Benefits of a Small-Aperture IOL in Eyes With Corneal Irregularities

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An expectedly soon-to-be-FDA–approved small-aperture IOL may be the answer for cataract patients with irregular corneas.

Optimizing visual outcomes in eyes with corneal irregularities is challenging. Irregular astigmatism and/or corneal higher-order aberrations (HOAs) can result from numerous etiologies, including prior keratorefractive surgery (eg, radial keratotomy, LASIK, and PRK), keratoconus, corneal dystrophies, corneal scarring, and even dry eye disease.[1-5] Traditionally, an aspheric monofocal IOL is preferred for these patients because it can reduce spherical aberration. One downside with monofocal lenses, however, is that the bulk of the corneal HOAs remain, limiting the visual potential. On the other hand, diffractive multifocal and extended depth of focus IOLs usually are not good choices because these lenses can worsen corneal aberrations. As a result, patients with complex corneas have limited options for presbyopia correction.

The IC-8 IOL (AcuFocus; Figure) can address both issues and improve visual quality and depth of focus by using the pinhole effect. This strategy is especially beneficial in highly aberrated eyes. The IC-8 is a hydrophobic acrylic IOL with an embedded small nondiffractive aperture (1.36 mm) and opaque annular mask that filters out peripherally defocused light. The annular mask, modeled after the Kamra corneal inlay (CorneaGen), helps focus central rays of light on the retina to produce a sharper image.[6,7] The IC-8 is not currently available in the United States, but FDA approval is anticipated soon. (Scan the QR code on the next page to read about three surgical cases with the IC-8 IOL that were performed abroad.)

Studies have shown that corneal HOAs cause less degradation of vision with a smaller (< 3 mm) compared to a larger pupil.[8] The small-aperture mechanism of the IC-8 can therefore improve vision in eyes with corneal irregularities by blocking out the defocused light that is normally scattered by the aberrated cornea. Because the pinhole effect simultaneously extends the depth of focus, the IC-8 IOL has also found success as a treatment for presbyopia when implanted binocularly or monocularly in the patient's nondominant eye.[9-11]

PATIENT SELECTION AND OTHER CONSIDERATIONS

Cataract patients with corneal irregularities stand to benefit the most from the IC-8 IOL because corneal aberrations often cause a substantial reduction in visual acuity independent of the cataract. Several studies have shown good outcomes with the IC-8 in eyes with significant corneal

Courtesy of AcuFocus

Figure. The IC-8 IOL uses an advanced small-aperture design to allow focused light to enter the eye, improving visual quality and depth of focus.

aberrations, including those with a history of keratoconus, penetrating keratoplasty, radial keratotomy, and scarring after ocular trauma.[1,2,4] In a study by Shajari et al, 16 of 17 patients experienced improvement in postoperative best corrected distance visual acuity following lens exchange with the IC-8 (off-label use).[2] Researchers have also found that targeting a slightly myopic outcome with the Haigis formula provided the most accurate refractive outcome.[4]

In addition to reducing HOAs, the IC-8 can address lower-order aberrations. Because of its broad landing zone, the IC-8 tolerates up to 1.00 D of defocus and 1.50 D of astigmatism while maintaining good visual acuity.[11-13] Compared to other available IOLs, the lens is more forgiving of residual refractive errors and may be a good option for patients with lower levels (< 1.50 D) of corneal astigmatism. This can negate the need for a toric IOL.[11-13]

The IC-8 IOL is also a reasonable choice for patients who desire greater spectacle independence, especially those who are not good candidates for diffractive multifocal or other presbyopia-correcting IOLs. A common strategy is to implant the IC-8 with a mini-monovision or blended vision approach. Plano is targeted in the dominant eye with an IC-8 or monofocal IOL, and -0.75 to -1.00 D is targeted in the nondominant eye with an IC-8 to achieve more extended depth of focus and better binocular distance vision compared to traditional monovision with monofocal IOLs.[9-11]

Because of its pinhole optics, the IC-8 has a much more favorable visual disturbance profile than diffractive multifocal IOLs. This makes the lens a good option for patients who prefer to minimize the risk of nighttime halos, glare, and starbursts. Additionally, the IC-8 has been shown to decrease photic phenomena and photophobia in eyes with a history of ocular trauma.[1]

Not every patient is a suitable candidate for an IC-8 IOL. Those with central corneal scarring that overlaps the center of the aperture should not receive the IC-8. It is also prudent to exclude eyes with large (> 5–6 mm) mesopic pupils because of an increased risk of glare. It may also be wise to avoid eyes with significant macular disease or glaucoma to prevent worsening of restricted visual fields and/or contrast sensitivity and to exercise caution in eyes with potential zonular weakness (eg, pseudoexfoliation), which may limit centration of the IOL and affect its performance. Finally, patients should be thoroughly counseled about the possibility of experiencing relative dimness in their IC-8 eye and the potential need for readers, especially under dim lighting conditions.[14]

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DIGITAL EXCLUSIVE

An Excellent Option for Irregular Corneas

Case examples and tips on using the IC-8.

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- A growing number of patients with a history of radial keratotomy (RK) are presenting for cataract surgery. According to Dr. LaHood, the IC-8 IOL (AcuFocus) offers benefits over other surgical strategies.
- In his article, Dr. LaHood shares three cases for which implantation of the IC-8 in eyes with irregular corneas led to a successful outcome. He describes the cases of a 63-year-old woman who had undergone bilateral myopic RK 20 years ago followed by astigmatic keratotomy for residual astigmatism, a 40-year-old woman who had undergone radial keratotomy and could no longer tolerate long-term wear of rigid contact lenses, and a 73-year-old woman with bilateral keratoconus.
- Dr. LaHood's extensive advice on implementing the IC-8 into practice include the following:
  - Optimize the health of the ocular surface;
  - Obtain multiple measurements;
  - Account for a hyperopic shift;
  - Place incisions carefully;
  - Maintain a clear optical zone;
  - Address regular astigmatism;
  - Be aware of pupil size;
  - Check alignment;
  - Inform patients of what to expect; and
  - Assess visual potential.

READ IT NOW

(***Benefits of a Small-Aperture IOL in Eyes With Corneal Irregularities***, *continued from page 77*)

DECISION TREE

Previous treatment options for eyes with corneal irregularities were limited to rigid gas permeable contact lenses and topography-guided LASIK or PRK. Eyes with severe corneal abnormalities, however, often are not amenable to these treatments. The IC-8 IOL can provide a simple and effective solution in such situations. It should be considered any time the surgeon suspects that the corneal aberrations may be limiting a patient's BCVA. Patients who desire greater spectacle independence but have elevated HOAs (< 0.30 µm root mean square) are especially good candidates for the IC-8.

Given the overall high safety index, visual outcomes, and patient satisfaction demonstrated in studies by our colleagues overseas, the small-aperture IOL may be the solution for aberrated eyes that we've been waiting for in the United States. ■

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