

Historically, cataract surgeons have been spoiled in terms of patient satisfaction, according to **David F. Chang, MD**, clinical professor of ophthalmology, University of California, San Francisco. Dr. Chang and **Richard S. Hoffman, MD**, clinical associate professor, Casey Eye Institute, Oregon Health & Science University, Portland, Ore., co-chaired a symposium on keratorefractive surgical enhancement of refractive IOL patients at the 2013 ASCRS•ASOA Symposium & Congress in San Francisco. “Who among us tires of hearing patients rave about how easy and painless the operation was; how quickly the vision improved; and how color, brightness, and uncorrected vision are so surprisingly good?” Dr. Chang said. “Indeed, we’ve become very accustomed to routinely exceeding the expectations of our cataract patients.”

However, in recent years, the increasing confluence between cataract and refractive surgery has changed patient expectations and altered the satisfaction equation. Cataract surgeons are now able to offer a wide range of refractive IOLs and

adjunctive procedures such as astigmatic keratotomy; with this in mind, even with uncomplicated surgery, patients may now be dissatisfied because their expectations for uncorrected visual function are not met.

“Part of the issue is that in an effort to understand confusing concepts such as refractive error, focal point and depth of focus, many patients tend to oversimplify the value proposition,” said Dr. Chang. In the U.S., since insurance already covers the cataract procedure, patients sometimes assume that the additional fees they pay for a lens mean they won’t need glasses to drive or read.

The value of preoperative counseling to set realistic expectations thus cannot be overstated; however, tempering patient expectations addresses only part of the problem.

According to Dr. Chang, the most common cause of patient dissatisfaction following any refractive IOL procedure is residual refractive error. “For instance, while 90% of our patients are typically within 1.0 D of spherical target, there may only be 75% who are within 0.5 D of their target,” he said.

This fact is particularly important when it comes to multifocal IOLs. Studies have shown that a large percentage of multifocal IOL patients who are unhappy with their outcomes complain of blurry vision due to residual refractive error.^{1,2} In one study, 28% of eyes had residual astigmatism of 0.75 D or greater.¹

“With a monofocal IOL, 0.5 D of myopia or a small amount of astigmatism are tolerable and may actually increase depth of focus,” said Dr. Chang. “However, with diffractive multifocal IOLs, the inherent loss of image contrast makes these lenses much less forgiving of the same errors.”

While Dr. Chang said that this is a lesson every cataract surgeon learns inevitably through experience, the phenomenon has been demonstrated objectively through optical bench testing in an elegant study conducted at the University of Rochester. This study demonstrated noticeable drops in image quality and depth of focus for a number of different refractive IOLs subjected to varying degrees of residual astigmatism, with multifocal IOLs found to be much more sensitive to corneal astigmatism compared with monofocal IOLs.

Program chairs

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The effect of pseudophakic ametropia on refractive IOL outcomes, methods for the management of pre-existing astigmatism intraoperatively and residual refractive errors postoperatively, and ways to incorporate these methods into practice were the focus of an EyeWorld CME Education program at the 2013 ASCRS•ASOA Symposium & Congress.

The impact of refractive error on quality vision and satisfaction levels

Refractive errors through the optical bench

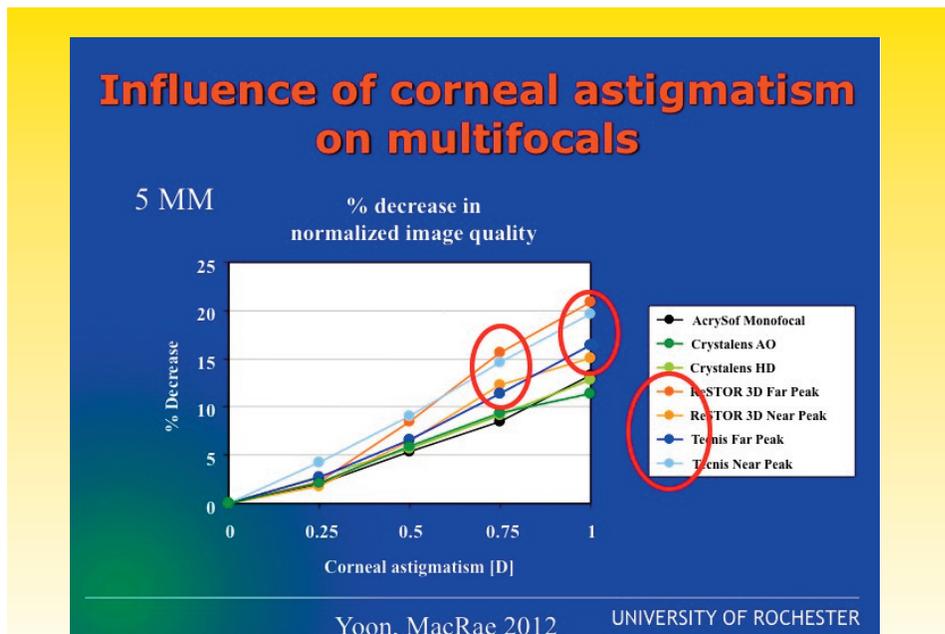
Bench analyses conducted by **Scott M. MacRae, MD**, and colleagues at the University of Rochester, N.Y., illustrate the effect of residual refractive error on pseudophakic eyes.

Quoting **Richard L. Lindstrom, MD**, Dr. MacRae, director of refractive services and professor of visual science, University of Rochester, said that “at one to three months, a disproportionate amount of people, about 57.6% of premium IOL users, may not have received the full visual correction. “Multifocals are disproportionately affected,” he added.

This effect has been documented in previous studies, such as one published by Hayashi and colleagues in the *Journal of Cataract & Refractive Surgery* (2010). Looking at patients implanted with the ReSTOR 3 and 4 (Alcon, Fort Worth, Texas), Hayashi and colleagues found that “astigmatism up to 1.00 D is tolerated.”

Dr. MacRae and his colleagues—including Geunyoung Yoon, PhD, Len Zheleznyak, MS, and **Jorge Alio, MD**—decided to look at this effect in detail using optical bench analysis. The optical bench can be used to simulate the visual system of an eye with any intraocular lens at any degree of refractive error. “We can introduce sphere, cylinder, or higher-order aberration and see what happens,” said Dr. MacRae.

In the optical bench or adaptive-optics IOL metrology system, a letter chart is projected through an artificial pupil and an IOL mounted in a wet cell. A Badal optometer can be used to change the apparent object distance, while a deformable mirror is used to induce corneal aberrations. A CCD sensor captures the image of the letter chart after passing through the entire system.



Decrease in image quality is significantly worse in multifocal IOLs compared to monofocal IOLs by 0.75 D of astigmatism.

In effect, the optical bench allows researchers to simulate the image projected through a lens that hits the patient’s retina—essentially, what a patient actually sees, or would see, objectively, subtracting neurological bias.

Dr. MacRae and his colleagues found that for eyes that have multifocal IOLs, there is a reduction in depth of focus as you move from 0.5 D to 1.0 D of corneal astigmatism; the depth of focus advantage of multifocal IOLs such as the ReSTOR 3D and the Tecnis Multifocal (Abbott Medical Optics, Santa Ana, Calif.) disappears at 1.0 D, compared with the AcrySof monofocal (Alcon), and the Crystalens AO and HD (Bausch + Lomb, Rochester, N.Y.).

Corneal astigmatism also decreases image quality, in which case the disproportionate effect on multifocal IOLs is seen as a decrease in image quality significantly worse than in monofocal IOLs by 0.75 D at both distance and near.

They also looked at the through-focus image quality curves of four different IOLs: three multifocal IOLs—the FineVision Micro F diffractive trifocal (Physiol, Belgium), the Mplus rotationally asymmetric refractive multifocal (Oculentis, Berlin), and the ReSTOR 3D—with the AcrySof monofocal.

In all cases, adding astigmatism up to 1.00 D, the image peaks of each lens

progressively flattened to match the monofocal lens, graphically illustrating the decrease in image quality.

Adding higher-order aberration similarly reduced image quality for all these lenses. “If you start adding in some subtle higher-order aberration in addition to astigmatism, image quality can go way down,” Dr. MacRae said.

“Corneal astigmatism more than about 0.5 D and higher-order aberrations reduce image quality for all multifocals and disproportionately affect these patients,” he concluded. “It’s critical to correct this.”

To address the problem, Dr. MacRae said he typically “falls back” on mini-PRK in patients with residual astigmatism and higher-order aberrations, in which, he added, the 7-mm treatment zone takes about 30% less epithelium off compared to the 8.5 mm treatment zone. “In these older patients, it’s very handy.”

Residual error and satisfaction

Optical bench testing “subtracts the patient’s brain” and examines the optical effects of IOLs directly on the visual system. But how does residual refractive error affect outcomes in actual, living patients?

Steven C. Schallhorn, MD, medical director, Optical Express, Glasgow, U.K., and in private practice, San Diego, looked at the

impact of residual refractive error in terms of patient satisfaction and visual acuity and quality.

Dr. Schallhorn and his colleagues at Optical Express took 2,485 consecutive patients who had bilateral refractive lens exchange (4,970 eyes). Each patient had a one-week interval between first and second eyes, was implanted with a multifocal lens, and was asked to respond to a patient questionnaire at one month. The average age of the patient population was 57.5 ± 7.5 years old, with younger patients who had high refractive error or cataract. Most of the treatments fell in the hyperopic range (84% of study patients), but as a whole the study included a wide range of treatments, with the mean spherical equivalent (MSE) of myopes at -3.89 ± 2.97 D, hyperopes at $+2.36 \pm 1.68$ D (overall preop MSE $+1.37 \pm 2.94$ D); average preop cylinder was 0.64 ± 0.48 D.

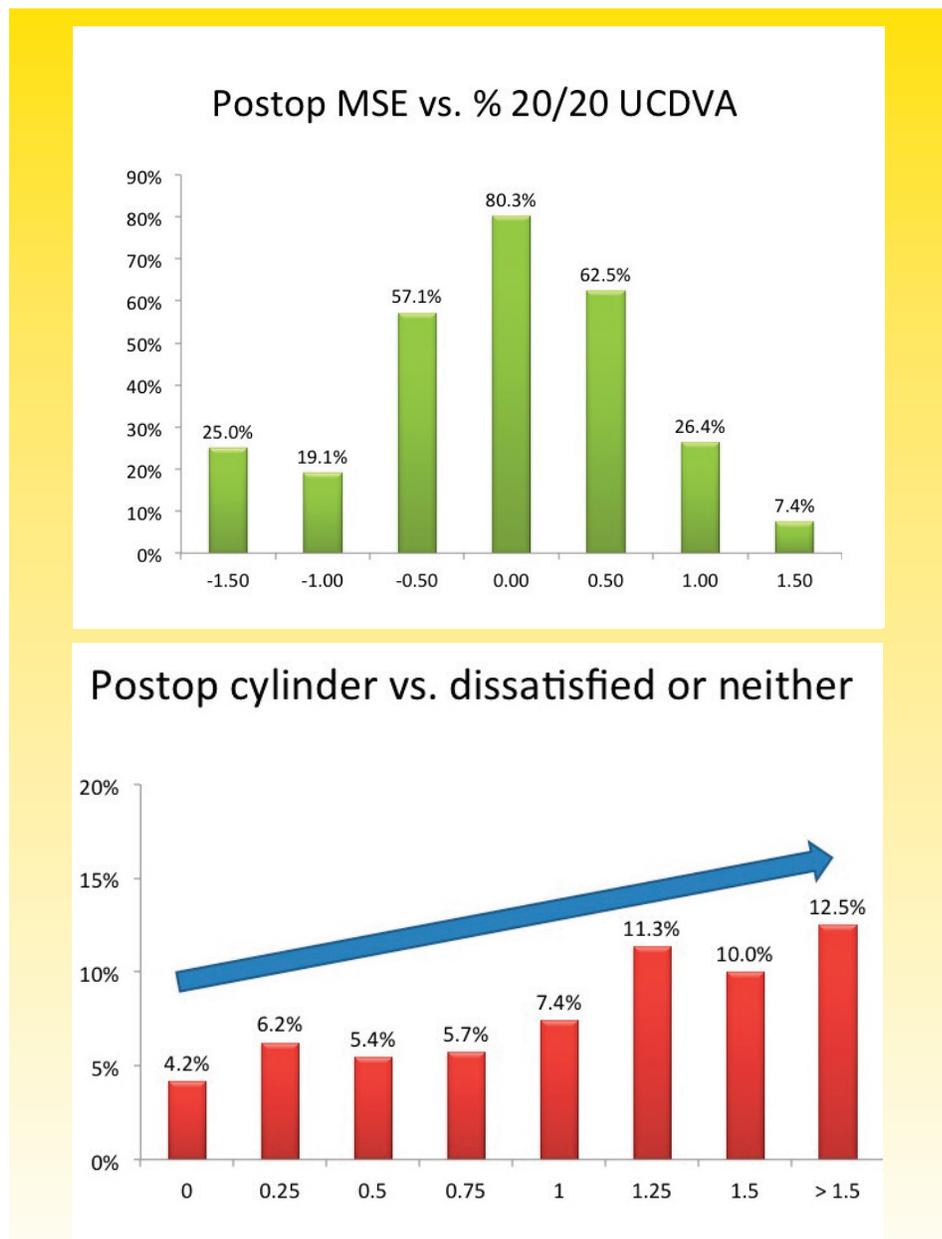
To address astigmatism, astigmatic keratotomy was performed for astigmatism between 1 and 1.5 D, and toric lenses were implanted for astigmatism more than 1.5 D.

About 70.6% of patients achieved 20/20 uncorrected distance visual acuity monocularly; postop, MSE was $+0.05 \pm 0.47$ D, cylinder 0.45 ± 0.41 D—“very reasonable results for refractive lens exchange in this target population,” said Dr. Schallhorn.

Dr. Schallhorn and colleagues also stratified the postop spherical equivalent by the percentage of patients who achieved 20/20 distance visual acuity. In patients stratified by 0.5 D MSE, patients with MSEs closer to zero were much more likely to have 20/20 distance visual acuity—80.3% of patients with 0.0 D spherical equivalent achieved 20/20. However on analysis, somewhat surprising to Dr. Schallhorn, a difference of even just 0.5 D MSE resulted in a dramatic drop in the percentage of patients achieving 20/20—only 62.5% of patients with +0.5 D and 57.1% of patients with -0.5 D MSE achieved 20/20 vision.

Postop cylinder also affected chances of achieving 20/20 visual acuity: 82.3% of patients with 0.0 D of postop cylinder achieved 20/20; in comparison, only 74.5% of patients with 0.5 D postop cylinder and 54.3% of patients with 1.0 D postop cylinder achieved 20/20. At 1.5 D of postop cylinder, only 26.5% of patients achieved 20/20.

But the “real outcome metric” Dr. Schallhorn and his colleagues were inter-



Incremental amounts of residual sphere and cylinder impact the patient's ability to achieve 20/20 vision and high levels of satisfaction.

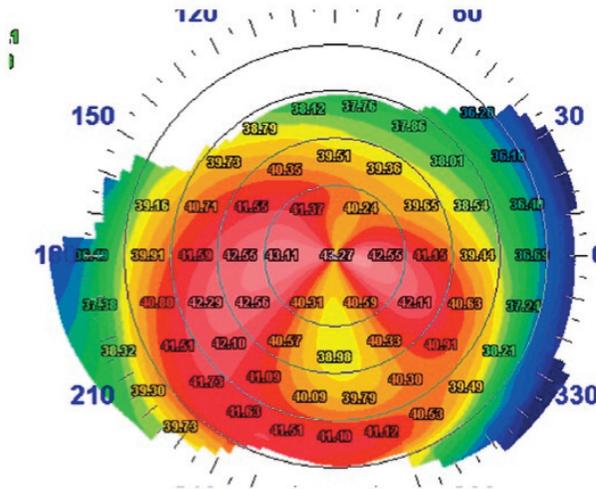
ested in was patient satisfaction. “I believe, certainly in the refractive lens exchange or laser vision correction patient—elective procedures—that the patient's satisfaction comes second only to complications as far as the most important outcome metric,” he said.

Patient satisfaction at their clinic was very high—94.1% were satisfied based on a 5-point scale from very satisfied to very dissatisfied; 1.6% were dissatisfied, and 4.2% were neither satisfied nor dissatisfied.

Dr. Schallhorn and his colleagues also stratified the outcome data against patient satisfaction. Again, there is a striking relationship between residual postop MSE and cylinder and satisfaction, with 70.8% of patients with 0.0 D postop MSE and 73.2% with 0.0 D postop cylinder saying they were very satisfied.

Although Dr. Schallhorn and his colleagues achieved good unaided vision and a high level of patient satisfaction in their patients receiving bilateral premium multifocal IOLs, ultimately they found that to

**63-year-old female with visually significant cataract—
would like to reduce need for distance lenses
Which approach (if any) would you recommend?**



63-year-old female with visually significant cataract; astigmatism relatively regular through the central visual axis

maximize patient satisfaction and quality of vision, the postop refractive error needs to be minimized.

“The closer to zero residual refractive error, the higher the satisfaction, and the better the quality of vision,” said Dr. Schallhorn.

Developing intraoperative strategies to manage pre-existing astigmatism

About 22% of patients scheduled for cataract surgery have pre-existing corneal astigmatism of greater than 1.25 D, according to **William B. Trattler, MD**, Center for Excellence in Eye Care, Miami, while 64% will have corneal astigmatism of 0.25–1.25 D. Since astigmatism is so common in patients scheduled for cataract surgery, it is important to consider the various treatment options available to help minimize astigmatism postoperatively.

Once patients with significant astigmatism are identified, the condition can be addressed intraoperatively with a variety of approaches, including astigmatic keratotomy (AK) or limbal relaxing incisions (LRI)—which can be performed with a blade or a femtosecond laser. Alternatively, toric intraocular lenses can be used to effectively address moderate to high levels of astigmatism.

Each approach comes with a specific set of considerations. Toric IOLs have limited cylindrical power gradations and address the corneal problem on the lenticular plane. AKs or LRIs using a blade can result in “skip lesions,” have the potential for perforation, and lack precision and reproducibility when created manually. Use of a femtosecond laser avoids “skip lesions,” minimizes the risk of perforation, increases precision and reproducibility, and allows better centration, angulation, and pairing of incisions. In addition, the femtosecond laser provides room for creativity, for instance allowing a sub-Bowman’s approach to AKs. However, the nomograms for femtosecond laser astigmatic keratometry are still being optimized.

“The key thing is to pick the right patients who are good candidates, be they for toric lenses or AKs,” said Dr. Trattler. Surgeons should evaluate both preop keratometry with devices such as the IOLMaster (Carl Zeiss Meditec, Jena, Germany) or Lenstar (Alcon), and preop topography, making sure that the test results are repeatable.

“Confirm that the astigmatism aligns when multiple measurements are taken,” he said. “Both magnitude of the astigmatism and the axis should line up nicely.”

If there are significant disparities between readings, he added, surgeons should repeat testing and evaluate closely for dry eye or meibomian gland dysfunction. Dry eye and a rapid tear film breakup time, he said, lead to irregularities in the measurement of corneal astigmatism, which can lead to inaccurate results.

How do you determine whether a patient is best suited for an AK/LRI, toric lens, or a simple monofocal lens? Dr. Trattler illustrated the factors surgeons need to consider in a series of cases.

Dr. Trattler’s first case was that of a 63-year-old female with visually significant cataract, whose astigmatism went from relatively regular through the central visual axis to increasingly irregular in the periphery. The lobster claw pattern is consistent with a diagnosis of pellucid marginal degeneration.

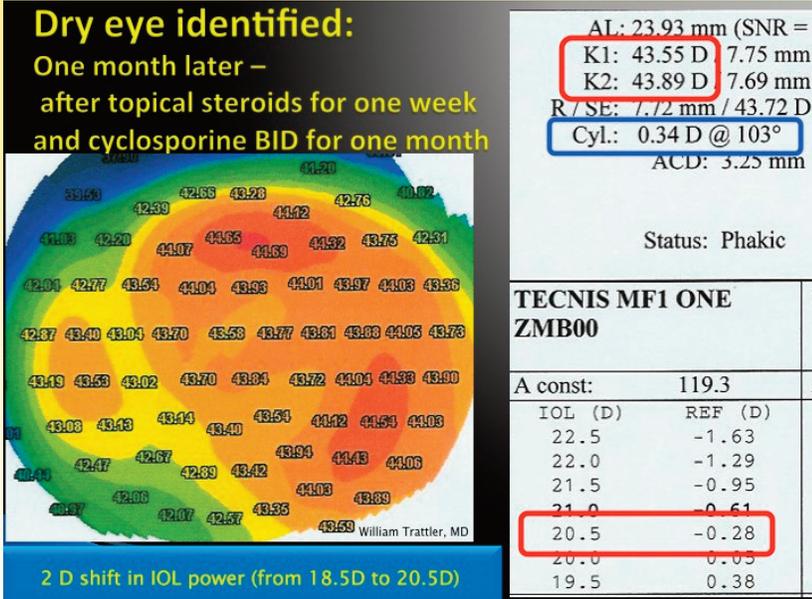
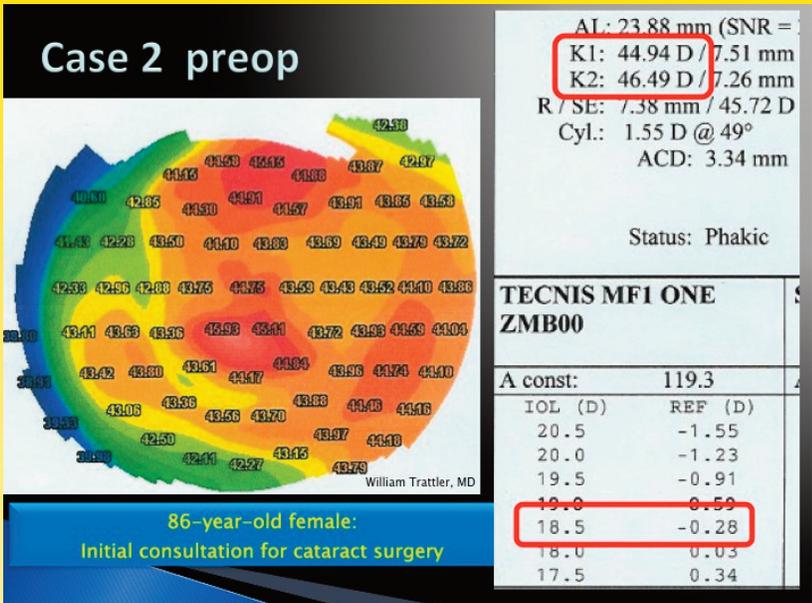
Because the astigmatism through the visual axis was very linear, not skewed, and regular, Dr. Trattler felt comfortable implanting a toric IOL. The patient achieved 20/20 at postop day five and was very pleased with the quality of vision.

On the other hand, in a patient whose astigmatism was skewed, asymmetrical, or angulated, Dr. Trattler went with a monofocal. A monofocal lens was also Dr. Trattler’s choice in a patient with keratoconus. Although the astigmatism was relatively regular, there was asymmetry from top to bottom. The keratoconus also meant an unstable cornea that precluded the use of AKs or LRIs.

In a final case (see images on next page), Dr. Trattler presented corneal topography with steepening and flattening “all over the map,” illustrating a classic case of dry eye. In this case, Dr. Trattler spent time treating the patient with topical steroids and topical cyclosporine, improving the topography over one month.

If Dr. Trattler had gone with the initial measurements, he would have implanted an 18.5 D lens; after treatment, he found that the patient needed a 20.5 D lens. “This big shift in IOL power just by treating the dry eye is why it’s so important to identify dry eye, treat patients, and then test them one more time before you perform their surgery,” he said.

Ultimately, said Dr. Trattler, whether you use a toric IOL or an LRI, preop evaluation of topography and keratometry is critical for optimizing the management of



Classic dry eye; one month treatment of topical steroids and cyclosporine shifted the recommended IOL from an 18.5 D lens to a 20.5 D lens

astigmatism. AKs/LRIs can be performed successfully with both a blade and a femtosecond laser, but the femtosecond laser provides some theoretical advantages.

Incorporating laser vision correction to address residual refractive error

Correcting low refractive errors: Efficacy and safety

There are a number of options now available to surgeons for treating residual refractive error after multifocal IOL implantation. These include lens repositioning, IOL exchange, piggyback IOL insertion, astigmatic keratotomy, and laser vision correction. Dr. Schallhorn focused his attention on photorefractive keratectomy (PRK).

According to Dr. Schallhorn, PRK is indicated when there is a visually significant refractive error after multifocal IOL implantation that does not warrant IOL repositioning or exchange that the patient wants corrected or improved. The patient should also meet all the conditions for PRK.

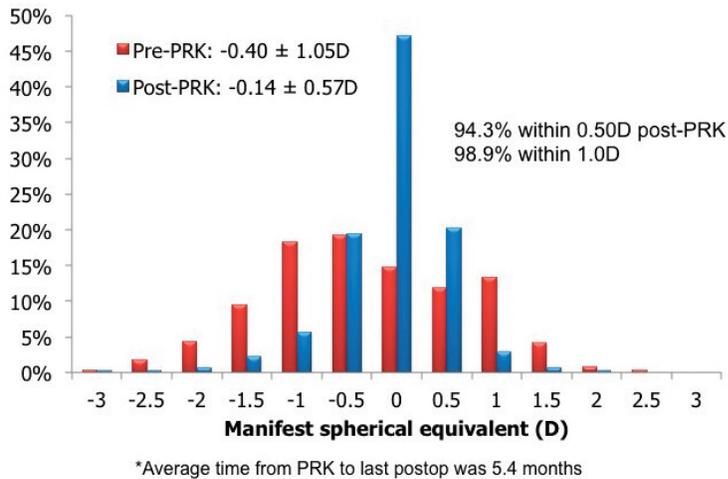
At Optical Express, Dr. Schallhorn and his colleagues have performed post-multifocal IOL PRK in 602 patients (724 eyes), with a mean age of 54 years (range 20 to 87 years). Most cases had undergone refractive lens exchange, though there were cataract patients in the population as well. Most of the patients were treated with PRK six to 12 months after MIOL implantation (48.9%); many underwent treatment within the first six months (31.5%), and some as late as 42 to 48 months after implantation (0.1%).

From a mean pre-PRK sphere of +0.14±1.12 D, their patients achieved a mean post-PRK sphere of +0.08±0.57 D; cylinder went from 1.08±0.67 D pre-PRK to 0.43±0.46 D post-PRK. Manifest spherical equivalent went from -0.40±1.05 D pre-PRK to -0.14±0.57 D post-PRK.

“Basically, performing PRK after a multifocal IOL results in good refractive predictability,” said Dr. Schallhorn.

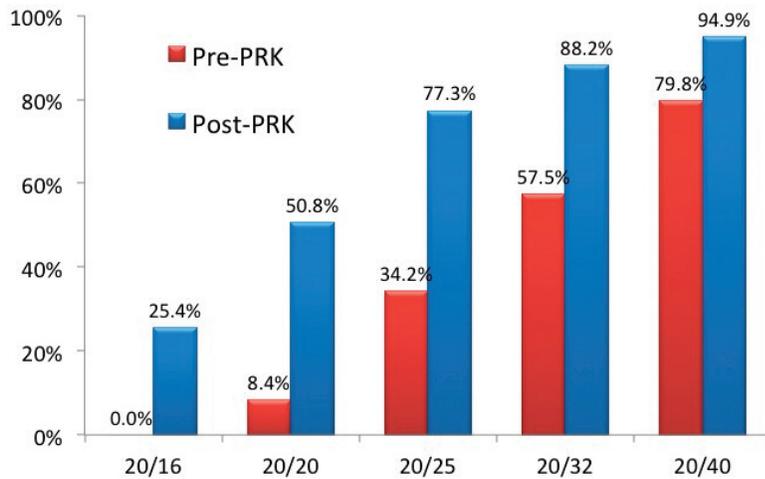
The patients also achieved significant improvement in visual acuity. Whereas only 8.4% of patients saw 20/20 uncorrected distance visual acuity (UDVA) pre-PRK, 50.8% of patients achieved 20/20 or better post-PRK, with 25.4% achieving 20/16.

Pre and post-PRK* manifest spherical equivalent



Improvement in spherical equivalent after performing PRK in multifocal patients

Uncorrected distant visual acuity



Improvement in UCVA after performing PRK in multifocal patients

This, in summary, said Dr. Schallhorn, is a procedure that is easy to perform and used to treat low refractive errors. In fact, Dr. Schallhorn has no set minimum limit of refractive error to treat. “It depends on the discussion with the patient,” he said. “I personally don’t have any lower limits on who I’m going to treat.” Even with small refractive errors, including those less than

0.5 D, the procedure achieves significant improvement in sphere and cylinder with good refractive predictability while improving UDVA.

“It’s up to the patient, the patient’s needs, whether I think I can improve the unaided vision and whether the expected improvement is worth the risk of the procedure

itself,” he added. “Fortunately, the procedure is very safe, producing no mean change in BCVA [best corrected visual acuity] in this study.”

Performing PRK

The first thing surgeons should always do when it comes to performing PRK, said **Karl G. Stonecipher, MD**, director of laser and refractive surgery, Laser Eye Centers, Greensboro, N.C., is tell their patients the difference between PRK and LASIK. This is particularly important in the immediate postoperative course. Patients may come in having heard about the quick recovery of friends who have had LASIK; in contrast, PRK produces more postoperative discomfort and irritation.

Knowing this, Dr. Stonecipher prescribes all his patients pain medication and sleeping pills. He does not require that his patients take the medication, but the pills can help them through the postoperative discomfort.

Perhaps most important is to have a regimen. “You have to stick with what you do,” he said. “That affects your nomogram and your outcomes.”

For myopic or myopic astigmatic patients, Dr. Stonecipher performs transepithelial PRK. He programs the laser to perform a 60- to 68-micron phototherapeutic keratectomy (PTK)—60 microns if the patient has had no previous surgery, 68 microns if the patient has had previous surgery—with a diameter of 6.5 mm, transition zone of 0.5 mm, spherical adjustment of 0.66 D—basically lasing away the surface “until the fluorescence is gone.” “There’s a little bit of an art to it but it’s not that hard,” he said.

Once the epithelium has been removed, Dr. Stonecipher waits for a minute with air flowing across the surface to dry it. He then performs a no-touch technique and uses the laser to treat the refractive error with a standard PRK of 6.0 mm. He applies 12 seconds of mitomycin-C (MMC) if indicated, as in all enhancements. He irrigates with frozen balanced salt solution and applies all his topical medication at the end.

A transepithelial approach is not possible with mixed astigmatism, hyperopia or hyperopic astigmatism—“Our lasers don’t go out that far in terms of PTK,” said Dr. Stonecipher. Instead, he performs alcohol epithelium removal, applying 20% alcohol

for 20 seconds. He then removes the epithelium mechanically, and lases away the refractive error.

For patients with quality of vision issues—determined by asking if the patient experiences night symptoms, glare, or halos—Dr. Stonecipher will perform custom treatment.

In almost all of his patients, Dr. Stonecipher still uses MMC—“it’s kind of ingrained in my nomogram,” he said.

After surgery, he said, “the contact lens matters.” Putting bandage contact lenses on after surgery allows the patient to “go out the front door happy,” with great quality of vision.

The postoperative drop regimen, he said, varies from surgeon to surgeon. Most use a corticosteroid for at least a month with a three-month taper, an antibiotic such as moxifloxacin or gatifloxacin for 1-2 weeks, and a topical NSAID, either ketorolac or bromfenac as needed. “Find your regimen, stick to it, and you don’t need to change it too often,” he said.

Complications can occur. Dr. Stonecipher estimates about 1 in 100 patients need enhancements for low level refractive errors, 1 in 1,000 develop dry eye disease (although, he noted, if a patient has dry eye before surgery, the patient will have it after), 1 in 1,250 have glare, halos, or starburst. Very rarely, a patient might have recurrent corneal erosion and—albeit not in Dr. Stonecipher’s own experience, fortunately—infections, which have been documented in literature to occur at a rate of about 1 in 5,000 cases.

How to obtain access to laser vision correction in your practice

PRK is a simple procedure, simple enough that just about any surgeon who has performed it can teach another surgeon, according to **Richard L. Lindstrom, MD**, adjunct professor emeritus, University of Minnesota; founder and attending surgeon, Minnesota Eye Consultants; and associate director, Minnesota Lions Eye Bank, Minneapolis. However, that so many cataract surgeons are unable to perform keratorefractive enhancement surgery remains a significant problem.

Part of the reason, Dr. Lindstrom said, is that somewhere around 6,000 of the 9,000 cataract surgeons in the U.S. simply do not have access to performing even a simple PRK.

“There’s no reason to have someone else do a PRK for you—your patients want you to have those skills, and you can access a center with a laser pretty easily.”

Richard L. Lindstrom, MD

Dr. Lindstrom said he has spent a significant amount of time looking at various options to provide surgeons that access. “I’ve worked hard to try to help people get access to that technology, working with a company called Sightpath Medical [Minneapolis],” he said. “I like the idea of a mobile laser brought to you, your hospital, and your office.”

Dr. Hoffman has had experience with a similar model. “For the last 15 years, we’ve had a very unique situation,” he said. “We’ve had an independent businessman who owned a laser go to about 10 different sites in the Pacific Northwest, and it worked out great.”

The model frees the surgeon from the burden of the initial investment. “The advantage of having a roll-on, roll-off is you do not have to invest in the technology,” said Dr. Hoffman. Even the responsibility of maintenance and constantly upgrading the technology, he said, falls on the owner of the laser. “It’s an excellent choice for low-volume surgeons who don’t have the volume of cases to justify the initial cost of such an investment.”

“Another model that we have in Minneapolis [is] an institute called Phillips Eye Institute,” said Dr. Lindstrom. “It’s an open-access facility with 150 ophthalmologists on the staff.”

In addition to the Phillips Eye Institute, TLC Laser Eye Centers and the San Diego Eye Bank are examples of open-access facilities that provide surgeons with lasers for performing PRK.

“You can also pick a friend and go with him over to his center and very occasionally surgeons will simply have someone else do the procedure for them,” said Dr. Lindstrom. “But there’s no reason to have someone else do a PRK for you—your patients want you to have those skills, and

you can access a center with a laser pretty easily.”

Some academic centers will also perform PRK on patients. Surgeons can refer patients to these centers for PRK and then have the patients sent back to them after the procedure.

Perhaps more importantly, according to **Sonia H. Yoo, MD**, professor of ophthalmology, Miller School of Medicine, University of Miami, these academic centers have programs set up so that the “infrequent laser vision surgeon” can get training.

“We do training sessions usually once or twice a year for those community doctors who are interested in learning,” said Dr. Yoo. “We also offer proctoring for those doctors who want to bring their cases to the laser center.”

Learning the technique presents one “minimal barrier” to incorporating PRK into practice, said **John A. Vukich, MD**, assistant clinical professor, University of Wisconsin-Madison Medical School, Madison, Wis.; however, as Dr. Yoo pointed out, there are options. Since the technique itself is fairly straightforward and easy to learn, a more significant barrier may be the need for certification.

A center can provide local certification, “which means basically that you’ve had someone with you who has done the procedure before for the first few cases,” said Dr. Vukich. “That’s actually very reassuring to surgeons, and quite frankly we’re all happy to do that.”

In addition, the various laser platforms do require a “minimum level of education,” Dr. Vukich said. This can be obtained from online courses provided by the manufacturers of all the commercially available platforms or through certification courses made available during scientific meetings.

“That helps you from a medicolegal standpoint,” he said. “From a confidence standpoint, it gives you the ability to understand what to do on a more sophisticated level.”

Once a surgeon has learned the technique and acquired certification, the next practical question for incorporating the procedure into practice is how to charge patients—how to make it work financially.

In some practices such as that of Dr. Stonecipher, the patients are charged upfront for a “facility fee.” “We have to make it something that is a discussion involved in the multifocal or premium IOL platform,” he said. “I tell everyone that there is a potential for enhancement following one of these refractive procedures, and in my hands it’s about 7-8%, but at the same time I tell them there will be a facility fee that we will have to charge them.”

According to Dr. Stonecipher, having a nominal fee that patients have to pay makes it less likely that patients will complain after.

Meanwhile, Dr. Trattler bundles the cost of the enhancement ahead of time. “It’s hard to tell unhappy patients they need to fork over a little bit more money,” he said. “By including your initial cost, it works out better for the patient.”

However, with this approach, Dr. Stonecipher thinks that the 90% of patients who don’t need an enhancement may feel overcharged. The nominal facility fee covers the additional charges of the enhancement without making it explicitly about the additional procedure itself, while circumventing the need to charge extra later on should an enhancement be necessary.

Dr. Lindstrom uses an alternative, “hybrid” strategy: He tells patients upfront that there will be a small facility fee, but waives the fee when the patient hits the target and does not need an enhancement—which is practically all the time in Dr. Lindstrom’s hands.

The reality is that most surgeons have a low enhancement rate anyway, said Dr. Vukich. The key is to understand the astigmatic component, perform thorough biometry, and optimize IOL calculations to reduce pseudophakic ametropia and drive enhancement rates down.

But should residual refractive error even at a very low level make an enhancement necessary, surgeons can take comfort in knowing that a procedure such as

PRK exists to provide a safe and effective means of improving visual outcomes even after refractive IOL implantation.

References

1. Woodward MA, Randleman JB, Stulting RD. Dissatisfaction after multifocal intraocular lens implantation. *J Cataract Refract Surg.* 2009; 35: 992-997.
2. de Vries NE, Webers CA, Touwslager WR, et al. Dissatisfaction after implantation of multifocal intraocular lenses. *J Cataract Refract Surg.* 2011; 37: 859-865.

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Key opinions and practice patterns from symposium attendees

Through surveys conducted before the symposium, the ASCRS leadership identified certain areas that represent potential gaps in the practical education of ASCRS members. This symposium focusing on the impact of residual refractive error on refractive IOL outcomes reached out to 354 attendees, representing approximately 210,300 cataract procedures annually, 44% of whom are in practice in the U.S.

Of the attendees, 78% said they are implanting presby-IOLs in their practice, representing 16,800 presby-IOLs implanted annually; 36% of these implanters are more than 10% converted to presby-IOLs. Forty percent of attendees do not perform laser vision correction, with another 9% performing it only occasionally.

After the symposium, 18% of attendees said they are “much more” likely to perform AI/LRIs on presby-IOL patients for pre-existing astigmatism (42% said they are “more” or “much more” likely); 42% said they are “much more” likely to perform PRK/LASIK on presby-IOL patients to address residual error (63% said they are “more” or “much more” likely).

Prior to the symposium, 80% of attendees said that if a presby-IOL patient is unhappy and has 0.75 D of residual astigmatism, they would perform or refer the patient for LRIs, AIs, or LVC; the percentage rose slightly to 87% after the symposium.

Meanwhile, 69% of attendees said that if a presby-IOL patient is unhappy and has 0.75 D of residual sphere, they would perform or refer the patient for LVC; the percentage rose significantly to 83% after the symposium.

Interestingly, a pre-registrant survey found that 37.78% of attendees believed that a multifocal IOL patient with no residual refractive error and a healthy ocular surface has a 1–5% chance of having significant night vision dysphotopsia; 40% believed the patient has a 6–10% chance, 20% believed in a 10–25% chance, and 2.22% believed in a greater than 25% chance.

The survey also revealed that 63.04% and 64.44% of attendees, respectively, believed that the highest acceptable amount of residual refractive error is 0.50 D for sphere and cylinder.