CASE REPORT

Cataract surgery with a small-aperture intraocular lens after previous corneal refractive surgery: Visual outcomes and spectacle independence

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Patients who have had previous refractive procedures often require cataract surgery at an early age; however, postoperative results are compromised by corneal aberrations and difficulties achieving a desired refractive endpoint. We describe the use of the IC-8 small-aperture intraocular lens (IOL) in 3 patients who had previous laser in situ keratomileusis (LASIK). Standard cataract surgery was performed in all cases. The small-aperture IOL was implanted in the patient's nondominant eye, and a clear aspheric monofocal IOL was implanted in the dominant eye. Visual performance was assessed between 1 month and 6 months after surgery. After surgery, all patients had good simultaneous near, intermediate, and distance visual acuities while maintaining stereoacuity and mesopic contrast sensitivity. This technique provided good visual outcomes in these patients who had cataract surgery after previous corneal refractive surgery.

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Patients who previously had corneal refractive surgery represent a challenge for cataract surgeons. This population has already shown a willingness to achieve and a desire for excellent vision without glasses or contact lenses by pursuing surgery for their ametropia. Thus, when presenting for cataract surgery, these patients can be demanding and tend to desire spectacle independence.

However, corneal refractive surgery procedures, such as laser in situ keratomileusis (LASIK), causes physical changes to the cornea that can influence intraocular lens (IOL) selection and visual acuity outcomes.[1] Patients who have had corneal refractive procedures are known to require cataract surgery at an earlier stage, likely because of higher levels of higher-order aberrations (HOAs) induced by the refractive procedure as well as low tolerance to the visual changes resulting from corneal irregularities.[2] Evidence suggests that in some cases, cataracts can be induced by repeated refractive procedures.[3] Although spherical aberration induced by previous refractive procedures can be counteracted in part by the use of aspheric IOLs, other aberrations remain unaddressed.[4] Furthermore, patients might also experience hyperopic shifts from corneal flattening that can progress with time.[4] In addition, the most commonly used IOL power calculators do not account for variations between anterior and posterior corneal refraction, resulting in undercalculation of IOL power. This can lead to refractive surprises and postoperative hyperopia that is often poorly tolerated. However, attempts have been made to minimize this issue with the availability of new IOL power calculation formulas that provide more accurate results.[5–9]

Conventional monofocal IOLs are not an ideal option for these patients because they do not address the demand for vision at all distances. More recently, focus has been placed on monovision or multifocal IOLs to achieve good near as well as distance vision. Although monovision can provide patients with some range of vision without the same level of risk for dysphotopsia, it also results in a loss of stereopsis.[10–12] Multifocal IOLs can contribute to visual distortions and reduced contrast sensitivity in post-refractive eyes,[9,13,14] and patients often still require spectacles for reading. Furthermore, visual quality is reduced in eyes with multifocal IOLs when the desired refractive endpoint is missed by more than 0.50 diopter (D).[1] Corneal small-aperture inlays, which introduce an artificial pinhole effect,

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have been shown to provide better stereoacuity and contrast sensitivity than monovision IOLs or multifocal IOLs, respectively.[12,13]

A relatively newer IOL option, the IC-8 IOL (Acufocus, Inc.), combines small-aperture and extended depth-of-focus technology to provide an alternative approach to the treatment of post-refractive patients. This IOL uses small-aperture technology to extend depth of focus. It is well understood that there is a relationship between pupil size and HOAs, with small pupils attenuating the visual effects of HOAs.[15,16] The IOL combines an opaque mask measuring 3.23 mm in total diameter with a 1.36 mm central aperture with a hydrophobic acrylic aspheric monofocal IOL platform. As a result, the IOL design artificially reduces the patient's pupil size, thereby extending depth of focus and reducing the influence of HOAs on visual acuity. Despite the presence of the opaque mask, the field of vision is maintained, visual disturbances are minimal, and vision remains good under low lighting.[17] Similar to the small-aperture corneal inlay, the small-aperture IOL is routinely implanted monocularly in the nondominant eye; a clear aspheric monofocal IOL is implanted in the fellow eye. Despite this, Linn et al.[18] found that, unlike traditional monovision, monocular implantation of a small-aperture IOL does not result in loss of stereopsis. The small-aperture IOL might therefore be a better option to enable spectacle independence after cataract surgery in post-refractive patients.

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Cataract surgery was performed by the same surgeon (S.A.) on 3 patients who had previous LASIK and desired spectacle independence. After standard phacoemulsification, a small-aperture IC-8 IOL was implanted in the nondominant eye and a clear aspheric monofocal IOL was implanted in the fellow eye. A suite of formulas (double-K, Holladay 1, optical coherence tomography [OCT] based, and Barrett True K) was used to calculate IOL power for both eyes. To avoid overcorrection, a target refraction of −0.75 D was used for the eye to have implantation of the small-aperture IOL. A target refraction of between 0.00 D and −0.25 D was used for the eye scheduled for monofocal IOL implantation.

After each surgery, patients were advised to remove the eye patch after 4 hours and to start ofloxacin eyedrops (Ocuflox) and prednisolone acetate–phenylephrine hydrochloride (Prednefrin Forte) eyedrops 1 drop every 2 hours until bedtime. On the following day, patients were advised to continue using ofloxacin and prednisolone acetate–phenylephrine hydrochloride eyedrops, applying 1 drop 4 times a day for 2 to 3 weeks and 3 to 4 weeks, respectively, and to start using ketorolac eyedrops (Acular), applying 1 drop 4 times a day for 3 days.

Visual outcomes were assessed 1 to 6 months after surgery. The uncorrected near (UNVA), intermediate (UIVA), and distance (UDVA) visual acuities were assessed using a Snellen vision chart. The uncorrected mesopic contrast sensitivity was assessed using a sinus chart, and uncorrected stereopsis was assessed using the fly stereoacuity test. Subjective vision was assessed using a brief questionnaire that rated the prevalence of visual disturbances (defined as glare, halos, or double vision), satisfaction with vision, and dependence on glasses using a Likert scale response system (ie, strongly disagree, disagree, neutral, agree, or strongly agree). The refraction before refractive surgery was not available. None patient reported ocular pathology before surgery.

Case 1

A 70-year-old patient presented to Wollongong Eye Specialists reporting a deterioration in vision over the previous 12 months. The patient had bilateral hyperopic LASIK 20 years previously. The preoperative corrected distance visual acuity (CDVA) was 20/30 in the right eye, 20/30 in the left eye, and 20/25 with both eyes. The patient was found to have bilateral cataract, worse in the right eye. Preoperative topography data were not available for this patient because of the unavailability of equipment. The right eye received a +21.5 D Acrysof IQ monofocal IOL (SN60WF, Alcon Laboratories, Inc.) and the left eye a +24.5 D small-aperture IOL. At the final visit, the subjective refraction was plano in the eye with the small-aperture IOL and +1.25 −0.75 × 115 in the eye with the monofocal IOL. The uncorrected visual acuities were 20/20, 20/32, and N10 for distance, intermediate, and near vision, respectively, in the eye with the small-aperture IOL; 20/20, 20/50, and N18, respectively, in the eye with the monofocal IOL; and 20/20, 20/25, and N8, respectively, with both eyes. The uncorrected stereoacuity threshold was 200 seconds of arc (arcsec). The uncorrected mesopic contrast sensitivity was 20.1 at 0.8 cycles per degree (cpd), 54.6 at 3.0 cpd, and 7.4 at 18.0 cpd in the eye with the small-aperture IOL and 20.1 at 0.8 cpd, 70.1 at 3.0 cpd, and 9.5 at 18.0 cpd in the eye with the monofocal IOL. The patient required spectacles for reading small print but expressed satisfaction with the vision and did not report visual disturbances.

Case 2

A 69-year-old patient presented to Wollongong Eye Specialists reporting deterioration in vision over the previous 18 months. The patient had bilateral myopic LASIK 20 years previously. The preoperative UDVA was 20/30 in the right eye and 20/40 in the left eye (corrected to 20/25 with pinhole). The measured total preoperative corneal HOAs were 0.22 μm and 0.21 μmin the right eye and left eye, respectively. The measured corneal coma was 0.13 μm in both eyes. The patient was found to have bilateral cataract, dermatochalasis, and corneal thinning that was worse in the left eye. The left eye received a +20.0 D Acrysof IQ toric IOL (SN6AT3, Alcon Laboratories, Inc.), and the right eye received a +22.5 D small-aperture IOL. At the final visit, subjective refraction was −1.00 −0.75 × 40 in the eye with the small-aperture IOL and +0.25 −0.50 × 19 in in the eye with the monofocal IOL. The uncorrected visual acuities were 20/20, 20/20, and N8 for distance, intermediate, and near vision, respectively, in the eye with the small-aperture IOL; 20/20, 20/25, and N14, respectively, in the eye with the monofocal IOL; and 20/20, 20/16, and N6, respectively, with both eyes. The stereoacuity threshold was 200 arcsec. The contrast sensitivity was 20.1 at 0.8 cpd, 42.5 at 3.0 cpd, and 7.4 at 18.0 cpd in the eye with the small-aperture IOL and 20.1 at 0.8 cpd, 70.1 at 3.0 cpd, and 12.2 at 18.0 cpd in the eye with the monofocal IOL. The patient required spectacles for sewing and reading small print but reported satisfaction with the vision and did not report visual disturbances.

Case 3

A 64 year-old patient presented to Wollongong Eye Specialists reporting a myopic shift in the left eye. The patient had bilateral myopic LASIK 15 years previously. The preoperative UDVA was 20/20 in the right eye and 20/60 in the left eye. The measured total preoperative corneal HOAs were 1.00 μm and 1.49 μm, respectively. The coma scores were 0.65 μm in the right eye and 0.56 μm in the left eye. The patient was found to have bilateral cataract, worse in the left eye. The left eye received a +22.5 D monofocal IOL. The patient presented again 2 years later reporting deterioration of vision in the right eye. The right eye then received a +24.5 D small-aperture IOL. At the final visit, subjective refraction was −1.25 + 1.00 × 173 in the eye with the small-aperture IOL and −1.50 + 0.75 × 2 in the eye with the monofocal IOL. The uncorrected visual acuities were 20/25, 20/32, and N10 for