate postoperative period.[12] By month 3, visual acuity in the control group was worse than in any treatment group.

ADVERSE EVENTS

The most common corneal side effects associated with NSAIDs are burning and irritation, superficial punctate keratitis, and delayed wound healing.[14] Severe corneal issues, such as thinning and perforation due to melts, have also been reported with all conventional NSAIDs.[15,16] Nevertheless, complications with these agents are rare and most often occur in eyes with severe ocular surface disease. An early cluster of corneal melts largely occurred with generic diclofenac.[17]

CONCLUSIONS

There is an evolving body of evidence to support when and how long NSAIDs should be taken around cataract surgery. Several studies have documented the benefit of the presurgical dosing of NSAIDs to suppress the initial production of prostaglandins.[18-19] (*Note: The Donnenfeld study used ketorolac 0.4% and the Roberts study used diclofenac.*) The best pre- and postsurgical regimens may be what was used in the Wittpenn ACME trial—3 days presurgically and approximately 4 weeks after surgery (Figure 1). High-risk patients (those with diabetes, capsule tears, or vitreous loss) may need a longer duration of therapy both before and after surgery. Treating these patients with NSAIDs for 3 months postoperatively decreased the incidence of CME to that of patients with a low risk of CME. In order to provide the best outcomes following ophthalmic surgical procedures, NSAID use should be routine practice to avert complications such as CME and to prevent and/or reduce inflammation and pain as well as prevent miosis. ●

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CME QUESTIONS

1. If trying to attract nuclear material to an unoccluded phaco tip, it is most effective to raise
A. vacuum
B. flow
C. bottle height
D. all of the above

2. To decrease chatter at the phaco tip, what should you do?
A. increase vacuum, flow, and ultrasound
B. increase vacuum and ultrasound simultaneously
C. either decrease vacuum and flow or increase ultrasound
D. either increase vacuum and flow or decrease ultrasound

3. What is the primary way to maintain chamber stability to prevent postocclusion surge?
A. lower the bottle height
B. lower the vacuum
C. raise the bottle height
D. increase vacuum

4. What is the preferred targeted refraction when implanting multifocal and toric IOLs?
A. Within 0.25 D
B. Within 0.50 D
C. Within 0.75 D
D. Within 1.00 D

5. In eyes that receive a multifocal or toric IOL, is it better to correct residual refractive error before or after an Nd:YAG capsulotomy?
A. before
B. after

6. What is the recommended length of time to wait for the eye to stabilize before correcting residual refractive error after the primary cataract/IOL surgery?
A. at least 2 weeks
B. at least 1 month
C. at least 2 months
D. at least 3 months

7. Cystoid macular edema can develop after surgeries with no obvious complications and in patients with no apparent risk factors.
A. true
B. false

8. What are the two primary clinical benefits of NSAIDs?
A. analgesic
B. antibacterial
C. antifungal
D. anti-inflammatory

9. What NSAID dosing schedule did the Wittpenn ACCME trial determine was optimal for healthy eyes?
A. 1 day preoperatively and 2 weeks postoperatively
B. 3 days preoperatively and 4 weeks postoperatively
C. 1 week preoperatively and 4 weeks postoperatively
D. no preoperative dosing and 2 weeks postoperatively

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Would you recommend this program to a colleague? ❒ Yes ❒ No

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If yes, please specify. We will contact you by e-mail in 1 to 2 months to see if you have made this change.

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