Presbyopia-Correcting IOLs

BY MALAIKA DAVID, ASSOCIATE EDITOR

Welcome to part two of three on premium IOL technologies. Because these lenses are entering the market at a rapid pace, the peer-reviewed literature clearly lags behind current trends.

The field has come a long way since the original Array IOL was introduced 15 years ago. Early experience with multifocal IOL technologies was less than satisfactory. Many patients complained of unacceptable amounts of glare, haloes, blur, poor contrast for reading, and a lack of intermediate visual acuity. Meanwhile, LASIK practices were booming. As a result, implant rates remained low for 10 years.

Fifteen years after LASIK's introduction to the US market, more than 1 million procedures are performed annually, and many of the original LASIK patients will soon return for surgery as they become presbyopic. With 3 million cataract procedures performed annually, more than 30% of patients will likely demand a spectacle-free lifestyle. Currently, 47% of patients over 50 years old are willing to pay more than $1,000 per eye, and 25% are willing to pay more than $2,000 per eye to achieve spectacle independence.[1] Cataract surgeons will need to embrace premium IOL technologies or face devastating declines in gross revenue over the next 10 years.

Fortunately, multifocal IOL technologies have improved significantly during the past several years. The articles summarized this month demonstrate patients' improved satisfaction and the IOLs' superior performance, especially in the area of diffractive optics (Acri.Lisa [not available in the US; Carl Zeiss Meditec AG, Jena, Germany], AcrySof IQ Restor IOL +3.0D [Alcon Laboratories, Inc., Fort Worth, TX], and Tecnis Multifocal IOL [Abbott Medical Optics Inc., Santa Ana, CA]).

I hope you enjoy this installment of "Peer Review," and I encourage you to seek out and review the articles in their entirety at your convenience.

—Mitchell C. Shultz, MD, Section Editor

DIFFRACTIVE AND REFRACTIVE MULTIFOCAL IOLs

Diffractive multifocal IOLs such as the Acri.Lisa 366D, the Tecnis ZM900, the AcrySof SN6AD3, and the SN6AD1 AcrySof Restor were designed to improve control of energy distribution by integrating a diffractive pattern that creates two major focal points at the lens plate.[2]

A prospective, nonrandomized, consecutive study, conducted at the Hospital Quirón and Hospital Clínico in San Carlos, Madrid, compared the vision of 40 patients after the bilateral implantation of two different diffractive multifocal IOLs. Only one eye of each patient was included in the study. Ten eyes (20 patients) received Acri.Lisa 366D multifocal IOLs, and an additional 10 eyes (20 patients) received the Tecnis ZM900 multifocal IOL. By 3 months postoperatively, investigators noted no significant difference between the two groups in postoperative mean spherical equivalent, mean monocular corrected distance, or near visual acuity. Point-spread function (PSF) was slightly lower in those who received the Tecnis IOL. The modulation transfer function (MTF) parameters were slightly higher in patients with the Acri.Lisa IOL than in patients with the Tecnis IOL ($P = .07$). The mean objective scatter index was 1.83 ±0.91 (SD) in patients with the Acri.Lisa IOL and 2.00 ±0.74 in patients with the Tecnis IOL ($P = .43$). Investigators concluded that "both diffractive multifocal IOLs improved functional visual capacity at distance and near."[2] Although the visual variables were slightly better in [the Acri.LISA 366D] than in [Tecnis ZM900], the differences were not statistically significant."[2]

A consecutive, prospective, interventional, noncomparative clinical trial evaluated the visual and refractive outcomes of the Acri.Lisa 366D multifocal IOL and determined its in vivo intraocular optical performance using an optical analysis model. Sixty-nine eyes of 52 cataract patients received the Acri.Lisa 366D IOL. By 6 months postoperatively, the investigators noted a statistically significant improvement in mean spherical equivalence of +1.22 D ±3.62 SD and +0.39 ±0.51 D/D. Additionally, 69.32% of eyes were within ±0.50 D spherical equivalence, and 86.36% were within ±1.00 D spherical equivalence. The researchers also observed improved mean visual acuities of 0.75 ±0.20 in uncorrected distance, 0.94 ±0.11 in best-corrected distance, and 0.90 ±0.14 in best distance-corrected near. Near-corrected acuity was reported as J1 in 91.76% of eyes and J2 in 4.71%. Investigators noted acceptable mean root mean square values of 1.45 ±0.73 µm for total aberration, 1.36 ±0.73 µm for lower-order aberration, 0.45 ±0.199 µm for higher-order aberration, 0.25 ±0.10 µm for sphere-like aberrations, and 0.37 ±0.21 µm for coma-like aberrations. "The mean Strehl ratio was 0.26 ±0.05."[3] The mean 0.5 MTF of 1.60 ±0.63 cpd and the mean MTF cutoff value of 50.25 ±17.18 cpd were also comparable.[3]

In a prospective study, investigators implanted the aspheric AcrySof Restor SN6AD3 IOL into 36 eyes of 18 patients (group 1) and implanted the diffractive Acri.Lisa 366D IOL into 40 eyes of 20 patients (group 2). Binocular UCVA and BCVA were measured as logMAR units to compare visual acuity. By 6 months postoperatively, the investigators noted mean best-corrected distance acuity of -0.05 ±0.09 logMAR in group 1 and -0.08 ±0.08 logMAR in group 2. Both groups achieved an average BCVA of 20/25 or better.[4] Investigators also observed a mean best distance-corrected near acuity of -0.01 ±0.16 logMAR (approximately 20/20) in the AcrySof Restor group and -0.05 ± 0.07 logMAR (approximately 20/20) in the Acri.Lisa group. Best-corrected intermediate acuity at 80 cm was reported as 0.20 ±0.18 logMAR (approximately 20/32) in group 1 and 0.16 ±0.13 logMAR (approximately 20/25) in group 2. Best-corrected intermediate acuity at 60 cm was reported as 0.16 ±0.16 logMAR (approximately 20/25) in the AcrySof Restor group and 0.18 ±0.13 logMAR (approximately 20/25) in the Acri.Lisa group. "Despite the differences between the 2 IOL groups, there were no statistically significant differences in visual acuity outcomes."[4]

Alfonso et al assessed distance, intermediate, and near visual acuities and distance contrast sensitivity under photopic and mesopic conditions in 20 patients (40 eyes) implanted with the aspheric AcrySof Restor SN6AD1 IOL. The prospective study revealed that, at 6 months postoperatively, patients showed a mean BCVA of -0.064 ±0.049 (approximately 20/25+2) and a mean best-corrected near visual acuity of -0.041 ±0.061 (approximately 20/20+2). Best-corrected intermediate vision was an average of 0.147 ±0.130 (approximately 20/25-2) at 70 cm, 0.036 ±0.133 (approximately 20/20-1) at 60 cm, and -0.126 ±0.077 (approximately 20/16) at 50 cm. Investigators noted that the mean BCVA and corrected near acuity were 20/25 or better in all patients.[5]

> "Cataract surgeons will need to embrace premium IOL technologies or face devastating declines in gross revenue over the next 10 years."

In a prospective study, 137 patients (250 eyes) received the Tecnis ZM001 or Tecnis Multifocal ZM900 IOL after cataract removal. All patients were assessed for monocular uncorrected and best distance-corrected near visual acuity and uncorrected and distance-corrected far visual acuity at 1 to 3, 30 to 90, and 150 to 210 days postoperatively. By 150 to 210 days after surgery, mean UCVA was 0.144 ±0.101 (approximately 20/25-2), and mean BCVA was 0.09 ±0.03 (approximately 20/25) ($P < .0001$).[6] Investigators noted a significant effect of time on mean near visual acuity of 0.215 ±0.082 (approximately 20/30) and mean distance-corrected near visual acuity of 0.189 ±0.045 (approximately 20/30) ($P < .0001$). A total of 96.8% of eyes could read J2 without correction, with 83.2% reading J1.[6] Post hoc analysis showed that UCVA, BCVA, near visual acuity, and distance-corrected near visual acuity improved from 30-to-90 to 150-to-210 days postoperatively. Investigators also reported mean monocular contrast sensitivity performance under photopic conditions of 1.44 ±0.26 at 150 to 250 days postoperatively.[6]

PRESBYOPIC CORRECTION

The following studies analyze the presbyopia-correcting IOLs approved for use in the United States and examine opportunities to enhance patients' satisfaction.

Investigators at The Center for Excellence in Eye Care in Miami discussed the history and surgical outcomes of three presbyopia-correcting IOLs: the Crystalens (Bausch & Lomb, Rochester, NY), the AcrySof Restor IOL, and the ReZoom Multifocal IOL (Abbott Medical Optics Inc., Santa Ana, CA). The investigators also examined the role that patient selection plays in surgical success and explored future IOLs that are in development. Investigators noted in conclusion that, although these presbyopia-correcting IOLs are not perfect, they have significantly improved over the past decade. The researchers further stated that familiarizing oneself with accommodating and multifocal IOLs, carefully selecting patients, and counseling them pre- and postoperatively maximize surgical success.[7]

Investigators compared the optical performance of six presbyopia-correcting IOLs with different designs. They used a model eye to evaluate spherical IOLs, the Crystalens AT-50SE, the AcrySof Restor SA60D3, and the ReZoom NXG1. The same model eye was used to evaluate aspheric IOLs, the AcrySof Restor SN6AD3, Acri.Lisa 366D, and Tecnis ZM900. Of the six IOLs examined, the AcrySof Restor SN6AD3 IOL had the highest MTF values at all spatial frequencies, and the Acri.Lisa 366D produced the second highest results at most frequencies.[8] The AcrySof Restor SA60D3, Tecnis ZM900, Crystalens AT-50SE, and ReZoom NXG1 all had lower MTF values than the Acri.Lisa 366D.[8]

The US Air Force 1951 Resolution Target (AFT) testing revealed that the AcrySof Restor SN6AD3 IOL produced the highest resolution. The Acri.Lisa 366D performed well and was followed in order of highest to lowest by the Crystalens AT-50SE, the AcrySof Restor SA60D3, and the Tecnis ZM900. The ReZoom NXG1 had the poorest resolution.[8] ■

Section editor Mitchell C. Shultz, MD, is in private practice and is an assistant clinical professor at the Jules Stein Eye Institute, University of California, Los Angeles. He acknowledged no financial interest in the products or companies mentioned herein. Dr. Shultz may be reached at (818) 349-8300; izapeyes@gmail.com.

1. Mahdavi S. A survey of consumer demand for premium cataract surgery. SM2 Strategic, Inc. Web site. http://www.sm2strategic.com/files/2009%20Mar%20-%20Premium%20Channel%20-%20Consumer%20Survey%20by%20SM2.pdf. Accessed November 15, 2009.
2. Castillo-Gómez A, Carmona-González D, Martínez-de-la-Casa JM. Evaluation of image quality after implantation of 2 diffractive multifocal intraocular lens models. *J Cataract Refract Surg.* 2009;35(7):1244-1250.
3. Alió JL, Elkady B, Ortiz D, et al. Clinical outcomes and intraocular optical quality of a diffractive multifocal intraocular lens with asymmetrical light distribution. *J Cataract Refract Surg.* 2008;34(6):942-948.
4. Alfonso JF, Puchades C, Fernández-Vega L, et al. Visual acuity comparison of 2 models of bifocal aspheric lenses. *J Cataract Refract Surg.* 2009;35(4):672-676.
5. Alfonso JF, Fernández-Vega L, Amhaz H, et al. Visual function after implantation of an aspheric bifocal intraocular lens. *J Cataract Refract Surg.* 2009:35(5):885-892.
6. Palomino Bautista C, Carmona González D, Castillo Gómez A, et al. Evolution of visual performance in 250 eyes implanted with the Tecnis ZM900 Multifocal IOL. *Eur J Ophthalmol.* 2009;19(5):762-768.
7. Buznego C, Trattler W. Presbyopia-correcting intraocular lenses. *Curr Opin Ophthalmol.* 2009;20(1):13-18.
8. Maxwell WA, Lane SS, Zhou F. Performance of presbyopia-correcting intraocular lenses in distance optical bench tests. *J Cataract Refract Surg.* 2009;35(1):166-171.

CONTACT US

Send us your thoughts via e-mail to letters@bmctoday.com.