The spectrum of IOL and laser technology at our disposal is broader and richer than ever. We can deliver excellent results by carefully tailoring the various surgical options to the individual needs of our patients.

Steven J. Dell, M.D.
The goal of customized LASIK is to reduce all higher-order aberrations
by Jack T. Holladay, M.D.

A recent study demonstrates that the wavefront-guided LASIK procedure induces significantly less higher-order aberrations, spherical aberration, trefoil, and coma than the wavefront-optimized LASIK procedure. In some cases, wavefront-optimized LASIK induced aberrations. Thus, wavefront-guided ablations provide the best results for the vast majority of patients with the lowest rate of retreatment over conventional LASIK and wavefront-optimized LASIK.

Reducing aberrations
Studies show that less higher-order aberrations in the eye result in better quality of vision. In the laboratory, Pablo Artal, Ph.D., showed eliminating all higher-order aberrations produces the best visual performance. In addition, studies from Steve Schallhorn, M.D., global medical director of Optical Express, with 140 pilots and 228 clinic patients showed that the best visual performance occurred with the lowest amount of higher-order aberrations. Similarly, pilots who had never had surgery naturally had lower higher-order aberrations.

With wavefront-optimized LASIK, the goal is not to reduce the spherical aberration, but simply not increase it. The treatment basis is sphere and cylinder. Optimized simply means “not intended to induce spherical aberration,” and therefore does not address pre-op spherical aberration or any other higher-order aberrations. Numerous studies have shown that by the time most patients reach their 40s, they have positive ocular spherical aberrations. With wavefront-guided LASIK, the goal is to reduce all higher-order aberrations. The spherical aberration target is zero.

Study and results
The purpose of our study was to compare wavefront-optimized and wavefront-guided procedures to determine which is more effective. The retrospective chart review study of 200 IntraLASIK procedures included 100+ IntraLase (Abbott Medical Optics, AMO, Santa Ana, Calif) Waveight (wavefront-optimized) eyes and 100+ IntraLase CustomVue (AMO) (wavefront-guided) eyes. Pre-op and post-op wavefront scans were done on all eyes at a 6-mm pupil size. Primary spherical aberrations, primary coma, primary trefoil, and total higher-order aberrations were measured.

One hundred and nine CustomVue eyes and 102 Waveight eyes were reviewed in 2006 and early 2007. These study results show that wavefront-guided ablation with femtosecond technology is optimal for the majority of patients.

Overall, the wavefront-guided treatment induces significantly less higher-order aberrations, spherical aberration, trefoil, and coma than the wavefront-optimized procedure (Figure 1 and 2). There was significantly more variation with the wavefront-optimized eyes. This study indicates that for all higher-order aberration in the wavefront-guided group, about 12% of patients were better, 76% were the same, and 12% were worse post-op. With wavefront-optimized, about 8% were better, 51% were the same, and 41% were worse. There was significantly greater safety for the patients with the guided procedure. The wavefront-guided procedure had the greater efficacy for total higher-order aberrations and the better safety with the lowest induced aberrations.

We have found that wavefront-guided LASIK has the best chance of maintaining or improving higher-order aberrations, and therefore has the best chance of providing optimal visual quality.

Dr. Holladay is clinical professor of ophthalmology at Baylor College of Medicine in Houston, Texas. Contact him at holladay@docholladay.com.

Figure 1: Wavefront-guided ablations were shown to improve or have no change on higher-order aberrations (HOA) in 88% of all patients in the study.

Figure 2: Wavefront-optimized ablations worsened higher-order aberrations (HOA) in 41% of all patients treated in the study, compared to 12% with wavefront-guided ablations.
Comparing conventional, custom, and wavefront-optimized LASIK

In an independent retrospective analysis of 721 eyes treated on three lasers, CustomVue produced excellent results

by Perry S. Binder, M.D.

Not long ago I retrospectively analyzed my LASIK outcomes to try to determine which laser algorithm provided my patients with the best results. At the time, we were using three laser platforms in our clinical refractive surgery practice. We compared a total of 721 eyes of 458 myopic patients across five treatment groups: Visx Star conventional and wavefront-guided, CustomVue (Abbott Medical Optics, AMO, Santa Ana, Calif.); LADARVision conventional and wavefront-guided (Alcon, Fort Worth, Texas); and Allegretto Wave wavefront-optimized (Alcon). Spheres and spherocylindrical eyes were analyzed separately.

I personally performed all the ablations and used the IntraLase femtosecond laser in every case, so the microkeratome and surgeon were constant. Iris Registration and Fourier-based wavefront analysis was not available at that time. I marked the corneas at the slit lamp for all conventional cases with greater than 0.5 D of astigmatism and for all custom cases.

In all cases, aberrometry was obtained pre- and post-op (using the same aberrometer both times) without regard to whether the patient had a custom ablation. Mean follow-up for the various groups ranged from 1 to 26 months. Stratification by pupil size (≤ 6.5 mm or > 6.5 mm) did not change any of the conclusions.

All of the lasers performed well. They all improved uncorrected and best-corrected visual acuity and produced very predictable refractive change. Visx CustomVue produced the best UCVA results in spheres, with 41.7% seeing 20/16 or better, while the Allegretto laser produced the best UCVA results in spherocylinders, with 30% achieving UCVA of 20/16 or better. Table 1 provides a summary of statistically significant results.

Overall, the Visx wavefront-guided ablations improved results compared to conventional Visx treatments. LadarVision wavefront ablations did not improve on conventional results.

All of the lasers induced higher-order aberrations (HOA). However, those patients with greater pre-op HOA did better with either a wavefront-guided or wavefront-optimized treatment than with a conventional one. Visx CustomVue produced the best HOA results in terms of total RMS and change in RMS, for both spheres and spherocylinders. Interestingly, the Allegretto Wave platform produced the worst spherical aberration (SA) results of any group, even though the Allegretto’s wavefront-optimized algorithm is designed to reduce the induction of SA. Spherical aberration is the most commonly induced HOA and the one that seems to cause the greatest problems with visual quality. Although the Allegretto laser performed well in terms of visual acuity, it did not reduce the induction of SA.

Following this study, I significantly increased the percentage of Visx CustomVue cases I perform, given the favorable across-the-board results in that group.

Dr. Binder was not a consultant for any of the laser manufacturers at the time the study was performed. Contact him at 858-455-6800 or psbinder@gbvision.com.


Table 1: Statistical Summary of Results

<table>
<thead>
<tr>
<th>Sphere Only Eyes</th>
<th>VISX STAR* CustomVue</th>
<th>Allegretto Wave</th>
<th>LADAR** Conventional</th>
<th>LADAR** Custom</th>
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<tbody>
<tr>
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<td></td>
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<tr>
<td>UCVA</td>
<td>LogMar</td>
<td>BEST</td>
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<td>BSCVA LogMar</td>
<td>BEST</td>
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<tr>
<td>HOA RMS (µm)</td>
<td>BEST</td>
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<td>HOA RMS</td>
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<tr>
<td>HOA RMS % Change</td>
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<td>WORST</td>
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<tr>
<td>Spherical Aberration (SA) change (µm)</td>
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<tr>
<td>Defocus (µm)</td>
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<td></td>
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<td>WORST</td>
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</tbody>
</table>

*VISX CustomVue was non-Fourier, non-Iris registration; in this study, VISX Star Conventional treatments were performed but were not statistically best or worst in any comparison.

** The Alcon LADARVision platform is no longer commercially available.

Figure 1: VISX CustomVue provided the best outcomes in most categories, including UCVA and BSCVA, for sphere-only eyes in the study.

"Following this study, I significantly increased the percentage of Visx CustomVue cases I perform, given the favorable across-the-board results in that group."
Wavefront-guided LASIK with the femtosecond laser yields safe, positive results with minimal complications

by Steven C. Schallhorn, M.D.

Results from a large clinical evaluation of refractive surgery reconfirm laser vision correction (LVC) as a safe and effective surgery to correct refractive errors with a low complication rate. A retrospective review of safety and efficacy was recently conducted of Optical Express, which has over 200 locations and is Europe’s largest provider of LVC, to evaluate surgical outcomes in a large corporate practice. Optical Express uses a multi-disciplinary patient care model with surgeons, optometrists, and their support staff who appropriately share patient care responsibilities.

The study includes data on consecutive, recently performed LASIK and LASEK procedures (49,011 eyes of 24,505 patients) for the treatment of myopia, hyperopia, and astigmatism where emmetropia was the goal. Patients received treatments with the STAR S4IR excimer laser system (Abbott Medical Optics, AMO, Santa Ana, Calif.). Either the Intralase FS-60 (AMO) or the Moria single-use microkeratome (Moria, Antony, France) was used to create the LASIK flaps. An alcohol solution was used to remove epithelium in LASEK cases. The mean pre-op sphere was −2.97 D for myopes and +2.34 D for hyperopes.

Corrections ranged from −12.00 D to +6.00 D. The mean pre-op cylinder was −0.76 D.

Study findings

LASIK was performed in 91% of patients while 9% received LASEK. Despite the added cost, most patients (80%) selected a wavefront-guided ablation profile (WFG, Advanced CustomVue) and most LASIK patients (70%) selected the femtosecond laser for their method of flap creation. This demonstrates an increasing public acceptance of the benefits of this advanced laser vision correction technology.

Most patients (92%) returned for their one-month follow-up examination. The mean one-month manifest spherical equivalent (MSE) of the entire cohort was −0.08 D. Eighty-five percent of eyes were within 0.5 D, and 97% of eyes were within 1.0 D of their intended correction (emmetropia). Bearing in mind the wide range of pre-op refractive error, the inclusion of LASEK, and the relatively early post-op time period, the one-month uncorrected visual acuity (UCVA) was excellent, as 86% of eyes treated for myopia and 61% of eyes with pre-op hyperopia achieved 20/20 UCVA (Figure 1). Further, for the entire cohort of patients who had bilateral laser vision correction, 93% achieved 20/20 or better uncorrected binocular vision. There was an average of nine lines gained in post-op UCVA compared to pre-op. Nearly all eyes reached 20/40. The loss of more than two lines of best corrected vision (BCVA) was 0.35%, and there was no difference in the mean post-op BCVA compared to pre-op. Continued improvement in uncorrected and best corrected vision is expected beyond one month post-op.

Low complications

The overall complication rate was very low (0.8%) and included many of the complications reported in the literature. Most complications (dry eye, DLK, flap striae, and transient light sensitivity, etc.) were successfully treated without long-term adverse effects. This reconfirms the safety of LVC.

Overall, LASIK flap complications were rare. While most of the flaps were created with the femtosecond laser, most of the flap complications, such as buttonhole and incomplete flaps, occurred with the mechanical keratome. This underscores the safety advantage of the femtosecond laser. Dr. Schallhorn is the global medical director for Optical Express and the past Director of Refractive Surgery for the U.S. Navy. Contact him at steveschallhorn@opticaexpress.com.
Bringing LASIK to the next level

Early data with the iLASIK technology used in naval aviation shows excellent post-op vision

by David J. Tanzer, M.D., CAPT, MC (FS), USN

Preliminary results from a study on the first 32 eyes using the 5th generation femtosecond laser (iFS laser, Abbott Medical Optics, AMO, Santa Ana, Calif.) at our facility showed improved outcomes over the FS 60kHz, with 97% of patients achieving 20/20 UCVA at day one and 100% at week one (Figure 1).

Next generation
Advancements with the new femtosecond laser, including the inverted side-cut architecture and elliptical flap-making capabilities, bring LASIK to the next level. We received our iFS in the beginning of January 2009 and have been using it exclusively since then with wavefront-guided ablations (CustomVue iLASIK). Our initial impressions were that the visualization of treatment through the flat screen monitor is significantly better than the optics of the microscope in the type II Intralase, the FS 60kHz. The flat screen monitor allows the surgeon to focus, adjust illumination, toggle between light eye and dark eye settings, and utilize customizable preset settings.

Our early results of the first 32 eyes have been excellent. The mean pre-op MRx was –2.00 D, with a range of –0.86 to –4.58. We compared this to 135 eyes with a mean pre-op MRx of –2.41 D, with a range of –0.54 to –6.94. Ninety-seven percent of patients in the iFS group achieved 20/20 UCVA at day one and 100% at week one, compared to 97% at day one and week one in the FS 60kHz group. Ninety-four percent and 92% of patients reached 20/16 on day one and week one, respectively, in the FS 60kHz group. Ninety-four percent and 92% of patients achieved 20/10 at day one and 19% at week one, compared to 8% at day one and week one in the FS 60kHz group.

Customization
One of the major benefits of the 5th generation femtosecond laser is that it allows surgeons to customize the architecture of the flap by either adjusting the side-cut angle (as steep as 150 degrees to make it a true inverted side-cut) and/or by creating an elliptical flap. The benefits of inverted side-cut architecture on flap stability were reported in November 2008 by Michael Knorz, M.D., FreeVis LASIK Center, Mannheim, Germany. This increased flap stability is an especially significant advantage for our particular patient population of military individuals, including special operations personnel, aviators, and other naval staff. Currently, we use the default setting for myopia of 140 degrees. At this angle, we create an 8.95-mm flap as measured from the uppermost portion of the bevel (at the epithelium). If the bevel is increased to 150 degrees, the exposure would be reduced below the target 9 mm of cornea for myopes. Thus, the 140-degree inverted bevel flap has proven to be an ideal setting for us. For hyperopes and mixed astigmatism treatments, I target a 9.15-mm exposure with a 120-degree inverted bevel.

In addition to the overall benefit of the inverted side-cut architecture, surgeons also have the ability to create an elliptical flap. This allows for a reduction in the size of the flap in the area perpendicular to the hinge, thereby sparing some peripheral cornea and resulting in a stronger corneal structure than was previously possible following LASIK.

I look forward to reporting additional patient data and results with the iFS in the near future.

Dr. Tanzer is a captain in the U.S. Navy Medical Corps and director of the U.S. Navy Refractive Surgery Program. Dr. Tanzer can be reached at david.tanzer@med.navy.mil.
O
ver the last decade, there have been significant advances in laser vision correction technology that provide improved visual outcomes for our LASIK patients. There are many excellent laser systems and modern flap-creating devices that are currently available. At my center, we routinely use the combination of CustomVue treatments on the VISX S4IR laser and the Intralase femtosecond laser, termed iLASIK (Abbott Medical Optics, AMO, Santa Ana, Calif.). Since having iLASIK available in our practice, I have been surprised to see an increased number of patients with 20/15 or better vision. We have noted that switching to the Intralase has dramatically reduced flap-related complications as well.

In order to quantify that impression, I have helped set up a prospective multi-center study to assess outcomes and patient satisfaction with iLASIK across a diverse range of practices and surgeons. More than 10 sites are participating; each will enroll 20 to 25 typical myopic subjects, for an expected total of more than 400 eyes in the study.

Subjects must be at least 21 years old, with BSCVA of 20/20 or better in both eyes. They must have pre-op manifest refractive error between -0.50 D and -6.00 D, with a cylinder component up to -3.00 D, and a maximum manifest spherical equivalent of -6.00 D. Both eyes must demonstrate refractive stability.

Patients with ocular pathology, prior ocular surgery, systemic conditions that affect wound healing, or a monovision target will be excluded from the study.

In addition to visual acuity measures, we are also tracking quality-of-vision changes with pre- and post-op WaveScan aberrometry and contrast sensitivity testing. Early results suggest that this may be where we see the biggest gains from iLASIK.

At one site, Lackland Air Force Base in San Antonio, Texas, Charles Reilly, M.D., consultant to the Air Force Surgeon General for Refractive Surgery, has already completed enrollment for this study. Analysis of his one-month results, conducted at a central study center, revealed that his patients not only achieved excellent mean uncorrected visual acuity of 20/16 but also experienced a significant improvement in their low-contrast visual acuity, from 20/35 best-corrected pre-op to 20/29 uncorrected post-op.

Preliminary results from the entire group are expected soon, with full three-month results available before the end of the year.

**Combining forces**

I have been performing custom ablation for many years now. On the Visx platform, our patients obtain superior results with custom ablations compared to conventional treatments. Custom ablations not only address higher-order aberrations but also ensure that the treatment is targeted to fixed features on the iris. This allows the ablation to be adjusted to compensate for pupil centroid shift and cyclorotation.

However, even custom ablations with iris registration can be hampered by quality-of-vision issues due to the LASIK flap. Several recent studies from different investigators have shown that thin flaps made with the Intralase femtosecond laser provide patients with the same visual results obtained with surface ablation but with much faster visual recovery.1,2

Steve Schallhorn, M.D., global medical director of Optical Express, compared conventional LASIK with metal microkeratome flaps to custom LASIK with femtosecond laser flaps. There were significant differences in both achievement of 20/20 acuity and in night driving simulations. The patients who had wavefront-guided surgery with femtosecond flaps saw improvements in their ability to detect and identify road hazards compared to pre-op, while about 40% of the conventional patients saw significant losses on this measure compared to pre-op (Figure 1).3

The end result of a thin femtosecond flap is a reduced risk of ectasia, less reduction in visual contrast sensitivity and therefore less dry eye, and better quality of vision in a shorter period of time.

The next generation femtosecond laser, the IFS (AMO), may help by continuing the enhancements in results seen with the 60 kHz Intralase. It is faster and allows more customization of the flap, as well as a beveled flap edge that may promote even better adhesion of the flap and improved corneal strength over time.4

Dr. Trattler is director of cornea at the Center for Excellence in Eye Care, Miami. Contact him at 305-588-2020 or vtrattler@earthlink.net.

**References**


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**Figure 1: Wavefront-guided ablations were shown on average to improve night driving simulation performance**

Source: Steve Schallhorn, M.D.
Tears for post-LASIK dry eye

Treating dry eye aggressively can boost patient satisfaction and outcomes

by Marguerite B. McDonald, M.D.

Like any other form of dry eye, there is often a disconnect between the signs and symptoms of post-LASIK dry eye. Some patients complain bitterly of discomfort and fluctuating vision, yet the doctor doesn’t see any significant clinical signs at the slit lamp. Treating these patients, even in the absence of clear clinical signs, can entirely change their appreciation of the surgical outcome and reduce the need for enhancement.

Palliative therapy with a high-quality, long-lasting tear like Blink Tears (Abbott Medical Optics, AMO, Santa Ana, Calif.) remains an important part of the preparation for LASIK, as well as a key to post-op success. The unique visco-adaptive formulation of Blink Tears combined with its distinctive mechanism of action ensures that the lubricant spreads out quickly on the eye, stabilizing the tear film and providing a smooth optical surface. This smooth surface is important in reducing fluctuations in vision as epithelial irregularities heal after surgery.

Blink Tears is preserved with OcuPure, a gentle dissipating in-eye, non-BAK preservative, so I am less concerned about corneal toxicity and more comfortable moving from unit-dose unpreserved tears to Blink Tears after four weeks, rather than insisting that patients use the more expensive non-preserved tears for a full three months, as I once did.

Blink Tears vs. Systane drops post-LASIK

A number of studies are currently underway to compare Blink Tears to other tears commonly used in the refractive surgery setting.

Christopher Starr, M.D., Weill Cornell Eye Associates, New York, assembled an impressive group of investigators, including Stephen Coleman, M.D., Coleman Vision, Albuquerque, N.M., John Stein, M.D., Ophthalmic Consultants of Connecticut, Fairfield, Conn., Damon Pettinelli, M.D., Baltimore Eye Physicians, Baltimore, Md., Marc Bloomenstein, O.D., Schwartz Laser Eye Center, Scottsdale, Ariz., and myself, to evaluate and compare Blink Tears versus Systane drops (Alcon, Fort Worth, Texas) in post-LASIK patients with dry eye symptoms. One hundred patients scheduled to undergo bilateral myopic LASIK were randomized to either group. The preliminary results show that treating the signs and symptoms of dry eye post-LASIK with artificial tears improves visual outcomes. The research demonstrates that Blink Tears significantly reduced higher-order RMS error compared to Systane drops, optimizing visual outcomes. It improved comfort and vision with less blur than other drops, and also significantly reduced corneal staining and increased tear retention on the ocular surface.

The results correlate with another study I recently completed with my colleagues Eric Donnenfeld, M.D., Ophthalmic Consultants of Long Island, Lynbrook, N.Y., and Stephen Klyce, Ph.D., professor of ophthalmology and anatomy, Louisiana State University Eye Center, New Orleans, evaluating higher-order aberrations after instillation of artificial tears. Early results from this study indicate that Blink Tears reduces higher-order aberrations compared to Systane drops. With uniform coating and fewer imperfections across the ocular surface, the Blink Tears group had better Snellen visual acuity. Most importantly, patients felt their quality of vision was improved.

With an aggressive regimen for treating dry eye symptoms both before and after surgery with artificial tears and other therapies, we can avoid or reduce post-LASIK dry eye and help our refractive surgery patients achieve the best possible outcomes.

Dr. McDonald is a clinical professor of ophthalmology at New York University School of Medicine, New York. She is in private practice with Ophthalmic Consultants of Long Island in Lynbrook, N.Y. Contact her at 516-593-7778 or margueritemcdmd@aol.com.
Cataract patients: refractive goals

We have the advanced technology to provide today’s cataract patients with the best possible refractive outcomes

by Eric D. Donnenfeld, M.D.

The common denominator in all of the major revolutions in anterior segment surgery, from intraocular lenses to phacoemulsification to LASIK, has been more rapid return of improved uncorrected visual acuity. Presbyopic IOLs offer the same promise—and demand the same kind of paradigm shift from anterior segment surgeons. In order to give our IOL patients the comfortable experience, nearly immediate visual rehabilitation, and excellent uncorrected vision they expect, we have to accept that cataract surgery has become refractive surgery.

Refractive IOLs

Of course, the choice with perhaps the greatest refractive consequence for the patient is the IOL itself. My first question for any prospective cataract patient is whether he or she minds wearing glasses for reading.

For those who are interested in spectacle-free near vision, we have several options. Monovision, of course, is a time-tested approach that has provided good results for many patients. However, it takes away stereopsis, reduces the patient’s depth perception and binocular contrast sensitivity, and may increase glare and halo.

Today’s accommodative IOLs provide good distance visual acuity but a limited and extremely variable degree of accommodation, and therefore cannot provide a full range of vision for most presbyopes. In my experience, patients with presbyopic IOLs implanted in one eye who are not fully satisfied almost always desire better near (not distance) vision. In the Custom Match trial, for example, only 1 in 100 subjects said they wanted better distance vision after the first IOL implant.

My lens of choice for patients who want spectacle independence is an aspheric multifocal IOL. This option provides by far the best range of near vision. In clinical trials of the Tecnis Multifocal (Abbott Medical Optics, AMO, Santa Ana, Calif.), for example, 93% of subjects achieved simultaneous 20/25 or better at distance and 20/32 (2-2) or better at near, with very high rates of spectacle independence for common daily tasks (Figure 1).

Customizing lens choice

Before recommending a presbyopic lens, find out more about the patient’s vocation, activities, and visual demands, as well as tolerance for glare and halo. In the recent Tecnis Multifocal clinical trial, only a small percentage of subjects noticed any glare or halo, so one can reassure patients that the chance of experiencing these visual symptoms is not high. I find that most patients who desire spectacle independence and are willing to pay for a premium lens are typically willing to accept the possibility of some visual symptoms to achieve their goal.

Pupil size is also an important consideration in IOL selection. The Tecnis Multifocal has a full 6.0-mm diffractive lens that is less dependent on pupil size for either near or distance vision.

The newest generation of aspheric multifocal IOLs, including the Tecnis Multifocal and the AcrySof ReStor +3.0 (Alcon, Fort Worth, Texas), offers a broader range of vision than accommodating IOLs and provides higher-quality distance vision compared to previous multifocal generations.

Surgeons who may have tried and given up on implanting presbyopic lenses in the past would be well served to try the latest-generation lenses because the optics are far superior to what was available even two years ago.

It is time for ophthalmologists to take a good look at what patients really want, which is quality distance vision but also the ability to read well and be less dependent on glasses for most of their daily activities. This demand is rapidly turning cataract surgery into refractive surgery. Fortunately, new techniques and technologies that improve outcomes allow us to deliver the “wow” factor our patients want.

Figure 1: The vast majority of subjects reported being able to function comfortably without glasses at all distances

Figure 2: Pupil independence is especially important in low light situations, particularly for near vision

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Innovations in ultrasound delivery, fluidics, and viscoelastics combine to make phacoemulsification safer than ever before

by Roger F. Steinert, M.D.

On parallel fronts, phacoemulsification surgery has been getting safer and safer. In terms of ultrasound energy, there is ongoing refinement in two areas. The first is the minimization of the energy delivered to the eye through improved computer control and more effective micropulsing. This began years ago with cold phaco, and the advances in power modulation have continued since, nearly eliminating the risk of wound burn and making phaco surgery much gentler for the eye.

Today we even have advanced pulse shaping that can deliver an initial power surge to help drive the needle into the nucleus, then modify the wave form back to normal levels for the rest of that individual pulse.

The other innovation in phaco power is the introduction of non-longitudinal modes such as torsional and transversal phaco. Both of these modes add lateral movement to the straight forward-and-back motion of the phaco tip, providing better followability and, in some cases, reducing energy requirements.

Torsional phaco must be performed with a bent needle, while transversal phaco, available on the WhiteStar Signature system with ELLIPS (Abbott Medical Optics, AMO, Santa Ana, Calif.), can be done with either a bent or straight needle. ELLIPS is a good option for the nearly two-thirds of surgeons who prefer a straight needle.

Getting with the flow

On a routine basis, it is this followability that the surgeon notices and most appreciates. As a surgeon, my goal is for every nuclear particle to be easily engaged by the phaco tip and remain adhered to the tip until fully emulsified. This ideal is about more than just convenience and procedure speed. As soon as one starts moving the tip more posteriorly or peripherally to pursue nuclear fragments, the risk of capsular rupture increases. Staying in the safer, central zone of the capsule, smoothly drawing the particles in and keeping them at the tip, dramatically improves safety.

Secondarily, a faster, smoother procedure is much gentler to the corneal endothelium, introducing less BSS and ultrasound energy into the eye, and causing less trauma. We see the payoff of this in clearer corneas and higher patient satisfaction on post-op day one.

Customizing your surgery

Where the WhiteStar Signature system excels is in marrying ultrasound and fluidics advancements for better followability, lower energy, and a more stable anterior chamber throughout the case. The system has a wide range of programmable settings that can be customized for each type of cataract.

The impact of transversal phaco, for example, is seen most clearly on harder nuclei that would otherwise be very challenging to emulsify. However, I use the same ratio of longitudinal and transversal phaco for all cases, even as I vary the energy and pulse rate. I think every case benefits from the combination of longitudinal and lateral phaco tip motion. An advantage of the Signature system is that both modes are used simultaneously, rather than switching back and forth as the torsional system must do.

The Signature also has fusion fluidics, which allow the surgeon to make use of both peristaltic and venturi pumps. This dual-pump capability allows me to perform surgery exactly the way I want to, without giving up the advantages of either pump style.

I like the peristaltic pump for phacoemulsification because I can use higher levels of vacuum while minimizing the risk of surge. For irrigation and aspiration, my system is programmed to switch over immediately to the venturi pump, which allows for very efficient vacuuming of the capsule without any need to change panel settings. This increases the safety of the procedure because if I happen to grab the capsule, the venturi pump is so responsive that vacuum and flow can be brought down to very low levels quickly. Unlike a peristaltic system, the venturi pump doesn’t have to reflux to release the capsule.

I am comfortable with venturi pumps and have always preferred them for I/A but in the past was unwilling to give up the peristaltic fluidics controls. Now I can have both.

Dr. Steinert is professor of ophthalmology, professor of biomedical engineering, director of the Gavin Herbert Eye Institute, and chair of ophthalmology at the University of California-Irvine (UCI). Contact him at steinert@uci.edu or 949-824-8089.
Clinical study outcomes of the Tecnis Multifocal

Study shows positive outcomes and high patient satisfaction for the Tecnis MF

by Farrell C. Tyson, M.D.

In clinical trials, the recently approved Tecnis Multifocal IOL (Abbott Medical Optics, AMO, Santa Ana, Calif.) provided excellent results, with enhanced near VA, reading acuity/speed, depth of focus, and spectacle independence compared to the monofocal IOL.

The one-year, non-randomized, multi-center, masked, bilateral, parallel-group comparative clinical evaluation of 125 multifocal and 125 monofocal subjects evaluated the safety and effectiveness of the aspheric diffractive Tecnis Multifocal ZM900 IOL. Subjects underwent bilateral implantation with the Tecnis Multifocal IOL (TCMF) or the CeeOn 911A monofocal IOL (CEMN, Abbott Medical Optics) according to the subject’s preference. The study was later expanded to include an additional 225 multifocal subjects.

Clinical experience

I was an investigator in the Tecnis MF Clinical Trial Expansion. I performed 38 bilateral and two unilateral implantations with the Tecnis MF lens. My patients had excellent results, with 87.5% reporting they never wore glasses post-op. They reported excellent patient satisfaction. Twenty-four percent of bilaterally implanted patients had 20/16 of distance uncorrected, and 22% were J1+ or better uncorrected.

Trial one-year results

One-year results are available for 118 Tecnis MF subjects and 116 CEMN subjects. Mean distance VAs were statistically and clinically equivalent between the two groups. Mean binocular and monocular uncorrected and distance-corrected near visual acuities were all significantly better for the TCMF than for the CEMN group by four to five lines of acuity. Eighty-four percent of TCMF subjects achieved uncorrected binocular combined VAs of 20/25 distance and 20/32 near, compared to 62% of the CEMN subjects.

The TCMF group had excellent depth of focus, maintaining a mean of 20/40 or better for far, intermediate, and near distances. Although mean contrast sensitivity scores were lower for the TCMF compared to the CEMN group, results were not considered clinically significant. Halos and night glare were more common in the TCMF group. Both reading acuity and speed were significantly better for the TCMF than the CEMN group. Furthermore, 84.8% of the TCMF group achieved complete spectacle independence compared to only 5.2% of the CEMN group. In addition, 96.4% of the Tecnis MF patients indicated that they functioned comfortably at near without glasses, compared to 30.4% of the CEMN group.

We concluded that a key reason for subjects choosing a multifocal over a monofocal IOL is the desire to be spectacle-free for reading. With best distance correction in place, the TCMF group performed significantly better on both reading acuity and reading speed tests compared to the CEMN group.

Summary

The Tecnis MF IOL provides patients with significantly improved near vision without significant loss of distance visual function compared to a monofocal IOL. Although a slight decrease in contrast sensitivity and an increase in halos and night glare were noted in this trial with the Tecnis MF IOL, subject satisfaction was very high for the lens. This was likely a result of improved reading ability, the low incidence of spectacle wear, and the large range of depth of focus provided by the aspheric Tecnis MF IOL.

Overall, my clinical experience with this trial has convinced me that bilateral implantation with the Tecnis MF is the way to go. With the bilateral implantation, I have found that the patient’s intermediate vision is just as good as or better than a mix-and-match implantation with another type of lens. This lens provides excellent visual outcomes for patients, who are especially happy that they are no longer dependent on their glasses.

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The lens provides improved PCO-protection

by Donald R. Nixon, M.D.

Two-year data on the Tecnis 1-piece lens (Abbott Medical Optics, AMO, Santa Ana, Calif.) shows improvement in optical quality, as well as biomechanical advantages such as decreased levels of PCO.

Design advances
The Tecnis 1-piece acrylic hydrophobic IOL was designed based on a desire in the marketplace to have access to aspheric 1-piece IOL technology. From its inception, this lens incorporated a spherical aberration correction, taking the advantages of the Tecnis 3-piece and fusing it into the advances of the Tecnis 1-piece platform to add versatility and choice for surgeons and their patients.

A central component of its design is a 360-degree posterior edge including that portion in the area of the haptic-optic junction. This feature enhances the inhibition of the lens epithelial cell migration along the anterior surface of the posterior capsule. Studies have shown that lenses, such as the AcrySof SA60AT (Alcon, Fort Worth, Texas), that do not have this trait are much more prone to early and very predictable PCO development through lens epithelial cell migration.

Another complimentary design feature is a step-down or posterior angulation of the optics relative to the haptics. This provides posterior compression of the posterior optic onto the anterior surface of the posterior capsule to further enhance IOL centration and stabilization. The unique haptic-optic geometry was designed to reduce the mass in this area to further promote the sealing of the posterior capsule in that particular area.

Studies have also shown that the Tecnis 1-piece has the advantages of improvement in functional vision as evaluated in the simulated driving test. Because the lens has a second-generation hydrophobic acrylic material, it is also glistening free (Figure 1).

Recently, it has become known that this lens has one of the highest ABBE numbers, which means it has the least amount of chromatic aberration. In the future, I think we will see that the effectiveness of lowering chromatic aberration may be of equally, if not greater, importance than its effect in terms of neutralizing spherical aberration.

Recent findings
In a recent study we set out to determine in vivo if these design features enhanced the performance of the lens. This evaluation of a head-to-head comparison in vivo showed superiority of the Tecnis 1-piece design over the AcrySof. It had better optical performance and an improved ability to resist lens epithelial cell migration.

We followed a group of 14 patients who were included in the FDA study. They were implanted with the Tecnis 1-piece lens in the first eye in November 2005, and the AcrySof SA60AT was implanted in the other eye within three months. Using high definition photography, we evaluated the performance of the lenses and looked at issues of posterior lens epithelial cell migration. We found in this relatively small but representative group of patients that there was a statistically significant greater incursion of lens epithelial cells with the AcrySof design. The study confirmed that the weakness was at the area of the haptic-optic junction, and the Tecnis 1-piece design appeared to have an effective barrier for lens epithelial cell migration so that it had a statistically significant lower incursion of lens epithelial cells. In addition, the grading of the lens epithelial cell migration and the cellular density was much lower with the Tecnis 1-piece over the AcrySof.

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Figure 1: Tecnis 1-piece in glistening free