IOLs Achieve Binocular Correction

One benefit of IOLs is that they are exchangeable.

BY ELIZABETH A. DAVIS, MD, FACS

Accommodation is a dynamic process and an unusually hard physiologic function to mimic. Surgical intervention for presbyopia correction falls into two categories, intraocular and corneal. In my opinion, an intraocular approach has several advantages over a corneal treatment.

In the United States, the only approved option for correcting presbyopia on the cornea is monovision. Monovision LASIK works for a segment of the population; however, not all patients adapt to the disparity of vision between the two eyes. Additionally, some of that effect can diminish as the patient becomes more presbyopic over time. European surgeons have more access to presbyopic laser vision correction techniques, but concerns with irregular astigmatism and other corneal irregularities as well as greater-than-acceptable loss of BCVA remain. Intraocular strategies include monofocal, multifocal, and accommodating IOLs. Aspheric monofocal lenses provide excellent quality of vision and can be used to create monovision if desired. In the United States, patients have the choice of several presbyopia-correcting lenses, including the only US Food and Drug Administration (FDA)-approved accommodating IOL, the CrystaLens (Bausch + Lomb, Rochester, New York), and one of three FDA-approved multifocal IOLs, the ReZoom and Tecnis Multifocal (both Abbott Medical Optics, Inc., Santa Ana, California) and the AcrySof IQ Restor (Alcon Laboratories, Inc., Fort Worth, Texas). In Europe, there is a more diverse sampling of available multifocal and accommodating IOLs. In addition to the lenses already mentioned, Europeans have access to the Akkommodative 1CU (HumanOptics AG, Erlangen, Germany), Synchrony (Abbott Medical Optics Inc.), Tek-Clear (Tekia, Inc, Irvine, California), and Tetraflex (Lenstec, St. Petersburg, Florida) on the accommodating side, and the AT. LISA (Carl Zeiss Meditec, Jena, Germany), Lentis Mplus (Oculentis GmbH, Berlin; distributed by Topcon Europe, Rotterdam, Netherlands), and the M-flex (Rayner Intraocular Lenses Ltd., East Sussex, United Kingdom), on the multifocal side.

CORNEAL RISKS AND COMPLICATIONS

In contrast to presbyopic LASIK, presbyopia-correcting IOLs are an exchangeable technology. In the case of an unhappy patient, I am free to remove the lens and exchange it for a monofocal lens, a different presbyopia-correcting IOL, or a lens with a different power. There is no reversibility with laser vision correction on the cornea; once the tissue is removed, it cannot be replaced. Additionally, unlike laser vision correction, an IOL (a fixed piece of plastic) is not subject to regression or loss of effectiveness over time. Certainly there are no risks of flap complications (eg, buttonholed or slipped flaps or epithelial ingrowth) with presbyopia-correcting IOLs. Laser vision correction also has associated complications such as dry eye, especially in the presbyopic population, and ectasia.

Dry eye. LASIK procedures transect the corneal nerves, and this increases the risk of dry eye. Although dry eye may occur after implantation of a presbyopia-correcting IOL, its incidence is far lower and most likely temporary.

Ectasia. With corneal tissue removal in laser ablative procedures, there is a chance for decompensation of corneal strength, progressive irregular astigmatism, and loss of BCVA. By bypassing the cornea with intraocular strategies of presbyopia correction, such a risk is avoided.

INTRAOCULAR RISKS AND COMPLICATIONS

There is a set of risks associated with intraocular surgery. In general, as we know from cataract surgery, lens exchange is a safe procedure, but laser vision correction does not penetrate the eye, and in terms of risk of infection, intraocular surgery could have more potentially devastating effects. Endophthalmitis may occur in both
procedures, but it is far more unusual with laser vision correction infection unless an aggressive corneal ulcer occurs. Nevertheless, the incidence of infection after intraocular surgery is still very low.

With lens extraction surgery, there are potential posterior segment risks such as retinal detachment, cystoid macular edema, and epiretinal membranes that are potentially vision threatening.

Available presbyopia-correcting lenses produce excellent outcomes, and the majority of patients achieve excellent uncorrected distance, intermediate, and near acuities. Multifocal IOLs may cause side effects including glare and halos at night and potentially fluctuating vision in different lighting conditions. However, recent improvements in lens design have led to markedly reduced incidence of side effects. With the newer lenses, there is a high patient satisfaction rate, significantly reduced dependence on spectacles, and excellent reading speeds.

**PERSONAL PREFERENCE**

I present a biased opinion because intraocular correction of presbyopia is my preference when possible. I primarily implant the Tecnis Multifocal or Crystalens. It has been my experience, supported by data I recently presented at the Aspen Invitational Refractive Symposium, that the Tecnis provides the best spectacle independence (excellent uncorrected acuity for distance, intermediate, and near)\(^1\). Quality of vision has been good, too, with only a small percentage experiencing noticeable glare and halos of mild severity. The Crystalens performs very well for distance and intermediate. Reading glasses are typically required for the smaller print, unless the surgeon aims for a myopic outcome in the non-dominant eye. Quality of vision with this lens is excellent.

I have seen a significant improvement in results with the AcrySof IQ Restor +3.0 D IOL compared with the +4.0 D model. Intermediate and near acuity are enhanced with the +3.0 D version. However, I prefer the quality of vision of the Tecnis Multifocal, and the pupil independence of this lens that emanates from its design (full diffractive optic surface).

**CONCLUSION**

I think that in experienced hands both intraocular and corneal strategies for presbyopia correction are safe. My personal preference is to use presbyopia-correcting IOLs because of the binocular correction achieved and ability to perform an exchange. In the future, accommodating IOLs will produce greater accommodative amplitude that will improve uncorrected acuity. Patients will not only achieve quality of vision without any glare, halos, or contrast sensitivity issues, but they will enjoy a full spectrum of spectacle-free vision, from distance to intermediate to near. We need versions of presbyopia-correcting lenses that also correct astigmatism; otherwise, simultaneous limbal relaxing incisions or subsequent laser vision correction for astigmatism are required.

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Correction of presbyopia accompanied by other refractive defects is an excellent option, better than other types of surgery. Correction of presbyopia with IOLs has several disadvantages compared with correction of presbyopia on the cornea:

1. IOL implantation is a definitive surgery that is not reversible without another invasive surgery;
2. When there is a mistake in the IOL calculation or astigmatism is present preoperatively, excimer laser correction is warranted, making it a two-step surgery. In my own analysis, 30% of patients receiving a multifocal lens require an additional excimer laser correction;
3. Accommodating or multifocal lenses are more sensitive to slight posterior capsular opacification and more often require Nd:YAG laser capsulotomy compared with monofocal lenses. My own rate of laser capsulotomy has risen to 45% with pseudoaccommodating lenses; and
4. Symptoms from multifocal and accommodating IOLs are sometimes disturbing for tasks such as night driving. Such symptoms are related to even small decentrations of the lens and to pupil size. These lenses can be contraindicated in eyes with large pupils, which are common in younger presbyopes.

CORNEAL CORRECTION MYTHS

My personal preference for presbyopic correction is corneal ablation. However, some surgeons have fallacious information on the risks and outcomes of this approach. Below is a list of myths and truths associated with the available presbyopic laser vision correction strategies.

**Myth No. 1.** Previous treatment design caused postoperative side effects such as irregular astigmatism.

**Truth:** New programs, new lasers, and new technology make this type of surgery safe and effective.

**Myth No. 2.** The historical complications of LASIK and excimer laser ablation are still present.

**Truth:** Severe complications of refractive surgery are as low as 0.2% today. Of those, sight-threatening complications are not seen. New technology such as femtosecond lasers makes presbyopic laser vision correction safer than ever.

**Myth No. 3.** If presbyopic patients treated with laser ablations develop a cataract, the calculation of IOL power is difficult.

**Truth:** Difficult, yes, but not impossible. New diagnostic programs include new IOL calculation software. After more than 25 years’ experience with excimer laser procedures, IOL calculation results have improved. Many postrefractive surgery patients undergo cataract removal with adequate IOL calculations and great success.

**Myth No. 4.** The multifocal cornea causes a decrease in contrast sensitivity.

**Truth:** I will confess that this is no myth; however, unlike the decreased contrast sensitivity from multifocal IOLs, these changes are not permanent. Personal analysis of my cases show that contrast sensitivity returns to normal 3 to 6 months after laser vision correction due to the normal corneal remodeling response of the epithelium.

**Myth No. 5.** Correction produces visual symptoms.

**Truth:** Another correct statement. However, such symptoms mirror those produced by multifocal lenses, are not any more severe, and improve with time. As a last resource, the treatment can be reversed if symptoms become problematic.

CONCLUSION

At the age of typical presbyopia onset, the patient is usually determined, energetic, busy, and successful. He is willing to research and ask his doctor about the surgical options for presbyopia correction. Therefore, refractive surgeons must be familiar with all surgical options; this must be part of his training.

Correction of presbyopia on the cornea, whether performed with the excimer laser, intrastromally with the femtosecond laser, or through implantation of corneal inlays, is part of the tools we have available to address this problem. Corneal surgery is an excellent option, as I outlined above. The patient often finds this minimally invasive approach to be a more attractive option than intraocular surgery. Some disadvantages are noted, but they are treatable and minor compared with other presbyopia correction techniques.

Reversibility makes this surgical option the best to offer patients. In patients older than 55 years of age, other options can be contemplated; yet corneal treatment is an excellent alternative for patients in this age range. When cataract is present or suspected, no doubt an IOL must be used.

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