What Premium IOLs Should be Considered?

For every patient, there is an ideal IOL; it is the surgeon's responsibility to discover it.

BY ANTONIO TOSO, MD; AND SIMONETTA MORSELLI, MD

Advances in IOL technology allow surgeons to correct presbyopia during cataract surgery. Whether the surgeon's preference is a multifocal or accommodating IOL, presbyopia-correcting designs are considered premium lenses because they offer an increased opportunity for patients to achieve spectacle independence compared with standard monofocal lenses. Toric IOLs are also considered premium lenses; however, they will not be discussed in this article.

The first modern presbyopia-correcting IOL, a multifocal design, was introduced in the United States in 1997. Since this time, manufacturers have improved the technology, reducing photic phenomena and improving the quality of vision that such lenses provide.[1,2] With newer IOLs, the rate of spectacle independence rises to 80%. The four main categories of premium presbyopia-correcting IOLs are diffractive multifocal IOLs, refractive multifocal IOLs, single-optic accommodating IOLs, and dual-optic accommodating IOLs.

MULTIFOCAL IOLs

There are three main multifocal IOLs worldwide, the diffractive AcrySof IQ Restor (Alcon Laboratories, Inc., Fort Worth, Texas; Figure 1) and Tecnis Multifocal (Abbott Medical Optics Inc., Santa Ana, California; Figure 2), and the zonal refractive ReZoom (Abbott Medical Optics Inc.; Figure 3). In Europe, we have a larger selection of multifocal designs, including the AT.LISA (Carl Zeiss Meditec, Jena, Germany; Figure 4), a diffractive-refractive IOL; the M-flex (Rayner Intraocular Lenses Ltd., East Sussex, England), a refractive IOL; and the Lentis Mplus (manufactured and distributed by Oculentis GmbH, Berlin, and Topcon, Rotterdam, Netherlands), based on an innovative refractive principle. This IOL may represent a breakthrough in multifocal IOL technology because of its sector-shaped near-vision segment, characterized by seamless transitions between the near and far vision zones.

The AcrySof Restor's apodized diffractive design consists of concentric rings with fine ridges that create zones to bend the light and provide correction over a wide range of viewing distances. Apodize, which literally translated is *to remove the foot*, refers to the way sharp discontinuities in the concentric rings have been smoothed to create a more seamless optical system at all distances. The difference between an apodized and nonapodized lens is similar to the difference between bifocal glasses that have a smooth transition between the near- and distance-lens zones and glasses without this smooth transition. Patients with an apodized multifocal IOL may experience glare or reduced distance vision. Distance vision may suffer due to the many circular ridges in the lens that bend light waves as they enter the eye.

The ReZoom multifocal lens has five focusing zones for a full range of vision at all distances.

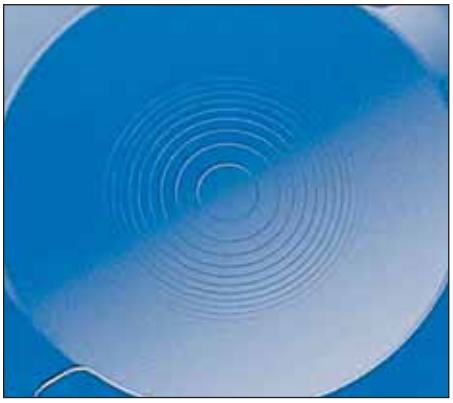

Figure 1. The diffractive AcrySof IQ Restor.

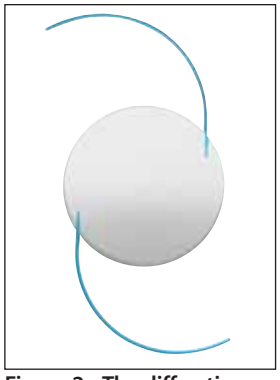

Figure 2. The diffractive Tecnis Multifocal.

Figure 3. The zonal refractive ReZoom.

Figure 4. The AT.LISA is a diffractive-refractive design.

The central zone is for distance vision, especially in bright light when the pupil is constricted. The first of four concentric rings around the central distance zone is a near-dominant zone. Its lens power provides good near vision in a variety of lighting conditions; the next ring is a second distance zone that supports good distance vision in moderate-to-low light situations; the third ring is another near zone to support good near vision in a variety of ambient lighting; the final concentric zone is another distance-dominant zone to support good distance vision in low light, such as driving at night. Depending on the patient's visual needs, the brain learns which portions of the lens to use for clear vision. Some patients may experience glare, halos, or inadequate near vision with this lens model.

The Tecnis Multifocal's front surface is aspheric; the back is a diffractive multifocal surface containing concentric rings with very fine ridges that create focusing zones to bend light and provide a multifocal correction. The optic is available in two materials, silicone and hydrophobic acrylic. The Tecnis Multifocal IOL is designed to have roughly an equal amount of light-focusing ability for distance and near vision. Distance vision may suffer with this lens, again due to the concentric rings that bend light waves as they enter the eye.

ACCOMODATING IOLs

Accommodating IOLs to date do not restore near vision to the same level it was prior to the development of presbyopia. Patients may need reading glasses after accommodating IOL implantation when reading small print or performing other specific near-vision tasks. A realistic expectation is that patients will be less dependent on reading glasses after accommodating IOL implantation and that they may be able to see adequately without glasses for a good part of the day.

The central optical portion of an accommodating IOL typically is less flexible than the eye's natural lens. Instead of changing shape, the accommodating IOL moves slightly forward within the eye in response to focusing effort. The haptics are positioned within the capsular bag; the ciliary muscle contracts, the zonules connecting the muscle to the lens capsule loosen, and the pressure exerted by the vitreous body increases, allowing the IOL to move slightly forward. This movement increases the magnifying power of the eye and provides better reading vision. When the focusing muscle relaxes, the accommodating IOL returns to its original position and provides clear distance vision.

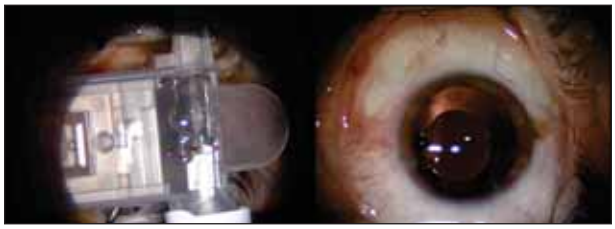

Figure 5. The Crystalens HD is a single-optic accommodating IOL.

In some patients, the ciliary muscle or the zonules may no longer function properly. In these patients, an accommodating IOL may not improve near vision, but it will still function well as a monofocal (single-power) IOL for good distance vision. Each accommodating IOL uses slightly different methods to achieve accommodation. The Tetraflex (Lenstec, Inc., St. Petersburg, Florida) is designed to move anteriorly with ciliary body contraction; the optic of the Crystalens HD (Bausch + Lomb, Rochester, New York; Figure 5), a single-optic accommodating lens, offers enhanced depth of focus and is designed to improve near vision without compromising intermediate or distance vision or inducing glare or night vision problems.

A new concept is the dual-optic accommodating IOL (Synchrony; Abbott Medical Optics Inc.; Figure 6). This one-piece, foldable lens connects a high-powered anterior optic (anterior convex) and a minus-powered posterior optic (posterior concave) with a spring-like haptic design. Movement of the anterior optic corresponds to the clinical amplitude of accommodation.

CUSTOMIZED IMPLANTATION

The chief problems with presbyopia-correcting IOLs include blurred vision and photic phenomena (ie, visual disturbances caused by optical aberrations; also called negative dysphotopsia). Causes of blurred vision include posterior capsular opacification (PCO) and residual nearsightedness, farsightedness, or astigmatism. Causes of photic phenomena include PCO and IOL decentration.[2]

Surgeons must consider the gender, age, profession, and daily activity of each patient before recommending premium IOLs. The first question is: who is contraindicated? Patients contraindicated for these lenses include those who drive at night for a living or whose occupation or hobbies depend on good night vision; patients who are amateur or

Figure 6. The Synchrony is the only dual-optic IOL on the market.

commercial airline pilots; and patients who have lifelong complaints about glare. Careful patient selection is crucial. Patients with significant cataract and mild hyperopia are easiest to satisfy, but we must first make sure the patient has realistic expectations about his vision, including the possible need for spectacles postoperatively.

It is also important that the patient have normal eyes with a potential for vision of no worse than 0.7 (20/30) in order to achieve our goal. Routine optical coherence tomography (OCT) evaluation is essential to detect any macular pathology compromising the visual outcome. We prefer to use premium IOLs in eyes with corneal astigmatism of less than 1.00 D and with photopic pupil size of less than 2.5 mm. Furthermore, we stress the importance of accurate power calculation with adequate biometry, which aids in achieving the correct and desired postoperative refraction.

In relatively young patients with subcapsular cataract, we prefer to implant accommodating IOLs. These IOLs work better in relatively young patients (approximately 50 years old). The mechanism of action of these lenses is not completely clear, but in our experience this IOL works better in younger patients. We choose to implant accommodating IOLs when the patient has an increased risk of glare or halos or when he needs the postoperative distance vision quality of a monofocal IOL.

Is not our habit to implant patients with diffractive IOLs in one eye and refractive IOLs in the contralateral eye, but we try to customize the implant in both eyes. In our opinion, the most important step to achieve the postoperative goal is to speak with the patient extensively before surgery, thus understanding his expectations and everyday needs.

SURGICAL STEPS

Following is a list of surgical pearls for premium IOLs:

• When possible, it is better to perform the main incision at the steepest corneal meridian;

• The size and shape of the capsulotomy should overlap the edges of the IOL optic around 360° to ensure good centration;

• It is mandatory to complete cortical clean-up and posterior capsular cleaning without causing any posterior capsular break, so that we can perform proper in-the-bag IOL implantation and have the lowest possible risk of PCO; and

• We prefer to perform a clear corneal incision, not more than 2.8 mm, and to seal the sideports only by wound hydration. The cartridge must be adequate for that size incision.

The availability of various premium IOLs for the correction of presbyopia makes choosing the right IOL for the patient not always easy. We usually prefer to implant a diffractive multifocal or a single-optic accommodating IOL rather than a refractive multifocal IOL. Diffractive designs seem to have an advantage compared with accommodating designs in providing better near vision; however, disadvantages include decreased intermediate or computer-distance vision. Furthermore, diffractive IOLs have a 5% chance of causing severe nighttime glare and halos.[3]

After all these considerations, we can confidently conclude that there is not yet a perfect premium presbyopia-correcting IOL. Because no two patients are alike, the IOL choice is different from patient to patient, requiring a customized implantation strategy. For every patient, there is an ideal IOL; it is the surgeon's responsibility to discover it. ■

TAKE-HOME MESSAGE

• Depending on the patient's visual needs, the brain learns which zones of the multifocal lens to use for clear vision.

• The chief problems with presbyopia-correcting IOLs include blurred vision and photic phemonema.

• Because the IOL choice differs from patient to patient, a customized implantation strategy is preferable.

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