

State of the Premium IOL Market in Europe

Surgeons share their current lens preferences, look ahead to promising new designs, and comment on the effects laser cataract surgery could have on this sector.

**BY JORGE L. ALIÓ, MD, PhD; GERD U. AUFFARTH, MD, PhD, FEBO;
ROBERTO BELLUCCI, MD; OLIVER KLAPROTH, DIPL-ING(FH);
THOMAS KOHNEN, MD, PhD, FEBO; PETER MOJZIS, MD, PhD, FEBO;
THOMAS F. NEUHANN, MD; TOBIAS H. NEUHANN, MD;
MILIND PANDE, MBBS, DO, FRCS, FRCOPHTH; DOMINIQUE PIETRINI, MD;
MAGDA RAU, MD; PAVEL STODULKA, MD, PhD;
MARIE-JOSÉ TASSIGNON, MD, PhD, FEBO; AND JÉRÔME C. VRYGHEM, MD**

This year's Annual IOL Issue focuses on premium IOLs. To accurately portray the landscape in Europe, the United States, and Asia, CRST Europe invited some of today's top cataract surgeons from these locations to participate in a virtual discussion on premium lens technologies. Answering questions about the dynamics of the premium IOL market and their specific experiences with multifocal, trifocal, accommodating, toric, and toric multifocal IOL designs, these panelists help to overview the status of premium IOLs across the globe. This first article concentrates on the state of the premium IOL market in Europe. Participants were asked to respond to five questions:

Question No. 1: What are your current preferences for premium IOLs? Describe your frequency of use, criteria for patient selection, and any advice you have for surgeons just beginning to use premium IOLs.

Question No. 2: The toric and multifocal toric IOL market in Europe has exploded recently. What toric IOL models do you use? Please share your pearls for success with these models, including toric IOL alignment strategies, and any advice you have for new users of toric IOLs. If your preference is for limbal relaxing incisions (LRIs), please describe why and for which patients you prefer LRIs over toric IOLs.

Question No. 3: Which new premium lens designs look promising for 2013?

Question No. 4: Several custom IOLs are available or under development, such as the Light Adjustable Lens (LAL; Calhoun Vision, Inc.), the FluidVision IOL (PowerVision), and the NuLens (NuLens, Ltd). In the future, will there be more indications for these custom IOLs? Where is the future of custom implants headed?

Question No. 5: How will laser cataract surgery affect IOL choices in 2013 and beyond? What special considerations must the surgeon think about when selecting an IOL to use in combination with laser cataract surgery?

JORGE L. ALIÓ, MD, PhD

Alicante, Spain

Response to Question No. 1: Currently, my favorite premium IOLs are the Lentis Mplus (Oculentis GmbH), the AcrySof IQ ReStor +3.0 (Alcon Laboratories, Inc.), and the AT LISA tri 839MP (Carl Zeiss Meditec), the first two of which are also available in toric models. All three of these lenses fit within my indications for refractive lens exchange and cataract surgery if visual potential is normal and the patient understands the advantages and tradeoffs of multifocality.

Among my favorite monofocal toric IOLs are those designed by Carl Zeiss Meditec, because they are available in unlimited cylindrical powers and implantable through a sub-2-mm incision, and the AcrySof IQ Toric IOL (Alcon Laboratories, Inc.). I am currently evaluating the latest AcrySof lens, the +2.5, in both toric and sphere-only models. So far, because of their high negative asphericity and the postoperative improvement in intermediate vision, both are attractive options.

Premium IOLs constitute approximately 40% of the lenses I implant. Contraindications for multifocal lenses include macular degeneration, glaucoma, and any potential problem that could affect contrast sensitivity. In all other cases, I explain to patients that my preference for them is multifocality. If more than 1.50 D of astigmatism is present on topography, I also suggest astigmatism correction. With a toric implant, the correction of astigmatism is straightforward and, when combined with the LenSx Laser System (Alcon Laboratories, Inc.), I have seen many advantages (see *Response to Question No. 5*). If the patient is interested in multifocality and he or she is a good candidate, which depends partly on lifestyle choices and hobbies, I proceed with implantation. Modern multifocal lenses require much less neural adaptation than previous-generation lenses, as halos and other phenomena occur much less frequently. Additionally, I have begun considering whether early macular changes are a true contraindication for multifocal IOLs. Because the optical and clinical profile of modern multifocal IOLs is different from older models, they have far fewer complications. Therefore, if proper patient selection is employed, multifocal IOLs may no longer be contraindicated in eyes with early macular changes. Long-term follow-up is needed to confirm this observation.

There are limitations to the use of multifocal lenses, however. Most reasons are budgetary, as in Spain patients pay for the entire procedure out of pocket if a premium lens is selected, and, unfortunately, the extra cost of the femtosecond laser and premium IOL may not be affordable. In some cases, patients base their decision for a premium IOL on whether their private medical insurance will cover the entire procedure or a portion of it. If these socioeconomic factors could be avoided, premium IOLs could represent 60% of my indications today.

Response to Question No. 2: I shared my preference for toric IOLs in Question No. 1. Regarding surgical pearls, I find it useful to mark the axis of alignment (0–180°) at the slit lamp—most of the time personally—and then implant the IOL in the appropriate meridian according to the intraoperative marks. I do not use an intraoperative optical device for centration, as not all are compatible with the microscopes that I use.

I do not perform LRIs but rather 2.75- or 3.2-mm opposite clear corneal incisions (CCIs), placed 1 mm inside the limbus if the astigmatism is between 1.00 and 1.50 D on corneal topography. I have found that opposite CCIs are more effective, less prone to regression, more controllable, and faster to

use. Because I perform sub-1-mm microincisional cataract surgery from the 12-o'clock position, I also use these CCIs to implant the IOL. If more than 1.50 D of astigmatism is present, I prefer to implant a toric IOL.

Response to Question No. 3: The AT LISA tri 839MP and the FineVision (PhysIOL) are the most promising IOLs for 2013, as they provide a better defocus curve profile, including intermediate and near vision, than other premium IOLs. The Lentis Mplus is also a fantastic lens, and the low near add model (1.50 D) might be a universal lens for any patient because of the improved intermediate vision and short neural adaptation process, which are clear advantages over monofocal lenses.

Response to Question No. 4: The NuLens and Akkolens (Akkolens International) are the two most promising lenses to restore accommodation. Artificial accommodation has failed in intracapsular IOL models, and it is not by chance that these two lenses are implanted in the sulcus. Ongoing studies, in which I am involved, look to confirm the effectiveness and application of these two lenses in clinical practice.

Custom IOLs are an excellent strategy to increase depth of focus, but the cost to customize the asphericity of each lens is extremely high. However, this is a component that I believe will be added to all the multifocal lenses listed above in the future.

Response to Question No. 5: Laser-assisted cataract surgery is a major step forward in clinical practice. Its main limitations are the extra cost and time in the operating room. We have estimated that the cost of the procedure is increased by €500 to €700, including the cost of the laser and the loan, the disposables, and the extra healing costs. Additionally, surgical time can increase by as much as 50%, making the practice much less efficient. These factors limit the use of the femtosecond laser to less than 20% of my cataract surgery cases. I would like to perform laser-assisted cataract surgery in every case, but the benefit of this technology is most notable when it is combined with multifocal IOL implantation.

Jorge L. Alió, MD, PhD, is a Professor and the Chairman of Ophthalmology at the Miguel Hernandez University, Alicante, Spain, and the Medical Director of Vissum Corp., Spain. Professor Alió states that he is a consultant to Bausch + Lomb and a clinical investigator for Alcon Laboratories, Inc., Oculentis, Carl Zeiss Meditec, and Hanita Lenses. He may be reached at tel: +34 96 515 00 25; e-mail: jlalio@vissum.com.



GERD U. AUFFARTH, MD, PhD, FEBO Heidelberg, Germany

Response to Question No. 1: We use toric, multifocal, multifocal toric, and add-on IOLs in our clinic. Specifically with multifocal IOLs, we have experienced a shift in use from

cataract toward refractive lens exchange patients, especially in those with presbyopia. We implant the AcrySof IQ ReStor or the Tecnis Multifocal (Abbott Medical Optics Inc.) as well as the Lentis Mplus and the FineVision trifocal IOL. In presbyopic lens exchange cases, we also use multifocal toric lenses including the M-flex T (Rayner Intraocular Lenses Ltd.), the Lentis Mplus toric, and the AcrySof IQ Toric. We use toric IOLs in cataract and refractive lens exchange patients with preexisting astigmatism, and add-on IOLs are used in rare cases to compensate for residual refractive errors. They are also frequently implanted in eyes with postkeratoplasty astigmatism, but in these cases we often have to order a customized IOL power.

Deciding which IOL to implant, especially which multifocal IOL, requires careful consideration of a patient's characteristics. Almost any multifocal lens can be used in hyperopic patients, as they are often extremely thankful for the gain of distance and near visual acuity. However, myopic patients are demanding in terms of near visual acuity and require more careful lens selection. Multifocal IOLs with a high near add (eg. 4.00 D), such as the Tecnis Multifocal, are recommended. If you want to make sure that a patient has a relatively low incidence of halos and glare, I prefer the Lentis Mplus. If the patient emphasizes an interest in very good intermediate vision, I prefer the FineVision because of its third focus.

For the surgeon beginning to implant multifocal IOLs, the best patient is hyperopic and hates to be dependent on glasses for near and distance vision. For toric IOL beginners, cataract patients are best, as they are usually more forgiving regarding IOL rotation. Clear lens extraction patients are pickier in the same situation.

Response to Question No. 2: We use toric lenses from Rayner Intraocular Lenses Ltd, HumanOptics/Dr. Schmidt, Oculentis, Abbott Medical Optics Inc, and Alcon Laboratories, Inc. Those with a fixed cylinder are usually used for standard patients who come in and leave the clinic on the same day. For special situations, we purchase customized toric IOLs. On that note, IOL power calculation is crucial and should take into account surgically induced astigmatism and incision location. We do not account for the astigmatic incision because we prefer toric IOLs in eyes with more than 1.25 D of cylinder. If patients are in a seated position and looking directly at a target when the eye is marked, postoperative IOL decentration is unlikely.

Response to Question No. 3: Promising IOL designs that are coming to market or are on the market include diffractive trifocal IOLs such as the FineVision lens. Other approaches such as so-called *extended depth of focus* (EDOF) lenses have the potential to become as popular as monofocal IOLs. We may also see more accommodating lens designs come to market because the restoration of accommodation is still a major goal of ophthalmic research worldwide. This technology aims to provide near, intermediate, and distance vision with little to no compromises compared with the

common photopic phenomena and reduced contrast sensitivity that occur after multifocal IOL implantation.

Response to Question No. 4: Customized IOLs will play an important role in the future to individualize treatments for different anatomic characteristics. Unfortunately, some current customized lens designs such as the FluidVision and NuLens need more clinical evaluation. I believe, however, that there will still be space for future designs and customized correction of wavefront errors to improve visual quality for patients.

Response to Question No. 5: Regardless of the IOL type, all lens implantation procedures benefit from laser cataract surgery because of the resulting standardized, accurate, round capsulotomy with perfect overlapping of the IOL. Because surgeons can place any IOL precisely in the capsular bag after laser capsulotomy, in the long run, accommodating IOL implantation and IOL power calculation may become more predictable. This would be beneficial for premium lens implantation and could also improve the function of the implanted IOL. As we do not know exactly where laser-assisted cataract surgery will head, I am hesitant to advocate a certain combination with a certain IOL right now. However, it might be possible that premium lenses can now be implanted in eyes with preexisting conditions that are today considered contraindications for such implants.

Gerd U. Auffarth, MD, PhD, FEBO, is the Chairman, Department of Ophthalmology, University of Heidelberg, Germany. Professor Auffarth states that he has no financial interest in the products or companies mentioned but has received research grants, lecture fees, and/or travel reimbursement from Alcon Laboratories, Inc, Abbott Medical Optics Inc, Bausch + Lomb, Carl Zeiss Meditec, Dr. Schmidt Intraocularlinsen, Eyesense, Oculentis, PowerVision, Rayner Intraocular Lenses Ltd, and Technolas Perfect Vision GmbH. He is a member of the CRST Europe Editorial Board and may be reached at e-mail: ga@uni-hd.de.



ROBERTO BELLUCCI, MD

Verona, Italy

Response to Question No. 1: I implant aspheric IOLs in every eye undergoing cataract surgery, and therefore my definition of premium IOLs includes multifocal, toric monofocal, and toric multifocal IOLs only. With regard to multifocals, I prefer lenses with a diffractive design. In Italy, we have access to diffractive hydrophobic acrylic lenses such as the Tecnis Multifocal and the AcrySof IQ ReStor and to diffractive hydrophilic acrylic lenses such as the SeeLens (Hanita; Figure 1) and AT LISA.

When I approach patients, I ask them the three questions I learned years ago from Mark Packer, MD, FACS, CPI: (1) Is it important for you to eliminate reading glasses? (2) If so, would

you accept a slight decrease in distance vision quality? (3) And if so, would you accept the extra cost involved in the procedure?

With three yeses, I suggest a multifocal IOL; however, because in Italy patients must pay for the entire procedure and not just for the lens, the implantation rate is lower than 10% in my practice. Additionally, I always inform patients that a possible imprecise refractive outcome could require LASIK enhancement. The best way I have found to explain this to patients is: "Spectacle removal is the result of a surgical path, not just of a single surgical procedure."

I currently prefer IOLs with a low near add because more patients use a computer or tablet device for writing and reading rather than paper.

Response to Question No. 2: I do not use LRIs, as the ability to control astigmatism with this specific incisional technique is poor in my hands. Rather, I prefer to enlarge the incision made on the steepest axis up to 3.5 mm when the corneal astigmatism is lower than 1.50 D and to prepare the patient for toric IOL implantation when astigmatism is higher. I use the enVista Toric (Bausch + Lomb), which has recently become available.

Online toric calculators are easy to use and provide accurate power calculations, and the printouts can be used to order IOLs. As this service is limited to higher levels of astigmatism—due to the cost of the lenses—and represents about 5% of implanted lenses at our practice, we purchase toric monofocal lenses one at a time.

I have had limited but satisfying experience with toric multifocal IOLs. Patients are delighted with the vision they achieve with toric multifocal IOLs and are among the most satisfied patients I have ever managed.

Response to Question No. 3: Of the available premium lenses, I believe the apodized diffractive hydrophilic acrylic SeeLens will gain the widest acceptance in 2013. It can be implanted through a 1.8-mm incision, and it has a sharp, square edge to limit posterior capsular opacification and a high Abbe number for color rendering. Of other new lenses, trifocal designs such as the AT LISA and the FineVision are worthy of closest attention. By alternating diffractive rings of different characters, these IOLs can provide trifocality without increasing image confusion or compromising contrast sensitivity. I have had no experience yet with these lenses, but I look forward to gaining some.

Response to Question No. 4: I have had limited but positive experience with the LAL. The drawback to this technology is the lengthy IOL power lock-in process, which can cause patient discomfort. In my opinion, this and other custom lenses are particularly useful after corneal refractive surgery because they can provide previously unavailable refractive precision. New developments with quicker adaptation processes, perhaps some of which will rely on the femtosecond laser to change the IOL, will be required for the adjustment process to gain popularity. The quest for the perfect IOL is ongoing, and it will be



(Courtesy of Roberto Bellucci, MD)

Figure 1. The SeeLens multifocal hydrophilic acrylic apodized IOL.

pushed forward by the recent advent of the femtosecond laser.

Response to Question No. 5: Cataract surgery is changing rapidly. I have found it easy to propose laser-assisted cataract surgery to my patients, who are delighted to be offered such an advanced procedure. In my opinion, the number of installed lasers for this purpose will continue to grow, prices will decrease, and, in 5 years, approximately 30% of cataract surgeries will be done with a femtosecond laser. I see no special issue in lens selection, because outcomes with any lens will benefit from a better surgical technique. Additionally, the round, centered femtosecond capsulotomy should increase the efficacy of evaluating new implants because it eliminates variability in capsulorhexis diameter, centration, and shape.

At the moment, however, the femtosecond laser is used only to mimic and improve the maneuvers already implemented for phacoemulsification. The incisions are the same, capsulotomy is the same, and lens fragmentation is the same. Improvements to our results in terms of postoperative lens centration, refraction, and optical quality are notable, but new ways to perform lens surgery are still to be discovered. Will the incision shape change? Will toric IOLs be implanted with reference to certain capsular marks made by the femtosecond laser? Will a completely different procedure for dismantling the lens be implemented? These are new areas to be explored and further developments we can only imagine.

Roberto Bellucci, MD, is Chief of the Ophthalmic Unit, Hospital and University of Verona, Italy. Dr. Bellucci states that he is a consultant to Bausch + Lomb. He may be reached at e-mail: robbell@tin.it.

**THOMAS KOHNEN, MD, PhD, FEBO;
AND OLIVER KLAPROTH, DIPL-Ing(FH)**
Frankfurt, Germany

Response to Question No. 1: The premium lenses we implant include aspheric, toric, and diffractive bifocal and trifocal lenses in various combinations for both cataract and refractive

Lasers, Cataract Surgery, and Toric IOLs

For this surgeon, toric lens implantation in conjunction with two complementary laser systems is a winning combination.

BY A. JOHN KANELLOPOULOS, MD

I have embraced the concept of toric IOL implantation since these lenses became available in Europe in 2006. Today, more than 50% of the IOLs I implant in Greece are aspheric torics (AcrySof IQ Toric; Alcon Laboratories, Inc.). Results have been extremely rewarding, even in the presence of 1.00 D of astigmatism; however, there is still potential for a clear corneal incision to induce astigmatic changes that can affect the quality of vision after cataract surgery. One way to minimize these topographic changes is to introduce laser-assisted cataract surgery in conjunction with toric IOL implantation.

CONSISTENT INCISIONS

One advantage of using a femtosecond laser for cataract surgery is that corneal incisions and capsulotomies are always of consistent size and shape. In my practice, the LenSx Laser System (Alcon Laboratories, Inc.) is used to create a 2.8-mm incision, a 5.0-mm capsulorrhexis, and a lens fragmentation circle 4.8 mm in diameter. In the technique we have developed, the anterior capsule is removed after capsulorrhexis, and then an ophthalmic viscosurgical device (OVD) is used to open the four-meridian nuclear dissection created by the LenSx laser. After the four nuclear pieces are separated, some OVD is burped out of the eye, and hydrodissection is performed. In many cases, one quadrant pops into the anterior chamber during the hydrodissection, increasing the efficacy and safety of lens evacuation.

At the conclusion of surgery, a toric IOL is implanted on the chosen axis, aligned to marks that were previously placed, guided by one mark placed at the 6-o'clock position at the slit lamp. If astigmatic keratometry is to be performed, this mark can also be used as a reference when placing the patient interface of the LenSx laser, as well as to place the two access markers for the toric lens.

surgery. We also implant aspheric and toric pseudophakic, intrastromal, and phakic (angle-supported, iris-fixated, and sulcus-supported) lenses in clinical practice and research projects.

We consider our premium IOL patients to be refractive surgery patients, and choosing an IOL in these cases is an individualized task that depends on the patient's anatomy, expectations, and visual requirements. Luckily, we have a variety of optical principles to choose from, with a wide

PHACO ENERGY NO LONGER REQUIRED

The latest enhancement to my procedure is the Cetus Nd:YAG laser (A.R.C. Laser), which creates a plasma resulting in a shockwave that emulsifies the lens. This addition has allowed me to complete several cases with no phaco energy. A video demonstration of emulsification with the laser can be viewed at eyetube.net/?v=dodiq. The probe does not need to be cooled, and there is adequate direct suction at the tip opening. Additionally, the 0.9-mm stylus of the probe provides tremendous grasp and followability of the nuclear pieces.

A contralateral eye study is being conducted to compare surgical results using the LenSx Laser System and the Inifiniti Vision System (Alcon Laboratories, Inc.) in one eye with the LenSx Laser System and the Cetus laser in the other. Thus far, with the latter combination, the average ultrasound energy is 6 J with the laser-phaco combination and fewer than 3 J with the laser-laser combination. This could potentially reduce endothelial cell loss and corneal wound damage associated with ultrasound energy.

CONCLUSION

In one line, the take-home message is that the best way to address astigmatism is with all-laser, bladeless cataract surgery and implantation of a toric aspheric IOL.

A. John Kanellopoulos, MD, is the Director of the LaserVision.gr Eye Institute in Athens, Greece, and is a Clinical Professor of Ophthalmology at New York University School of Medicine. He is an Associate Chief Medical Editor of CRST Europe and states that he has no financial interest in the products or companies mentioned. He may be reached at tel: +30 21 07 47 27 77; e-mail: ajkmd@mac.com.



eyetube.net/?v=dodiq

range of add powers including 4.00, 3.00, 2.50, and 1.50 D.

We use aspheric lenses for patients with low astigmatism if the following two requirements are met: (1) If the pupil diameter is in excess of 4.0 mm for at least mesopic conditions, and (2) if the incision size will be less than 2.5 mm to avoid inducing significant changes to corneal aberrations. It is then the surgeon's decision whether to customize the aspheric IOL according to the patient's preoperative corneal asphericity.

We always choose an aspheric IOL with negative spherical aberration, as a lens with zero spherical aberration does not compensate for corneal spherical aberration.

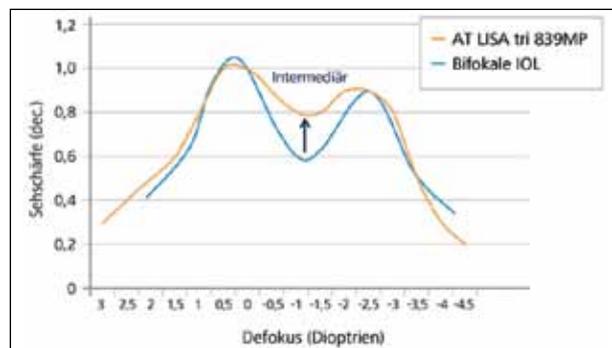
Bifocal IOLs are our standard multifocal solution at the moment. We have used the AcrySof IQ ReStor lenses for about 12 years now. This platform is available with a blue-light filter as well as in aspheric, toric, and multifocal models and in addition powers of 4.00, 3.00, and 2.50 D. Some patients experience glare or halos; however, proper patient selection and education minimize these problems. We also use the AT LISA tri 839MP IOL. Despite previous worries about severe optical phenomena and loss of contrast sensitivity, our early cataract and refractive lens exchange patients are extremely happy with this IOL.

Response to Question No. 2: The patient population suitable for toric IOL implantation is relatively easy to identify. We implant these lenses in patients with significant corneal astigmatism, which for our practice means those with at least 0.75 D of cylinder. However, we also use LRIs as a less costly alternative in eyes with corneal astigmatism up to 2.00 D. In eyes with extremely high astigmatism (eg postkeratoplasty), we choose a custom toric lens such as the T-flex (Rayner Intraocular Lenses Ltd.), which can correct up to 30.00 D of cylinder.

Any time a toric lens is implanted, it is important to leave as little manifest astigmatism and cause as little surgical stress to the patient as possible. Because toric multifocal IOLs work best to attain this goal, they are our lenses of choice. When implanting a toric IOL, we follow three guidelines. (1) We mark the IOL axis with the patient in a seated position. (2) Because manual markers produce large marks that can fade with longer surgery time, we prefer computer alignment software that tracks the iris and limbus structures intraoperatively and displays the exact axis position during surgery. (3) Proper removal of the ophthalmic viscosurgical device (OVD) and postoperative control of IOL alignment are key factors for successful implantation.

We recommend rerotating a misaligned toric IOL 3 to 4 weeks postimplantation because the capsular bag is then slightly opacified and sticky, which keeps the IOL in the desired position.

Response to Question No. 3: This year, we are most enthusiastic about trifocal principles. We started implanting the AcrySof ReStor +2.5 D multifocal IOL last year, and our early patients showed promising results in terms of visual acuity and optical quality and a low rate of visual disturbances. Nevertheless, this lens will work only for patients who are willing to sacrifice near visual acuity for excellent distance and intermediate vision. Implanting this lens in combination with an AcrySof IQ ReStor +3.0 D in the nondominant eye, however, results in binocular trifocality. We also started implanting the AT LISA trifocal lens last year, and our first defocus curves (Figure 2) with this lens looked almost flat—from -3.00 to 0.00 D of defocus—resulting in extremely happy patients. Patients still experience some glare and halos; however, the same is



(Courtesy of Carl Zeiss Meditec)

Figure 2. Potential defocus curves of a trifocal (orange) versus a bifocal IOL (blue).



(Courtesy of Calhoun Vision)

Figure 3. Schematic representation of the LAL's mode of action.

true for any multifocal IOL. We hope to be able to implant a toric model of the AT LISA tri this year.

Response to Question No. 4: We do not anticipate that the strategy of translating ciliary muscle contraction to accommodation under physiological stimulation will work in the near future. Attempts to create an accommodating lens have failed thus far, and no clinical trials have proved the principle to date. In our opinion, the multifocal lenses mentioned above will continue to be the best options, at least in the near future. We have implanted the LAL for the past year with great success. By changing the refractive power after lens implantation, we can personalize the optical functionality, resulting in residual myopia for improved near vision, perfect astigmatism correction not influenced by cyclotorsion, monovision or multifocality, and increased depth of focus (Figure 3). Another nice feature is that these optical changes can be reversed to a certain degree. The LAL is implanted using any formula suitable for postrefractive surgery cataract patients, and residual refractive error is corrected by changing the refractive power of the IOL. The only major disadvantage is one of inconvenience, as after implantation patients must wear ultraviolet-blocking glasses during the refractive power adjustment period.

Response to Question No. 5: The femtosecond laser is changing the way we think about cataract surgery and refractive lens exchange. In addition to predictable capsulorhexes and better visual results, laser procedures lower complication rates, even at this early stage of development and with the associated learning curve. Using this method, we can standardize nuclear fragmentation, capsulorhexis

creation, and corneal incisions to a degree that was inconceivable with a conventional surgical technique. We have used the LenSx femtosecond laser in our premium cataract and refractive lens exchange patients since 2012 and have updated our A-constants accordingly.

Oliver K. Klapproth, Dipl-Ing (FH), is the Trial Center Manager in the Department of Ophthalmology, Goethe-University, Frankfurt, Germany. Mr. Klapproth states that he has received travel reimbursement and/or lecture honoraria from Alcon Laboratories, Inc., Bausch + Lomb, Neoptics, Rayner Intraocular Lenses Ltd., and Schwind eye-tech-solutions. He may be reached at e-mail: o.klapproth@med.uni-frankfurt.de.

Thomas Kohnen, MD, PhD, FEBO, is Professor and Chairman of the Department of Ophthalmology at Goethe-University, Frankfurt, Germany and is a member of the CRST Europe Editorial Board. He states that he is a consultant to Alcon Laboratories, Inc., Rayner Intraocular Lenses Ltd., and Schwind eye-tech solutions and has received research grants, lecture honoraria, and travel reimbursement from Alcon Laboratories, Inc., Abbott Medical Optics Inc., Bausch + Lomb, Neoptics, Rayner Intraocular Lenses Ltd., Schwind eye-tech-solutions, and Carl Zeiss Meditec. He may be reached at tel: +49 69 6301 3945; e-mail: kohnen@em.uni-frankfurt.de.



PETER MOJZIS, MD, PhD, FEBO

Havlickuv Brod, Czech Republic

Response to Question No. 1: In the past few years, implanting multifocal and multifocal toric IOLs has become a popular method to restore vision after cataract surgery and an option to correct presbyopia. Although multifocal IOLs provide excellent distance and near vision, intermediate vision results may not be as impressive. But several new IOLs restore intermediate vision without compromising near and far vision, including the FineVision and the AT LISA tri.^{1,2}

I implant premium lenses in approximately 10% of my patients, and I prefer using this technology in presbyopic patients or in patients with cataracts with up to a small degree of astigmatism, acceptable angle kappa, and excellent potential for neural adaptation.

The first premium lens I implanted was the AcrySof IQ ReStor, followed by the Lentis Mplus; however, now my preference is for diffractive-refractive multifocal lenses and more specifically a trifocal lens such as the AT LISA tri. Combined with this lens' intermediate addition of 1.66 D and near addition of 3.33 D, the fact that it is pupil independent enables excellent visual performance in all light conditions. Additionally, its preloaded, single-use injector improves my control of

postoperative surgically induced astigmatism and corneal aberrations.

Response to Question No.2: In my hands, preoperative corneal astigmatism greater than 1.25 D is an indication for a toric or multifocal toric IOL. Because multifocal lenses are sensitive to residual astigmatism leading to patient dissatisfaction, however, I only recommend a multifocal toric if the indications for a multifocal lens are fulfilled. I prefer the stability of four-haptic multifocal toric lenses with the option to implant through a small incision, and therefore the ideal lens for my patients is the AT LISA toric. Preoperative lens calculation is performed using an online calculator.

Some have questioned the stability of plate-haptic IOLs; however, we have observed excellent rotational stability of the AT LISA toric during a 12-month follow-up study.³ Both axes were almost perpendicular, the mean absolute angle was 87.16°, and the mean misalignment was 5.98°. In the case of any corneal pathologic findings such as keratoconus (Figures 4 through 6) or penetrating keratoplasty or in eyes with myopic retinopathy, a bitoric model such as the AT TORBI may be useful.

For toric IOL implantation, I prefer to make reference points at the 3- and 9-o'clock positions to avoid cyclotorsion errors. Then I mark the cylinder axis using a Mendez ring. Accurate axis alignment can be facilitated with various devices; I prefer the Callisto Z Align (Carl Zeiss Meditec).

On the first postoperative day, I measure the IOL axis in retroillumination using the Toric Summary Program (OPD Scan III; Nidek). In one step, the steepest and flattest meridians and the precise location of marks on the IOL surface are measured. I then use a reticle to identify the differences between the marks on the IOL surface and the steepest corneal meridian. The outputs are archived in the OPD database and can be compared in any long-term follow-up.

My pearls for successful toric IOL management include performing accurate biometry and IOL power calculations; preoperative corneal topography; and precise optical coherence tomography (OCT), axis marking, and IOL alignment. To achieve exact keratometric data, the patient should stop wearing contact lenses at least 2 weeks before measurements. I usually check the IOL position on the first postoperative day using objective measurements. In the past, I preferred the OPD internal map, but currently I prefer the Toric Summary Program of the OPD Scan III.

One main challenge for new users is achieving proper power calculation for a toric IOL. My advice is to summarize all the measurements you have and send them to the IOL manufacturer to suggest spherical and cylindrical powers. Furthermore, use of monofocal toric lenses in patients with mild cataract is advisable. The limiting factor for using LRIs is lack of predictability, and I use them only for patients with less than 1.25 D of corneal astigmatism or in patients not willing to pay extra money for a toric lens.

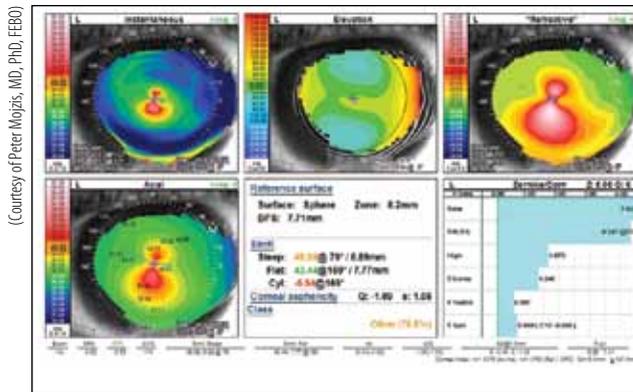


Figure 4. Preoperative corneal summary in a keratoconus patient.

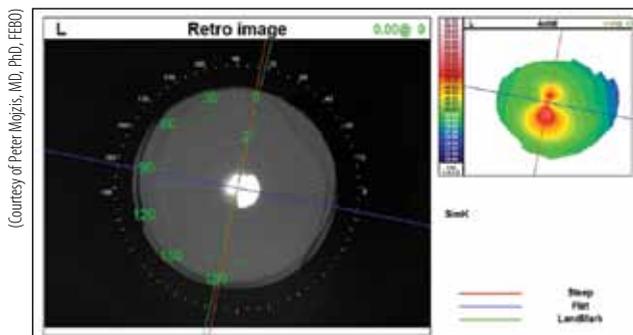


Figure 5. Six months after AT TORBI lens implantation, there was only a 2° axis misalignment.

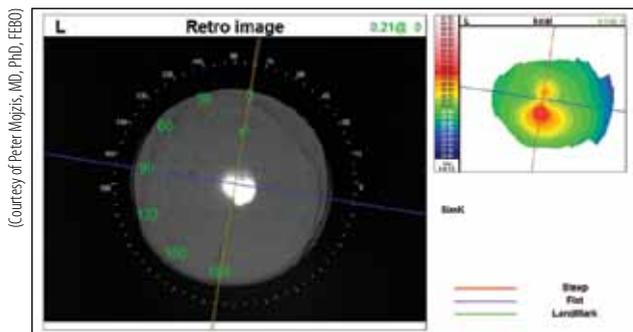


Figure 6. The same patient 12 months after surgery.

Response to Question No. 3: Because residual cylindrical refractive error and poor intermediate vision can negatively affect patient satisfaction after multifocal lens implantation, I am keen on implanting a lens that can not only restore the full range of vision but also correct corneal astigmatism.

Response to Question No. 4: Current accommodating IOLs such as the Crystalens (Bausch +Lomb), Tetraflex (LensteC Inc.), and Synchrony (Abbott Medical Optics Inc.) work by moving the IOL optic forward using the contraction of the ciliary muscle and the increase of vitreous pressure. Another approach is to change the lens shape. The LAL, for example, consists of photosensitive silicone materials that change under application of UV light to influence the

refractive power of the IOL. Other approaches include the FluidVision lens, which changes its shape by moving fluid from the periphery through a central actuator to the anterior surface, and the NuLens, in which flexible material is pressed between two rigid plates and bulges through an aperture in the anterior plate. Clinical experiments with these technologies are promising, but I am not sure about their use in clinical practice just yet.

Response to Question No. 5: The femtosecond laser enables creation of a perfect capsulorrhexis, perfect IOL centration, nuclear fragmentation with reduced phaco power, and protection of the corneal endothelium. It can also be used to perform LRIs. I believe that this sophisticated technology will be in demand, especially for patients who select a premium lens. The main limitations of broader application include the extra charge for each procedure, inability to use the technology in hard nuclei, the possibility of subluxated or luxated cataracts, and limitations of use in uncooperative patients or those with corneal pathologies.

Peter Mojzis, MD, PhD, FEBO, is a Medical Director at Premium Clinic Teplice and Head of the Eye Department, Havlickuv Brod, Czech Republic. Dr. Mojzis states that he is a speaker and paid consultant to Carl Zeiss Meditec. He may be reached at e-mail: mojzispeter@hotmail.com.



1. Alió JL. Early experience with FineVision IOL. Supplement to *Cataract and Refractive Surgery Today Europe*. November/December 2012.
2. Mojzis P, Plaza AB, Ziak P, et al. Clinical results after implantation of the first premium preloaded trifocal lens. Paper presented at: the XXX Congress of the ESCRS; September 8–12, 2012; Milan, Italy.
3. Mojzis P, Pinerio D, Cvrteckova V, et al. Analysis of internal astigmatism and high order aberrations in eyes implanted with a new diffractive multifocal toric intraocular lens. *Graefes Arch Clin Exp Ophthalmol*. In press.

THOMAS F. NEUHANN, MD

Munich, Germany

Response to Question No. 1: I dislike the expression *premium IOL*; it is meaningless marketing baloney. I also avoid using the term *multifocal IOL*, as it is a misnomer. It pretends—and, if we are honest, is meant to pretend—that the lens is comparable with multifocal spectacle correction. Therefore, I prefer to speak about IOLs with special properties or benefits.

In the bifocal/trifocal IOL category, my increasing preference is for trifocal IOLs such as the FineVision. These lenses provide good near addition that corresponds with approximately 2.75 D at the spectacle plane, and they also close the intermediate vision gap. From explicitly questioning my patients, I have also gathered that trifocal IOLs do not exhibit any disadvantages over bifocal IOLs. It is difficult to judge whether glare and halos occur less with trifocal than with bifocal IOLs, as is sometimes claimed, because direct comparison by the same observer is not possible; they do, however, certainly not appear to be worse.

For patients interested in achieving as good UCVA as pos-

sible, we favor toric IOLs for astigmatic correction. No incision will, by principle, be as exact as a lens correction. Our preferred posterior limbal incision with a square profile induces less than 0.25 D of cylinder during cataract surgery, as we have evaluated in a topography-controlled internal series (personal data). In eyes with no more than 1.00 D of cylinder, we use a slightly more corneal and less square incision, created in the steep meridian, which will induce no more than 0.50 D of cylinder.

Several years ago, we stopped implanting IOLs with spherical optical surfaces. When patients desire optimal image quality, we measure the corneal wavefront with the Pentacam (Oculus Optikgeräte GmbH) and choose an IOL with an asphericity that will match that of the cornea as closely as available choices allow. The Zernike Z40 term is the best approximation of spherical aberration. If patients do not need this extra differentiation, we routinely implant aspheric IOLs that do not induce spherical aberration. My patients—and therefore I—prefer optimal image quality and the resulting contrast sensitivity to an increased depth of focus, which comes with a higher amount of spherical aberration and lost contrast sensitivity and deteriorated mesopic and scotopic vision. However, if depth of focus is required, a bifocal or trifocal lens is the more efficient choice, at the inherent cost of lower contrast sensitivity.

Response to Question No. 2: Toric IOLs are mainly chosen on the basis of their asphericity. In Europe, we have the considerable advantage of a few models with custom cylindrical powers that can be manufactured for the correction of high astigmatism, which is particularly useful after keratoplasty procedures or in eyes with pellucid marginal degeneration.

We currently align toric IOLs using the conventional method of marking the horizontal meridian of the cornea preoperatively and aligning the lens intraoperatively with ring markers. However, we have plans to change to an optically controlled system in the near future. We always explicitly inform our patients before surgery that positional corrections may be necessary, because we are dealing with a biological and not a technical system. For astigmatic eyes, toric bifocal or trifocal lenses are, in my view, preferable over postoperative laser correction.

Response to Question No. 3: No response.

Response to Question No. 4: The IOLs mentioned in this question may be fascinating concepts, but they are not yet premium IOLs ready for implantation in a patient population that, by definition, has high expectations regarding outcomes (not least provoked by use of the term *premium*, as noted above).

Response to Question No. 5: I have active plans to explore the expenditure-to-benefit ratio of laser cataract surgery in the near future.

Thomas F. Neuhann, MD, practices at MVZ Prof. Neuhann in Munich, Germany. Professor Neuhann states

that he has no financial interest in the products or companies mentioned. He may be reached at tel: +49 89 159 4040; fax: +49 89 159 40555; e-mail: prof@neuhann.de.

TOBIAS H. NEUHANN, MD

Munich, Germany

Response to Question No. 1: In January 2012, the German legislature passed a law that gives all public health care patients the option of selecting a premium IOL when they undergo cataract surgery. The public health care insurance company will pay for a standard IOL, which is defined by the medical specialists of the public health care service as a foldable, spherical, biconvex lens with sharp edges for protecting against the formation of posterior capsular opacification. Any higher-priced IOL, such as aspheric, blue-light-filtering, toric, heparin-coated, multifocal, and light adjustable lenses—in any combination—are premium IOLs.

As a result of this new law, we recommend a premium IOL when we believe that the patient will benefit from this technology. About 70% of our patients now opt for a premium IOL with higher costs. We determine the best premium IOL based on biometry with laser interferometry, keratometry, Pentacam topography, endothelial cell measurement, corneal aberrometry and, if necessary, spectral domain OCT (SD-OCT). We also consider the patient's desired postoperative refraction when selecting the IOL, for which several are outlined below.

Aspheric IOL: With the ability to measure corneal asphericity (Z4), we try to match the positive corneal asphericity with the closest possible negative asphericity of the implanted IOL. This approach allows us to imitate the condition of a young crystalline lens. Most surgeons do not measure corneal asphericity because they select an asphericity-neutral IOL for their patients. This approach is not wrong; however, in doing this they miss an ideal moment for optimizing the postoperative result. In other words, if the optimization of asphericity in corneal refractive laser surgery provides superb results, why shouldn't we transfer this experience to cataract surgery, which has become a true refractive procedure? We recommend that our patients visit the website premiumiol.de for more information on premium IOLs.

Toric IOL: If the result of our examination shows 2.00 D or more of corneal astigmatism, we select a toric IOL. Several IOL companies have online calculators for these specific lenses. If the astigmatism is less than 2.00 D, we recommend an aspheric monofocal IOL and wait for the postoperative result. If the patient is unhappy with the remaining cylinder, we then suggest a corrective treatment—glasses, a toric add-on IOL, laser astigmatic keratotomy, or excimer laser astigmatic correction.

Multifocal IOL: I prefer not to go into detail here, because this patient group is too specific. In general, however, with

the right patient selection, we can achieve perfect results in most cases. Hyperopic patients are easier to correct than myopic patients, and we inform all patients that a fine-tuning surgery may be necessary if the postoperative refractive result is not satisfactory. Preoperative SD-OCT is mandatory because multifocal IOLs work only with a healthy fovea.

Blue-light-filtering IOL: Debate about the benefits and side effects of these lenses is ongoing. I recommend this type of lens only for patients with dry or wet macular disease because it provides the same filter as the aging human lens. Nature is sometimes more clever than science.

LAL: The LAL is more than a premium IOL; it is our platinum version. All patients with previous corneal refractive surgery or complicated corneal measurements are informed about the difficulty to meet the desired postoperative refraction with current IOL power formulas. With the LAL, however, it is both time-consuming and relatively easy to meet the desired refraction. Postoperatively, the patient is able to select the refraction that he or she is comfortable with. Additionally, monovision is easy to apply; as with any other IOL, we calculate plano in the dominant eye and -1.50 D in the nondominant eye. For 2 weeks, the patient lives with this refraction. If it is acceptable, we lock in the refraction, and if not we correct the refraction to what is acceptable.

The LAL corrects cylinders between 0.50 and 2.00 D perfectly. It is the ideal IOL because the patient always gets his or her desired postoperative refraction. Postoperative treatment time and additional costs are currently the limiting factors, and in this sense it is the true platinum IOL.

Response to Question No. 2: We have more than 20 years' experience with toric IOLs, as we started implanting the STAAR Surgical toric lens when it was introduced in 1992 in patients with at least 2.00 D of corneal astigmatism. The risk with toric IOLs is postoperative instability due to haptic design. Each company assures the surgeon that its design has rotational stability, and it is true that most toric lenses stay in the implanted axis after implantation. Postoperative rotation is easy and should not be done too early. To avoid a second surgical intervention, I implant a capsular tension ring with the toric IOL to minimize postoperative rotation. I also pressurize the eye to about 5 or 10 mm Hg and not more.

My favorite toric IOL is a foldable, bitoric, plate-haptic design. Marking the corneal axis can be performed with digital or analog markers. Digital markers transfer preoperative measurements into a microscope; these include the Osher Toric Alignment System (Haag-Streit) and the Electronic One-Step Toric Marker (ASICO). Analog systems either connect to the slit lamp, like the Tomark System (Geuder), or are handheld like the Neuhann One-Step Marker (ASICO). The only significant difference is pricing; precision of marking is around 5° for all digital and analog systems.

Response to Question No. 3: Because all surgeons treat patients with negative or positive dysphotopsia, updates to optic and haptic designs are expected. Softec just released an IOL with an oval optic, and we are interested to see the early results. We are also waiting for early results from trials of newer accommodating IOLs, including the NuLens.

In the multifocal IOL market, today's companies are going different ways. PhysiOL and Carl Zeiss Meditec are presenting good results with trifocal optics, and Alcon Laboratories, Inc., is releasing a new multifocal IOL with a near add of 1.50 D to eliminate halos and glare. Oculentis recently announced that it will offer a customized, aspheric, monofocal IOL that matches a patient's individual corneal asphericity. This is an interesting concept and is much like corneal refractive surgery meeting lens refractive surgery. Lastly, 1stQ presented the first results with its new supplementary multifocal IOL, which reportedly can correct residual astigmatism, spherical error, and pseudophakic presbyopia.

Response to Question No. 4: See answer to Question No. 1.

Response to Question No. 5: Laser cataract surgery is the way to go. The only question is when to start. Even with most of the first-generation machines, initial results have shown that, especially in difficult cases, capsulorrhexis, corneal astigmatic correction, and lens softening are more safe and effective than with manual surgical techniques.

If a surgeon decides to go this new route, he or she must calculate the costs associated with the new investment of laser equipment. The challenge is that the patient now must pay for two components: (1) the premium IOL and (2) the bladeless procedure with mandatory astigmatic correction. One strategy is to offer a package that charges a set fee for the premium IOL and the laser surgery. The price differential between a customized aspheric monofocal IOL and a toric multifocal is negligible with a charge between €1,500 and €2,000 for the package.

Tobias H. Neuhann, MD, is the Medical Director of the AaM Augenklinik am Marienplatz, Munich, Germany. Dr. Neuhann states that he has no financial interest in the products or companies mentioned. He may be reached at tel: +49 89 230 8890; fax +49 89 230 88910; e-mail: sekretariat@a-a-m.de.

MILIND PANDE,
MBBS, DO, FRCS, FRCOPHTH
United Kingdom

Response to Question No. 1: I use a range of premium IOLs, including aspheric lenses with different amounts of additive spherical aberration, monofocal toric lenses, bitoric lenses, multifocal toric lenses, accommodating lenses, and multifocal diffractive and refractive pupil-independent and pupil-dependent lenses with different adds and light energy distributions. My aim for patients is seamless binocular vision

of 6/9 or better from 40 cm to 6 m in both photopic and mesopic conditions, with the least possible compromise to quality of vision—in other words, a flat top defocus curve for both photopic and mesopic conditions with minimal compromise in retinal image contrast. When this is not possible, I make a compromise that will best suit the patient's lifestyle and needs. I use premium lens styles in combination or the same type of lens in both eyes to get the patient to the ideal objective described above or as close to the patient's targeted focal range as possible with minimal contrast sensitivity loss, halos, and glare. I call this the *CustomLens Strategy*.

A common scenario is to start with a multifocal IOL that can achieve the ideal add at the spectacle plane—between 2.00 to 2.50 D for the average eye—with enough light energy focused for quality near vision. Because IOL plane add translates to different spectacle plane adds depending on the patient's anterior chamber depth and corneal power, it is important to calculate the effective spectacle plane add for each eye. If a patient is a heavy computer user, I might target a small amount of hyperopia (less than 0.50 D) so that the depth of field from the near focus improves intermediate vision. Two weeks after surgery, my associate optometrist conducts a panfocal visual acuity assessment to establish the monocular focal range achieved with the operated eye and tests the patient's objective task performance. On the basis of this assessment and the patient's feedback, a lens design is chosen for the other eye to complement the strengths and fill in the gaps of the previously implanted IOL and achieve the objectives outlined above. In many cases, the best choice is an aspheric monofocal IOL with a small amount of myopic astigmatism to blend and overlap intermediate vision. Other times, the second lens may be the same type of multifocal, toric monofocal, or toric multifocal IOL implanted in the first eye. All lenses are treated as tools to fill the gaps in a patient's defocus curves.

I have been using multifocal IOLs for 16 years, accommodating IOLs for 11 years, and toric IOLs for more than 6 years. My pattern of use has evolved with time as new designs and diagnostic technologies have become available. Along with new technology, my understanding of pseudophakic vision, binocular vision processing, and patient assessment have evolved. My current strategy works well in my hands, and my advice to beginning surgeons is to think in terms of a patient's vision profile, choosing a premium lens that will achieve the ideal profile for that particular patient. Some of the most unhappy patients are those who can see 6/6 and N5 but have a big hole in intermediate vision. It is only by thinking within the framework of a vision profile—a focal range—that one can identify such pitfalls. All IOLs by reputable manufacturers work to their optical designs. The challenge for the clinician is to familiarize him- or herself with the optics of each IOL, to understand what that lens can and cannot do, and to use it to achieve its design potential in patients who are ideal can-

didates for that particular lens design. The fact is, there is no premium lens mode that works best for all patients; it is too simplistic to expect such a lens.

Response to Question No. 2: I use the AT TORBI bifocal, the T-flex Aspheric, and the Mplus toric IOLs, and I will be using the enVista and Tecnis Multifocal toric IOLs soon. I do not mark the eye, but I do identify limbal blood vessels at the slit lamp and draw a diagram in my notes identifying the meridian of these limbal blood vessels. I specifically identify two or three vessels that I can use to align the protractor and mark the steep meridian with ink. I always operate on the steep meridian. At the end of the case, I check the alignment to these markings and reposition the IOL until I am happy that the correct alignment is achieved and stable. I also use LRIs in patients with less than 2.00 D of topographic cylinder if they are more than 65 years of age and less than 1.25 D if they are younger.

Response to Question No. 3: I am excited by the range of new adds soon to be available on various multifocal lens designs. This will allow further customization of the IOL selection process.

Response to Question No. 4: IOLs are optical devices that bend light to their specific designs. The holy grail for an IOL would be the ability to change focus like a zoom lens from 33 cm to 6 m without any compromise in optical quality. An IOL with such functionality must also be implantable through a microincision, achieve predictable effective lens positioning, be stable, induce no significant posterior capsular opacification, and be practical for clinical situations. The LAL, FluidVision, and NuLens concepts are potentially exciting and may provide answers to some of these challenges; however, none of these concepts can solve all the problems.

Response to Question No. 5: I believe that laser cataract surgery will succeed in the long term only if we can develop IOLs that improve refractive and visual outcomes and at the same time can be used only with laser cataract procedures. Time will tell how this technology use evolves.

Milind Pande, MBBS, DO, FRCS, FRCOphth, is the Medical Director of the Vision Surgery and Research Center, United Kingdom. Dr. Pande states that he is a consultant to Abbott Medical Optics Inc., and Bausch + Lomb. He may be reached at e-mail: mp@visionsurgery.co.uk.

DOMINIQUE PIETRINI, MD

Paris, France

Response to Question No. 1: Our interest in multifocal IOLs has focused on two problems: (1) the lack of intermediate visual acuity obtained with diffractive bifocal IOLs and (2) the level of halos and other night visual disturbances that continuously decrease with improved lens technologies. Most of today's multifocal IOL designs achieve a higher level of efficiency and quality

of vision and allow us to select the right IOL for each patient. For computers users, I choose the AT LISA tri, implanted through a 1.8-mm incision, because of its excellent intermediate visual acuity. Another option for these patients is the Lentis Mplus, which with its transitional nonrotational symmetric multifocality achieves excellent light transmission. This lens is also available in a toric version. For readers or previously myopic patients, I like aspheric bifocal diffractive IOLs with excellent near vision, such as the bifocal AT LISA or the Tecnis Multifocal.

I use multifocal IOLs mainly for clear lens extraction, but I also implant them in approximately 40% of my cataract cases as a means to simultaneously correct refractive error and presbyopia. Indications for multifocal IOL implantation are based on patient demands and preoperative measurements. Patients who do not meet the inclusion criteria should be informed that multifocal implantation is not recommended.

For a surgeon to begin implanting multifocal IOLs, he or she should be convinced that most of these lenses provide excellent vision and that suboptimal results are related to poor patient selection, biometry, or surgery. I would recommend beginning with cataract patients and routinely using a low-add multifocal IOL such as the Lentis Comfort (Oculentis GmbH), which has a 1.50 D add resulting in excellent far and intermediate vision. It can improve depth of field compared with a monofocal IOL and performs well in standard cataract cases for patients or surgeons reluctant to use a multifocal IOL. The Lentis Comfort can be used with a mix-and-match approach.

Response to Question No. 2: Toricity has become a major concern in the quest for emmetropia, as 15% to 20% of patients have preoperative cylinder between 1.00 and 12.00 D. Today's incisions are relatively astigmatically neutral, and therefore I find it easier to plan astigmatism correction, even for low cylinder, with toric IOLs. I like using four-haptic designs such as the AT TORBI or the Lentis Mplus Toric, as they are remarkably stable in the capsular bag. Online calculators are mandatory to simplify the procedure and monitor postoperative refraction. My surgical pearls include creating nonastigmatic incisions, performing perfect biometry, and correctly marking the axis of alignment on the steep axis. Also keep in mind that 1° of misalignment induces a 3.3% under-correction of cylinder and that lens rotation of about 30° can increase the cylinder for higher values of astigmatism.

Response to Question No. 3: Diffractive trifocal IOLs such as the AT LISA tri or the FineVision IOL improve upon the intermediate visual acuity achieved with other diffractive multifocal IOLs. For refractive multifocal IOLs, the Lentis Mplus can decrease disturbances of mesopic vision through use of a lower level of light than diffractive IOLs (7% vs 15%). In the accommodating IOL category, the latest version of Synchrony, the Vu, is promising. Piggyback IOL implantation is useful for secondary multifocal implantation; however, it is not yet developed for a primary pro-

cedure. The concept of a dual-optic strategy (monofocal plus premium IOL) could provide reversibility at any time, and different lens models are currently under evaluation.

We have also evaluated an IOL with custom asphericity developed by Oculentis, the My Lentis. The intent of this kind of IOL is to customize asphericity for patients with extreme or aberrated corneas and to induce pseudoaccommodation.

Response to Question No. 4: The present is an excellent time for cataract surgeons, and the future will be even better. Accommodating IOLs are certainly part of this future, among them the LAL.

Response to Question No. 5: We have reached a high level of precision in IOL calculation, and the source of imprecision in our results is now related to the final IOL position in the capsular bag. The size and shape of the anterior capsular opening influences this effective lens position. A perfect capsulotomy customized to each IOL will help to refine our usual formulas and improve our refractive results, especially for premium IOLs implanted with a laser-assisted cataract surgery technique. Accommodating IOLs will also benefit from this new technology, as a perfect capsulotomy can improve capsular dynamics.

Dominique Pietrini, MD, practices at the Clinique de la Vision, Paris. Dr. Pietrini states that he has no financial interest in the products or companies mentioned. He may be reached at tel: +33 1 58 05 2000; fax: +33 1 58 05 2001; e-mail: dpietrini@club.fr.



MAGDA RAU, MD

Cham, Germany and Prague, Czech Republic

Response to Question No. 1: I began implanting premium IOLs 14 years ago, first with the distance-dominant Array (Abbott Medical Optics Inc; no longer available) and the near-dominant MF4 (Carl Zeiss Meditec) multifocal IOLs. I found that mixing and matching these lenses could satisfy the individual needs and demands of patients. Later, I replaced these lenses with the ReZoom (Abbott Medical Optics Inc.) and Tecnis Multifocal IOLs. I also observed that men and women tended to accept visual disturbances associated with multifocal IOLs differently, with men more critical of postoperative outcomes for distance vision and women more interested in achieving perfect near vision and spectacle independence.

A brief overview of my premium IOL preferences follows. Because the asymmetric Lentis Mplus produces less halos and glare than other multifocal IOLs and provides patients with excellent distance and intermediate vision and good near vision, it is the perfect multifocal IOL for men, demanding and anxious patients, those who are seeking clear distance vision, and women who do a lot of com-

puter work. The FineVision trifocal lens is the ideal IOL for patients who do a lot of computer work but also require excellent near vision, and the Tecnis Multifocal is advantageous in many patients because of its 4.00 D near addition, which can grant patients independence from reading glasses. I continue to use a mix-and-match strategy when a patient is not completely satisfied with the outcomes of the first implantation. I implant the Accommodative 1CU (HumanOptics) in patients who request partial spectacle independence for near vision but will not tolerate the side effects associated with multifocal IOLs, calculating the IOL power for the nondominant eye at -0.50 or -1.00 D.

Today, one-third of my cataract patients select a premium IOL, and the number is increasing because of new regulation in Bavaria that requires patients only to pay the difference in cost between a monofocal and premium IOL. My advice to colleagues who are on the brink of implanting multifocal IOLs is to invest more chair time with patients, especially men, and to understand patient demands prior to surgery.

Response to Question No. 2: To correct up to 1.25 D of astigmatism, I use the Lentis Mplus Toric or Tecnis Multifocal Toric IOL. In my experience, patients usually choose a toric multifocal IOL because the cost is only slight higher and they receive the additional benefit of spectacle independence. I usually implant the Lentis Mplus toric because of its availability in a large dioptric range. Additionally, it can be customized, enabling the exact correction of corneal astigmatism and of presbyopia. I have also started implanting the Tecnis Multifocal Toric. Its 4.00 D near addition provides most patients with freedom from reading glasses. I like its C-loop haptics because they reduce zonular stress during implantation, postoperative shrinkage of the capsular bag, and IOL decentration.

Patient selection for multifocal toric IOLs is the same as for standard multifocal IOLs. I usually implant the Lentis Mplus toric in men and in women who do a lot of computer work, and I implant the Tecnis Multifocal Toric in patients who request complete spectacle independence.

Response to Question No. 3: Newer multifocal IOL designs reduce the incidence of optical side effects and improve the quality of intermediate vision, and I am satisfied with my outcomes after implantation of multifocal toric IOLs, including the Lentis Mplus Toric and the Tecnis Multifocal Toric. In my opinion, LRIs are not precise enough and can negatively influence the optical outcome after implanting a multifocal IOL. Also, bioptics, or implantation of a multifocal IOL in conjunction with an excimer laser treatment, has many postoperative risks including loss of contrast sensitivity and added cost. Many patients consider the need for a second operation as failure of the multifocal lens.

Response to Question No. 4: Both the FluidVision IOL and the NuLens have large accommodation ranges and are

promising designs. Regarding custom lens designs currently in clinical use, the Lentis Mplus Toric can be customized to correct high myopia, hyperopia, and astigmatism. I implant this lens in patients with high anisometropia when excimer surgery is not possible. In the future, custom IOLs will hopefully compensate for the individual aberrations of each eye.

Response to Question No. 5: I do not perform laser-assisted cataract surgery, partly because I believe that this technology is developing; however, I also do not see any advantages currently over phacoemulsification.

Magda Rau, MD, is the Head of the Augenlinik Cham and Refractive Privatklinik-Dr. Rau, Cham, Germany, and Eye Centre Prag, Czech Republic. Dr. Rau states that she has no financial interest in the products or companies mentioned. She may be reached at tel: +49 9971 861076; e-mail: info@augenlinik-cham.de.



PAVEL STODULKA, MD, PhD

Zlin, Czech Republic and Austria

Response to Question No. 1: During the past year, a premium IOL was implanted in approximately 10% of eyes treated at our center. Personally, I use a premium implant in about 70% of eyes, with the most frequent being the FineVision. Of the remaining 30% of eyes, 20% received a hydrophobic aspheric blue-light filtering IOL, mostly the Hyflex Y (EyeoUK), and 10% a spherical IOL. During the past several years, we also have almost entirely avoided implanting IOLs with a higher reported incidence of glistenings. I was the first surgeon to implant the Lentis Mplus into a human eye, but unfortunately the original C-loop haptic design caused decentration. Today, the plate-haptic design of the Mplus seems to cause less glare than most other multifocal IOLs. I perform almost exclusively microincision cataract surgery (MICS) surgery, packaging laser cataract surgery with trifocal IOL implantation to provide patients with the best chance for spectacle independence.

Response to Question No. 2: For up to 2.00 D of cylinder, I enlarge the incision on the steep meridian. From 2.00 to 5.00 D of corneal cylinder, I prefer laser arcuate incisions (Figure 7) provided there are no signs of keratoconus or dry eye. Because laser relaxing incisions are easy to open (Figure 8) and precise in location, shape, length, and depth, we use toric IOLs in less than 3% of cases. My monofocal toric IOL of choice is the enVista Toric and my toric blue-light-filtering monofocal and multifocal lenses of choice are the Acriva BB T UDM 611 and Acriva Reviol BB T MFM 611 (both by VSY Biotechnology), respectively. Of hydrophobic toric lenses, I like the Hyflex. I like to mark the steep axis at the slit lamp. I turn the slit toward the desired axis and make an ink mark at

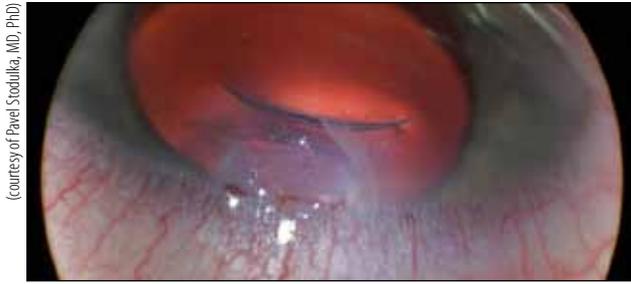


Figure 7. Laser arcuate corneal incisions are preferred for correction of 2.00 to 5.00 D of cylinder.

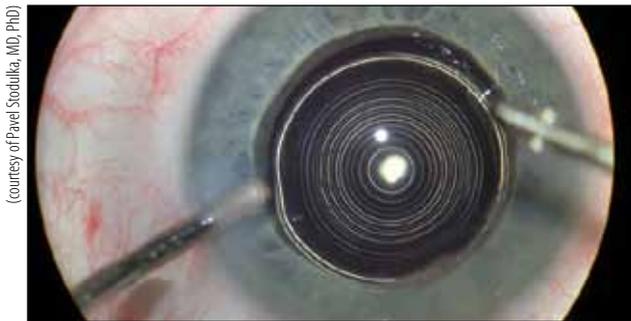


Figure 9. Under the operating microscope, the diffractive structure on the anterior aspheric surface of the FineVision trifocal IOL is visible.

the limbus. I do not use any specific instrument to mark the axis on the eye.

Response to Question No. 3: One breakthrough of this past year was introduction of a trifocal IOL, and the FineVision quickly became the most frequent premium lens implanted at Gemini Eye Clinic with almost 1,000 cases. The dual diffractive pattern (Figure 9) can provide patients with spectacle independence at distance, intermediate, and near and is less demanding for neural adaptation. Now we are waiting for an accommodating IOL—but I do not believe we will get it as soon as this year.

Response to Question No. 4: In the future, I believe that accommodating IOLs will become a first choice for many surgeons. Early experience with some of the IOLs mentioned above by other respondents looks promising, but clinical use is still a long way off.

Response to Question No. 5: I perform laser cataract surgery in more than 90% of cases and have completed approximately 2,000 procedures with this technology to date. We offer patients a package combining a premium IOL with laser surgery. Laser corneal incisions are part of the package when they are indicated. The most frequent premium IOL we implant in these patients is the FineVision; for a video demonstration of this procedure, visit eyetube.net/?v=begin. Trifocal IOLs, just like



eyetube.net

eyetube.net/?v=begin



Figure 8. The laser relaxing incision is opened with a spatula.

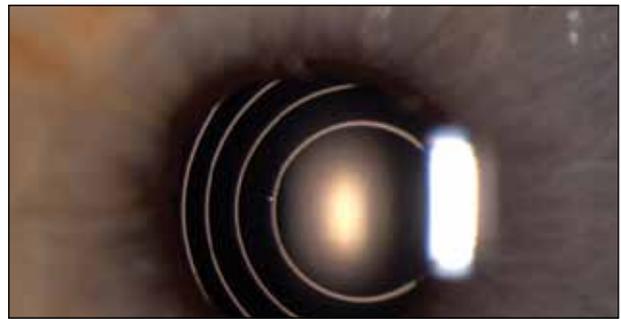


Figure 10. The diffractive structure of the FineVision IOL at the slit lamp provides a clear marker of IOL centration.

multifocals, require precise centration (Figure 10).

Pavel Stodulka, MD, PhD, is with the Gemini Eye Centre, Zlin, Czech Republic. Dr. Stodulka states that he is a speaker for and paid consultant to Technolas Perfect Vision GmbH/Bausch + Lomb. He may be reached at e-mail: Stodulka@lasik.cz.



MARIE-JOSÉ TASSIGNON, MD, PhD, FEBO

Edegem and Wilrijk, Belgium

Response to Question No. 1: The only premium IOL I currently use is the toric Bag-in-the-Lens (BIL; Morcher GmbH; Figure 11). I had previously implanted add-on diffractive and refractive IOLs in addition to the BIL, but unfortunately outcomes were poor. For this reason, I have begun to develop a multifocal BIL.

Response to Question No. 2: To center the toric BIL, I developed an instrument called the Eye Cage (Eye Tech; Figure 12), which allows the caliper ring to be centered using limbal centration. Additionally, to center the corneal vertex, I refer to the Purkinje image of the microscope's light reflex.

Response to Question No. 3: Diffractive IOLs are sensitive to coma, astigmatism, capsular opacity, and cell prolif-



Figure 11. The Bag-in-the-Lens toric IOL in situ.



Figure 12. The Eye Cage caliper ring can be used to center the toric Bag-in-the-Lens.

eration within the visual axis. Because these conditions are not as prevalent with the BIL as with conventional IOLs, the logical step is now to design a diffractive or multifocal BIL.

Response to Question No. 4: I am convinced that only IOLs that allow the surgeon better control of IOL centration will survive in the premium IOL market. Until now, the only IOL to achieve these requirements is the BIL.

Response to Question No. 5: The real breakthrough of laser-assisted cataract surgery is the reliability and reproducibility of IOL alignment, independent of the anatomy of the capsular bag. This is what I feel is most attractive about it.

Marie-José Tassignon, MD, PhD, FEBO, is Head of the Department of Ophthalmology at the Antwerp University Hospital, Edegem, Belgium, and Full Professor in the Department of Medicine, Antwerp University, Wilrijk, Belgium. Dr. Tassignon states that she has intellectual property related to the BIL IOL. She may be reached at tel: +32 3 821 33 77; fax: +32 3 825 19 26; e-mail: marie-jose.tassignon@uza.be.



JÉRÔME C. VRYGHEM, MD

Brussels, Belgium

Response to Question No. 1: In 1997, I was the first surgeon in Belgium to implant a multifocal IOL, the Array. Since then, I have used other multifocal and accommodating IOLs including the MF4, Crystalens, Acritwin (Acritec; no longer available), Lentis Mplus, and AT LISA. With earlier multifocal IOL models, many patients complained of disturbing halos at night, disappointment with reading ability limited to one focal point, and either nonfunctional intermediate vision or good intermediate vision at the expense of reading vision. These results led to moderate patient and surgeon satisfaction and, in some cases, explantation of the IOL.

Today, my preferred premium lens is the FineVision diffractive trifocal IOL, which has allowed me to meet most of my patients' expectations. I look forward to later this year when it will be available in a toric version. For now, I implant the FineVision in patients with less than 0.50 D of against-the-rule astigmatism or less than 1.50 D of with-the-rule astigmatism. If outside this range, the patient must be counseled regarding a possible postoperative secondary excimer laser enhancement.

Although 24% of my patients receiving the FineVision IOL notice halos immediately after surgery, 8% of these report them on inquiry only. Remarkably, complaints tend to disappear with time, and all patients can read J1 or better at a fixed distance of 40 cm. Intermediate vision (65 cm) is also satisfactory, allowing most patients to perform computer work without problems. In the defocus curve, the mean intermediate UCVA is 0.84, which is much better than the results obtained with bifocal IOLs. Approximately 5% of patients need excimer laser enhancement to cope with residual refractive error. Therefore, we warn patients in advance that fine-tuning with an excimer laser might be needed, and that this will warrant additional costs.

In my busy refractive surgery practice, the FineVision IOL is now my first choice in hyperopic patients older than 45 years. Even presbyopic patients with high myopia are satisfied with their results, as long it has been made clear to them that they will lose reading ability at very close distance. I have implanted more than 500 FineVision IOLs since September 2010, and today I implant the lens in 90% of my refractive lens exchange patients and 25% of my cataract patients, with the lower percentage mostly due to financial issues. For a video demonstration of the implantation procedure, visit eyetube.net/?v=senan.

Response to Question No. 2: In the presence of astigmatism, I often implant the AT TORBI or the AcrySof IQ Toric IOL. If patients want good reading ability, I recommend

(Continued on page 58)



Weigh in on this topic now!



Direct link: <https://www.research.net/s/CRSTEuro18>

I use premium lens implants in the following percentage of patients:

- 0% to 30%
- 31% to 60%
- 61% to 100%

(Continued from page 53)

the FineVision IOL with a secondary laser enhancement to correct astigmatism. However, this will change when the FineVision toric IOL becomes available. In those patients who are ready to cope with a lack of intermediate vision or those who do not want to undergo a two-step procedure, I implant the AT LISA toric. I still perform arcuate keratotomy (optical zone, 7 mm; depth, 550 μ m; arc length dependent on the amount of astigmatism) using the Mastel Arcuate Corneal Compass in patients with a low astigmatism or those who are not ready to pay for a toric IOL.

Response to Question No. 3: I do not think that the AT LISA tri IOL will outperform the FineVision IOL because its trifocal area is limited to the central 4.5 mm and its periphery is still bifocal.

Response to Question No. 4: Light-adjustable IOLs are potentially useful when the refractive outcome is unpredictable. The photosensitizer tools must become more affordable before surgeons will consider using this technology regularly. I have no experience with the FluidVision and NuLens IOLs.

Response to Question No. 5: As long as the purchasing and disposable costs of the femtosecond laser remain high, laser cataract surgery is nothing more than an expensive marketing tool. In my opinion, the incisions created are not always easy to find, the strength of the capsulorrhexis is not as good as that of the manual rhexis, and the advantage of better centration is marginal. When a phaco-chop technique is used, most nuclei are easily split in minimal time. Laser cataract surgery will look more promising if purchase prices and handling time are reduced. In the actual circumstances of today, laser cataract surgery essentially pleases the companies, not the surgeons. ■

Jérôme C. Vryghem, MD, practices at Brussels Eye Doctors in Brussels, Belgium. Dr. Vryghem states that he has no financial interest in the products or companies mentioned. He is a member of the CRST Europe Editorial Board. Dr. Vryghem may be reached at tel: +32 2 741 6999; e-mail: info@vryghem.be.

