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Accommodating lenses, including dual optics, liquid optics, injectable lenses and even liquid crystal electronic devices, as well as lenses that can be customised after implantation, are becoming a reality, Nick Mamalis MD of the University of Utah, US, told the ASCRS annual symposium.

Range of accommodation, and long-term function and biocompatibility are major development questions being examined, said Dr Mamalis, who was awarded the Binkhorst Medal in honour of his contributions to intraocular lens (IOL) research and design.

Cataract surgical technique and IOL design have both advanced remarkably since the earliest procedures by Sir Harold Ridley in the early 1950s, Dr Mamalis noted. “Results are very good, but we still lack a good way to give clear near and distance vision.”

Most available presbyopia correcting lenses are limited, Dr Mamalis said. Multifocal lenses split incoming images, reducing contrast and inducing dysphotopsias, while single-piece hinged lenses have a limited range of accommodation. Lenses offering a greater range of accommodation will soon be available to solve the problem, he predicted.

One such accommodating lens on the market outside the US is the Synchrony (Abbott Medical Optics), Dr Mamalis said. A dual-optic design, Synchrony pairs a high-power positive anterior with a posterior negative lens that matches patient refractive needs. The foldable lens can be injected through a small incision but fills the capsular bag. When the ciliary muscles are relaxed, the lenses are close together for distance vision. Under contraction of the ciliary muscles, the lens changes shape and thickness, providing accommodation in much the same way as the crystalline lens.

The FluidVision IOL (PowerVision) also accommodates by changing shape, but uses internal hydraulic pressure to do so, Dr Mamalis said. The lens consists of a central optic surrounded by balloon haptics containing silicone oil. With contraction and relaxation of the ciliary muscles, fluid is pushed between the haptics and the flexible optic, which changes the shape and refractive power of the anterior optic surface. In push-down tests, early versions of the lens have demonstrated up to 5.0 D accommodation.

The Sapphire autofocus IOL (Elenza) uses advanced electronics to achieve accommodation, Dr Mamalis said. The lens incorporates a liquid crystal optic array, microprocessor and rechargeable battery into a monofocal optic. The device is programmable to adjust as patient refractive needs change.

In the late 1980s, Dr Mamalis predicted that injectable IOLs would be available in five to 10 years. “Obviously that’s now been 25 years, and unfortunately this has been a little bit more difficult to come up with.”

Potential advantages include very small incisions and customisation. But cataract extractions still require sizable capsulotomies and coming up with injectable materials with appropriate cure rates is a challenge.

Nonetheless, the injectable lens concept is moving closer to reality through the work of Okihiro Nishi MD of Japan, Dr Mamalis noted. His system incorporates an optic with a grooved edge into which the edges of the capsulotomy are inserted much like a bicycle tyre on a rim to seal the capsular bag. Silicon gel is then injected behind the cap, filling the bag. Under pressure from the ciliary muscles, the lens changes shape and thickness, providing accommodation in much the same way as the crystalline lens.

The Light Adjustable Lens (Calhoun Vision) is made up of partially polymerised material which can be cross-linked after surgery with ultraviolet light to change the shape and refractive characteristics of the lens. Once a good refraction is achieved, the pattern is locked in, Dr Mamalis added.

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