The light-adjustable IOL may be the most predictable way of providing optimal visual outcomes to cataract patients who have undergone previous refractive surgery, according to the results of a study presented by H Burkhard Dick MD, Ruhr University Eye Clinic, Bochum, Germany, at the XXIX Congress of the ESCRS.

“The light-adjustable lens (LAL) in my hands is effective in managing cataracts in eyes that have undergone refractive surgery. It allows the post-implantation correction of up to 2.5 D in sphere and cylinder, and multiple adjustments are possible. That means that patients can check their refractive status in their daily life and then decide if they want an additional improvement or additional myopisation or emmetropisation,” Dr Dick said.

The multicentre retrospective study involved 37 cataract patients who had undergone previous refractive surgery, he noted. All underwent implantation of the light-adjustable IOL. In 20 eyes the post-implantation adjustment targeted emmetropia and in 17 eyes the targeted refraction was 1.5 D of myopia, for the purpose of monovision, he added.

Fine-tuned refraction Dr Dick pointed out that among eyes targeted for emmetropia, uncorrected visual acuity after adjustment was 0.8 or better in 70 per cent of eyes, 0.63 or better in 90 per cent of eyes, 0.5 or better in 95 per cent of eyes, and 0.4 or better in all eyes. Among 17 eyes targeted for slight myopia with a target refraction of -1.5 D, they had a manifest refraction spherical equivalent after the final adjustment of -1.5 D and a mean uncorrected visual acuity of J2.

Dr Dick noted that the digital light delivery device used to polymerise the lens material was very effective in fine-tuning patients’ post-implantation manifest refraction spherical equivalent (MRSE). That is, among eyes targeted for emmetropia, only 15 per cent of eyes had an MRSE within 0.25 of emmetropia before adjustment, compared to 60 per cent after adjustment, he continued.

Furthermore, only 40 per cent of eyes were within 0.5 D of emmetropia before adjustment, compared to 95 per cent of eyes after adjustment, and all eyes were within 1.0 D of emmetropia after adjustment, compared to only 60 per cent before adjustment. Moreover, the mean uncorrected visual acuity improved from 0.5 following implantation to 0.88 after adjustment of the IOL’s refractive power. Their mean best-corrected also improved slightly, from 0.91 after IOL implantation to 0.96 after adjustment.

The refractive predictability of the LAL compares favourably to all of the IOL power calculation formulas currently used for patients who have undergone previous refractive surgery, Dr Dick said. According to a study by Douglas Koch MD and associates, the mean absolute errors with the other IOL power calculation techniques in those patients ranged from 0.57 D to 1.31 D (Wang et al, J Cat Refract Surg 2010;36:1466-1473), he noted. That compares to a mean absolute error of only 0.25 D among the same kind of patients who receive a LAL.

Malleable silicone optic material Dr Dick noted that the optic of the three-piece foldable silicone lens is composed of an unpolymerised silicone matrix polymer, a polymerised macromer, a photo-initiator, and a UV-absorber at the back of the lens. The digital light delivery device induces polymerisation of the unpolymerised silicone, causing a local shrinkage of the lens material.

Irradiating the centre of the lens decreases the central curvature, with a resulting hyperopisation of the IOL’s refraction, Dr Dick explained. Conversely, irradiating the periphery of the IOL increases its central curvature, with a resulting myopisation, he added. For a few weeks before final lock-in of the IOL power, patients wear protective eyewear and have the opportunity to experience their vision with the initial refractive adjustment in their day-to-day life. During that trial period they can undergo further adjustments if necessary.

Dr Dick noted that he and his associates first began implanting the LAL in May 2008. As of now, they have implanted over 410 of the lenses. In addition to cataract patients with a history of refractive surgery, they have implanted the IOLs in very long and very short eyes for a customised near add, he said.

He added that he and his associates have been conducting some research into the use of LAL technology for the individual modulation of negative asphericity. Optimal asphericity values can increase depth of focus and improve quality of vision. Future refinements in the technology may make possible the individual correction of higher order aberrations, he continued. An additional possibility, as is a toric version of the lens, which could enhance the fine-tuning of post-implantation cylinder, he said.

Dr Dick noted that even in virgin eyes, IOL calculation is prone to some degree of error. In fact, around two-thirds of cataract patients require spectacles for optimal distance vision after implantation of a standard monofocal IOL, he said. The causes for postoperative refractive error include mislabelling of the IOL’s power, imprecision in biometry and power calculation, and post-implantation movement of the IOL.

In eyes that have undergone refractive surgery there are additional causes of refractive surprises. The factors include mismatches between the corneal radii and the axial length, irregular corneal surfaces, and the biometric abnormalities that are common in long and short eyes. Dr Dick noted that, apart from the predictability the technology provides in difficult cases, the LAL may be particularly suited to post-refractive surgery patients because of their proven willingness to pay a higher price for optimal vision.

“If there is one thing you should remember from this talk it is that the light-adjustable lens technology can treat sphere, cylinder, spherical aberration and presbyopia using one IOL after previous refractive surgery,” he concluded.