

Limbal Relaxing Incisions and Premium IOLs

In patients with astigmatism fitted with a premium lens, LRIs can enhance the postop outcome.

BY BARTLOMIEJ J. KALUZYNY, MD

The goal of modern cataract surgery is for patients to achieve distance, intermediate, and near vision without correction. In the past few years, we have witnessed a dramatic increase in implantations of newer IOL models that allow patients greater opportunity to live without glasses—presbyopia-correcting lenses. However, spectacle independence cannot be promised without the use of appropriate techniques for astigmatism correction. Is there still room for conventional limbal relaxing incisions (LRIs) in the era of excimer and femtosecond laser technology?

LIMBAL RELAXING INCISIONS

Corneal relaxing incisions, also called astigmatic keratotomy, have been used for decades to reduce high pre-existing corneal astigmatism in cataract patients.¹ Single or paired arcuate incisions are placed concentric to the visual axis to a depth of 90% of the thinnest pachymetry measurement. Corneal relaxing incisions correct relatively high astigmatism, but they have limited predictability, especially for lower cylindrical refractive errors.

In the 1990s, surgeons began to move the location of relaxing incisions to the limbus. LRIs (Figure 1) produce less astigmatism correction than corneal incisions; however, they result in smoother corneal topographies and less corneal irregularity. They have a better safety profile, are easier to perform, and are more comfortable for the patient than corneal incisions. Additionally, precise on-axis placement of LRIs is not as crucial because of their length (4–12 mm). Several nomograms have been developed to improve predictability and clinical outcomes.

LRIs are a well-established refractive incisional technique for astigmatism correction² most commonly performed at

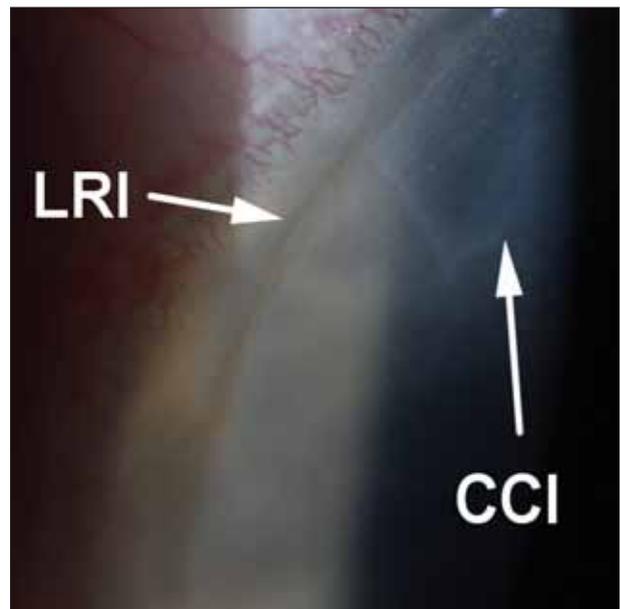


Figure 1. The location of the LRI induces less corneal irregularity compared with clear corneal incisions (CCI).

the time of cataract surgery with implantation of a monofocal, multifocal, or accommodating IOL. How does their performance compare with toric IOLs? My study³ revealed that both methods are predictable and effective in correcting preexisting corneal astigmatism up to 3.00 D, with high patient satisfaction in both groups; however, the toric IOL group achieved significantly better results in UCVA, contrast sensitivity, subjective residual refraction, and spectacle independence for distant vision. Table 1 summarizes advantages and disadvantages of both procedures. Other options for intraoperative astigmatism correction, such as clear

TABLE I. ADVANTAGES AND DISADVANTAGES OF LRIs AT THE TIME OF PHACOEMULSIFICATION VS TORIC IOL IMPLANTATION

	LRIs	Toric IOL
Precise on-axis placement	+	√
Risk of rotation	+	√
Predictability of refractive result		√ +
Difficulty to perform	√	+
Risk of complications	√	+
Reversibility of the procedure		√ +
Corneal stability		√ +
Quality of vision		√ +
Patient satisfaction	√ +	√ +
Cost	+	√
Total score	++++	+++++++

√ = presence of the feature, + = advantage

corneal incisions in the steep axis or opposite clear corneal incisions, are used only in selected cases.

PREMIUM IOLs

Premium IOLs are usually a synonym for presbyopia-correcting IOLs, although some surgeons include toric IOLs in this category. There are many presbyopia-correcting-lens concepts, including refractive and diffractive multifocal IOLs and accommodating IOLs, which are, at this time, more appropriately called *pseudoaccommodating IOLs*.

Just 10 years ago in the United States, only one zonal refractive multifocal IOL was available (Array; Abbott Medical Optics Inc., Santa Ana, California; no longer available). In 2005, three premium lenses were approved by the US Food and Drug Administration (FDA): a single-optic accommodating lens (Crystalens; Bausch + Lomb, Rochester, New York), a zonal refractive multifocal IOL (ReZoom; Abbott Medical Optics Inc.), and a diffractive multifocal IOL (AcrySof Restor; Alcon Laboratories, Inc., Fort Worth, Texas). More recently, an aspheric diffractive lens (Tecnis Multifocal; Abbott Medical Optics Inc.) became available.

These same lenses are available in Europe, where they are the most popular presbyopia-correcting IOL models; however, we have a larger selection of presbyopia-correcting lenses compared with our peers in the United States. Many accommodating lenses have received the Conformité Européenne (CE)-Mark but are awaiting FDA evaluation, such as the Akkommodative 1CU (HumanOptics AG, Erlangen, Germany), the Tetraflex (Lenstec, St. Petersburg, Florida) and the dual-optic Synchrony (Abbott Medical Optics Inc.).

We also have additional multifocal lens technologies in

Europe, including the AT.LISA (Carl Zeiss Meditec, Jena, Germany), M-flex (Rayner Intraocular Lenses Ltd., East Sussex, United Kingdom), and Lentis Mplus (manufactured and distributed by Oculentis GmbH, Berlin, and Topcon Europe, Rotterdam, Netherlands). The latest approval in the European market is the first multifocal toric IOL, the M-flex T; European surgeons are also anticipating approval of the AT.LISA toric and awaiting the official launch of the Mplus Toric at the World Ophthalmology Congress in Berlin in June.

DO LRIs AND PRESBYOPIA-CORRECTING IOLs WORK TOGETHER?

Preoperative corneal astigmatism of 1.00 D or more is the most common contraindication for implantation of multifocal or accommodating IOLs. Multifocal IOLs are especially sensitive to residual cylindrical refractive error resulting in patient dissatisfaction and postoperative spectacle dependence.

About 30% of eyes undergoing cataract surgery have at least 1.00 D of astigmatism,⁴ and eliminating visually significant corneal astigmatism is one of the key factors in successful premium IOL implantation. These facts have led physicians to revisit LRIs as an option to treat preoperative corneal astigmatism at the time of cataract surgery. My own unpublished results using the Nichamin age- and pachymetry-adjusted (NAPA) nomogram show a reduction of mean corneal astigmatism from 2.19 D to 0.98 D. Muftuoglu et al⁵ provide stronger evidence of success with LRIs in conjunction with premium IOLs, with the preoperative mean keratometric astigmatism of 1.30 ±0.68 D reduced to 0.59 ±0.48 D postoperatively. Some

TAKE-HOME MESSAGE

- Limbal relaxing incisions result in less corneal irregularity and more comfort for the patient than corneal incisions, but they induce less astigmatism correction.
- LRIs predictably and effectively correct up to 2.00 D of preexisting corneal astigmatism, but toric IOLs perform even better.

eyes with higher corneal astigmatism (28.7%) required subsequent LASIK for residual refractive error correction.

Postoperative laser vision correction after implantation of presbyopia-correcting IOLs is a viable strategy for patients with significant preoperative corneal astigmatism. However, the main disadvantage is the need for and cost of an additional surgical procedure. It is essential to inform the patient of the possibility of the need for further intervention before cataract surgery. Muftuoglu⁵ shows that laser enhancement can successfully be done after previously performed LRIs.

CONCLUSION

LRIs are a predictable and effective means of correcting preexisting corneal astigmatism up to 2.00 D at the time of presbyopia-correcting IOL implantation. However, some eyes may require further laser enhancement. LRIs may increase the percentage of patients who fulfill inclusion criteria for premium IOLs and improve clinical outcomes in these patients. Another option that is worth recommending is postoperative laser enhancement, which can also be done after LRIs. Further development of premium IOLs, such as the recent introduction of toric multifocal lenses, will diminish the need for both LRIs and laser enhancements in the future. ■

Bartłomiej J. Kaluzny, MD, is an Assistant Professor, Department of Ophthalmology, Collegium Medicum, Nicolaus Copernicus University, Poland, and Consultant Ophthalmic Surgeon, Oftalmika Eye Hospital, Poland. Dr. Kaluzny states that he has no financial interest in the products or companies mentioned. He may be reached at e-mail: bartka@by.onet.pl.



1. Gills GP. Treating astigmatism at the time of cataract surgery. *Curr Opin Ophthalmol.* 2002;13:2-6.
2. Carvalho MJ, Suzuki SH, Freitas LL, Branco BC, Schor P, Lima AL. Limbal relaxing incisions to correct corneal astigmatism during phacoemulsification. *J Refract Surg.* 2007;23:499-504.
3. Kaluzny BJ. Management of astigmatism at the time of cataract phacoemulsification: limbal relaxing incisions versus AcrySof Toric implantation. Presented at: XXVII Congress of the ESCRS; September 12-16, 2009; Barcelona, Spain.
4. Ferrer-Blasco T, Montés-Micó R, Peixoto-de-Matos SC, González-Méijome JM, Cervino A. Prevalence of corneal astigmatism before cataract surgery. *J Cataract Refract Surg.* 2009;35:70-75.
5. Muftuoglu O, Dao L, Cavanagh HD, McCulley JP, Bowman RW. Limbal relaxing incisions at the time of apodized diffractive multifocal intraocular lens implantation to reduce astigmatism with or without subsequent laser in situ keratomileusis. *J Cataract Refract Surg.* 2010;36:456-464.

(Continued from page 47)

CONCLUSION

Implanting toric IOLs appears to be an efficient, safe, and predictable method for managing corneal astigmatism in cataract patients and a viable product offering for the premium IOL surgeon. Those considering introducing toric IOLs to their practice are encouraged to do so, as these lenses provide the opportunity for patients with astigmatism to achieve excellent distance UCVA and resulting spectacle independence. ■

Noël J.C. Bauer, MD, PhD, practices in the Department of Ophthalmology at the Academic Hospital, Maastricht, Netherlands. Dr. Bauer states that he is a consultant to Acri.Tec (now Carl Zeiss Meditec). He may be reached at e-mail: n.bauer@mumc.nl.

Rudy M.M.A. Nuijts, MD, PhD, is an Associate Professor of Ophthalmology in the Department of Ophthalmology at the Academic Hospital, Maastricht, Netherlands. He is a member of the CRST Europe Editorial Board. Dr. Nuijts states that he is a consultant to Alcon Laboratories, Inc., Ophtec, and ASICO, and receives research funding from Alcon Laboratories, Inc., and Ophtec. He may be reached at e-mail: rudy.nuijts@mumc.nl.



Nienke Visser, MD, is a doctoral (PhD) student in the Department of Ophthalmology at the Academic Hospital, Maastricht, Netherlands. Dr. Visser states that she has no financial interest in the products or companies mentioned. She may be reached at tel: +31 43 3877133; e-mail: nienke.viss-er@mumc.nl.

1. Ferrer-Blasco T, Montes-Mico R, Peixoto-de-Matos SC, et al. Prevalence of corneal astigmatism before cataract surgery. *J Cataract Refract Surg.* 2009;35:70-75.
2. Chang DF. Early rotational stability of the longer STAAR toric intraocular lens: fifty consecutive cases. *J Cataract Refract Surg.* 2003;29:935-940.
3. De Silva DJ, Ramkissoon YD, Bloom PA. Evaluation of a toric intraocular lens with a Z-haptic. *J Cataract Refract Surg.* 2006;32:1492-1498.
4. Linnola RJ, Sund M, Ylonen R, et al. Adhesion of soluble fibronectin, vitronectin, and collagen type IV to intraocular lens materials. *J Cataract Refract Surg.* 2003;29:146-152.
5. Bauer NJ, de Vries NE, Webers CA, et al. Astigmatism management in cataract surgery with the AcrySof toric intraocular lens. *J Cataract Refract Surg.* 2008;34:1483-1488.
6. AcrySof Single-Piece Posterior Chamber Intraocular Lenses with Toric Optic, models SA60T3, SA60T4 and SA60T5. U.S. Food and Drug Administration. Document number P930014/S15, 2005.
7. Chang DF. Comparative rotational stability of single-piece open-loop acrylic and plate-haptic silicone toric intraocular lenses. *J Cataract Refract Surg.* 2008;34:1842-1847.
8. Dardzhikova A, Shah CR, Gimbel HV. Early experience with the AcrySof toric IOL for the correction of astigmatism in cataract surgery. *Can J Ophthalmol.* 2009;44:269-273.
9. Mendicutie J, Irigoyen C, Aramberri J, et al. Foldable toric intraocular lens for astigmatism correction in cataract patients. *J Cataract Refract Surg.* 2008;34:601-607.
10. Zuberbuhler B, Signer T, Gale R, et al. Rotational stability of the AcrySof SA60TT toric intraocular lenses: a cohort study. *BMC Ophthalmol.* 2008;8:8.
11. Weinand F, Jung A, Stein A, et al. Rotational stability of a single-piece hydrophobic acrylic intraocular lens: new method for high-precision rotation control. *J Cataract Refract Surg.* 2007;33:800-803.
12. Liekfeld A, Torun N, Friederici L. A new toric diffractive multifocal lens for refractive surgery. *Ophthalmologe.* 2010;107(3):256-261.
13. Peckar C. Rayner Centreflex Toric IOL shows stability in astigmatic eyes. Paper presented at: the XXIV Congress of the ESCRS; September 9-13, 2006; London.
14. Harman F, Sim K, Lee N. Evaluation of the Rayner T-flex toric intraocular lens. Paper presented at: the XXV Congress of the ESCRS; September 8-12, 2007; Stockholm, Sweden.
15. Borkenstein AF, Reuland A, Limberger IJ, et al. Transscleral fixation of a toric intraocular lens to correct aphakic keratoplasty with high astigmatism. *J Cataract Refract Surg.* 2009;35:934-938.