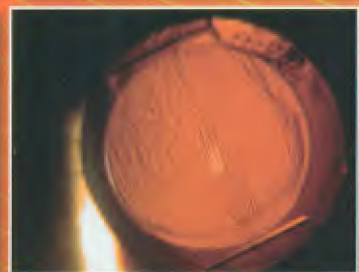
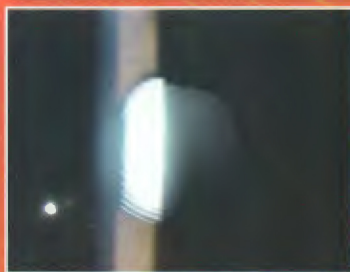
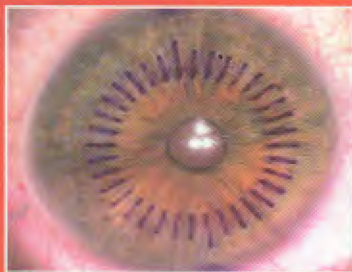
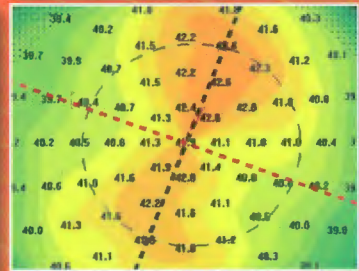
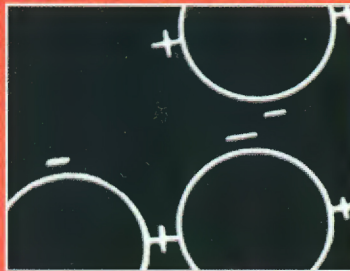
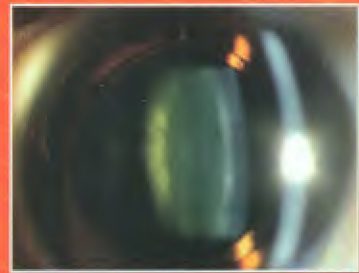


Premium Cataract Surgery

A step-by-step guide

Editor:

John A. Hovanesian



SLACK Incorporated

Chapter 15

Excimer Laser Enhancements After Intraocular Lens Surgery

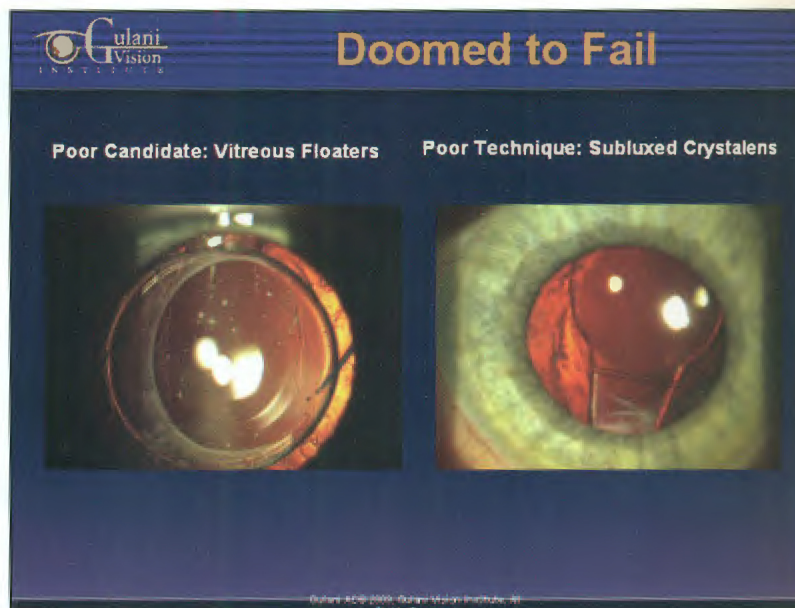
Jay Bansal, MD and Arun C. Gulani, MD

The demographic of patients who are opting to pay for an upgrade to a premium lens means increasing expectations clinically as well as emotionally. The ever-elusive fountain of youth is not their actual goal but the Baby Boomers who are transitioning from being prime LASIK candidates to cataract patients have new sets of expectations and demands. They expect to have the vision of their youth and may become a surgeon's loudest advocate for happiness or chagrin depending on how well a surgeon navigates the process. For "20/happy" all around, it is essential that the entire team is involved in negotiating patients' expectations, providing information that gives them choices, and preparing them for options in enhancement scenarios. The movement of the "bump in the snake" indicates that it makes sense long-term to adjust practices to accommodate this shift in patient type.

SETTING THE STAGE

While many surgeons may have a preferred lens, the patient's visual needs dictate the lens choice. Considering the many choices of premium intraocular lenses (IOLs) available, counseling is a critical component of helping patients understand what the technology can give them, what trade-offs they should expect when they choose a premium lens, and what may be necessary to achieve optimum visual function postsurgery. Many practices have taken counselors from their LASIK team and utilized them in helping patients walk through their options. Sending materials and having a point of contact before the initial exam is proving successful in preparing patients for their choices. Privacy and an office space where discussions on their choices in the lane and with the surgical scheduler are often appreciated.

Figure 15-1. Good candidacy and surgical technique is the basis for success. Only then can they be enhanced with the laser or else are doomed to fail.



Achieving maximum visual function after premium IOL implantation may take several months and the more they understand this and have a contact in the practice that is empathetic, patient, and available, the better the period of their neuroadaptation rate. It is critical that the patient be comforted ahead of time regarding this and also be educated about the possible need for additional treatments preoperatively, including optimization of the ocular surface, neodymium: yttrium-aluminum-garnet (Nd:YAG) laser posterior capsulotomy, and keratorefractive surgery.

Ophthalmologists have various options available when it comes to premium IOLs. These include the AcrySof, ReSTOR IOL +3.0 D and +4.0 D, and toric (Alcon Laboratories, Fort Worth, TX), the ReZoom and Tecnis IOLs (Abbott Medical Optics, Santa Ana, CA), and the Crystalens 5.0, HD, and AO (Bausch & Lomb, Aliso Viejo, CA).

To produce optimal visual outcomes and excellent patient satisfaction after premium IOL surgery, laser vision correction enhancement procedures such as LASIK or photorefractive keratectomy (PRK) are necessary additional skills needed for a successful cataract surgeon. The enhancement element is creating several trends as surgeons consider the best case scenario for their patients. Some cataract surgeons are outsourcing enhancements to LASIK surgeons with whom they are “partnering”, others are investing in equipment and training to do their own enhancements, and/or they are using open access centers and doing the enhancements there themselves. The first two rules of premium lens surgery still are selecting good candidates for appropriate technology and also good, consistent surgical techniques.¹⁻⁵ This base work has to be right before any enhancement can be considered, otherwise such cases are doomed to fail (Figure 15-1).

Enhancements are a necessary and important part of achieving the optimal outcomes for patients who have a presbyopia-correcting IOL. For some patients, correcting even small amounts of residual refractive error—sometimes as small as 0.5 D of myopia, hyperopia, or astigmatism—can really change the patient’s perception of his or her

outcome. Cataract surgeons who provide premium IOLs (toric, accommodating, and multifocal) must be able to offer enhancement procedures to achieve excellent outcomes and thus satisfy their patients' expectations. Ultimately, until optimal vision is obtained, the patient's care is not complete.

Laser vision correction enhancements to premium IOL cases can be classified as follows⁶:

- ▲ Planned laser combination surgeries
- ▲ Laser enhancement for unexpected, visually significant refractive errors
- ▲ Laser surgery to correct complications

ENHANCEMENT OPTIONS: PHOTOREFRACTIVE KERATECTOMY, LASER-ASSISTED IN-SITU KERATOMILEUSIS, CONDUCTIVE KERATOPLASTY, AND RADIAL KERATOTOMY

Most surgeons employ LASIK or PRK to correct residual refractive error in these premium IOL patients. Laser vision correction gives surgeons the confidence to achieve emmetropia even with a "refractive surprise" or significant preoperative astigmatism. While an IOL exchange is certainly an option for treating residual spherical refractive errors (especially large errors), a strong argument can be made for treating smaller residual refractive errors and/or astigmatism with laser vision correction after cataract surgery.

Any additional intraocular surgical procedure for an IOL exchange is stressful for both the patient and surgeon along with the significant additional expense of returning to an operating room. While the prospect of performing LASIK surgery may be daunting even to seasoned cataract surgeons, surface ablation with PRK is a simple and powerful means by which to adjust residual refractive errors that remain after cataract surgery. PRK is a simpler technique with equivalent efficacy for the majority of patients.

Performing topographic mapping and corneal pachymetry for IOL patients is wise in the event that refractive surgery is necessary postoperatively, as well as a complete eye evaluation and for IOL calculations. External disease is treated and the ocular surface optimized before cataract surgery. Because it has been observed that minor postoperative fluctuations in vision are frequently related to dry eyes, an aggressive pretreatment of dry eye may be in order to achieve a healthy ocular surface.

Additionally, if there are concerns or doubts about the topography or pachymetry of the cornea, proceeding with PRK instead of LASIK for the enhancement may be the better course of treatment.

Some patients may ask about having LASIK instead of PRK. LASIK is an outstanding first choice, but for many older patients, their poorly adherent corneal epithelium will be a red flag. Furthermore, PRK is less likely to induce extreme ocular dryness, and dryness is a frequent (albeit usually temporary) byproduct of even cataract surgery alone. Also, older patients are more prone to vascular disease, increasing the (still unlikely) possibility that the prolonged suction required during LASIK could precipitate a retinal vascular event. Surface ablation for most elderly patients who require laser vision correction after cataract surgery is often a procedure of choice.

TIMING

It is important to allow the refractive error and best-corrected visual acuity (BCVA) to stabilize after surgery and to resist the urge to jump right in. A period of observation is especially important if the patient has had prior refractive surgery because fluctuations in corneal shape, and hence refractive error, may continue. Under- or overcorrection is readily evident 1 to 2 weeks postoperatively in an eye that has never undergone refractive surgery. Eyes that had prior LASIK, PRK, or radial keratotomy (RK) may take longer to stabilize. If the patient has more than 2.5 D of unintended refractive error, an IOL exchange within the first postoperative month may be a better option depending on the surgeon's comfort with the exchange versus laser vision correction. For a PRK enhancement after IOL surgery, it is not necessary to wait 3 to 6 months before enhancing the result of prior PRK or LASIK; 6 to 8 weeks is usually sufficient. Surgeons should prescribe spectacles if patients need them postoperatively. If the unintended refractive error is less than 2.00 D, anisometropia should be tolerable. If the patient does not achieve the expected correction, surgeons should look for and treat other causes of decreased BCVA that may distort the refraction (eg, cystoid macular edema).

Things to consider prior to any enhancement are as follows:

- ▲ Has the ocular surface been optimized?
- ▲ Is there another issue that needs to be resolved first (eg, cystoid macular edema, posterior capsular opacification)?

OPEN THE CAPSULE?

Consider performing an Nd:YAG laser capsulotomy before PRK. If the subjective visual acuity endpoint is not distinct with manifest refraction, an Nd:YAG capsulotomy often allows for the determination of a consistent refraction with which to plan a PRK enhancement. If the patient has received the Crystalens, it is advisable to perform the capsulotomy before any refractive surgery because the effective IOL position may shift.

LASER OR INCISIONS?

An excimer laser rather than limbal relaxing incisions (LRIs) to enhance premium IOL recipients' outcomes is preferred due to the control over the astigmatic correction. LRIs may be fairly unpredictable for patients who have more than 1.00 D of astigmatism. The advanced IOL calculations for premium cataract surgery leave most patients' postoperative spherical equivalent close to plano. Consequently, the amount of postoperative correction these patients need is generally very small (less than 3.00 D). With the predictability and stability of laser vision correction available today, there are very few cases in which either conductive keratoplasty (CK) or RK may be of greater benefit than the excimer laser.

WAVEFRONT-GUIDED VERSUS OPTIMIZED VERSUS CONVENTIONAL

For optimal results regardless of attention to detail during biometry and meticulous surgery, a refractive correction may be necessary after IOL surgery regardless of the lens selected. This can occur secondarily to other factors also: incision-related refractive change, over- or undersized capsulorrhexis, effective lens position, biometry error, etc. The refractive surgery enhancement choices include PRK, LASIK, CK, RK, astigmatic keratotomy, and IOL exchange. There is greater refractive predictability using LASIK to correct hyperopic refractive errors post-IOL surgery. With laser vision correction, however, the decision must be made between wavefront-guided versus optimized versus conventional treatment.

It is advisable to obtain wavefront measurements on everyone; however, for simple myopia and myopic astigmatism, a treatment of choice is often conventional PRK using a transepithelial approach. This method is engaged primarily because of the rapid re-epithelialization, minimal ablation depth, and less induced dry eye postoperatively.

Multifocal IOLs can affect the accuracy of the wavefront aberrometer and thus wavefront-guided treatments are not appropriate. Wavefront-optimized treatments are also an excellent treatment option in all cases and even more pronounced in higher refractive errors.

NOMOGRAMS, SPECIAL CONSIDERATIONS FOR PATIENTS

The laser vision correction procedures (LASIK and PRK) are performed exactly the same for primary and secondary treatments utilizing the same nomogram adjustments.

COUNSELING

When planning premium IOL surgery in which a primary goal is clear, uncorrected vision, it must be determined ahead of time whether the patient is a candidate for an enhancement with PRK. If so, this is the time to share with the patient that laser vision correction may be an option to enhance less-than-perfect results. The fees for this may be separated or included depending on the practice's preference. Patients need to know that an IOL exchange may be the only surgical option if residual spherical error remains. Most patients are not overly worried about the risks of intraocular manipulation during cataract surgery, but it may be comforting that this can be accomplished without another operating room procedure.

Further discussion with patients about their visual recovery after PRK is usually a good idea. Individuals undergoing PRK often have the misguided idea that they will see well immediately, as they are likely to know someone who has undergone LASIK. Letting them know that their vision will fluctuate significantly for the first 4 to 6 days until the bandage contact lens is removed is essential, along with emphasizing that full recovery may take 8 weeks or longer. Most patients achieve functional vision in the 20/30 to 20/50 range within days of the bandage contact lens removal. If they are aware that visual recovery is a process, patients tend to be more accepting of the time it involves. Again, the time and investment in developing meaningful patient information

packets with timelines, frequently asked questions, and having a counselor who is able to communicate swiftly and reassuringly can make all the difference in the world.

PREOPERATIVE EVALUATION

The Ocular Surface

Ocular surface instability from dry eye and/or lipid tear deficiency from meibomitis frequently causes refractive changes after cataract surgery. Patients with multifocal IOLs will be especially sensitive to this. Eyelid hygiene, Restasis (cyclosporine ophthalmic emulsion), artificial tear supplements, and punctal occlusion are all valuable treatments in this situation and should be used aggressively to optimize lubrication before any decisions about a PRK enhancement. Ocular rosacea is common, and consideration should be given to the use of adjunctive topical AzaSite (azithromycin) and/or oral tetracycline, doxycycline, or minocycline to improve meibomian gland function before surgery in such patients. Sufficient lubrication of the ocular surface is essential during the post-PRK healing process. Consider prescribing preservative-free artificial tears qid postoperatively, the placement of permanent punctal plugs, and the initiation of Restasis therapy. If the patient was using Restasis before surgery, it is recommended that usage stop until topical antibiotics are discontinued.

A large group of patients who are having cataract surgery have pre-existing dry eye or blepharitis and have compromised ocular surfaces. A healthy ocular surface ensures accurate measurements of the cornea and is essential to a successful outcome with all cataract surgery. Optimizing the ocular surface dramatically improves patient satisfaction, quality of vision, and may potentially reduce the need for postoperative enhancements. Based on the clinical evaluation, there are a variety of methods to optimize the ocular surface, varying from topical medications, therapeutic treatments, and/or nutritional supplements.

INTRAOPERATIVE STEPS

Verify that topography correlates with the refractive error. Although most patients have some degree of orthogonal, regular corneal astigmatism before and after surgery, those who experience epithelial sloughing during cataract surgery can develop irregularities in the epithelial surface that manifest as increased refractive astigmatism, as can patients with keratoconus.

To correct astigmatism in eyes with intraoperative epithelial sloughing, superficial keratectomy (epithelial débridement) is preferable to PRK or LRIs. If the corneal topography appears to be normal and unexplained astigmatism is still present, the surgeon should examine the IOL for evidence of tilt or decentration. If the position of the IOL is in doubt based on the slit-lamp examination, imaging with a device such as the Pentacam Comprehensive Eye Scanner (Oculus, Lynnwood, WA) or anterior segment optical coherence tomography can be helpful.

The laser vision correction procedures (PRK and LASIK) are performed exactly the same for primary and secondary treatments utilizing the same nomogram adjustments.

PRK and LASIK enhancements 8 to 12 weeks after the original lenticular surgery are my standard timetable, and I usually prefer PRK to LASIK for these secondary procedures because the former will not compromise the integrity of the capsular bag or zonules and is less likely to induce dry eyes. If it seems likely preoperatively that the patient will need a retreatment (eg, a very high cylinder patient), a LASIK flap will be created before performing the cataract surgery, and 8 to 12 weeks later the flap is able to be lifted and the enhancement completed. This is possible using the femtosecond laser to cut all LASIK flaps because it places much less pressure on the postoperative eye than do mechanical microkeratomes. For PRK, it is important for surgeons to be comfortable with the techniques for gently removing the corneal epithelium during surgery (a rotary brush or transepithelial approach are preferable) and with the strategies to optimize the management of pain postoperatively.

For wavefront-optimized PRK treatment with the Allegretto Wave excimer laser (Alcon), first use a rotary brush to remove the corneal epithelium and verify all epithelium is removed with a dry Merocel sponge. After ablation, apply chilled balanced saline solution for 45 seconds followed by a bandage contact lens.

For conventional PRK with the VISX Star excimer laser (Abbott Medical Optics), the transepithelial “no-touch” approach is preferred. The laser is preprogrammed in the epithelial mode (−0.75 D spherical and 45 μ m plano) to remove the epithelium followed by the actual correction. This allows for very smooth epithelial edges and quite rapid recovery. Again after ablation, apply chilled balanced saline solution for 45 seconds followed by a bandage contact lens.

An extended-wear lens with high oxygen permeability such as the O2 Optix (CIBA Vision, Duluth, GA) with a base curve of 8.6 mm and a diameter of 14.2 mm, or the Acuvue (Jacksonville, FL) OASYS lens with a base curve of 8.4 mm seems to work well. For patients who have steeper corneas (46.00 D and up), the Soflens 66 Steep/Medium lens (Bausch & Lomb) is the bandage contact lens of choice. The lens should fit snugly but not be overly tight. On the day after PRK, an optimally fit bandage contact lens should move slightly (0.25 mm) with blinking or be movable with gentle upward digital pressure on the lower eyelid.

Many refractive surgeons now use a single dose of intraoperative dilute mitomycin (MMC [usually 0.02%]) routinely during PRK surgery for 12 to 20 seconds, especially for eyes that have undergone prior LASIK or RK. MMC is not necessary for eyes undergoing treatment for small corrections, as discussed earlier, but surgeons will need to be comfortable using this agent if they plan to treat eyes that have had prior corneal surgery. The best method by which to deliver MMC to the central cornea (where it needs to be applied) seems to be incubation with a saturated corneal light shield. Once the light shield is removed, it is important to irrigate the corneal surface generously with chilled balanced saline solution. The use of MMC during PRK is considered off-label, and it is prudent to obtain a separate, informed consent for this practice.

POSTOPERATIVE CARE

Proper postoperative medical therapy after PRK is key to success. Fitting a bandage contact lens after PRK enhances the patient's comfort and helps to ensure prompt healing of the corneal epithelium. A collagen punctal plug in the eyes of all PRK patients to

enhance lubrication of the ocular surface and maintain hydration of the bandage contact lens performs well.

Medical therapy after PRK consists of topical antibiotic prophylaxis as well as anti-inflammatory treatment with topical steroids and nonsteroidal anti-inflammatory drugs (NSAIDs). In practice, patients may use a fourth-generation fluoroquinolone solution and prednisolone acetate 1% suspension qid for 1 week, at which time the epithelium has healed and the bandage contact lens has been removed (generally on postoperative day 4 for myopes and day 5 for hyperopes). Additionally, for pain relief, they take a topical NSAID Xibrom (bromfenac) bid until the bandage contact lens is removed.

After 1 week, antibiotics are discontinued, and topical steroids are tapered by 1 drop/day every 1 week during a 4-week period. While a topical NSAID is very helpful for controlling pain, it can impede epithelial healing and incite sterile corneal stromal inflammation in some patients if continued for too long. Thus, it is discontinued when the bandage lens is removed. Oral analgesia after PRK is also important for patients' comfort. If there are no medical contraindications, oral NSAID therapy with higher doses of ibuprofen (600 to 800 mg bid) or naproxen sodium (440 mg bid) is helpful and can minimize the need for stronger medications.

TURNING BACK THE CLOCK

Laser Advanced Surface Ablation: Premium Lens Implant Combinations in Previous Refractive Surgery Cases

With millions of people who have had previous refractive surgeries seeking 20/20 again, we need to be well prepared to face an inevitable epidemic in the world of ophthalmology—an evolving population of previous refractive surgery patients who are now in their cataract age. Most of these patients can be corrected back to the excellent vision they once had by way of premium lens implants. In a way, turning back the clock!

Once we understand this concept of laser advanced surface ablation (ASA) surgery combination with premium lens implants as a required and mandatory skill of a premium cataract surgeon, you shall see how every patient deserves an opportunity for premium lens implants.

With this vision-oriented approach, we first manipulate the intraocular optical elements of such cases using specific lens implants to be followed by using the cornea as a vision rehabilitative platform (with the excimer laser) in turning back the clock and once again aiming for unaided emmetropia with the technologies and expectations of the present times.

What Functions Does the Excimer Laser Achieve in Previous Refractive Cases?

The need for staged laser combination following premium lens implants in previous refractive surgeries using the PRK mode (ASA) is a conceptual shift from thinking in terms of just “refractive enhancement” to “optimizing vision.” The excimer laser ASA can additionally be used to correct all of the following:

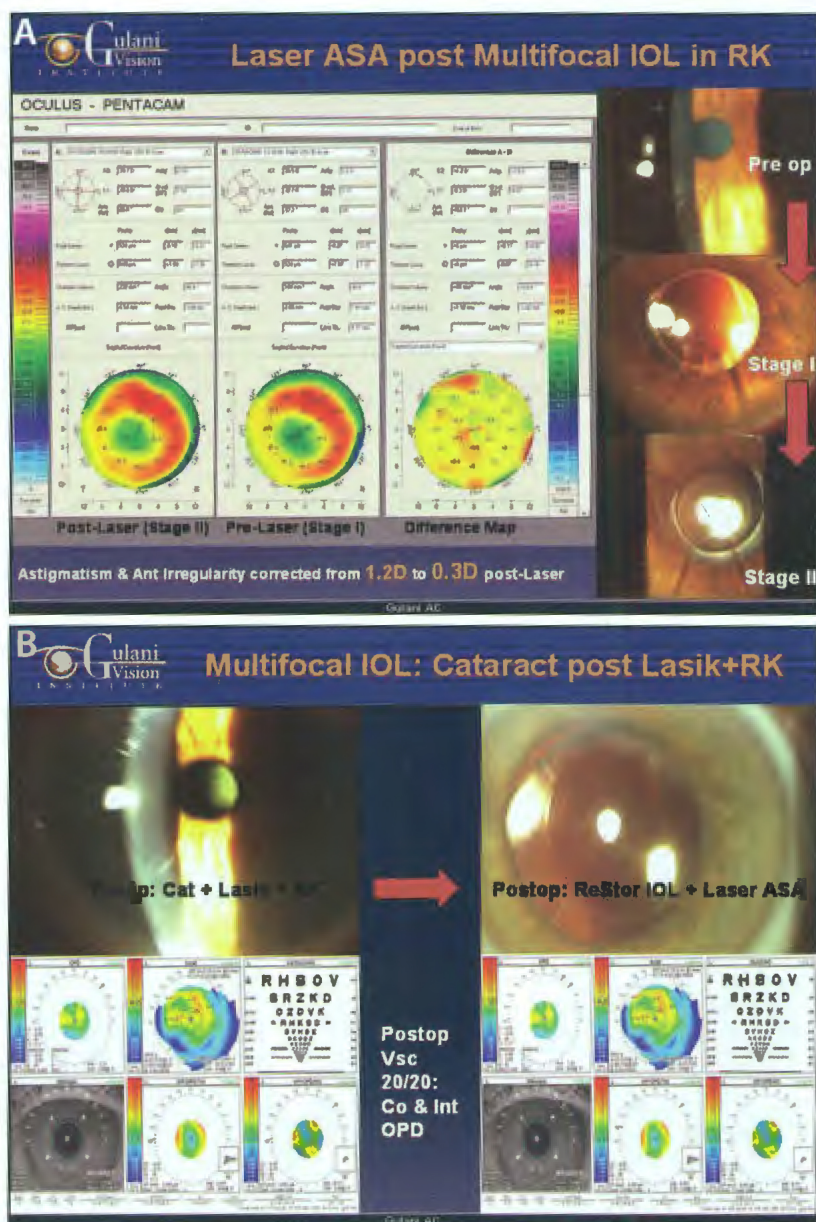


Figure 15-2. (A) Laser ASA following multifocal lens implant in an RK case. (B) SA based selection of premium IOL in case of LASIK and RK cataract to 20/20 outcomes.

- ▲ Residual refractive error
- ▲ Irregular astigmatism
- ▲ Superficial irregularity/scars
- ▲ Increasing the effective optical zone
- ▲ Optimizing/reversing corneal optics to compensate for previous keratorefractive surgery

This concept of looking at the excimer laser ASA surgery as an essential component of premium lens implant surgery in previous refractive cases (Figure 15-2) will enable millions of suitable candidates to enjoy the technology and vision of the 21st century.

Figure 15-3. Toric lens implant in DSAEK surgery.

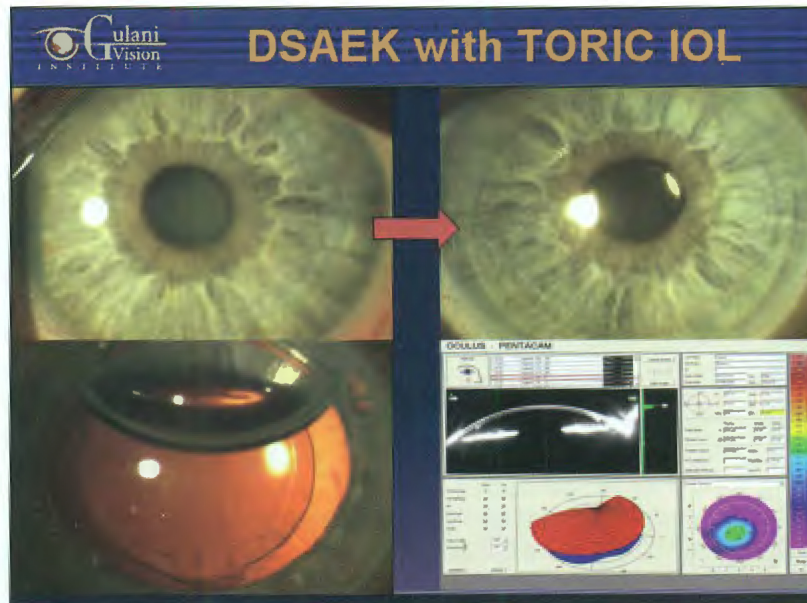


Figure 15-4. Toric lens implant in a keratoconus case.



It will also extend the indications to include patients with conditions such as Fuchs' dystrophy (Figure 15-3) and keratoconus (Figure 15-4) as premium lens candidates as well as provide patients with inadequate or complicated premium lens outcomes a second chance for vision (Figure 15-5).

CONCLUSION

Cataract surgeons offering premium IOLs have a good array of enhancement options at hand to fine-tune residual refractive errors and optimize the final visual outcome after

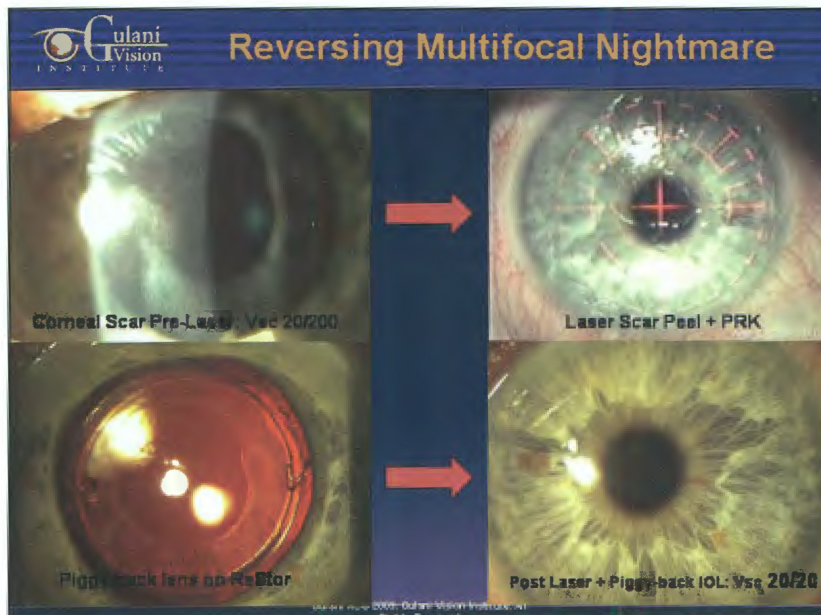


Figure 15-5. Reversing complication of a multifocal lens implant with laser ASA.

IOL procedures. Patients will appreciate receiving all of their care from their treating cataract surgeon, which makes it well worth these ophthalmologists' efforts to acquire the requisite skills for successful excimer laser enhancements after IOL surgery.

REFERENCES

1. Gulani AC. Principles of Surgical Treatment of Irregular Astigmatism in Unstable Corneas. TextBook of Irregular Astigmatism. Diagnosis and Treatment. Thorofare, NJ: SLACK Incorporated; 2007:251-261
2. Gulani AC. Think Outside the Cone: Raising Keratoconus Surgery to an Art. *Advanced Ocular Care*, Nov/Dec 2010; 35-37.
3. Gulani, AC. Lens Laser Combination Surgery: In: Ashok G, Alió JL. *Surgical Techniques in Ophthalmology Cataract Surgery*. Jaypee Publishers 2009;59:360-362
4. Gulani AC. Future of Corneal Topography. In: Wang M. *Corneal Topography in the Wavefront Era*. Thorofare, NJ: SLACK Incorporated. 2006;26:303-304
5. Gulani AC. Meeting the challenge of Post-RK patients. In: McDonald M, Majmudar P, Koch D, Packer M, Waltz K. *Review of Ophthalmology*, 2007;IV(10):49-54.
6. Gulani AC. Refractive Surgery to the Rescue. Presented at XXXII World Congress of Ophthalmology; June 2010; Berlin, Germany.

BIBLIOGRAPHY

- Gulani AC. Corneoplastique. *Techniques in Ophthalmology*. 2007;5(1):11-20.
- Gulani AC. Art of vision surgery. *Video Journal of Cataract and Refractive Surgery*. 2006;XXII(3).Hardten D. Surgeon offers advice for optimum vision after premium IOL surgery. *Refractive Surgery News*. June 24, 2010.
- Manrique C. Laser enhancements after premium cataract surgery: my experience compared with limbal relaxing incisions. *Cataract & Refractive Surgery Today*. February 2010.
- Talamo JH. How to perform excimer laser enhancements after premium IOL implantation: making a good thing even better: a primer for cataract surgeons. *Cataract & Refractive Surgery Today*. February 2010.