

What Would You Do?

Surgeons respond to case studies and identify what IOL they would select in each situation.

BY GERD U. AUFFARTH, MD, PhD; FRANCESCO CARONES, MD; JOHN S.M. CHANG, MD; GEORG GERTEN, MD; RUTH LAPID-GORTZAK, MD, PhD; AND ULRICH MESTER, MD

Choosing the right IOL is not always easy. There are monofocal, multifocal, accommodating, toric, and now multifocal toric IOL models to choose from. Not only must you decide among these options, but you have to select a specific brand and model as well. This is no small feat in today's market, which boasts ever-growing numbers of lens manufacturers and designs.

To see which IOLs some of Europe's leading ophthalmologists are selecting, CRST Europe invited a panel of cataract surgeons to weigh in on five case studies submitted by our Chief Medical Editors. Below are answers from six surgeons responding to the first three cases. In the following pages of this issue, surgeons respond to two additional cases.

CASE NO. 1

Patient A is a 74-year-old man with grade 3 nuclear sclerosis and some cortical spokes. His BCVA has deteriorated to 6/24, and he indicated that after surgery he is looking for an improvement in vision. He experiences vertigo and previously fractured a hip as a result of a fall. He does not mind wearing glasses for reading and admits that he is willing to wear glasses full-time after cataract surgery, as he has worn them all his life. What would you do for this patient?

– Case submitted by Arthur B. Cummings, MB ChB, FCS(SA), MMed (Ophth), FRCS(Edin)

GERD U. AUFFARTH, MD, PhD

In this case, I would perform phacoemulsification of the lens and implant a monofocal IOL calculated for emmetropia. If Patient A has any residual refractive error

after surgery, I would suggest correction with spectacles. I would not try to talk him into considering a premium lens, such as a multifocal. However, if he had an interest in obtaining good distance UCVA, I might ask him to consider a toric monofocal lens.

FRANCESCO CARONES, MD

Because the patient does not mind wearing spectacles for any distance, the target of the surgery should be to achieve uncompromised quality of vision postoperatively.

I would not consider multifocal IOLs a good option for Patient A, as he has not requested spectacle independence. These lenses can decrease contrast sensitivity and induce night vision problems. Neither would I consider an accommodating IOL in this situation, because the optic is relatively small, and, therefore, visual compromises can occur at nighttime. I would advise against monovision, so as not to exacerbate the vertigo symptoms Patient A already experiences. His age, coupled with vertigo and a fractured hip, may limit his confidence in participating in activities of daily life, such as crossing high-traffic streets or grocery shopping.

For these reasons, Patient A would most likely benefit from bilateral implantation of an aspheric IOL to compensate for his corneal spherical aberration. My IOL of choice for this case would be the AcrySof IQ (SN60WF; Alcon Laboratories, Inc.) because of its excellent material and the low posterior capsular opacification rate associated with this hydrophobic acrylic lens.

The most reasonable refractive target is emmetropia, which should eliminate Patient A's need for distance-vision spectacles, and I see no reason to not implant a toric IOL (SN6ATT; Alcon Laboratories, Inc.) should Patient A's corneal astigmatism require correction. My surgical technique is minimally invasive surgery through a 2-mm, astigmatism-neutral incision, facilitating faster healing and visual recovery.

JOHN S.M. CHANG, MD

This case is fairly straightforward. Patient A is most likely myopic, as he has worn glasses his entire life; if he were hyperopic, he would be wearing glasses only later in life. However, just a simple check of his current glasses will confirm that he is a myope. If Patient A is a mild myope and has been removing his glasses to read, I would do the same and aim for approximately -2.50 D. This uncorrected refraction would provide him with the most comfortable reading distance. If he is a moderate or high myope, however, I would let him choose whether to be myopic or plano and wear reading glasses.

I would mention that monovision is an option, but I would most likely rule it out in this case because the patient experiences vertigo. The discrepancy between the two eyes may make this condition worse.

If Patient A is a very high myope (most likely with astigmatism as well), I would choose the AT.Torbi IOL (Carl Zeiss Meditec). If he is a moderate myope with astigmatism, I would use the AcrySof IQ Toric or the AT.Torbi. If he is a low myope with astigmatism, I would use the AcrySof IQ Toric. If Patient A has little (less than 1.50 D) or no astigmatism, I would opt for the Tecnis 1-Piece (ZCB00; Abbott Medical Optics Inc.) and perform limbal relaxing incisions (LRIs) as needed.

If Patient A does not drive, I would offer a multifocal IOL such as the Tecnis Multifocal IOL, but I would warn him about the potential for postoperative halo, glare, and possibly diplopia.

Patient A should know that the usual risks and benefits of cataract surgery apply, but, if he is a high myope, he should also be told that he may be at higher risk of retinal detachment. I would also counsel him that his zonules may be loose and he may need a capsular tension ring (CTR).

Because Patient A may not be very mobile after his fractured hip, and because his cataracts are not very mature, I would offer immediate sequential bilateral cataract surgery (ISBCS). I would perform endothelial cell counts to make sure they are in the normal range. I would also explain in detail how I perform ISBCS and the additional risks involved.

My surgical strategy would be straightforward, except that during the continuous curvilinear capsulorrhexis (CCC) I would watch for loose zonules (ie, notable folds when depressing the anterior capsule) and see if the lens is moving excessively. If there are loose zonules, I may consider placing a CTR before I initiate phacoemulsification.

GEORG GERTEN, MD

A distance BCVA of 6/24 is quite low for a case of nuclear sclerosis, and it does not explain Patient A's accident. (Vertigo is likely the cause of the fall.) I would check the

patient's visual fields, retina, optic nerve, and vascular status. Assuming that the decline in visual acuity is either fully or partially associated with the cataract, I would recommend cataract surgery immediately, with the time interval between eyes as short as possible. I would choose a monofocal aspheric IOL and aim for emmetropia in both eyes.

RUTH LAPID-GORTZAK, MD, PhD

In this and all other cases, the choice of lens is based on the patient's lifestyle choices, his or her ocular health and biometry, and the ophthalmologist's impression of the results that can and should be achieved through surgical intervention.

With this 74-year-old man, I would like to know how vital he is. What is his lifestyle? Does he have active hobbies? Notwithstanding his hip repair, which is the No. 1 surgery to improve quality of life (with cataract surgery being No. 2), the man could still be very active.

Because Patient A has no problem wearing glasses (including reading glasses), and because of his vertigo, I would advise implanting a monofocal lens. The postoperative target refraction depends on the patient's preoperative refraction and keratometry as well as his visual needs. If Patient A was emmetropic or hyperopic, then I would recommend keeping emmetropia and using reading glasses; however, if he was myopic there are two possible solutions: (1) target emmetropia for distance vision and prescribe reading glasses or (2) keep the patient myopic (-2.40 D) and prescribe glasses for distance vision. The option of monovision seems precluded by Patient A's vertigo, as I would be concerned that it would contribute to vertigo-related complaints and perhaps cause him to fall again, even with minimal aniseikonia and anisometropia.

Should Patient A have significant corneal astigmatism (more than 0.75 D against-the-rule or 1.00 D with-the-rule), I would correct it, and if after surgery in his left eye the patient had more than 1.00 or 1.50 D of ametropia, I would prefer to do surgery on the other eye as well.

When counseling Patient A, I would discuss all available options, but I would also not be afraid to steer him away from multifocal IOLs. Patient A's vertigo issues must be addressed before surgery, including the causes and the aggravating and alleviating factors. Can he lie supine for 20 minutes? Does he have nystagmus? This would influence my choice of anesthesia. If the patient is uncomfortable in the supine position and it cannot be suppressed medically, I would recommend general anesthesia. If the vertigo is manageable in the supine position but there is nystagmus, I would anesthetize with a peribulbar injection. If there is no nystagmus and the patient can lie still, I would preferably anesthetize as I usually do, using oxybuprocaine and tetracaine drops and a 0.5-cc superior

subconjunctival injection of lidocaine 2%.

In patients who select a monofocal IOL, the two lenses I use most regularly are the SN60AD (Alcon Laboratories, Inc.) and the Seelens AF (Hanita Lenses Ltd.).

ULRICH MESTER, MD

Patient A's history speaks strongly against implantation of a multifocal IOL. Because he does not mind wearing glasses for reading—and even full time—after cataract surgery, I would recommend implantation of a monofocal IOL. The attempted refraction should be adapted to the refraction of the fellow eye to prevent significant postoperative anisometropia. Additionally, the choice of a blue-light-filtering IOL should be in accordance with the fellow eye if this eye has been operated on previously. This will avoid any imbalance between eyes.

CASE NO. 2

Patient B is a 58-year-old man with posterior subcapsular cataracts that developed as the result of steroid inhaler use over many years. He works as an accountant and spends at least 5 hours per day on a computer. He tried monovision LASIK, performed 13 years ago, but disliked it so much that he had the monovision reversed. He has been wearing reading glasses ever since, as well as glasses for computer use for the past 5 years. He would like to be free from spectacles if at all possible. If he does need to wear spectacles, the use of reading glasses for small print would bother him least. He is hoping for something more than simple monofocal IOLs and is not interested in monovision at all. What would you do for this patient?

— Case submitted by Arthur B. Cummings, MB ChB, FCS(SA), MMed (Ophth), FRCS(Edin)

GERD U. AUFFARTH, MD, PhD

Patient B wants to achieve spectacle freedom, and he is not interested in monovision; therefore, he might consider multifocal lens implantation. However, a multifocal lens can reduce contrast sensitivity and increase glare perception, especially in post-LASIK patients, such as Patient B. Additionally, IOL power calculation is not as accurate after refractive surgery and requires a special calculation formula and extra attention.

If, despite counseling on these potential negatives, the patient still desires a multifocal IOL, the model with the

best near addition is the Tecnis Multifocal IOL, which is a diffractive lens. Because of the contrast sensitivity and glare issues with this lens, however, the Mplus IOL (Oculetis) may be a better choice. The loss of light energy is only 8% with the Mplus, and this IOL can be produced as a customized lens.

FRANCESCO CARONES, MD

This relatively young accountant encounters many job activities that involve intermediate vision tasks, such as computer use. Patient B's ocular history (previously trying monovision) indicates a degree of interest in decreasing the use of reading glasses, but he also admits poor acceptance for compromise, as the previous monovision LASIK was reversed. This contraindicates any monovision approach, including blended monovision and mini-monovision.

Multifocal IOLs do not seem to be the best option for Patient B, because the intermediate vision they generate may be suboptimal compared with near (reading) vision, and the patient may complain. Moreover, the previous attempt at monovision LASIK and its reversal may have induced some corneal higher-order aberrations (HOAs) in the treated eye. If so, multifocal IOLs are quite possibly even more contraindicated because their performance may be affected by preexisting HOAs.

There are two strategies I would discuss with Patient B to manage his expectations for postoperative vision and the use of spectacles. The first approach involves implanting an accommodating IOL, such as the Crystalens HD (Bausch + Lomb), in both eyes. Although this IOL performs better when some low degree of myopia (0.50–0.75 D) is present in the nondominant eye, I would target plano in both eyes because of his previous negative experience with monovision. This strategy would provide Patient B with excellent distance visual acuity and good intermediate (computer) vision. Unfortunately, accommodating IOLs do not perform the same way in every eye. Some patients are totally spectacle independent if the accommodation process works properly in their eyes; however, some patients are left with spectacle dependence for reading and intermediate vision if the accommodative component of the IOL is ineffective and it performs similarly to a monofocal IOL. Given the relatively small optic diameter of the Crystalens, there may also be some night-vision complaints when the pupil dilates. Therefore, I would screen the patient with dynamic pupillometry to make sure the nighttime quality of vision would not be affected.

The second option I would discuss with Patient B is implantation of a monofocal aspheric IOL targeted at plano in both eyes. This option would provide him with uncompromised distance vision. If the patient still desires spectacle

independence a couple months after surgery, I would then consider implanting an intrastromal corneal inlay such as the Kamra (AcuFocus Inc.) in the nondominant eye, which is presumably the one that received LASIK for monovision. Intrastromal corneal implants usually provide at least good computer vision without the need for spectacles. The advantage of this strategy is the possibility for the patient to examine his real need and motivation to get rid of intermediate and reading glasses after the cataract procedure. The reversibility of the intrastromal corneal inlay procedure is also an advantage, should the patient dislike the results.

JOHN S.M. CHANG, MD

Accountants are usually meticulous and sensitive to the smallest changes in their surroundings. Patient B will not tolerate monovision, as evidenced by his experience with monovision LASIK 13 years ago, and most likely he will not tolerate halos and glare either. Therefore, a multifocal IOL is not a consideration in this case. However, I will still mention multifocality as an option, as occasionally I come across a patient with friends who had this surgery, who have already done a lot of research and know what they are in for. I also stress that the surgery is not perfect and that a LASIK enhancement may be necessary.

Because Patient B uses the computer a lot and does not mind wearing glasses for small print, he may be a candidate for the Crystalens. This lens provides good distance and some intermediate vision. Another lens that may suit him is the Lentis Mplus. Munoz et al¹ showed that 84.4% of patients implanted with this IOL achieved spectacle freedom, with moderate halo, glare, and night vision problems in 6.2%, 12.5%, and 15.6% of patients, respectively. This is less than what I have seen after implanting a diffractive multifocal IOL, as almost half of my patients experienced moderate to severe halos and 15% experienced moderate to severe night glare.

Patient B's expectations must be clearly defined before surgery, and he must be prepared for a lens exchange (with associated additional risks) if he is intolerant of the lens. My inclination is to talk him into monofocal lenses, aim for plano, and tell him he needs to wear glasses for computer use and reading. If Patient B decided on a monofocal lens, I would use an aspheric lens (ZCB00) or a toric aspheric (AcrySof IQ Toric) if he is astigmatic. If he decided on the Crystalens, I would aim for full correction in both eyes rather than the usual slight monovision in one eye.

GEORG GERTEN, MD

There is no doubt that the cataracts must be removed in both eyes; however, IOL selection will be challenging. In 1998, ablation profiles and optical zones were not the same as they are today. Therefore, IOL selection for

Patient B will depend on the status of the cornea. According to the amount of previously corrected refractive error, the mechanics and optics of the cornea have already been altered. I would perform an extensive refractive examination including Scheimpflug imaging (Pentacam; Oculus Optikgeräte GmbH), aberrometry (I-Trace; Tracey Technologies, Corp.), optical and ultrasound biometry, and pupil size. In highly aberrated eyes, dynamic retinoscopy (OPD Scan; Nidek) is a robust tool to evaluate the optical status of the eye.

During preoperative evaluation, the following questions would come to mind:

- (1) How small is the optical zone, and how high is the positive spherical aberration?
- (2) Is enough corneal tissue preserved for an excimer laser touch-up after the cataract/IOL operation?
- (3) Is the patient's BCVA still good enough to evaluate mild monovision (approximately 1.00 D)? At 45 years of age, Patient B's presbyopia was not prominent enough to convince him of the advantages of monovision.
- (4) Are the meibomian glands and tear film in reasonably good condition?
- (5) Are there any additional sources of straylight in the eye's optics, such as cornea guttata or extensive vitreous floaters?

If, after testing, monovision is not an option, the cornea is not too aberrated, and the eyes are otherwise healthy, I would proceed with bilateral implantation of a diffractive multifocal IOL such as the AcrySof ReStor or the AT.LISA (Carl Zeiss Meditec). There is a potential risk that Patient B will not tolerate the side effects or profit from a multifocal optic due to his altered cornea. As an alternative, I would consider implanting two IOLs in the eye: a posterior chamber monofocal IOL in the capsular bag and a diffractive secondary IOL, such as the Add-On (Humanoptics AG/Dr. Schmidt IOL) or the Basis-Z (1st Q), or a refractive secondary IOL such as the Sulcoflex (Rayner Intraocular Lenses, Ltd.) in the sulcus. If Patient B does not tolerate the side effects or does not profit from the multifocal implant due to his altered cornea, the secondary lens can easily be explanted without touching the monofocal IOL in the bag. This is an elegant way to give Patient B the opportunity to adapt to multifocal visual perception without the risk of a potentially traumatic IOL exchange.

I would aim for distance emmetropia in both eyes. If the central corneal cylinder is more than 1.00 D, I would recommend a toric multifocal IOL. Because the defocus curve of a diffractive IOL causes decreased reading ability in the intermediate distance, I would inform Patient B that he may need to wear glasses for computer use or change the distance at which he uses the computer.

Patient B must also be made aware of the typical side effects of a diffractive multifocal IOL, which include halos, glare, and loss of contrast sensitivity; however, these side effects should not be over-emphasized, as sub-capsular cataracts often entail such large amounts of light scattering that these patients adapt easily to the optical adverse effects of multifocal IOLs after surgery.

IOL calculation is, of course, a difficult issue in this case. First I would learn what preoperative data is accessible, such as pre-LASIK corneal power, changes in refractive equivalent, and post-LASIK corneal curvature measurements. Depending on the available information, the clinical history method, contact lens over-refraction, or post-LASIK corneal power measurements can be applied to determine IOL power. As a rule of thumb, the IOL power must be increased by 1.00 D for every 2.00 to 3.00 D of LASIK refractive correction (as calculated with a modern formula such as SRK/T, Hoffer Q, Holladay 1 or 2, or Haigis).

I would point out to Patient B that if, despite preoperative testing and calculations, a postoperative refractive surprise occurred, the IOL could be exchanged or retreatment with an excimer laser could be performed. In eyes implanted with a multifocal IOL, a small amount of cylinder can degrade optical perception more than in eyes with a monofocal IOL. In our clinic, therefore, a growing number of the multifocal IOLs we implant have toric components.

After the IOL is selected and the correct power calculated, in surgery I would create a 5-mm capsulorrhexis, perform phacoemulsification, and implant a CTR. I would then implant the diffractive multifocal IOL into the capsular bag. The IOL should be positioned with regard to the assumed line of sight. If toric, the IOL would then be dialed into the correct axis corresponding to the corneal marks. The operation is completed by hydration of the paracentesis, and antibiotics are injected into the anterior chamber in accordance with the European Society of Cataract and Refractive Surgeons (ESCRS) Endophthalmitis Study.

RUTH LAPID-GORTZAK, MD, PhD

Patient B clearly has high demands and an overwhelming desire for spectacle freedom. In order to make a decision, it is important to know his pre-LASIK refraction, keratometry (K) reading, topography, wavefront aberrometry, and pachymetry, along with his current status in terms of biomicroscopy, retinal health, and posterior vitreous detachment. His visual acuity must be measured, as well as his level of glare disability. I would recommend an objective measurement such as straylight measurement, which can then be correlated with the patient's complaints of glare.

If these tests do not show Patient B's eye to be extremely aberrated, it is likely that the laser ablation was well centered. In this situation, a multifocal diffractive IOL would be my first choice. I would choose the AcrySof IQ ReStor IOL (SN6AD1), as we have extensive experience using this lens in eyes that previously underwent a corneal laser procedure. The lens power calculation must be done with the American Society of Cataract and Refractive Surgery (ASCRS)'s postrefractive surgery online calculator (iol.ascrs.org/). Should there be too many discrepancies, I would recommend performing a contact lens over-refraction as well.

Patient counseling is a crucial component of the preoperative process. I would discuss the risks and benefits of cataract surgery with Patient B just as I do with all patients. I would also discuss in depth the expectations with a multifocal diffractive apodized implant versus a monofocal IOL. The fact that this procedure will follow a previous corneal laser procedure will merit additional explanation.

Beside discussing halos, dysphotopsias, blur circle, contrast sensitivity, and economic issues, I would also thoroughly discuss the difficulty of calculating IOL power, the level of refractive accuracy that can be expected, and the possible need for a corneal touch-up procedure after surgery. I would also discuss the costs involved in any such step.

Because Patient B is a relatively young man, I would discuss the possibility of a vitreous detachment with him and mention the excess risk of retinal problems. Patient B must be made aware that, if certain symptoms arise, he will need to urgently seek ophthalmic care. As a rule, I do not perform refractive lens exchange in eyes with an axial length greater than 25 mm without a posterior vitreous detachment. There is increased risk of a retinal detachment secondary to acute posterior vitreous detachment after lens surgery in men under the age of 55 years and those with an axial length of 25 mm or greater.

The recurring use of steroid inhalers points to chronic lung disease. I would operate under local anesthesia, provided the patient can lie still without coughing for 20 minutes. When planning surgery, I would advise Patient B to use his inhalers in the morning and do a coughing session. I would then perform the surgery at noon, when the morning coughs are over. I tell all smokers to stop smoking 2 weeks before surgery; the reason for this is that the ocular surface is connected to the oronasal cavity mucosa by way of the lacrimal ducts, and smokers are known to be more susceptible to infection.

ULRICH MESTER, MD

One important aspect in this case is Patient B's wish to become free of spectacles after cataract surgery.

Highly motivated patients such as Patient B are usually good candidates for multifocal IOLs. Furthermore, the history and ocular findings in this case show no contraindications for multifocal IOL implantation. The cataract is likely steroid-induced and probably bilateral—another reason multifocal IOL implantation is the best choice, as several studies have demonstrated that bilateral multifocal IOLs lead to better visual performance and patient satisfaction compared with unilateral multifocal IOLs.^{2,3}

With IOL selection narrowed to a multifocal IOL, the second consideration is the lens' near addition. There are two important pieces of information in Patient B's history: (1) he performs extended computer work (5 hours per day) and (2) he accepts use of reading glasses for small print. Therefore, the near focus of the multifocal IOL should be suitable for computer work (ie, distance of 50 to 60 cm). In my experience, most patients with similar demands are satisfied with multifocal IOLs with a reduced near addition of 3.00 D, which is approximately 2.50 D at the spectacle plane. Therefore, I would select the AcrySof ReStor IOL +3.0 D. Depending on Patient B's personal needs, a further reduction of near addition may be advantageous. In this case, a multifocal IOL with a 2.00 D near addition might be indicated. I would suggest that the surgeon determine the individual's preferred near focus prior to surgery.

CASE NO. 3

Patient C is a 71-year-old retired chief executive officer who had bilateral penetrating keratoplasty (PKP) for Fuchs endothelial dystrophy. He has noticed a reduction in vision in his left eye over the past year. At examination, his BCVA is 20/60 in the left eye, decreased from 20/25 a year ago. The diagnosis is cortical and nuclear cataract. His refraction is +5.75 -4.50 X 88°, keratometry is +41.25 +45.75 X 5°, and his endothelial cell count is 1,856 cells/mm². What would you do for this patient?

— Case submitted by Sheraz M. Daya, MD, FACP, FACS, FRCS(Ed)

GERD U. AUFFARTH, MD, PhD

I would consider lens-based surgery for Patient C. The question is, however, will the endothelial cell count drop after surgery, necessitating a repeat PKP? On the one hand, a toric IOL could be an interesting choice for this patient to compensate for his corneal astigmatism; however, in the event of corneal decompensation, he would

have to undergo a new PKP, and as a result the cornea will have a different refraction.

Instead, I might choose to perform phacoemulsification, providing corneal protection with an ophthalmic viscosurgical device (OVD), and implant a monofocal IOL. If the cornea remains stable 3 months after surgery, I would then consider implanting a secondary supplementary lens in the sulcus to compensate for residual astigmatism. If in the long run the patient requires a new PKP, the secondary lens can be removed and later replaced with a newly calculated one.

FRANCESCO CARONES, MD

The ocular history of Patient C (Fuchs endothelial dystrophy and bilateral penetrating PKP) is a contraindication for any multifocal IOL approach. The patient's corneal astigmatism is significant, and there is a discrepancy between the K readings and refractive cylinder, meaning that the PKP resulted in some sort of corneal, irregular, asymmetric astigmatism. There is also a high likelihood that the previous surgery may have generated other HOAs such as coma, trefoil, and secondary astigmatism, as is almost always the case with PKP.

Any multifocal IOLs—diffractive, refractive, or zonal—present a compromise in terms of light transmission, and this compromise may be too significant for an eye with a cornea that does not focus properly due to preexisting aberrations. Accommodating IOLs also are not advisable for eyes like this one because of the corneal issues and, most important, the high degree of astigmatism.

The real question for this eye is whether to implant a standard monofocal (aspheric, nontoric) IOL and manage the astigmatism with additional surgery or spectacles or to implant a toric IOL to reduce or correct the astigmatism at the time of cataract surgery. Both strategies have a rationale and are worth discussing.

The first point I would discuss with Patient C is whether he is bothered by the use of spectacles at all distances, as he is already doing for the left eye. If he does not mind, my advice would be targeting plano with the implant and leaving him with the same spectacle regime he is currently using. Unfortunately, we have no information regarding the fellow eye. Assuming that there is no cataract and significant astigmatism due to the PKP, any further consideration depends on Patient C's willingness to surgically correct the astigmatism in the other eye. If he does not want to undergo any astigmatic surgery in the right eye, I would advise him not to have the astigmatism corrected at the time of cataract surgery in his left eye. This would avoid aniseikonia issues.

If Patient C wants some degree of spectacle independence and he is interested in surgical correction of the

astigmatism in his fellow eye, I would probably recommend targeting near (reading) spectacle independence rather than distance. This is because even with some residual astigmatism, spectacle independence at reading distance can be easily achieved. I would suggest cataract surgery in both eyes, followed by implantation of an aspheric toric lens such as the AcrySof Toric IOL, targeted for some residual myopia (-1.50 D for one eye, -2.50 D for the fellow). This would allow me to fix both eyes at the time of a single-step surgery and give the patient a good, stable outcome for the future (with no cataract issues in the right eye).

I would not advise targeting spectacle independence for distance vision, because the preexisting irregular astigmatism, the HOAs, and the possibility of residual regular astigmatism would make this outcome difficult to achieve. I would not correct the astigmatism with LRLs because they are much less reliable and stable than the correction provided by toric IOLs. I would not perform any laser vision correction (LASIK or surface ablation) because Patient C's astigmatism is too high and the accuracy of these procedures after grafts is lower than that of toric IOLs.

JOHN S.M. CHANG, MD

Because Patient C's vision was 20/25 approximately 1 year ago, we can deduce that he had PKP at least 1 year ago. Therefore, his graft should be fairly firm by this point. It appears that his refractive astigmatism is against-the-rule and is similar to his K readings (manifest refraction astigmatism +5.75 -4.50 X 88°; K reading, +41.25 +45.75 X 5°).

I would implant a toric lens (either a monofocal AcrySof Toric or an AT.Torbi) in Patient C and counsel him that, because this surgery is not very accurate, he may need surface ablation a few months later. If his graft wound opens, resuturing will be required. Therefore, I would perform phacoemulsification under low flow and low vacuum to avoid wound opening.

Patient C's endothelial cell count is good. Because there can be 10% to 20% loss of endothelial cells after phacoemulsification, a dispersive OVD is recommended to fill the peripheral anterior chamber and coat the endothelium. During phacoemulsification, repeated injection of the dispersive OVD can further protect the endothelium. I would set the phaco energy very low. To reduce the total phaco energy, I would use a prechopper to split the nucleus. It is important to ensure that the two phaco sideports for outflow of balanced saline solution are not directed toward the endothelium. Use of the phaco tip bevel-up may cause less damage to the endothelium.⁴ In this case, it is important to use as much

manual chopping and suction as possible, relying on phaco only when the tip is occluded.

Either toric lens (AcrySof Toric or AT.Torbi) should be injected through a cartridge directly into the capsular bag to minimize haptic-cornea touch. I would fill the central anterior chamber and the capsular bag with a cohesive OVD so that it can be easily removed, minimizing the amount of time and fluid flow and reducing trauma to the endothelium. During irrigation and aspiration, I would avoid directing the irrigating fluid toward the endothelium. Minimizing the number of entries into the anterior chamber will also cause less damage to the endothelium.

GEORG GERTEN, MD

The long-term prognosis for PKP after Fuchs dystrophy is typically poor; however, Patient C seems to be doing well after his corneal transplantation. Assuming that the transplant has been in the eye for several years, the endothelial cell count is relatively high. Therefore, Patient C will probably not need another transplant during his lifetime, and I would recommend implanting a toric monofocal IOL in his left eye.

In this case, IOL selection will depend on the corneal status. Assuming a stable cornea from which the sutures have been removed, the patient's corneal mechanics and optics must be evaluated; examinations such as Scheimpflug imaging, topography, and optical and ultrasound biometry are mandatory.

Patient C's K readings and refraction correspond nicely in the amount and the axis of astigmatism. This suggests that the total refractive astigmatism is caused almost entirely by the cornea and thus can be corrected with a toric IOL. Corneal astigmatism can be evaluated further with the examinations mentioned above. Even if the cornea has an overall irregular component (ie, HOA) and astigmatism is only partially regular, a toric IOL makes sense. I would expect to find a considerably regular shape in the central 3-mm zone. This regular portion of astigmatism and the ametropia could then be corrected by implanting a custom-made toric IOL such as the Basis-Z or the Add-On IOL.

If Patient C has high corneal astigmatism, precise axis alignment between the IOL and central corneal astigmatism is important. Using an axis-alignment system such as an intraoperative aberrometer or guiding system to compare intra- and preoperative images of the eye can create intraoperative difficulties with highly aberrated corneas, as is the case with this patient. To secure the precise axis for toric IOL implantation, I would use a one-step 360° corneal marker with special blades and ink (Gerten Pendulum Marker G-33764; Geuder AG), marking the correct corneal axis with Patient C in an upright

position. With this device, I can mark the final implantation axis in one step and identify the correct implantation axis intraoperatively without additional tools.

I would then create a temporal posterior-limbal incision, keeping maximal distance from the host-graft interface. After careful phacoemulsification is performed with maximal endothelial protection, I would implant a toric IOL into the capsular bag, dialing it into the correct axis.

Despite all surgical efforts, the endothelium in any patient can decompensate in the future. If this occurs, I would recommend not to do a secondary PKP but would instead perform a selective lamellar endothelial transplant such as Descemet membrane endothelial keratoplasty behind the old transplant, removing only the endothelium. This approach is less traumatic than PKP and preserves the refractive status of the eye so that the cornea and toric IOL can keep working together.

RUTH LAPID-GORTZAK, MD, PhD

Before treating Patient C, I would examine his bilateral refraction, visual acuity, corneal topography, pachymetry and endothelial cell count. The status of the corneal sutures would guide the first step. If the PKP was performed less than 1 year ago and the vision in the patient's other eye is good, I would wait to take out the sutures until at least 1 year after surgery. I would then perform corneal topography 4 to 6 weeks later and implant a toric monofocal IOL at cataract surgery. If the sutures have already been removed, I would proceed more rapidly to cataract surgery and use a toric monofocal lens, such as the AcrySof Toric, the AT.Torbi, the Lentis Mplus, or the T-flex toric IOL (Rayner Intraocular Lenses, Ltd.).

Depending on the status of the contralateral eye, in terms of the cornea, sutures, and refraction, I would discuss the option of a unilateral procedure with Patient C. Implanting a toric monofocal IOL would maximize the UCVA in his cataractous eye. I would explain that the IOL will not solve surface irregularity issues and that these may need attention in the future in the form of contact lenses or PRK with mitomycin C.

The asymmetry between eyes is not a cause for great concern unless I would be inducing significant anisometropia and aniseikonia. If this were the case for Patient C, I would discuss a bilateral approach, in which the choice of IOL would depend on his refraction. My preferred lens would be the AT.Torbi monofocal toric lens, the Mplus plate-haptic monofocal toric lens (especially in the higher cylinders, as they are custom-made), or the T-flex monofocal toric IOL, as these three lenses have the best rotational stability.



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Preoperatively I would inform Patient C of all costs related to the different scenarios. I would also explain that cataract surgery in a patient after corneal transplant carries the risk of graft rejection or graft failure. I would discuss the extra protective measures that I will take at the time of surgery and explain that Patient C will have closer follow-up postoperatively to ensure graft survival.

I use the Mendez Ring and the Nuijts Toric Axis Marker (Model No. AE-2740; ASICO) to mark the axis of astigmatism using the waterpass system. If I had an unlimited budget, however, video- and wavefront-based equipment seem to me the most accurate and easiest means of marking the axis.

I would use my standard surgical approach, creating a limbal incision and opening the conjunctiva. I would take care that the main incision as well as the sideport incisions do not go through the grafted tissue. Because of the change in corneal and ocular rigidity after corneal transplantation, I would suture the wound to provide more assurance of the desired postoperative outcome and to prevent excessive corneal flattening at the wound. I would use a heavy OVD to enhance endothelial protection. Additionally, I would significantly increase the usual amount of topical steroids in the first few days after surgery to prevent corneal graft rejection.

ULRICH MESTER, MD

Patient C presents with a unilateral cataract and high corneal astigmatism (4.50 D) after successful keratoplasty. Fortunately, the endothelial cell count is 1,856 cells/mm²; however, because cataract surgery is challenging after keratoplasty, endothelial morphology should be further investigated. Given normal findings, cataract surgery with optimal protection of the endothelium by injecting Viscoat (Alcon Laboratories, Inc.) or Healon 5 (Abbott Medical Optics Inc.) can be performed with limited risk.

Because Patient C's corneal astigmatism is regular, a toric IOL is indicated. Some companies offer toric IOLs with the high cylinder power that is needed in this eye. Due to my personal experience with toric IOLs, I would expect a satisfying result. ■

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