The IOL technology we are using today was identified 5 years ago. The technology we will be using in 2015 is already here and being used in select ORs around the world. Emmetropia and full accommodation remain the goal of refractive cataract and lens surgery.

We have already witnessed dramatic advances in the IOL arena. Only 10 years ago, a single zonal refractive multifocal IOL was available in the United States. Today, an array of refractive and diffractive multifocal lenses and single-optic accommodating IOL designs are approved by the FDA. Since May 2005, the Centers for Medicare & Medicaid Services have allowed beneficiaries to pay out of pocket for services associated with the implantation of presbyopia-correcting IOLs to reduce or eliminate their need for glasses after cataract surgery. In 2005, there were three lenses in this category: the Crystalens (Bausch + Lomb, Rochester, NY), a single-optic accommodating lens; the ReZoom (Abbott Medical Optics Inc., Santa Ana, CA), a refractive multifocal IOL; and the AcrySof Restor (Alcon Laboratories, Inc., Fort Worth, TX), a diffractive multifocal IOL. During the past 4 years, both the Crystalens and the AcrySof Restor lens have undergone major makeovers, and Abbott Medical Optics Inc. has launched an entirely new multifocal, the aspheric diffractive Tecnis Multifocal IOL. In addition, toric IOLs from both STAAR Surgical Company (Monrovia, CA) and Alcon Laboratories, Inc., are now available

Innovative IOL designs are in development. As surgeons, we will be fortunate to have the opportunity to provide these lenses to our patients. Here is a brief review of some of the exciting new technologies on the horizon.

**TetraFlex**

The TetraFlex (Lenstec KH-3500; Lenstec, Inc., St. Petersburg, FL) is a single-piece acrylic lens with a 5.75-mm, square-edged, biconvex lens optic. The haptics have a unique design that resembles a perforated plate haptic in appearance. The lens is foldable and can be inserted with a 1.8-mm cartridge. The TetraFlex is designed to move anteriorly with ciliary body contraction.

Sanders and Sanders reported on a series of 95 eyes of 59 patients implanted with the Tetraflex lens, including 36 who received it bilaterally. Six months postoperatively, 63% of all patients achieved a distance-corrected near visual acuity of 20/40 or better. Virtually all had at least 1.00 D of accommodative amplitude (98% at 1 month, 100% at 3 and 6 months); 75.7% had at least 2.00 D of accommodative amplitude 6 months after surgery. Six or more months postoperatively, 92.2% of patients had 20/40 or better uncorrected distance visual acuity. The proportion of patients achieving an uncorrected distance visual acuity of 20/40 or better remained relatively constant at 45% to 47%. Six months after surgery and later,
98.7% of patients had a best-corrected distance visual acuity of 20/40 or better. Among the bilaterally implanted subjects, all had at least 1.00 D of accommodative ability 1 month postoperatively, and 96% had at least 2.00 D of accommodative ability 6 months after surgery. One hundred percent achieved a best-corrected distance visual acuity of 20/40 or better, 89.3% achieved a distance-corrected near visual acuity of 20/40 or better, and 74.1% achieved an uncorrected near visual acuity of 20/40 or better 6 months postoperatively. The researchers concluded that the Tetraflex provides enhanced near vision with good distance vision 6 months after surgery.

**SYNCHRONY**

At the 2009 AAO Annual Meeting, the big news was the acquisition of Visiogen, Inc., by Abbott (Abbott Park, IL). Visiogen was a small, privately funded company with one product, the Synchrony dual-optic accommodating IOL. The lens is not yet approved for sale in the United States, but a response is expected from the FDA this year.

The Synchrony promises to deliver a percentage of spectacle independence closer to that of the Tecnis Multifocal and AcrySof Restor lenses without the loss of contrast sensitivity and unwanted optical side effects such as halos around lights at night that are part and parcel of multifocal IOL technology. A large body of data collected outside the United States has demonstrated that the Synchrony may offer a successful alternative to current multifocal lenses. In addition, the Synchrony features a preloaded injector that delivers the dual-optic implant through a 3.8-mm clear corneal incision (Figure 1).

Imaging studies have demonstrated movement of the Synchrony’s anterior optic corresponding to the clinical amplitude of accommodation. In a retrospective analysis of five patients implanted with the Synchrony, distance-corrected near visual acuity ranged from 0 to 0.20 logMAR (20/20 to 20/32 Snellen acuity), push-down accommodative amplitude ranged from 2.76 to 3.22 D, and defo-

---

**THE PATIENT CUSTOMER**

In a cartoon in *The New Yorker* magazine many years ago, one socially erudite martini-wielding fashion plate said to another, “I don’t have time for instant gratification.” In the world of refractive surgery, the concept of the “wow” factor reflects the attitude lampooned in this satire. In fact, LASIK has offered immediate relief to the vast majority of optically challenged individuals willing and able to undertake the surgical path, and 95% say they would undergo the procedure again.

Refractive lens surgery (the cataract’s or crystalline lens’ removal followed by the implantation of a multifocal or accommodating IOL for the correction of presbyopia) does not offer the same instantaneous results, because patients need time to adapt to new visual imagery. Nevertheless, 95% may achieve the same level of satisfaction 1 year after surgery as people who had LASIK.

The individual with cataracts who sees the opportunity to achieve freedom from bifocals in the context of a medically necessary procedure represents a unique hybrid in the world of medicine: a patient (by virtue of having a diagnosis) and a customer (by opting for an elective procedure not covered by any type of health insurance). Who is this individual?

The phrase *patient customer* epitomizes the patience required for neural adaptation to multifocal lens implants. Furthermore, because patience is a virtue people generally develop in the second half of life, patience is appropriate to the practice of presbyopic correction. Lastly, because personal payment for a valued service carries with it the conventional customs of commerce, these individuals possess the identity of customers, with all the rights and responsibilities pertaining thereto.

Physicians, do you have time to serve the patient customers? They are waiting for you, but they will only be patient for so long.

---

cus curve accommodative amplitude ranged from 1.50 to 2.75 D. Objective-
ly, ultrasound biomicroscopy con-
firmed axial forward movement of the
front optic, and the iTrace (Tracey
Technologies, Houston, TX) showed a
dynamic power change in refraction.

The Synchrony IOL is a new
approach to presbyopic correction in
the setting of cataract surgery and for
refractive lens exchange. The latter
procedure is increasingly seen as hav-
ing an advantage over cornea-based
refractive procedures, especially in
patients over 45 years of age. The
function of the Synchrony’s dual optic
offers the opportunity to achieve
accommodative amplitudes of 3.00 to
4.00 D by virtue of the IOL’s increasing
power. To optimize surgical outcomes
with the dual-optic IOL design (as
with any other new IOL technology), I
would emphasize the importance of
careful patient selection, adequate
and consistent biometry for accurate
power calculations, and the imple-
mentation of a consistent surgical
technique (eg, capsulotomy’s size and
shape, complete cortical cleanup,
anterior capsular polishing, in-the-bag
IOL implantation, and a rigorous post-
operative regimen). Further studies
with large sample sizes and longer
follow-up are necessary for this lens.
These data will be available after the
FDA’s evaluation (expected this year)
of the US multicenter clinical investi-
gation of the Synchrony.

Abbott’s confidence in this technol-
ogy has sent ripples of excitement
throughout the cataract and refrac-
tive technology sector. Visiogen’s early
success will spur on innovation and
creativity in the ophthalmic industry
and give rise to even better solutions
for independently minded baby
boomers.

US AND INTERNATIONAL
TECHNOLOGY

When it comes to the correction of
astigmatism, in the United States,
outside of Investigational Device Exemption clinical investigations, we are limited to FDA-approved devices. At present, these include only the STAAR 4203 TF and 4203 TL in 2.00 and 3.50 D powers and the AcrySof Toric lens models SN60T3, SN60T4, and SN60T4 in 1.50, 2.00 and 2.50 D powers, respectively. Manufacturers outside the United States that have heeded the call to provide toric solutions include Rayner Intraocular Lenses Ltd. (Hove, United Kingdom), which manufactures the T-flex 573T/623T from 1.00 to 11.00 D in 0.25 D increments. The Torica-S (HumanOptics AG, Erlangen, Germany) and the Acri.Comfort 643TLC/646TLC (Carl Zeiss Meditec AG, Jena, Germany) also offer an expanded range of powers in toric IOLs.

THE SULCOFLEX

Rayner introduced its C-flex platform in the United States this year (Figure 2), and the company also has an intriguing line of supplementary sulcus-fixed IOLs for pseudophakic patients. The Sulcoflex IOLs are designed for implantation in the ciliary sulcus of pseudophakic eyes as piggyback lenses. These single-piece hydrophilic acrylic IOLs can be inserted through a 3-mm incision. The 6.5-mm optic and haptics’ edges are round. The haptics are angulated and have an undulated design to preclude the IOL’s rotation. A spherical, monofocal version of the Sulcoflex has been implanted in the ciliary sulcus of pseudophakic eyes in order to correct residual ametropia. Toric, multifocal, and aspheric versions of the lens correct residual astigmatism, address presbyopia, and reduce higher-order aberrations in pseudophakic eyes. The availability of these implants in the United States could significantly enlarge the potential pool of premium IOL patients by making presbyopic and astigmatic correction available to pseudophakics.

FluidVision

The FluidVision fluid-controlled accommodating IOL (PowerVision, Inc., Belmont, CA) utilizes natural, muscular, accommodating forces in the eye to transport fluids in the lens. This results in a change of the lens’ shape, similar to what occurs in the natural lens, which changes from thin to thick upon accommodative effort to create a large accommodative range. Roux presented a study demonstrating clinically that the FluidVision accommodating IOL has the potential to achieve more than a 5.00 D change in power.

NuLens

The novel design of the NuLens (NuLens Ltd., Herzliya Pituach, Israel) mimics the accommodative mechanism of the avian eye. The design uses changes in the refractive power of the lens to increase the accommodative effect. Flexible material is displaced through an opening in a diaphragm, creating a bulge. The curvature of this bulge determines the power of the lens. The IOL’s implantation in primates has revealed a displacement of the lens of up to 0.8 mm with pharmacological stimulation in the initial postoperative period and of 0.3 mm at 18 months. In addition, the change in curvature could add 40.00 D of accommodative power, as determined with pharmacological stimulation.

CONCLUSION

Emmetropia and full accommodation remain the goal of refractive cataract and lens surgery. Already, we have witnessed dramatic advances in this field from 10 years ago, when only a single zonal refractive multifocal IOL was available in the United States, to today’s variety of refractive and diffractive multifocal as well as single- and dual-optic accommodating lens designs. More innovative lenses are in development. As surgeons, we are fortunate to have the opportunity to investigate these IOLs and provide them to our patients, who are the true beneficiaries of a life without spectacles.

Mark Packer, MD, is a clinical associate professor at the Casey Eye Institute, Department of Ophthalmology, Oregon Health and Science University, and he is in private practice with Drs. Fine, Hoffman & Packer, LLC. He is a consultant to Abbott Medical Optics Inc., Bausch + Lomb, and Rayner Intraocular Lenses Ltd. Dr. Packer may be reached at (541) 687-2110; mpacker@finemd.com.

“Visiogen’s early success will spur on innovation and creativity in the ophthalmic industry and give rise to even better solutions.”

6. Roux P. Early clinical experience with PowerVision/FluidVision Accommodating IOL. Paper presented at: The ASCRS Symposium on Cataract, Refractive and IOL Surgery; April 6, 2008; Chicago, IL.