Evolving Corneal and Lens-Based Refractive Surgery

Understanding and selecting surgical solutions to maximize visual acuity, patient satisfaction, and quality

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CONTRIBUTORS

Steven J. Dell, M.D.
H.L. “Rick” Milne, M.D.
Angel López Castro, M.D.
Colman R. Kraft, M.D.
W. Bruce Jackson, M.D.
Mounir A. Khalifa, M.D.
Baha Toygar, M.D.
Maj. Charles Reilly, M.D.
Y. Ralph Chu, M.D.
Capt. Steven C. Schallhorn, M.D.
Martin A. Mainster, Ph.D., FRCOphth.
Farrell “Toby” C. Tyson II, M.D., F.A.C.S.

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Maximizing Patient Satisfaction With Multifocal IOLs

Patients can see well at all distances and are happy with much less dependency on glasses

by Doug Grayson, M.D.

Recent clinical experience implanting nearly 1500 ReZoom (Advanced Medical Optics, AMO, Santa Ana, Calif.) multifocal IOLs shows patients are extremely satisfied with their increased vision at all distances and enjoy spectacle independence postoperatively.

My clinical experience, coupled with the experiences of several other surgeons, including Steven Dell (M.D., Austin, Texas) and Stephen M. Weinstock (M.D. Largo, Fl.), illustrate that the majority of patients enjoy a wide range of excellent vision and have much less dependency on spectacles postoperatively.

Use of ReZoom

Of the 1200 ReZoom lenses I have implanted, 90% have been bilateral ReZoom implantations. Initially, I evaluate the patient’s pupil size to determine whether he should receive ReZoom or ReStor. Assuming the patient does not have very myopic pupils, ReZoom will always be my first choice. Because we extensively discuss patient desires, visual needs, and expectations prior to multifocal implantation, most patients are extremely happy with their results.

Depending on reading ability after the first ReZoom implantation, I consider mixing and matching ReZoom with other lens technologies in some patients. If the patient’s reading ability is good (but not absolutely perfect), I will implant another ReZoom because patients receive an added effect from having ReZooms in both eyes. In other cases, if the patients’ reading is very moderate because they are not going into the full near zone on the ReZoom, then they will receive a ReStor in the other eye.

The reading level is not necessarily based on objective measurement, it is more subjective. For example, if patients can’t read the newspaper or they are just not happy, then they will receive a ReStor in the other eye. If the patient’s vision is good and there are only a few things he cannot read, then he will receive another ReZoom.

Results

ReZoom patients included in this combined group have excellent overall spectacle independence (see table). Ninety four percent of these patients implanted with bilateral ReZoom achieved spectacle independence at all ranges and 99% have spectacle independence at distance. For near vision and intermediate tasks such as prolonged reading or small print and craft and computer work, some patients chose to wear reading glasses. For example, some patients may use a light pair of reading glasses because they do not feel their near vision is good enough to see the back of a pill bottle.

The other main reason why patients use any form of vision correction post ReZoom lens implantation is residual astigmatism.

Astigmatism is the big wild card. For instance, some patients may have 2 D of astigmatism and they are reduced to 1 D of astigmatism with limbal-relaxing incisions (LRIs). They still are not totally happy, but they do not want another procedure.

Therefore, they chose to wear glasses for correcting that remaining astigmatism. This is related to post-operative astigmatism or another post-operative refractive component, not the ReZoom lens.

Post-operative Enhancement

Post-operative enhancement is not needed in the majority of cases. In my practice, less than 2% of bilateral ReZoom patients receive a secondary procedure to manage residual error post lens implantation.

I use LRIs at the time of the initial procedure to manage preexisting astigmatism. However, cases with significant astigmatism may require LASIK, unless the patient decides the residual astigmatism is acceptable. If LASIK is required, the patient receives laser vision correction from my partner for an additional fee.

For example, patients with more than 1 D of preexisting astigmatism receive an intra-operative LRI. Patients with more than 2 D of astigmatism they would receive more LRIs or LASIK post-operative. Patients with greater than 2.5 D of astigmatism receive a staged procedure in which they receive the multifocal implant and are scheduled for a planned LASIK post-operatively.

Optimizing Outcomes

Conventional LASIK also is used by my colleagues, including Stephen Weinstock, to eliminate any refractive surprises or astigmatism that was not corrected during the original procedures.

For surgeons such as Steven Dell, wavefront-guided laser enhancements are helpful in optimizing patients’ outcomes. He uses wavefront-guided laser enhancements whenever high-quality wavefront diagnostic testing results are obtained because the wavefront increases the probability of reaching the refractive target. However, if the scans are poor, he would use traditional laser vision correction.

Doug Grayson, M.D. is in private practice, Parsippany, N.J.
Pseudophakic Refractive Management with Multifocal IOLs

Patient counseling regarding visual needs and expectations helps boost patient satisfaction

by Steven J. Dell, M.D.

“I use a wavefront-guided laser enhancement over a toric IOL to resolve astigmatism issues because the laser is much more accurate.”

Steven J. Dell, M.D.

Bilateral implantation with the ReZoom (Advanced Medical Optics, AMO, Santa Ana, Calif.) multifocal lenses provides excellent post-operative vision at a variety of distances. At our practice, we educate all of our patients about various presbyopic IOL options and discuss with them realistic expectations pre-operatively. We make use of patient questionnaires and handouts to streamline this process (Figure 1). As a result, patient expectations are set at an appropriate level, and post-operative patient satisfaction is very high.

Patient Selection

The best ReZoom patients are those with dense cataracts and a high refractive error who do not do much night driving and desire good vision at all three working distances (distance, intermediate, and near). However, with appropriate pre-operative counseling, it is possible to achieve good results in many other patients who do not meet this specific profile.

Surgeons can take a number of steps to help patients achieve the highest level of satisfaction. The most important things are to assess the patient’s visual demands and personality and match these to the most appropriate IOL. Patients also need to be forewarned about the possibility of halos or glare with all multifocals. They must understand that some residual spectacle use is a possibility with any IOL.

Clinical Experience

I generally split most of my presbyopia correction IOL patients between the ReZoom and the crystallines. When I believe that a multifocal is best for the patient, I typically will use the ReZoom. I prefer this multifocal over the ReStor typically because the ReZoom seems to provide better overall visual function for the patient in all three vision zones. It is a fairly forgiving lens, and it is the easier of the two to use. In some cases, we mix and match these two multifocal IOLs. We caution all patients that they might require spectacles for some tasks after receiving any IOL, but for most tasks, virtually all patients are spectacle free with the ReZoom. Reading for prolonged periods of time is the most typical situation in which ReZoom patients use any form of vision correction. Most of these patients enjoy complete spectacle independence for intermediate vision and distance vision.

To treat preexisting cornal astigmatism, I typically perform limbal-relaxing incisions (LRIs) at the time of surgery first. This successfully addresses the majority of astigmatism cases. However, some patients with higher degrees of astigmatism pre-operatively have a bit of residual astigmatism and might use some distance correction on occasion. Laser touch-up or further LRIs are options for those cases.

Post-Operative Enhancement

Despite careful biometry and astigmatism management, multifocal IOL patients receive a secondary procedure to manage residual refractive error post lens implantation in about 5% of cases. Our enhancement numbers are low because we do not promise total spectacle elimination with any surgical procedure. We explain that there are limits to the accuracy of our measurements, and the patient should anticipate the chance of a small residual refractive error post-operatively. We also explain that there is an added charge for a secondary procedure to manage this residual refractive error.

To correct astigmatism or residual errors after cataract or refractive lens exchange patients, I rely on one of several procedures, depending on the case. Most receive wavefront-guided laser enhancement, but I also use conventional wavefront correction and enhancement and supplementary LRIs. LRIs are reserved for cases in which the spherical equivalent is close to zero. I use a wavefront-guided laser enhancement over a toric IOL to resolve astigmatism issues because the laser is more accurate.

In rare cases, I will choose piggybacking IOLs for large ammetropias or when corneal surgery is contraindicated.

My secondary procedure of choice is wavefront-guided laser enhancements whenever we obtain high-quality wavefront diagnostic testing results. We prefer not to induce new aberrations into the equation. Also, a high percentage of my patients are referrals who have had prior keratorefractive surgery, and I want to minimize post-operative aberrations in these cases especially.

Wavefront raises the chances of hitting our refractive target, which is especially critical in these cases because patients may not be willing to let you perform a third procedure on them. The Advanced CustomVue (Advanced Medical Optics, AMO, Santa Ana, Calif.) system has been able to image the majority of multifocal and crystalline pseudophakes for treatment. However, if the scans are poor, or other factors such as tissue conservation limit our ability to use wavefront treatment, we will use traditional laser vision correction.

This still works well because the refractive errors involved are typically small.

Steven J. Dell, M.D. is medical director, Dell Laser Consultants, Austin, Texas.
Custom Matching Multifocal IOLs

A refractive multifocal in the dominant eye and a diffractive multifocal in the fellow eye provides patients with the broadest range of vision

by H.L. “Rick” Milne, M.D.

ReZoom multifocal IOL, hoping to give patients better intermediate vision and maximizing the advantages of both lenses.

Diffractive and refractive IOLs have complementary strengths in different lighting conditions. The diffractive IOL performs better for near in bright light and the refractive IOL provides better near in dim light. For distance, the opposite is true. In addition, the refractive IOL provides the intermediate vision that patients were missing previously.

**Bilateral Versus Mix and Match**

I conducted a small study to compare the results of bilateral diffractive lenses with this custom mix-and-match approach. Based on the results, I no longer implant bilateral ReStor at all.

In this study, all 68 patients were followed for six months. All of them achieved near vision of at least J2 and distance acuity of 20/40 or better, so, objectively, all had good reason to be satisfied with the results of their multifocal IOL procedure.

Most importantly to me, the percentage of patients who reported being completely spectacle independent went from 65% in the bilateral group to 90% in the custom-match group. And of those wearing glasses, no one wore glasses for any type of task more than 50% of the time. Satisfaction and spectacle independence rates around 95% are what I want and expect to see with premium multifocal IOLs (Table 1).

I have found that the eyes in these custom-match cases summate beautifully, often giving the patients one or two lines better visual acuity improvement with both eyes than they are able to see with either eye individually.

**Customizing the IOL decision process**

When I talk to prospective IOL patients about their visual needs and expectations, the vast majority of them want to have it all: near, intermediate, and distance vision without glasses. For these patients, I test for eye dominance and implant the refractive ReZoom multifocal in the dominant eye.

I don’t plan for the second eye implant until I have evaluated the results of the first eye. On the follow-up visit at two to three weeks post-operative, I ask patients how they are functioning with the treated eye.

When patients are happy with their vision after the first surgery, I usually will implant the same refractive multifocal IOL in the second eye. But if they perceive any limitations in their near vision, I implant a diffractive multifocal—currently the ReStor IOL—in their second eye. To date, I have implanted about 400 refractive/diffractive combinations, without any explanations.

I truly enjoy being able to provide my cataract patients with good uncorrected vision that lets them reduce their dependence on glasses. Part of my job is to match patients with the best possible IOL for their visual needs. And in most cases, I believe it is the combination of one refractive and one diffractive IOL that provides the highest levels of satisfaction and spectacle independence.

H.L. “Rick” Milne M.D. is in private practice at the Eye Center in Columbia, S.C.

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**Table 1: Results of Custom-Match Approach Compared to Bilateral Diffractive IOLs at Six Months Postoperative**

<table>
<thead>
<tr>
<th></th>
<th>ReStor (n=23)</th>
<th>ReZoom - ReStor (n=45)</th>
</tr>
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<tbody>
<tr>
<td>Satisfied or very satisfied with distance vision</td>
<td>74%</td>
<td>98%</td>
</tr>
<tr>
<td>Satisfied or very satisfied with near vision</td>
<td>83%</td>
<td>98%</td>
</tr>
<tr>
<td>Completely spectacle independent</td>
<td>65%</td>
<td>90%</td>
</tr>
<tr>
<td>Halos during day</td>
<td>43%</td>
<td>18%</td>
</tr>
<tr>
<td>Halos at night</td>
<td>86%</td>
<td>73%</td>
</tr>
<tr>
<td>Would recommend the procedure to others</td>
<td>65%</td>
<td>98%</td>
</tr>
<tr>
<td>Would have the procedure again themselves</td>
<td>70%</td>
<td>98%</td>
</tr>
</tbody>
</table>

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**Maximizing Range of Vision for Cataract Patients Reading Acuity and Reading Speed With Diffractive Multifocal IOLs**

At the 2006 ESCRS meeting in London, Werner W. Hütz, M.D., (Bad Hersfeld Clinic, Germany) presented data from his study comparing the reading acuity and reading speed of cataract patients implanted bilaterally one of two MIOLs; the Tecnis ZM001 (n=20) and the AcrySof ReSTOR (n=20). At six weeks post-operative, reading acuity and reading speed were evaluated under bright (100 cd/m²) and dim light conditions (6 cd/m²) using the standardized Radner reading charts.

Dr. Hütz and colleagues found that under bright light conditions, uncorrected reading acuity of the patients with the Tecnis ZM001 lens was not significantly different from the AcrySof ReSTOR (P>0.2). However, under dim light conditions, the Tecnis ZM001 group achieved an uncorrected log-marin reading acuity of 0.275±0.106 compared to a poor score of 0.435±0.162 (P<0.001) for the AcrySof ReSTOR.

In terms of reading speed without correction, Dr. Hütz reported that under bright light conditions, the Tecnis ZM001 group achieved a reading speed of 174 ± 30 words/min compared to 138 ± 45 words/min for the AcrySof ReSTOR group. For dim light conditions, the Tecnis ZM001 achieved a reading speed of 142 ± 43 w/min, which still outperformed the bright light condition reading results for the AcrySof ReSTOR group.

Both of these MIOLs provide distinctly different reading capabilities, and Dr. Hütz concluded that the Tecnis ZM001 outperformed the AcrySof ReSTOR under all lighting conditions.
Evaluating the Next Generation of Custom-Match IOLs

Combining aspheric diffractive and refractive IOLs maximizes patients’ range of vision, improves satisfaction, and reduces night-vision complaints

by Angel López Castro, M.D.

New technology IOLs offer us a wonderful opportunity not only to implant these lenses in cataract or refractive lens exchange patients bilaterally but to combine the technologies, where appropriate, to maximize the patient’s range of vision.

There are many possible combinations, but the one that makes the most sense to me and to many others is combining refractive and diffractive multifocal IOLs. Most of my custom-match experience has been with Advanced Medical Optics’ (AMO, Santa Ana, Calif.) Tecnis multifocal and ReZoom IOLs. These two lenses complement each other well, so integrating their technological advantages and optical properties offers an ideal result for the patient.

The refractive ReZoom lens provides the intermediate vision that is missing in bilateral implantation of diffractive IOLs. In bright light, it provides superior distance visual acuity with no loss of light transmission, while the diffractive multifocal Tecnis provides excellent near with the high quality of vision we expect from the aspheric Tecnis platform.

In dim light, ReZoom provides reading capability in the middle range of the pupil. Meanwhile, the outer portion of the Tecnis multifocal lens becomes dominant, providing better distance vision and decreasing nighttime photic phenomena. Thus, the combination of both lenses provides a full range of vision under most lighting conditions.

In my experience, healthy eyes have no problem integrating the visual input from two different IOLs in their eyes. As with any multifocal lens, there is a process of neural adaptation that can take up to two or three months. During this period, contrast sensitivity and near vision continue to improve.


Study Results

We analyzed two groups of patients. Group 1 was comprised of 36 patients with bilateral diffractive multifocal IOLs with a one-year follow-up and laser vision correction touch-ups, as necessary. Group 2 was comprised of 31 patients with a ReZoom refractive multifocal in the dominant eye and a Tecnis diffractive multifocal in the other eye.

The comparison is a bit unfair to the mix-and-match group because I had only three months of follow-up with this group and none of them has yet had LASIK enhancements. Despite this, the results clearly favor the mix-and-match group.

For example, in mesopic conditions, 85% of mix-and-match patients achieved J3 or better reading vision versus 70% in the bilateral diffractive group. The average near acuity for the mix-and-match group is J2.4 compared to J4.1 for the bilateral group. The difference was statistically significant.

When it comes to intermediate vision, three times as many mix-and-match patients (60% versus 20%) can see J3 or better in bright light, and twice as many (60% versus 30%) can see at least J5 in dim light. Distance visual acuity was very good in both groups (Figure 1).

Quality of Vision and Enhancements

Because multifocal IOLs cannot correct astigmatism, we still will need to perform laser touch-ups, but the need for enhancement has been significantly reduced with a mix-and-match approach. Nearly half (46%) of the bilateral diffractive group needed a laser enhancement compared to only 33% of the mix-and-match patients.

Overall, the mixed IOL group members were more satisfied with their vision after surgery, with 88.5% saying they would choose these lenses again, compared to 82.5% of the bilateral diffractive group. In the mixed IOL group, about 85% said they never wear glasses.

When we asked about photic disturbances, 92% of mix-and-match patients said they experienced no glare or moderate glare versus 64% in the bilateral diffractive group. Halos were the most common complaint in both groups. However, none of the mix-and-match patients, versus 36% of the bilateral diffractive group, reported severe night-vision problems.

Patient Satisfaction

This study shows that patients gain near mesopic vision, distant photopic vision, and intermediate acuity at all light levels from a mix-and-match approach. Patients with a combination of refractive and diffractive IOLs report high visual quality, with most (85%) achieving total freedom from spectacles even before LASIK enhancement.

We observed significantly lower night-vision complaints in the mix-and-match patients, with fewer requests for LASIK enhancements. Patient satisfaction reports show that complementary IOLs offer these patients the opportunity to maximize their vision to meet all their lifestyle needs.

Angel López Castro, M.D. is in private practice in Madrid, Spain.

**SUMMARY**

<table>
<thead>
<tr>
<th></th>
<th>Bilateral MIOls</th>
<th>Tecnis/ReZoom</th>
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<tbody>
<tr>
<td>Near mesopic</td>
<td>J 4.1</td>
<td>J 2.4</td>
</tr>
<tr>
<td>Near photopic</td>
<td>J 2.2</td>
<td>J 2.1</td>
</tr>
<tr>
<td>Intermediate mesopic</td>
<td>J 5.3</td>
<td>J 4.2</td>
</tr>
<tr>
<td>Intermediate photopic</td>
<td>J 5.6</td>
<td>J 3.7</td>
</tr>
<tr>
<td>Distance mesopic</td>
<td>1.18</td>
<td>1.17</td>
</tr>
<tr>
<td>Distance photopic</td>
<td>1.12</td>
<td>1.20</td>
</tr>
</tbody>
</table>

Figure 1: Intermediate vision improvements were 60% with J3 or better in bright light for the mix-and-match patients versus 20% with the bilateral group, and 60% versus 30% with J5 in dim light, respectively.
Wavefront-Guided Treatments for Presbyopes: U.S. Clinical Trials Update

Whether you aim for omnifocal vision or monovision, early data show presbyopes benefit from wavefront-guided correction

by Colman R. Kraff, M.D.

Ninety-seven percent of subjects said they would elect to have Advanced CustomVue LASIK monovision again."

Colman R. Kraff, M.D.

I would like to report on the results of two studies that would expand our abilities to provide wavefront-guided treatments that allow presbyopic patients to increase their level of spectacle independence. We take different approaches, depending on whether the treatment is hyperopic or myopic.

Myopic presbyopes: Custom monovision
For the myopic presbyope who wants to be less dependent on glasses, monovision with Advanced CustomVue (Advanced Medical Optics, AMO, Santa Ana, Calif.) LASIK or PRK is the best option. However, at this point, physicians can only make a ±0.75-D adjustment to the WaveScan refraction, which doesn’t induce enough monovision to provide the near vision most of our patients are looking for. We end up treating the distance eye with a custom correction, but having to use a conventional treatment for the near eye.

I have been participating in a prospective multicenter food and Drug Administration (FDA) clinical trial to treat myopic patients with custom wavefront-guided treatments with a monovision target. In this study, the distant dominant eye was targeted for emmetropia and the near eye was under-corrected by up to -2.0D.

All study patients undergo a contact lens monovision trial if they haven’t previously worn lenses for monovision. This has been quite helpful in screening for monovision tolerance and in demonstrating to the patient what monovision is like.

In all, 296 eyes of 160 patients were treated. Patients range from 40 to 65 years old; the mean age is 50. Pre-operative MRSE in the dominant eyes, which were targeted for distance, was -3.82 D, while the non-dominant eyes were -4.15 D, on average.

The results have been excellent. At six months, 87% of patients achieved uncorrected binocular distance acuity of 20/20 or better and more than two-thirds were 20/16 or better (Figure 1). Nearly 90% had uncorrected binocular near acuity of 20/20 or better and close to half were 20/16 or better (Figure 2). The intermediate vision results were similarly good.

We don’t see the losses in quality of vision that patients typically experience with monovision. The percentage of people who said they never or rarely experience glare or halos around lights actually rose slightly after surgery. Only about 10% of patients experienced any decrease in contrast sensitivity under distance dim-lighting conditions.

There was no significant change in higher-order aberrations from pre- to post-operative.

Satisfaction was very high. Ninety-seven percent of subjects said they would elect to have Advanced CustomVue LASIK monovision again. The remaining 3% said they weren’t sure. And nearly all (95%) had a reduction in the need for spectacles six months after the procedure.

Hyperopic presbyopes: Custom aspheric ablation
Wavefront-guided multifocal or aspheric ablations for hyperopic presbyopes have been under inves-...
Hyperopic Presbyopic Experience in Canada

Latest data show that aberration profile changes are predictable and patients maintain normal contrast sensitivity following treatment

by W. Bruce Jackson, M.D.

In Canada, we've been treating hyperopic presbyopes with multifocal Advanced CustomVue (Advanced Medical Optics, AMO, Santa Ana, Calif.) ablations for several years now. We have treated 93 eyes of 56 patients at three centers, with 12-month follow-up now available on many of these eyes.

Hyperopic presbyopic ablations are unique. They differ from a standard hyperopic correction in that a subtle ablation shape change is made to the patient's wavefront map, using variable spot-scanning technology. This makes the cornea aspheric, with a near zone in the center that blends into distance vision in the periphery.

In addition to expanding the patient's range of vision with a curvature change, we also are addressing higher-order aberrations with a wavefront-guided ablation. The treatment is further customized to take the patient's pupil size into account. If the pupil is relatively large, for example, the surgeon can increase the central near zone. We have found that aiming to have the reading pupil fully within the central near treatment area is optimal.

The Results

The visual acuity results, which we have reported many times, are very good. Uncorrected distance vision corresponds to what one would expect from non-aspheric wavefront hyperopic treatments, even in bright light when the pupil contracts. At 12 months, 100% of subjects achieve uncorrected vision of both 20/25 or better for distance and J3 or better for near. Eighty-five percent are seeing at least 20/25 and J1 simultaneously, and satisfaction rates are high.

We recently began looking at what happens to higher-order aberrations and contrast sensitivity. We found that while contrast sensitivity (CS) does drop from pre-operative values, it improves steadily during the post-operative period. At 12 months, CS is still a little below pre-operative levels, but it is well within the normal values for a population of 50- to 75-year-olds (Figure 1).

This is reflected in the high rates of satisfaction with night vision. There was some concern early in the trial that night-driving vision might be adversely affected by the treatment. However, patient surveys have consistently indicated that patients are happier driving at night without their glasses after surgery than they were with their glasses pre-operatively.

We also compared pre- and post-operative wavefront data. Earlier iterations of presbyopic ablation, in which the treatment was purposely off-center, tended to induce a lot of coma and other higher-order aberrations. In our approach, however, coma increases only slightly following surgery and remains stable over time (Figure 2). As one would expect, the creation of an aspheric, more prolate cornea also shifts the spherical aberration (SA) from positive to negative. SA then remains stable over 12 months of follow-up.

For the young hyperopic presbyope with a healthy lens, an aspheric ablation is an excellent procedure for reducing spectacle independence without intraocular surgery.

W. Bruce Jackson, M.D. is professor of ophthalmology and director, University of Ottawa Eye Institute, Ontario, Canada.

Figure 1. Dim contrast at 12 mos, CS is well within population norms for the 50- to 75-year-olds.

Figure 2. Advancements in aspheric treatment design are resulting in a reduction in the amount of induced coma.
Understanding the Importance of Ablation Registration When Correcting Mixed Astigmatism

Advanced CustomVue with Iris Registration is critical for these challenging cases

by Mounir A. Khalifa, M.D.

Wavefront-guided LASIK with iris registration is the safest, most efficient, most predictable method for treating mixed astigmatism. At our practice, our clinical experience has shown that the accurate registration—either axial with the adjustment of the pupil centroid shift or torsional with the iris pattern torsional alignment—is the crucial factor in accurately treating mixed astigmatism with the customized bitoric ablation.

However, Iris Registration (IR) in a mixed astigmatism case can be a challenge. For axial registration, the larger the difference between scotopic pupils and photopic pupils, the greater the chance for pupil centroid shift. For torsional registration, the change from erect to supine position leads to excyclo-torsion 2.2 degrees or more (up to 10 to 15 degrees). However, studies in the literature have shown that in bitoric ablation, centration and torsional alignment are crucial.

Our Experience

In our study, we evaluated wavefront-guided ablation (customized bitoric) with or without iris registration in treating mixed astigmatism. The study included three groups. Group A was a retrospective study of 20 eyes of mixed astigmatism with conventional ablation (manual marking). This group included four males and six females with a mean age of 22.7 years. Mean pre-operative sphere was +1.67±1.32 D, and mean pre-operative cylinder was -2.79±2.24 D.

Group B was a retrospective study of 20 eyes of mixed astigmatism with wavefront-guided ablation without IR (manual marking). This group included three males and seven females with a mean age of 23.8 years. Mean pre-operative sphere was +1.27±0.6 D, and mean pre-operative cylinder was -3.35±1.48 D.

Group C was a prospective study of 20 eyes of mixed astigmatism with wavefront-guided ablation with IR. Four males and seven females with a mean age of 25.4 years were included in this group. Mean pre-operative sphere was +1.0±1.69 D, and mean pre-operative cylinder was -2.5±5.6 D.

A wavescan aberrometer with Fourier analysis was used to measure low-order and high-order aberrations pre- and post-operatively and to design the CustomVue (Advanced Medical Optics, AMO, Santa Ana, Calif.) wavefront-guided ablation for groups B and C. Manual marking was done at the slitlamp in groups A and B, and iris registration was used in group C.

Results

For uncorrected visual acuity at three months, 90% of the wavefront-guided plus IR patients were 20/20 or better, while 70% of the wavefront-guided only and 65% of the conventional laser vision correction (LVC) patients were 20/20 or better. One hundred percent of the wavefront-guided plus IR patients were 20/30 or better, while...
The Importance of Iris Registration in Presbyopia Correction

by W. Bruce Jackson, M.D.

Iris registration (IR) with Advanced CustomVue (Advanced Medical Optics, AMO, Santa Ana, Calif.) offers several advantages in treating hyperopic presbyopes with aspheric ablations. First, as with any other treatment, IR ensures that the wavefront pattern ablated at the time of surgery corresponds precisely to the pre-operative wavefront map. This is accomplished partly by compensating for any cyclotorsion that occurs between measurement and treatment.

However, it is the second component of IR—pupil centroid compensation—that is absolutely critical for aspheric ablations. To achieve optimal results, the change in curvature that provides the near vision enhancement must be delivered over the entrance pupil, corresponding exactly to the center of the wavefront map. The center of the pupil can shift considerably as the pupil changes size under different lighting conditions, but IR identifies and compensates for any such shift.

Our study of aspheric ablations actually provides a good model for examining the role of IR because this technology was introduced about halfway through enrollment. Of the 96 eyes treated, 50 had IR. The group with IR ended up a little closer to emmetropia than those without IR (Figure 1) and had slightly better near acuity (Figure 2).

We prefer to use IR on every CustomVue case. Our capture rates are now well above 95%. Thanks to software modifications, almost all eyes can be captured, although pale, featureless irides remain the most challenging. Surgeon and technician experience and technique play a role in ease of capture as well.

As aspheric ablations for hyperopic presbyopes become more widely available, proficiency with IR will be a critical factor in success with these treatments.

Figure 1: The 50 patients that had IR were closer to emmetropia compared to the eyes that were not treated with IR.

Figure 2: At three months post-operative, 80% of the patients treated with advanced CustomVue with IR were within 0.5D of intended correction versus 60% of the conventional and 65% CustomVue without IR cohorts.

80% of the wavefront only and 75% of the conventional LVC patients were 20/30 or better (Figure 1).

At three months post-operative, many cases gained one or more lines in their best-corrected visual acuity (BCVA) in the iris registration group. Predictability with the wavefront plus iris registration was excellent. For both sphere and cylinder, 100% of patients were less than ±1 D of intended correction (Figure 2).

Scotopic contrast sensitivity significantly improved in the iris registration group. This might be because we found that wavefront-guided ablation with iris registration precisely corrected the challenging refractive error without significant induction of high-order aberrations.

Coma, trefoil, and secondary astigmatism showed significant increase in the conventional and wavefront groups, while there was no significant change in the wavefront plus IR group.

Trefoil and secondary astigmatism showed the most significant improvement with IR indicating more accurate axis alignment of the bitoric customized ablation. When we imagine the nature of the bitoric ablation with myopic pattern in one axis and hyperopic pattern in the other, one can find the crucial importance of accurate alignment of the ablation pattern on the cornea either axially or radially. The effect of misalignment is augmented by the nature of the bitoric ablation. Therefore, we have found that precise registration is an integral factor in accurately treating the challenging cases of mixed astigmatism with the customized bitoric ablation.

Mounir A. Khalifa, M.D. is in practice at Horus Vision Correction Center, Alexandria, Egypt.
Wavefront-Guided Laser Vision Correction is the Answer for Basic and Complex Retreatments

A small series demonstrates the value of Advanced CustomVue corrections when patients are symptomatic after refractive surgery

by Baha Toygar, M.D.

With the Advanced CustomVue system, we have been able to correct any residual refractive error and also address the night-vision or quality-of-vision complaints in a single procedure.

"With the Advanced CustomVue system, we have been able to correct any residual refractive error and also address the night-vision or quality-of-vision complaints in a single procedure."

Baha Toygar, M.D.

We have treated thousands of patients with various laser systems. As with any laser system, when patients have some residual refractive error and are not satisfied with the correction, we have typically been able to turn them into satisfied patients with a simple enhancement.

There are some patients, however, who present more complex cases. They complain of symptoms such as ghosting, double vision, or night-vision problems, despite apparently good visual acuity. To be honest, my colleagues and I have sometimes written these patients off as having psychological problems because their subjective complaints didn't correlate with our objective testing.

The Advanced CustomVue (Advanced Medical Optics, AMO, Santa Ana, Calif.) system has completely changed my attitude toward these “troublesome” patients. In five cases over two months, we have performed custom re-treatments for patients I would otherwise have been extremely reluctant to re-treat—with superb results.

WaveScan imaging, first of all, provided diagnostic confirmation of a real problem. In every one of these five cases, the patients had unusually high higher-order aberrations (HOAs), particularly coma. Moreover, we were chastened to discover that the point-spread function (PSF) generated by the WaveScan looked, in each case, very distorted and often validated what the patient described seeing when looking at a point source of light.

Once we realized the patients weren't making up their complaints, it has been very reassuring (for both patient and surgeon) to be able to cut a PreVue lens to get a sense of whether second treatment will resolve the patients’ complaints. In a normal treatment, I never use a PreVue lens, but it can be very valuable in complex, post-surgical cases, especially when we are concerned about the liability involved in taking on a dissatisfied patient referred in from elsewhere.

With the Advanced CustomVue system, we have been able to correct the night-vision or quality-of-vision complaints in a single procedure. Thus far, we have not experienced any problems with wavefront capture or Iris Registration (IR) in post-surgical cases. In fact, I believe IR is an important factor in successfully performing these re-treatments.

Case example 1

A 30-year-old female was treated at our hospital. Her pre-operative refraction was +4.25 -0.50 x 125 OD and +4.75 OS. She had normal topography and was deemed a good candidate for hyperopic LASIK. Flap creation and a standard Wavelight Allegretto treatment in early 2005 were uneventful. Postoperative topographies were normal and the treatments appeared to be well centered.

However, the patient complained of double vision, halos and glare, and severe night-vision problems. At the nine-month post-operative visit, her best-corrected visual acuity (BCVA) was 20/25 in the right eye but only 20/50 in the left. The refraction was -0.75 - 1.50 x 165 OD and -0.75 D OS. My colleagues and I could not decide whether to attempt an enhancement.

When we got the CustomVue system and heard that patients like this had been successfully treated, we decided to give it a try. The WaveScan showed high coma and trefoil in both eyes and the PSFs looked exactly like what she had described seeing at night. We tested the attempted correction with PreVue lenses, and the patient liked the improvement, so we treated her with CustomVue in May 2006. Post-operatively, her complaints were resolved; she was seeing 20/28 uncorrected and was very happy.

Although we await longer-term follow-up data for this and our other four CustomVue re-treatment patients, we are quite confident that they remain satisfied because our phones are quiet. These patients had been calling almost daily, and now we have to call them to remind them to come in for the follow-up examination. Based on these preliminary outcomes and an equally positive experience treating normal vision eyes, we feel confident performing wavefront-guided laser vision correction on all patients that present for correction to our practice.

Baha Toygard, M.D. is in practice at the Duny Eye Hospital, Istanbul, Turkey.
Surface and Lamellar Wavefront-Driven Enhancements

Technology and technique advancements allow surgeons to confidently re-treat a wider array of enhancement patients than ever before

by Maj. Charles Reilly, M.D.

W wavefront-guided laser technology, with its accuracy and precision, is a crucial element when dealing with patients who require an enhancement after laser vision correction (LVC). Patients in need of an enhancement are a special subset of the LVC population. In order to optimize the chance for a successful enhancement, it is important to examine clinical factors that may have played a role in the refractive outcome before another laser procedure is performed.

Clinical factors such as treating any ocular surface disease or underlying systemic condition need to be addressed. In addition, the patient may be taking systemic medications that might have contributed to the unsatisfactory refractive outcome. During the physical examination, surgeons should carefully evaluate if the patient is developing a cataract or if there is some other reason the refractive shift might have occurred.

### WFG Enhancement

In our experience with the Air Force, patients usually only have a small amount of refractive error that needs to be addressed. However, with very low amounts of refractive error, the astigmatism portion often contributes to a great amount of the overall refractive error. Therefore, it becomes crucial to correct that astigmatic portion as precisely as possible. Ocular alignment is a key factor.

The best method to do this is with a wavefront-guided enhancement. The true value of a wavefront-guided enhancement, in addition to producing a more accurate picture of the entire optical system, is the ability to lay down that treatment and compensate for any cyclotorsion that is created when the patient transitions from an upright position to a supine position.

Our current enhancement rate is less than 1%, but because we are the referral center for the Air Force Refractive Surgery Program, we have had the opportunity to treat some complex cases. We have found excellent results with both lamellar and surface enhancements using wavefront-guided technology. As expected with all enhancements, the uncorrected visual acuities are markedly improved after enhancement; we averaged more than 2.5 lines of improvement in uncorrected visual acuity in the Early Treatment Diabetic Retinopathy Study (ETDRS) high contrast acuity.

We also follow low contrast visual acuity and are pleased to demonstrate good response to our enhancements with no statistically significant worsening of low contrast vision in our lamellar enhancements and an improvement in low contrast sensitivity in our surface enhancements. In addition, we are able to capture wavefront data in some of our enhancements, which demonstrates a decrease in HOA RMS at six months follow-up in our surface treatments with only a small statistically non-significant increase in HOA RMS in the lamellar re-treatments (Figures 1 and 2).

### Surface vs. Lamellar

There is controversy within the refractive surgery community regarding whether the creation and maintenance of a lamellar flap during wavefront-guided enhancements contribute to higher-order aberrations. It is worthwhile to consider performing a surface enhancement instead of a lamellar one. Specifically, with a surface enhancement, there is less concern regarding ectasia, epithelial ingrowth, and residual stromal bed issues.

Our experience has shown that with surface enhancement there is a superior result in overall quality of vision as well as not inducing additional higher-order aberrations. We have found that with surface enhancements it can take as long as six to nine months for final visual acuity to stabilize as opposed to a LASIK enhancement, in which patients usually stabilize by month three.

Despite the longer visual acuity stabilization time, wavefront-guided laser enhancement using a surface approach is a worthwhile consideration to maximize patients’ visual outcomes.

Understanding the Clinical Differences Between Aspheric IOLs

Tecnis aspheric offers best chance for improved contrast acuity for broadest range of patients

by Y. Ralph Chu, M.D.

“Overall, contrast sensitivity was slightly higher with the Tecnis lens compared to the other two IOLs, particularly at greater spatial frequencies.”

Y. Ralph Chu, M.D.

There are now three aspheric IOLs in the marketplace, each claiming to reduce or minimally induce spherical aberration (SA) inside the optical system of the eye. As we know, corneal spherical aberration increases with age, a problem typically compounded by the implantation of a standard IOL that also increases SA.

Aspheric lenses were designed to reduce this effect and thereby provide cataract patients with better night vision and contrast acuity. However, each of the three lenses has a slightly different theoretical goal.

The Tecnis Z-9000 (Advanced Medical Optics, AMO, Santa Ana, Calif.) lens was designed to fully compensate for the positive SA of the average cornea. In fact, the multicenter, prospective, randomized Food and Drug Administration (FDA) clinical trial for this lens demonstrated that total SA was reduced to nearly zero in a human study population.

The AcrySof SN60WF IQ was designed to partially compensate for the average cornea’s positive SA. I am not aware of any large prospective trial showing that it actually reduces SA to a given point in a patient population, but eye models predict the average eye still would have about 0.1 µm of SA.

The SofPort AO lens attempts to not induce any positive spherical aberration, or to be SA-neutral. Because this goal is intrinsic to the lens, it has no relationship to the average or actual SA in the eye and may be less dependent on perfect placement of the IOL.

Study Groups

We set out to see how all these claims pan out in a typical cataract patient population. In a multicenter study, we took all comers from the general population and randomized them to one of these three aspheric IOLs, without regard to pre-operative SA.

We intend to enroll about 90 patients (30 in each IOL group) and follow them for six months. Thus far, 22 patients have reached the three-month visit.

Pre-operative best-corrected visual acuity (BCVA) and corneal SA were similar across all three groups. Interestingly, each group’s average post-operative BCVA was better than 20/20, reinforcing our anecdotal clinical finding that patients with aspheric lenses do achieve slightly better acuity.

We measured SA pre-operatively (when possible) and post-operatively. The mean total SA increased in the SofPort AO eyes, decreased considerably (but not down to zero) in the AcrySof IQ eyes, and went down to zero in the Tecnis eyes (Figure 1).

Thus far, our study supports the expectation that the Tecnis lens will achieve zero SA (or very near zero) in the majority of eyes. Steven Schallhorn (M.D., director, refractive surgery, Naval Medical Center, San Diego) and others have shown that reducing higher-order aberrations, especially SA, to as close to zero as possible is important in achieving optimal visual outcomes.

All three of these lenses provide excellent Snellen acuity. However, we know that Snellen acuity doesn’t describe every aspect of a patient’s perceptive vision. With aspheric IOLs, we are hoping for subtle improvements in the quality of vision, especially in low-light, low-contrast situations.

To determine whether this was achieved, we measured contrast sensitivity, a sort of stress test for the eye. Overall, contrast sensitivity was slightly higher with the Tecnis lens compared to the other two IOLs, particularly at greater spatial frequencies (Figure 2).

The Future

Enrollment and follow-up are ongoing, and we hope to soon be able to report more on how these three aspheric lenses perform in a typical patient population.

Certainly, the drive toward improved functional vision or improved quality of vision in both cataract and refractive surgery will continue. Spherical aberration is only the first higher-order aberration to be addressed with wave-front-designed IOLs. As we learn more about how to measure aberrations and quantify their effect on a patient’s perception, I expect the trend toward improving quality of vision for cataract patients to accelerate and IOLs to become more customizable.

For now, aspheric IOLs are an important advance. Although our data are preliminary, they indicate that the Tecnis IOL is the most likely of the aspheric lenses to bring patients’ total spherical aberration back into balance at zero SA.

Y. Ralph Chu, M.D. is founder and medical director, Chu Vision Institute, Edina, Minn., and adjunct assistant professor of ophthalmology, University of Minnesota.

Figure 1: Mathematical models demonstrate that zero optical aberrations will yield the best retinal image.

Figure 2: Patients implanted with the aspheric Tecnis lens demonstrated slightly higher contrast sensitivity compared to the SofPort AO and AcrySof IQ patients.
Less Is More

Achieving the best visual system possible means striving for zero higher-order aberrations, including zero spherical aberration

by Capt. Steven C. Schallhorn, M.D.

As our abilities in corneal and lenticular refractive surgery advance, one of the issues we continue to wrestle with is identifying the optimal aberration profile. In other words, what goal should we strive for in order to optimize patients’ visual quality?

**An In-Depth Look**

Mathematical models demonstrate that zero optical aberrations (i.e., none) will yield the best retinal image. The ideal optical system also would have no lower- or higher-order aberration (HOAs).

Increasing aberrations lead to greater visual distortion (Figure 1).

It’s important to appreciate that there can be a coupling effect on vision between lower- and higher-order aberrations. I use this analogy: Lower-order aberrations are to higher-order aberrations as paper is to cylinder. A low myope may have better uncorrected vision if combined with plus cylinder, so a patient with a refraction of -1.00 +2.00 D (spherical equivalent (SE) of zero) likely will have better uncorrected vision than if his refraction was simply -1.00 D sphere, even though the cylinder adds aberrations.

In the same fashion, a patient with 1.00 D of myopia may have better vision if combined with a specific amount of spherical aberration (SA). The SA may cause other visual symptoms, but it can couple with the myopia to provide better high-contrast vision.

At the Naval Medical Center, San Diego, we’ve also studied laser refractive surgery outcomes extensively in an attempt to tease out the optimal aberration profile. In one study, we looked at 300 eyes of 150 consecutive subjects who underwent conventional LASIK. Pre-operatively, the average SE was -3.80 D.

We found correlations between higher-order aberrations and subjective and objective quality-of-vision measures while looking at the eyes with worse uncorrected visual acuity (n=150). For example, in a plot of halo complaints versus the amount of spherical aberration (all 6.0-mm pupil analysis), despite considerable scatter, there is a positive correlation (Figure 2).

More spherical aberration correlates to more symptoms. Subjects with more HOA also have worse best-corrected visual acuity (BCVA) and worse low-contrast acuity. In these refractive surgery patients, all our analyses point to the conclusion that lower levels of HOA are related to better quality of vision.

**Pilot Study**

We compared a large sample of 140 pilots to a typical refractive surgery clinic population of 300 patients with healthy eyes. Whether you look at high-contrast (photopic) visual acuity, 5% contrast (photopic) acuity, or 25% contrast (mesopic) acuity, the distribution is similar. Across the board, the pilots have better vision than the clinic patients. The real question is whether they have some particular aberration profile that we would want to duplicate using laser or lenticular surgery.

WaveScan imaging shows that the pilots’ eyes are not completely aberration free. We found no correlation between their higher-order aberrations and high-/contrast visual acuity (all with 6.0-mm pupil analysis). However, there is a positive correlation between their HOA and low-contrast acuity under photopic or mesopic conditions. Lower amounts of HOA are related to better quality of vision even in this group of pilots with super-normal vision.

On average, the pilots had 0.08 microns of SA. Is this the ideal SA? Should we target this amount? The answer is no. The reason: We also found a positive correlation between spherical aberration and mesopic contrast acuity. The correlation holds if we look at absolute SA, without letting the positive and negative SA cancel each other out.

In dim light, less spherical aberration is related to better contrast acuity in these pilots. Again, this tells me that the ideal SA, even in pilots with super-normal vision, is zero. In other words, zero spherical aberration should be our surgical target.

In conclusion, every analysis that we have done—refractive surgery patients, pilots with super-normal vision, and optical modeling—all point to the same conclusion: Less aberration is better.

Capt. Steven C. Schallhorn, M.D. is director of refractive surgery, Naval Medical Center, San Diego.

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**Figure 1:** Mathematical models demonstrate that zero optical aberrations will yield the best retinal image.

**Figure 2:** Despite considerable scatter, there is a positive correlation between halo complaint and spherical aberration—more spherical aberration correlates to more symptoms.
Blue Light’s Important Role in Good Health

Blue light is important for mesopic and scotopic vision and critical for entraining biological clocks to environmental day-night rhythms

by Martin A. Mainster, Ph.D., M.D., FRCOphth.

S cientists have speculated for decades that light exposure may play a role in age-related macular degeneration (AMD). This relationship is intriguing, but none of the 11 large epidemiological investigations that studied it found no correlation between AMD and environmental light exposure. Additionally, a growing body of scientific evidence now demonstrates that effective environmental blue-light exposure is vital for optimal systemic and mental health.

**AMD and retinal phototoxicity**

Recognition that early polymethylmethacrylate IOLs transmitted potentially harmful ultraviolet (UV) radiation to the retina[12] led to the inclusion of UV-blocking chromophores in most IOLs.[13] Subsequent suggestion that IOLs also block violet light[14] was followed by introduction of the first visible light-blocking IOLs in the early 1990s. Acute exposures to brilliant light sources cause photic retinopathy (retinal phototoxicity). Hazardousness of acute UV-blue retinal phototoxicity increases with decreasing wavelength. Thus, UV radiation (100-400 nm) is more hazardous than violet light (400-440 nm), which is more hazardous than blue light (440-500 nm). UV radiation is responsible for 67% of acute UV-blue phototoxicity, but violet light accounts for 18% and blue light for only 14% of potentially pseudophakic UV-blue phototoxicity.[13]

**Visual benefits of blue light**

Figure 1 shows that blue light is much more important for dim light (mesopic and scotopic) than bright light (photopic) vision. In fact, it provides 35% of scotopic and 7% of photopic aphanic sensitivity. In comparison, violet light, which is more hazardous, accounts for only 10% of scotopic and 1% of photopic sensitivity.[16] It’s obviously a better strategy to reduce radiation than blue light.

Rod photoreceptors provide dim light vision. Driving, mobility, and peripheral vision problems are all associated with rod-mediated, not cone-mediated, dark adaptation parameters. When you get up in the middle of night and lighting is too dim for you to see the color of objects, you are using rod-mediated vision.[14]

Unfortunately, older adults lose much of their dim light vision because of natural yellowing of their crystalline lens and age-related decreases in pupillary diameter and rod photoreceptor populations. Scotopic sensitivity decreases and dark adaptation slows with aging. Impaired dark adaptation increases the risk of falling in older adults. Falling increases the risk of debilitating injuries, costly long-term hospitalization, and even death.[17]

**Health benefits of blue light**

Age-related pupillary miosis and natural crystalline lens aging limit the blue light needed by retinal ganglion photoreceptors, contributing to circadian dysfuction and its many consequences. Circadian dysfuction is present in aging and disorders such as coronary artery disease, hypertension, diabetes, Alzheimer’s disease, asthma, and most forms of cancer. Health care risks are correlated with both the degree and duration of circadian disruption. Numerous clinical studies have shown the risks of disturbed circadian phototainment and the benefits of optimal rhythmicity.[18]

Blindness has widespread physiologic effects. Overall life expectancy is decreased. Even mild visual impairment doubles mortality risks. Cataract itself is associated with poorer survival. Fortunately, light therapy and cataract surgery can help. In particular, cataract surgery has been shown to decrease insomnia, sleepiness, and depression. Thus, improved blue-light-dependent retinal ganglion photoreception is an important consideration in cataract surgery, extending its benefts beyond better vision to improved systemic and mental health and increased longevity.

**Weighing the trade-offs**

Blue-blocking IOLs provide 20% less UV-blue phototoxicity protection than a 53-year-old crystalline lens. Most AMD occurs in phakic adults over 60 years of age, so 53-year-old crystalline lenses don’t prevent AMD. If light is a significant risk factor in AMD, then blue-blocking IOLs won’t prevent it.[4] Blue-blocking IOLs also provide 14% to 21% less scotopic sensitivity and 27% to 38% less melatonin suppression than conventional UV-blocking IOLs.[5]

Older patients want better nighttime vision, less insomnia, and better health. Cataract surgery is a once-in-a-lifetime chance for patients to overcome natural aging and achieve better circadian rhythmicity and vision in dim light. Ophthalmologists improve visual photoreception with cataract surgery. Improving blue light–dependent, non-visual retinal photoreception extends the benefits of cataract surgery far beyond mere conscious, image-based vision.

**References**

Creating the Optimal Surgical Environment for Success with Premium IOL Implantation

The right technology and surgical techniques will ensure your patients are seeing great on postop day one and referring their friends

Farrell "Toby" Tyson II, M.D., F.A.C.S.

When I converted to Healon5, I actually found that it made me a faster surgeon because every case is the same.

Farrell "Toby" Tyson, M.D., F.A.C.S.

My goal has always been to perform the best cataract surgery I possibly can. With multifocal IOL implantation, patient expectations are higher, and the surgeon's margin of error is lower. These lenses are less forgiving of small power miscalculations or even minor corneal edema or posterior capsular opacification. In short, premium IOLs demand high-precision surgery to give the patient the fastest recovery and the best possible chance of spectacle independence.

The right tools simplify cataract surgery

The most important factor in choosing both phaco technology and in refining one's phaco technique is to use as little phaco energy as possible. This reduces endothelial loss, improves corneal clarity, and speeds up postoperative visual recovery.

I use the Sovereign WhiteStar system (Advanced Medical Optics, AMO, Santa Ana, Calif.). Cold phaco with this system reduces phaco energy by about 60%. New ICE (Increased Control & Efficiency) technology further reduces ultrasound energy by using a brief "punch" in the first millisecond of the pulse to accelerate cavitation (Figure 1). For a fast surgeon, this may not make a huge difference, but it can really reduce effective phaco time (EPT) for someone who is in the eye longer.

WhiteStar has very good fluidics, so I don't get any chamber bouncing or "trampolining" of the back of the capsular bag when I am performing in-the-bag phacoemulsification. And, while all the newer phaco systems significantly reduce the chance of a corneal burn, WhiteStar almost eliminates the possibility.

Surgeons who are implanting multifocal IOLs should be performing small-incision surgery with clear corneal incisions. Clearly, we are moving toward even smaller wounds through bimanual microincision surgery. As IOL manufacturers catch up and start making lenses that can fit through smaller incisions, we'll see a rapid migration to bimanual surgery, but even now it is valuable for ease of placing the incision on the axis of astigmatism and again, reducing phaco energy.

In a study I recently conducted, 245 consecutive eyes were randomized to either bimanual WhiteStar phaco or standard coaxial WhiteStar phaco. All variable phaco settings were the same in both groups. With a 3+ nuclei, the reduction in EPT with bimanual surgery was 38.2%. With 2+ nuclei, there was a 51.5% reduction in EPT (Figure 2).

The choice of an ocular viscoelastic device (OVD), while often considered a minor detail, is actually a critical part of cataract surgery. I use Healon5, a high molecular weight, high-viscosity, viscoadaptive OVD, on almost all my cataract surgeries.

I think some have avoided Healon5 for fear that OVD removal will slow down their surgery day. My average procedure time is only about five minutes. When I converted to Healon5, I actually found that it made me a faster surgeon because every case is the same. The capsulorhexis, cataract removal and lens insertion are all smooth and predictable. This viscoelastic will hold a floppy iris in place or allow you to enlarge the iris without using retractors in a small pupil case. It doesn't ooze out of the eye; in fact, if I have a wound that is a little bit leaky, I will put a dab of Healon5 behind it to act as a spackle. I'm not stressed out or slowed down by mistakes or the need for additional instruments in tougher cases.

Adding up the advantages

I think the combination of WhiteStar cold phaco and Healon5 is healthier for the endothelium, which may result in more years of better vision. We can't predict that with certainty, but it makes sense to me that preserving endothelial cells may give patients better contrast sensitivity in the long term.

In the short term, the biggest difference of new technology cataract surgery has been noticeably clearer corneas on day one post-operative. I now expect all my cataract patients to be 20/30 or better the day after surgery unless there is some retinal or corneal disease. When your patients can see this well, they become your biggest fans and word-of-mouth referrals increase significantly.

Farrell "Toby" Tyson II, M.D. is in private practice in Cape Coral, Fla.
Please join us in Las Vegas for CME Symposia during the AAO Annual Meeting

Sunday, November 12, 2006
Wynn Las Vegas

The Next Generation of Wavefront-Guided Ablations
Supported by an unrestricted educational grant from Advanced Medical Optics – AMO

Registration: 6:00 – 6:30 AM
Program: 6:30 – 8:00 AM

Program Chair: Capt. Steven C. Schallhorn, MD
Faculty:
- Michael C. Knorz, MD
- Colman R. Kraff, MD
- Jeffery J. Machat, MD
- Edward E. Manche, MD
- Louis E. Probst, MD
- Major Charles Reilly, MD
- Kerry D. Solomon, MD
- Julian D. Stevens, FRCS
- John A. Vukich, MD

Preliminary Program:
- Redefining Custom Correction
- Wavefront-Guided Enhancements
- Techniques and Technologies for Laser Vision Correction of Presbyopia

Monday, November 13, 2006
The Venetian

Redefining Lenticular Refractive Outcomes: Pseudophakic Refractive Management, Lens Selection, and Patient Expectations
Supported by an unrestricted educational grant from Advanced Medical Optics – AMO

Registration: 7:00 – 7:30 AM
Program: 7:30 – 9:00 AM

Program Chair: Steven J. Dell, MD
Richard L. Lindstorm, MD
Faculty:
- Angel López Castro, MD
- Michael C. Knorz, MD
- Shareef Mahdavi, BA
- Martin A. Mainster, PhD, MD
- H.L. “Rick” Milne, MD
- Louis D. Nichamin, MD
- Terrence P. O’Brien, MD
- Capt. Steven C. Schallhorn, MD
- Farrell C. Tyson III, MD

Preliminary Program:
- Keys to Communicating With the Lenticular Refractive Patient
- Matching the Presbyopia Procedure With Patient Needs and Expectations
- Pursuing Refractive Success in the Pseudophakic Patient
- Keynote Lecture