Truly accommodating IOLs set the trend for presbyopia correction

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TRULY accommodating, physiologic IOLs with fewer optical side effects are the hope for the future in presbyopia correction, as compared with pseudo-accommodating IOLs, said Samuel Masket MD during his presentation of the Ridley Lecture at the annual congress of the German Ophthalmic Surgeons (D.O.C.).

"Single-lens, rigid-optic IOLs with flexible haptics (HumanOptics 1CU, CrystaLens) were the first of these devices to reach the market but proved to be limited in their accommodative function. True accommodative-function depends on many factors including the IOL design concept and may require long-term flexibility of the lens capsule," he reminded the gathering.

The Visiogen Synchrony dual-lens intraocular telescope IOL mimics true accommodation by maintaining 20/25 visual acuity at all ranges, according to the outcome of a comparative investigation that included the Synchrony and ReZoom IOLs (Ossma, South San Diego) The pseudo-accommodative devices (ReZoom (Alcon), ReZoom (AMO)) performed less well at intermediate and close visual ranges, Dr. Masket explained. Reading speed and contrast sensitivity were similar in the Synchrony and the ReZoom under photopic conditions, but only the Synchrony sustained reading speed and contrast of vision under reduced light conditions.

The ReZoom and ReZoom IO IOLs had lower reading speed and reduced contrast sensitivity due to the principle of light division inherent in multifocal lenses, Dr. Masket said. Only roughly 90 per cent of transmitted light is useable with refractive lenses and half of the light is divided between distance and near. As a result of the division of light energy, reduced contrast ensues and patients with increasing cylinder become much more susceptible to blurred vision, he said.

The Synchrony IO IOL is comprised of two lenses: an anterior +32D optic and a variable posterior minus optic. It has spring-like haptics to store energy for forward and backward motion. The principle behind the lens is that with accommodation, the zonules relax, and the capsular bag expands in an anterior-posterior dimension as the lenses separate, yielding increased optic power.

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A high-definition UBM investigation (Ossma, South San Diego) verified that the two-lens optics were positioned close together (non-accommodated position) during distance vision and that the anterior optic moved forward with near stimulation of the fellow eye (accommodated position: two lens optics far apart, Dr. Masket said. Other lens designs offer alternatives for achieving true accommodation, defined by the Helmholtz theory that says either a transient increase in optical power of the IO IOL (shape change) and/or a transient anterior movement of the optic, or both, need to occur. The NuLens (NuLenses, Ltd), for instance, with its soft pliable silicone centre and hard exterior ringplate, is an interesting option for achieving true accommodation. The hard plate rests in the ciliary sulcus and causes indentation of the silicone centre through the hard ring, leading to bulging and a simulation of accommodation.

A recent study on 10 eyes with advanced macular degeneration revealed improved UCLVA with the NuLenses. Nonetheless, patient satisfaction remains to be seen, due to an ‘opposite accommodation’ effect noted with these lenses. This manifests as silicone bulge and dioptr change in cycloplegia and loss of accommodation with ciliary muscle contraction.

Beyond the Synchrony and NuLenses, new ideas in IOL design set the stage for interesting future trials. For instance, the ‘PowerVision’ IOL (Power Vision) involves a dynamic optic with fixed haptic. The fluid vision IO IOL (Power Vision), with implantations scheduled within upcoming months, incorporates new applied fluidic technology in a single-piece IO IOL. The idea is that upon accommodative stimulation, fluid (liquid silicone) is pumped (reversibly) through peripheral channels into a bladder in the centre of the lens, which alters the radius of the curvature and moves the lens forward, affecting an increase in IOI power for near vision purposes, Dr. Masket observed.

The Medennium Smart IOL, a dynamic single-piece optic IO IOL is a full-sized IOI (9.3 x 3.5mm) designed to fill the capsule bag through a 3.5mm incision, which represents a different approach to achieving true accommodation. Similarly, the LiquiLens (Vision Solutions Technologies) offers a unique accommodation solution by achieving different optical effects according to patient eye position. This dual liquid gravity dependent IOL has an optic chamber containing two immiscible fluids, each with different indices of refraction. The liquids shift as the eye looks down or up, giving different near and far optical effects.

While true accommodating IOls may appear in the near future, the current presbyopia market is still largely dominated by pseudo-accommodative devices, defined by multifocality or increased optical power focus depth, rather than lens movement or shape change, he said. In fact, the use of presbyopic IOls according to an ASCRS learning survey revealed that 73.2 per cent were ReSTOR lenses, 28 per cent ReZoom and 10 per cent CrystaLens.

Rigorous criteria for success

Success with multifocal IOls depends on astigmatism control, accurate biometry, appropriate formulae, and adjusting the outcome enhancements. Undesired optical side effects are higher in these patients than in patients receiving monofocal lenses, such as severe halos occurring for instance in up to five per cent of patients with the ReSTOR lens as opposed to in under one per cent of monofocal patients, Dr. Masket pointed out. In addition, multifocal success relies on excluding patients with co-morbidities that would reduce the performance of these lenses, such as: maculopathy (age-related macular degeneration, epiretinal membrane), keratopathy, optic neuropathy; patients with prism in glasses, and those with difficult/negative personalities.

Implanted in the right candidate, multifocals can be extremely well tolerated. When asked if they would want the same implant again, 95 per cent of patients from different FDA trials said yes.

A final approach that merits some attention is the Acufoc. The Acufoc corneal inlay, a 10 µm-thin device placed in the LASIK bed, uses a 1.6cm reduced optical aperture effect for increased depth of focus, but does not reduce distance visual acuity.

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