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CATARACT

Testing a trifocal IOL

by Vanessa Caceres EyeWorld Contributing Editor

Trifocal design undergoes theoretical testing

IOLs are available literally in all different shapes, sizes, and types, including bifocal, monofocal, and multifocal. Now a trifocal IOL is under investigation as well.

Damien Gatinel, M.D., Ph.D., Fondation Ophtalmologique A. de Rothschild and Center of Expertise and Research in Optics for Clinicians, Paris; Christophe Pagnouille, Ph.D., PhysIOL, Liège, Belgium, and co-investigators reported on the design of the diffractive trifocal FineVision IOL (PhysIOL) in the November 2011 issue of the Journal of Cataract & Refractive Surgery. The IOL is based on 100% diffractive technology and provides three focal distances. "We aimed at designing an aspheric diffractive multifocal IOL that provides improved intermediate vision without impairing near and far vision," the investigators wrote. "This IOL favors distance vision with a large pupil diameter to minimize the halos or glare perception under mesopic conditions." This design is possible by what the investigators describe as an asymmetric distribution of energy among near, intermediate, and far vision. The article compares theoretical findings with the IOL against in-vitro testing on the optical bench, including modulation transfer function (MTF) and point-spread function (PSF). The PSF "describes the response of an imaging system to a point source or point object," the investigators wrote. MTF tests the magnitude of the optical transfer function. This pinpoints spatial variation induced by an optical system. Investigators found what they describe as "good agreement" between the theoretical profile and the achieved IOL profile. "The simulated and achieved light distribution and focus distribution showed good concordance," they wrote. "The FineVision aspheric trifocal IOL provided intermediate addition at 1.75 diopters." The 1.75 D focus for intermediate vision is an improvement relative to standard bifocal IOLs while also maintaining near and far visual performance, the investigators wrote. They also said the risk for patients is limited compared with the benefit as the IOL's structure is designed to allocate less energy to intermediate vision than to far and near vision. "Regardless of pupil size, the limited amount of energy allocated to intermediate vision minimizes the risk for monocular diplopia associated with intermediate focus," the investigators wrote.

The IOL's anterior aspheric optic with a negative spherical aberration of -0.11 microns with a 6.0 mm pupil partially reduces whole-eye spherical optical aberration, which leaves most patients with residual limited spherical aberrations and provides a slight increase in depth of field. This enables improved vision at far and near without decreasing the performance at intermediate.

Investigators concluded that previous studies suggest a need for an aspheric diffractive multifocal IOL with improved intermediate vision that does not impair near and far vision and that does not increase halos or glare. The design of this particular IOL allows small incision insertion, which could help to minimize astigmatism. However, the investigators concluded that further clinical studies are needed. Clinical trials are in progress for the lens; the IOL received the CE mark in February 2010.

Weighing in

The FineVision IOL appears to be an interesting concept, but the real test will be in its clinical trial outcomes, surgeons said.

"There has been limited clinical experience reported with this lens so far," said Mark Packer, M.D., clinical associate professor of ophthalmology, Casey Eye Institute, Oregon Health & Science University, Portland. Dr. Packer is aware of a presentation from the 2011 ASCRS Symposium & Congress in which the results for the FineVision IOL are comparable to those with the Tecnis Multifocal (Abbott Medical Optics, AMO, Santa Ana, Calif.) and the ReSTOR +3 (Alcon, Fort Worth, Texas) aspheric diffractive multifocal IOL. That presentation showed one line better acuity at intermediate and one line worse acuity at near based on a comparison of the defocus curves. "Although the modulation transfer functions and point-spread function look promising, it's difficult to tell how much patients will be bothered by halos or decreased vision in dim light," Dr. Packer said. Whether or not there is an actual need for a trifocal lens remains to be seen, considering the tradeoff of near for intermediate, Dr. Packer said. "My patients implanted with the Tecnis Multifocal do find that intermediate range vision takes awhile longer to come into focus, but it almost always



The FineVision IOL Source:
Erik L. Mertens, M.D.,
F.F.B.Ophth.

does," he said. He also finds the ReSTOR +3 performs somewhat better at intermediate, although mesopic vision is a challenge. That said, Dr. Packer believes that adding another lens option for premium IOL patients is always welcome.

Tobias Neuhann, M.D., Munich, Germany, agreed that adding new lens options for premium patients is welcome. The recent addition of the Lentis Mplus (Oculentis, Berlin, Germany) to the IOL mix in Europe has prompted a number of surgeons, including himself, to use that particular lens more often because of its visual outcomes. "We have excellent results, better than with refractive and diffractive IOLs," he said. Dr. Neuhann heard about the trifocal IOL concept and finds it intriguing but believes that more clinical studies are needed. Even with options currently available, there can still be halos, glare, secondary treatments, and unhappy patients. "We have good formulas, but we do not have the formula," he said.

Dr. Neuhann would also like to see the long-term outcomes with lenses such as FineVision as well as other newer entries to the market. For example, lenses that seemed promising several years ago are now not as effective as once thought, he said. This makes lens selection as well as patient selection challenging, he added.

Editors' note: Drs. Gatinel and Pagnouille have a proprietary interest in the optical frame described in their study. Dr. Neuhann has no financial interests related to this article. Dr. Packer has financial interests with AMO, Bausch + Lomb (Rochester, N.Y.), and other ophthalmic companies.

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