Laser Refractive Surgery After Multifocal IOL Implantation

Special considerations are needed when correcting residual refractive errors in this population.

BY ORKUN MUFTUOGLU, MD

Cataract and refractive surgery have greatly improved in the past 2 decades, and patient expectations have risen significantly. Monofocal IOLs are usually implanted to provide patients with the best possible distance correction after crystalline lens removal, but as a result patients become presbyopic. Multifocal IOLs were introduced with the aim of restoring both distance and near visual acuities without the need for additional correction.[1] Despite limitations with early models related to glare and halos,[1] recent multifocal IOL models have been reported to provide powerful near correction with fewer unwanted visual phenomena.[2-4]

Because multifocal lenses inherently split the available incoming light, eyes with these implants may be more sensitive to changes in contrast sensitivity associated with residual refractive error, posterior capsular opacification (PCO), and macular disease.[1-4] Despite advances in IOL power calculation, there may still be residual spherical refractive error as well as surgically induced astigmatism after IOL implantation.[5,6] Additionally, it is reported that, for a general cataract population, approximately 10% of patients come to surgery with greater than 2.00 D of cylinder, and another 20% have between 1.00 and 2.00 D.[7] Enhancements are often necessary to provide patients with spectacle independence for distance and near vision after lens extraction with presbyopia-correcting IOLs.

Previous studies have demonstrated that laser vision correction, particularly LASIK with femtosecond-laser flap creation, is a safe and effective modality for refractive error correction.[8] This modality can also be used for the correction of residual ametropia after multifocal IOL implantation. Compared with other refractive modalities such as incisional keratotomy and conductive keratoplasty, laser vision correction can precisely correct residual myopia, hyperopia, and astigmatism, as well as higher-order aberrations.[8]

CONSIDERATIONS FOR SECONDARY LASIK

This article reviews some of the issues that must be considered in performing secondary LASIK in patients after multifocal IOL implantation.

Patient discussion. Prior to lens surgery, the surgeon should devote extra time to discussing the advantages and disadvantages of multifocal IOLs and the possible need for further correction of residual refractive errors after surgery. Also, it would be wise to define the financial responsibilities of the surgeon and the patient in advance.

Refractive stability. Scheimpflug imaging studies show that the IOL adheres to the capsule within 2 months after lens surgery. However, corneal changes can occur up to 6 months after cataract surgery.[4] After that, dehiscence of self-sealing incisions is unlikely during flap creation with a femtosecond laser or microkeratome. Therefore, it is wise to wait at least 6 months before proceeding with further laser vision correction.[5]

It is possible that autorefractometers and wavefront refractive error measurements may not be accurate, and even manifest refractions can be multifocal in eyes with presbyopia-correcting IOLs. In these patients, it is important to perform a careful retinoscopic evaluation and determine manifest refraction by pushing toward the most hyperopic refraction possible that refracts the distance portion of the lens. Also, the manifest refraction should be confirmed just before the correction to detect any fluctuation.[5]

Preoperative exam. It would be better to perform measurements before lens extraction and compare them with postoperative measurements to determine whether laser vision correction is possible and safe. Any ocular disease that decreases contrast sensitivity can affect outcomes with multifocal IOLs. Slit-lamp examination will help to identify corneal disease, pupil and iris problems, IOL problems such as decentration and phacodonesis, and the clarity of the

posterior capsule. A funduscopic examination and/or optical coherence tomography (OCT) should be performed to exclude the presence of macular and optic-nerve disease.

Anterior segment OCT or ultrasound biomicroscopy can be performed to identify any IOL, iris, and ciliary body problems. Although keratoconus progression decreases with older age, corneal topography should be carefully evaluated before and after lens extraction. Additionally, recent technologies such as Scheimpflug rotating imaging or the Ocular Response Analyzer (Reichert Ophthalmic Instruments, Depew, New York) may be helpful. Reliable pachymetry measurements are important to make sure that there will be enough residual stroma to allow excimer laser ablation. In eyes with previous refractive surgery, residual stromal thickness measurements with anterior segment OCT can help to identify if it is safe to perform further excimer laser treatment.

In eyes with multifocal IOLs, photic phenomena such as halos, glare, and starbursts can be 3.5 times more likely to occur than with monofocal IOLs and may persist even after Nd:YAG laser capsulotomy.[9] Laser refractive surgery studies suggest that most of these symptoms get better within a year,[10] possibly because of neural adaptation. However, these symptoms should be discussed with the patient, and a decision regarding IOL exchange should be made before any further Nd:YAG capsulotomy or excimer laser enhancement.

Dry eye. A large epidemiologic study demonstrated that the prevalence of dry eye syndrome can be up to 33%,[11] and another study found that self-reported dry eye symptoms were noted by 14.4% of patients aged 48 to 91 years.[12] A 3-mm full-thickness clear-corneal incision during cataract surgery cuts all the corneal nerves traversing its segment, and this may increase dry eye symptoms.

Dry eye is also a common problem after LASIK,[13] and the suggested cause is the severing of corneal nerves during creation of the flap, whether with microkeratome or femtosecond laser. Because multifocal IOLs split incoming light, the effects of dry eye on visual quality may be exacerbated by multifocal IOL implantation.[14] Therefore, there is a high likelihood of encountering dry eye problems in a 65-year-old female patient who undergoes cataract surgery with multifocal IOL implantation and further correction with LASIK. In a study of 85 eyes (59 patients), we found that dry eye was the only reason for lost lines of BCVA (ie, two eyes lost 1 line of BCVA).[5]

Among the diagnostic tests available for the evaluation of dry eye, conjunctival staining with lissamine green can facilitate a diagnosis within seconds.[15] Rose bengal and fluorescein corneal staining; Schirmer testing; and evaluation of tear film meniscus, debris, and corneal sensation also can be helpful in the diagnosis of dry eye. Diagnosis of meibomian gland disease is easy after evaluation of the lid margin for inspissated glands. Pre- and postoperatively, the surgeon should treat the patient's ocular surface aggressively with artificial tears, ointments, topical cyclosporine, punctal plugs, and/or nutritional supplements as needed. Other ocular surface and lid problems such as significant conjunctivochalasis, ectropion, floppy eyelids, and lagophthalmos should be addressed appropriately.

Capsulotomy. High rates of Nd:YAG laser capsulotomy have been reported after multifocal IOL implantation[14,16] because lower grades of PCO become more visually significant in eyes with multifocal IOL implantation than in eyes with monofocal IOLs.

We have found even higher Nd:YAG rates in eyes that undergo laser refractive correction after multifocal IOL implantation for several reasons: (1) PCO can interfere with accurate refractions and wavefront aberrometry, (2) capsulotomy may enhance visual quality and allow better assessment of manifest refraction and decisions regarding further LASIK surgery, and (3) changes in refraction due to movement of the IOL after capsulotomy should be taken into consideration before further laser correction.[17] Therefore, the surgeon should have a low threshold to perform capsulotomy before refractive enhancement in eyes with multifocal IOLs.

On the other hand, capsulotomy should be reserved until all other causes of patient complaints are treated or addressed, because IOL exchange is significantly more challenging with an open posterior capsule. In a recent study,[5] we did not observe any complication related to laser capsulotomy, and we observed no difference in visual and refractive outcomes between eyes that underwent Nd:YAG laser capsulotomy and eyes that did not.

TREATMENT OPTIONS

LASIK or surface ablation. Because LASIK provides faster visual recovery than surface ablation techniques such as PRK, LASEK, and epi-LASIK, many patients and surgeons prefer LASIK.[8] Recently, with the advent of femtosecond lasers, flap complications are fewer. It is advisable to use femtosecond lasers to create LASIK flaps when possible.[5] However, the surgeon must be careful about epithelial ingrowth and other flap complications and should treat these conditions appropriately.

TAKE-HOME MESSAGE

- LASIK with femtosecond laser flap creation may correct residual ametropia after multifocal IOL implantation.
- In eyes with multifocal IOLs, photic phenomena can be 3.5 times more likely to occur than with monofocal IOLs and may persist even after Nd:YAG laser capsulotomy.

On the other hand, surface ablation may be a safer option in certain cases, such as eyes with thin corneas or suspicious corneal topographic patterns. In the presence of significant amounts of corneal neovascularization and anterior basement membrane dystrophy, surface ablation should be preferred over LASIK. Also, eyes with a compromised endothelium are at risk for a poorly adherent LASIK flap.

Conventional or wavefront-guided treatment. It has been reported that wavefront-guided laser treatments may provide better outcomes compared with conventional LASIK.[18] Some excimer lasers have the ability to perform customized LASIK with iris registration (IR), which may result in better astigmatism correction. However, there are some concerns about the accuracy of Hartmann-Shack aberrometry in eyes with multifocal IOLs because of the multifocality of the lens or in the presence of capsular opacity or a small capsular opening. If the manifest refraction of the eye matches the wavefront measurement, it would be advisable to prefer wavefront-guided treatment to standard ablation. In eyes with suspect wavefront measurements, conventional LASIK can be performed with good results.

In a recent study, we were able to perform wavefront-guided treatment with IR in only 13 of 85 (15%) eyes, mainly due to inability to capture an image with the wavefront system, and we observed no significant difference in refractive and visual outcomes between conventional and wavefront-guided IR treatments.[5]

CORRECTION OF MYOPIA, HYPEROPIA, AND ASTIGMATISM

We found that correction of different refractive errors (myopia, hyperopia, and astigmatism) was almost equally effective and had similar postoperative outcomes.[5] The mean distance and near UCVA improved in all groups, except the mean near UCVA may decrease after myopic corrections, particularly in the case of overcorrection.

Residual refractive errors cannot always be corrected with just one treatment, and patients should be informed about the possibility of further retreatments. Our study showed that retreatments after LASIK are possible with good results.[5] Compared with surface ablation, retreatments are easier after LASIK with relifting of the flap. However, it should be noted that the risk of epithelial ingrowth increases with each retreatment after LASIK.

OUR EXPERIENCE

In a study of 85 eyes of 59 patients who underwent LASIK to correct residual refractive errors after implantation of an apodized diffractive multifocal IOL (AcrySof Restor, Alcon Laboratories, Inc., Fort Worth, Texas) at University of Texas Southwestern Medical Center at Dallas, we found excellent refractive results; 99% of eyes were within ±1.00 D, and 96% of eyes within ±0.50 D of emmetropia at last follow-up. The predictability of astigmatic correction was good, with 98% of eyes within ±1.00 D of cylinder. Overall, these patients had good concurrent uncorrected distance and near visual acuity, with 86% of eyes having distance UCVA of 20/25 or better and near UCVA of J1 or better concurrently.[5]

CONCLUSION

Laser refractive surgery is a safe and an effective modality for the correction of residual refractive errors after multifocal IOL implantation. However, this treatment requires not only additional careful preoperative evaluation and extra time to discuss with the patient but also knowledge and experience about corneal diseases and refractive surgery. ■

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