A residual refractive error after premium IOL implantation, in cataract surgery or other refractive lens procedures, is a major cause of patient dissatisfaction. Coinciding with an increase in the accuracy of postoperative refractive and visual outcomes, there has been an increase in patient demands for optimal outcomes. For patients with a residual refractive error, a bioptics procedure is usually an effective means of improving their vision, refraction, and satisfaction.

Surgeons have accepted stepped interventional treatment as the best way to resolve refractive errors. The term bioptics was coined for treatments in which patients with high myopia underwent clear lens extraction with maximal possible correction of the error using an IOL and consecutive corneal excimer laser surgery to treat the remaining myopia. Slowly, the focus of bioptics has shifted from being used to treat large refractive errors to the correction of smaller refractive errors.

Bioptics can be beneficial to treat residual refractive errors after multifocal IOL implantation.

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ASSESSMENT

The method of retreatment, whether it is LASIK or surface ablation, depends on the surgeon’s preference. Because residual refractive errors after lens implantation are usually quite small, the preoperative assessment, especially for the tear film and posterior capsule, is extremely important.

Tear film. Abnormalities of the tear film must be ruled out as a reason for the visual complaints, as these patients are often older than those typically seeking corneal refractive surgery. If dry eye disease is confirmed, it must be addressed before proceeding with any enhancement. Treatment can include warm compresses, lubricants, and tetracylines for meibomian gland dysfunction and topical cyclosporine for tear production deficiency.

One helpful method of grading the ocular surface’s response to cyclosporine treatment is the lissamine green score. With this test, the ocular surface is divided into three areas: nasal conjunctival, central corneal, and temporal conjunctival. Each area can score between 0 and 3 on staining (0 = no staining; 3 = confluent staining). The total score ranges between 0 and 9 and will decrease in patients responsive to cyclosporine, thus implying improvement.

Cyclosporine treatment also allows more time for neural adaptation, and it is crucial for the surgeon to await a response to cyclosporine in terms of tear film parameters before proceeding with any surgery. After this period, patients will usually convey how motivated they are to have another procedure to gain better UCVA.

Posterior capsule. The posterior capsule plays a major role in visual quality, especially in patients who receive diffractive multifocal IOLs. The dilemma is whether routine posterior capsulotomy should be performed in every patient before laser enhancement. The advantage of doing a Nd:YAG posterior capsulotomy is that the posterior capsule and any...
opacification are removed and, therefore, will not influence the refraction. This enables a more accurate calculation and treatment. However, performing a posterior capsulotomy comes with a low risk of major complications including cystoid macular edema, retinal detachment, and IOL dislocation. Additionally, and most importantly, capsulotomy makes an IOL exchange, if needed, a more complex procedure.

There are scant data in the literature on the effects of Nd:YAG laser posterior capsulotomy on IOL position. The concern that capsulotomy may change the IOL position, and thus the refraction, was the basis of our recent study.9 Taking refraction as a surrogate for IOL movement, we found that, in about 5% of patients with a diffractive apodized multifocal IOL, the refraction changed more than 0.50 D after the capsulotomy. Additionally, some of these patients needed a laser enhancement after the capsulotomy.

Based on our study, we decided against routine Nd:YAG posterior capsulotomy before laser enhancement of a residual refractive error. We now explain to patients that there is a choice: capsulotomy followed by laser, or laser followed by treating posterior capsular opacification if needed. In the latter, the patient must also understand the chance for a possible change in refraction later, which we again would treat if needed. Thus far, all of our patients have followed our advice and chosen the latter (safer) option.

**DEBATE: WHICH RETREATMENT METHOD IS BEST?**

We have conducted a study on the outcomes of LASIK versus LASEK for bioptics procedures. Outcomes were comparable in terms of refraction, visual acuity, safety, and efficacy indices (Figure 1).10 The most common side effect, occurring in 8% of the LASEK eyes and 4% of the LASIK eyes, was a residual refractive error.10 The timing of bioptics surgery in our clinic is usually 6 months after the IOL procedure, after stabilization and neural adaptation have been achieved; however, it can be done as early as 6 weeks post-IOL surgery. One technique is to cut a LASIK flap before the IOL surgery, lifting the flap only if bioptics is needed. We believe extra intervention should be performed only when indicated to reduce the risks associated with flap creation.

Complications are the same in bioptics as they are in primary LASIK and LASEK procedures. The only major difference is that the mean age of patients undergoing bioptics is about 20 years older, and therefore issues of epithelial adhesion, dry eyes, and delayed healing may be more of a concern.

**TREATMENT NOMOGRAMS**

Using nomograms for wavefront-based treatments3,5,6,8,10 for bioptics procedures in multifocal pseudophakic eyes is problematic, as measurement of the wavefront in those eyes is unreliable. First, the optic of the IOL is usually 6 mm and the diameter of the wavefront measurement requires a diameter of the pupil to be at least 6 mm in most instances. Therefore, the aberrations extending beyond the 6-mm optic of the IOL are incorporated into the measurement and the calculation. Because these erroneous measurements are corrected on the central cornea, unreliable results after the bioptics procedure may result.

Second, there is an issue with the reliability of the measurement. Which corrective surface of the IOL will be measured? Will the distance-corrective surface be measured or will the near-addition surface be measured? In our experience, the use of a good subjective refraction, with the verification of visual acuity for distance and near, is a reliable method of treating the refractive error. In cases with decentered lenses, the refraction may not lead to an optimal visual acuity, even when corrected, and this is an indication for repositioning the IOL.

Using wavefront nomograms for radially asymmetric multifocal IOLs is even more problematic, as subjec-
Figure 2. Percentage of multifocal pseudophakic eyes undergoing a secondary corneal laser procedure, from the total number of eyes undergoing a multifocal implantation per quarter of a year. The effect of changes in procedures is shown with arrows: (1) Use of the IOLMaster with newer software, (2) Reducing the operative wound from 2.75 to 2.2 mm, (3) Implementation of multifocal toric IOL for patients with a corneal cylinder greater than 1.50 D, and (4) Use of relaxing incisions in patients with a cylinder between 1.00 and 1.50 D on axial Orbscan (Technolas Perfect Vision GmbH) topography.

decrease, however, was from implementing multifocal toric IOLs for patients with a corneal cylinder greater than 1.50 D (Figure 2; Arrow 3). The use of relaxing incisions to treat lower astigmatism, for which toric IOLs are superfluous, contributed to another decrease in the incidence of bioptics (Figure 2; Arrow 4). It should be noted that fluctuations related to the sample sizes in the specific time periods can occur.

**CONCLUSION**

Careful biometry and preoperative analysis increases the accuracy of outcomes and is essential to avoid the need for bioptics. However, when bioptics is needed, treatment parameters must be assessed as in any procedure, and the risk-benefit ratio discussed, preferably at the time of informed consent for the initial lens surgery. Bioptics is an important tool for the refractive cataract surgeon, allowing the improvement of results and increased patient satisfaction.

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