

LASIK Bioptics

Planning performance strategies to maximize refractive outcomes.

BY Y. RALPH CHU, MD

The evolution of cataract surgery techniques and advancements in IOLs have blurred the line between refractive and cataract surgery. Improved technologies as well as patients' higher expectations have heightened the importance of treating postoperative residual refractive error, which can be the cause of increased night vision complaints. Patients receiving presbyopia-correcting IOLs can be very sensitive to small amounts of astigmatism ($\geq 0.75D$). They may experience more significant degradation in their quality of vision and be more likely to notice a decrease in their ability to read without correction than patients without residual astigmatism.

A surgical technique that can precisely treat this type of residual refractive error is essential. A planned bioptics procedure with LASIK or advanced surface ablation is an excellent way to maximize patients' outcomes.

HISTORY OF BIOPTICS

The concept of bioptics was first described by Roberto Zaldivar, MD,¹ when he performed LASIK to correct residual refractive error in eyes that had received phakic IOLs. Dr. Zaldivar found that the bioptics procedure was an effective and predictable method for correcting residual error in patients who had extreme preoperative myopia of up to $-35.00D$. In 1994, José Güell, MD, described his concept of adjustable refractive surgery²; he performed LASIK to correct residual ametropia after different types of intraocular surgeries, including implantation surgeries for IOLs and phakic IOLs, penetrating keratoplasties, and corneal refractive surgeries such as PRK and radial and arcuate keratotomy.³ Currently, ophthalmologists use the term *bioptics* when techniques for IOL implantation are followed by a procedure involving excimer laser corneal ablation such as LASIK, Epi-LASIK, or PRK.⁴⁻⁹ The advantage of placing the IOL first is the improvement in the patient's quality of vision. Using corneal refractive surgical techniques, such as LASIK, as a secondary enhancement tool improves the accuracy of the final refractive outcome.

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REASONS FOR BIOPTICS

Potential candidates for a planned bioptics procedure include patients who wish to minimize their dependence on corrective eyewear after lens surgery. If a patient desires a presbyopia-correcting IOL and has more than $0.75D$ of residual postoperative astigmatism with a healthy cornea, he may be a good candidate for a planned bioptics procedure. Most available excimer lasers can effectively treat up to $5.00D$ of astigmatism. For higher levels, the surgeon may use a combination of limbal relaxing incisions with bioptics to effectively fine-tune the refractive outcome.

PATIENT ASSESSMENT

Surgeons should first confirm the health of the cornea and ocular surface with a complete anterior segment examination, including corneal topography, corneal pachymetry, and Schirmer's testing. Other tests such as tear breakup time and Lissamine Green staining (Accutome, Inc., Malvern, PA) can also be considered to assess the quality of the ocular surface.

Many patients undergoing cataract surgery and lens implantation are more than 50 years of age and thus have a higher risk of dry eye after a corneal ablative procedure. A surgeon can manage the ocular surface prior to considering further corneal surgery. Artificial tears, Restasis (Allergan, Inc. Irvine, CA), and punctal plugs are options. If a patient's Schirmer's test is significantly low, advanced surface ablation such as Epi-LASIK can help minimize the risk of severe dry eye postoperatively. Eyes with asymmetric topography may also do better with

advanced surface ablation as opposed to LASIK due to the risk of potential ectasia.

Pupillometry is essential, especially if a patient is considering choosing a presbyopia-correcting IOL with a bioptics procedure. Although many patients with astigmatism have grown accustomed to dealing with moderate-to-severe amounts of glare and halo, a thorough discussion of these phenomena before surgery can help manage patients' expectations.

TECHNIQUE FOR BIOPTICS

Timing of Flap Creation

One of the biggest questions when performing a planned LASIK bioptics procedure is when to create the LASIK flap. One may cut the flap 1 to 2 weeks in advance or at the time of the intraocular surgery.^{2,3} Cutting the flap prior to placing the IOL avoids the possible risks related to a microkeratome use in eyes that contain an IOL. The major potential risk of using a microkeratome in an eye with an IOL is corneal endothelial damage.

Creating the flap before the intraocular procedure allows the earlier correction of residual ametropia (4 to 6 weeks after the intraocular surgery). The surgeon can simply lift the LASIK flap instead of risking potential complications due to the increased IOP secondary to placing a microkeratome suction ring on these eyes. A potential disadvantage of creating the flap before the intraocular procedure is the increased risk of epithelial ingrowth after lifting the flap for the enhancement procedure.

Another technique is to perform the bioptics procedure in a sequential fashion. After the IOL surgery, the eye is allowed to heal, and the refraction is permitted to stabilize for at least 3 months prior to the LASIK enhancement.^{1,4-6} The advantage of this approach is that it avoids having to lift the flap on the eye, thus minimizing the incidence of epithelial ingrowth and other potential flap-related complications, such as diffuse lamellar keratitis, for these patients. There is a difference between cutting a new flap after the intraocular procedure and lifting a previously created flap in terms of the risk of epithelial ingrowth. This risk is higher with a relifted versus freshly cut flap. This sequential method is the only option for patients awaiting advanced surface ablation.

Type of LASIK Correction

Surgeons must also decide whether to use conventional or wavefront-guided laser ablation. My colleagues and I found that this choice depends on the type of lens implant. Currently, it is difficult to obtain accurate wavefront measurements consistently in eyes that have multifocal IOLs. Using a conventional laser treatment technique based on a patient's preoperative manifest refraction seems to provide the most accurate results. Wavefront-guided corrections are an option in patients who have received monofocal IOLs. Further study is needed concerning combining wavefront-driven ablations with newer IOLs such

as toric and aspheric lenses.

CONCLUSION

Planned LASIK bioptics, limbal relaxing incisions, and toric IOLs are essential tools for treating postoperative residual astigmatism. For patients with extreme degrees of astigmatism, combining all three modalities may be necessary.⁹

Bioptics offers several advantages over IOL implantation or LASIK surgery alone. The theoretical benefits of the combined technique include maximization of the optical zone's size and improved predictability of the refractive outcome.¹ Moreover, bioptics allows patients with degrees of astigmatism and refractive error outside the limits of each individual procedure to obtain satisfactory results.

The biggest concern associated with a bioptics procedure is that it carries the risks of two procedures. The patient has to accept the risks of IOL surgery (endophthalmitis and bleeding) as well as those of corneal refractive surgery, which include irregular astigmatism, dry eye, and keratectasia as well as subjective complaints of halos, glare, and ghost images.^{10,11} ■

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