



A New Generation of IOLs

As recently as five years ago, U.S. cataract surgeons and their patients had a choice between either monofocal or multifocal IOLs. Since then, new-technology lenses have come to market in the United States, changing the cataract surgery landscape.

By Mike Mott, Contributing Writer

CATARACT SURGERY IS THE MOST frequently performed operation around the globe. And because the world's population is increasing and aging, the demand for IOLs is rising. Continually more patients also expect that the surgery will free them from glasses. To answer the call, IOL manufacturers have been rolling out a number of premium lenses that are now on the market for U.S. surgeons.

"We're in an incredibly exciting time in the refractive cataract space," said Brian M. Shafer, MD, at Chester County Eye Care in Malvern, Pennsylvania. New monofocal, extended-depth-of-focus (EDOF), and multifocal offerings are available to patients who in the past had no possibility of spectacle independence following cataract surgery, he said.

This competition is good for patients, surgeons, and, ultimately, industry, said Michael Greenwood, MD, at Vance Thompson Vision in West Fargo, North Dakota. He added that it also creates challenges for ophthalmologists because when lens options increase, so too does the difficulty of knowing what's best for each patient. "We all

have our go-to fastball—the lenses we're most comfortable with for one reason or another—but it's our responsibility to be well-versed in the new IOL options and stay up to date on the nuances involving their use."

Monofocal IOLs

Monofocal IOLs offer spherical correction for a single distance and are many ophthalmologists' first choice because of their superior image clarity and minimal visual aberrations, said Kendall E. Donaldson, MD, MS, at the Bascom Palmer Eye Institute in Plantation, Florida. In addition, they're ideal for patients with preexisting ocular comorbidities, she said.

Tecnis Eyhance. Johnson & Johnson's latest monofocal IOL acts like a monofocal-plus, said Dr. Shafer, in that it provides functional intermediate vision and excellent distance visual acuity. But because it does drop off at the near range, the Eyhance does not meet the criteria to be considered an EDOF or multifocal lens, he said.

"The benefit of the Eyhance lens is that it provides intermediate vision without the glare or

halos commonly found in EDOF and multifocal technology,” said Dr. Shafer. Plus, he added, “The modulation transfer function—the amount of light that transfers through the lens—is such that patients can expect to see well even in low-light conditions.”

And because the lens’ defocus curve moves toward the intermediate range, said Dr. Donaldson, the surgeon can offset the eyes with a slight mini-monovision—correcting for distance in one eye and near in the other—to provide the likelihood of spectacle independence across the full range of vision. “The Eyhance has become my go-to lens,” she said. “Although approved as a monofocal lens, I tell my patients that it’s a distance lens; however, I can get an extra diopter to a diopter and a quarter of intermediate vision with it—which is especially key because of how tied we now are to our smartphones.”



**TECNIS
EYHANCE.**

surgeon has three opportunities to adjust the LAL before locking it in, you can change your target for a patient who decides that maybe they do want a little bit more near vision after the fact.” As a result, patients can

optimize their postoperative visual acuity and potentially avoid a corneal refractive procedure that might otherwise be needed to meet the patient’s expectations, he said. “The LAL is also nice because if you want to create a customized monovision for a patient who’s never had experience with that world, you can ease them in, almost to the point where they can’t really tell the difference.”

Caveat. Patient selection is key, though, said Dr. Shafer. “Highly irregular corneas, for example, may not adjust as predictably as those that are perfectly regular,” he said. “Nevertheless, you can still give patients who have retinal pathology the option for a premium experience and true customization.”

It’s also very important that surgeons implant the LAL in patients who are willing to protect their eyes with UV glasses for the full three weeks before the final adjustment period begins, said Dr. Greenwood. Although RxSight has recently updated its lenses with technology that makes the LAL less reactive to ambient UV light, natural sunlight may still inadvertently polymerize the lens and lead to internal higher-order aberration, he said.

Clareon. Cataract surgeons should also be aware of Clareon, Alcon’s new lens material for its monofocal line, said Dr. Shafer. “We’re all very familiar with the tried-and-true AcrySof platform, but we also know that its downside is the development of glistenings in the lens. While there’s debate about whether these glistenings are visually significant, they are measurable, and internal ray tracing shows us that they can result in the development of higher-order aberrations.”

Clareon is the response to these glistenings, said Dr. Greenwood. “In the surgeon’s hands, the new material is very similar to previous AcrySof IOLs—same optics, same haptic design,” he said, “just with better clarity and a new automated injector system that allows the surgeon to gently deliver the IOL.” Although available only in Alcon’s



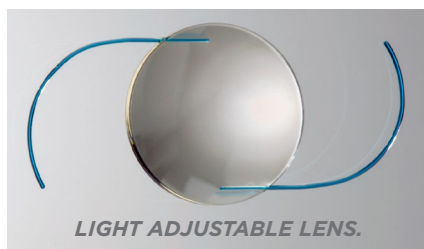
ENVISTA.

enVista. Like the Eyhance, Bausch + Lomb’s enVista IOL is a monofocal lens that may provide added depth of focus. What sets it apart from standard monofocal lenses is that the optic is aberration-free, said Dr. Shafer. “This is very beneficial because the lack of asphericity allows for the spherical aberration of the cornea to

provide for a little bit of added depth of focus. As a result, you can expect the defocus curve to push the patient closer toward acceptable vision in the intermediate range. This also makes the lens more forgiving when slightly decentered.”

Light Adjustable Lens. RxSight’s Light Adjustable Lens (LAL) is a silicone, three-piece monofocal IOL that’s filled with macromers, a photosensitive material that changes the lens’ shape and power in response to ultraviolet light. Because it’s the only lens on the U.S. market that’s fully adjustable after cataract surgery, the LAL has completely disrupted lens technology, said Dr. Shafer. “Every other type of IOL moves in half diopters, but we can throw that out the window here. The light delivery device allows us to fine-tune down to quarter diopters, which allows for adjustability in ways we’ve never had available to us before.”

This is especially helpful in patients whose preoperative calculations are difficult to measure or who have undergone previous laser vision correction, said Dr. Greenwood. “Because the



LIGHT ADJUSTABLE LENS.



CLAREON.

monofocal line, the Clareon platform is expected to be phased into the company's multifocal lens offerings in the near future, he said.

Extended-Depth-of-Focus IOLs

EDOF lenses extend the range of focus and augment intermediate and near vision via the creation of a single elongated focal point rather than several foci, as in multifocal lens technology. "Near vision with EDOF IOLs may not have the same clarity as their multifocal counterparts," said Dr. Donaldson, "but they are especially appealing

because of reduced aberrations and improved intermediate vision without compromising distance visual acuity or introducing bothersome positive dysphotopsias, which can be associated with some multifocal lenses." EDOF lenses are also more forgiving in patients with certain existing preoperative conditions, she added. For example, patients with a small epiretinal membrane or a history of LASIK with mild higher-order aberrations may not be candidates for multifocal lenses, but they might still be a fit for an EDOF lens, she said.

Tecnis Symphony. Johnson & Johnson's EDOF

Happy Patient, Happy Surgeon

Because of the wealth of new IOLs, patient selection has become all important. Choosing the right patient for the right lens is the magic of optimizing these lenses, said Dr. Donaldson.

Setting expectations. Good communication with your patients should be the basis for the entire process of lens selection, said Dr. Donaldson. At the initial consultation, it's paramount that the cataract surgeon identify the patient's expectations and determine their willingness to work together as a partner. "To set expectations, I emphasize to all my patients that this is a process," she said. "Your cataract surgery involves two eyes, not just one. And I explain that because the two eyes work together, often-times we might choose to adjust our target for the second eye or adjust the type of lens in the second eye to complement the visual results from the first."

It's also important to let your patients know ahead of time that neuroadaptation is a part of this process, and it may take up to six months for their eyes to adjust. And even then, said Dr. Donaldson, patients should be aware of the variety of ways to enhance their vision postoperatively, be it an Nd:YAG capsulotomy or laser vision correction of the cornea.

Compromise is also key, said Dr. Donaldson. Because this isn't a perfect technology, she always tells her patients that she can aim to provide them with the very highest degree of freedom from glasses, but there's always a compromise—for example, the patient has to be willing to understand that there will be some degree of potential glare and halo that she can't fully measure in advance of surgery. "My patients need to know that there's no technology available to make them 20 years old again," said Dr. Donaldson. "If that's their goal, we can't achieve it. But we do have technology

that gives a very high degree of freedom from glasses and a very low—but not necessarily zero—side effect profile."

Educating the patient. Once expectations are set, she then educates her patients about their options so that they can make the best choice and participate in decision-making alongside her. And, she said, this involves knowing more about patients than ever before: What do they do for a living? What are their visual demands? What are their hobbies? What do they ultimately want most out of their cataract surgery?

"In addition to an insurance overview, I provide a short and sweet, simply stated synopsis of all the various lenses that are available," said Dr. Donaldson. "And I give the same presentation to every patient, even if they might not be a candidate for a certain IOL, because their neighbor may end up with that lens, and my patients might wonder why they weren't offered that same piece of technology."

And the education process doesn't end at the initial consult, said Dr. Donaldson. Her staff of surgical coordinators and nurse practitioners carry on the lens discussion during the entire preoperative process—from the patient's first topographic and biometric measurements up through the actual surgery prep.

It might sound like a long and tedious process, she said, but it's entirely necessary in order to avoid turning cataract surgery into a confusing and negative experience. "We want this to be a wonderful moment for the patient," said Dr. Donaldson. "It's life-changing to take a patient who's been completely dependent on glasses and give them freedom for the first time. That's what we'd love to be able to offer our patients. And if we have happy patients, we're happier as surgeons."

offering, the Tecnis Symphony, utilizes a proprietary design to provide an intermediate vision profile, said Dr. Greenwood. One scenario in which he frequently uses the Symphony lens is mixing and matching, where a patient receives an EDOF IOL in their dominant eye and a multifocal in the nondominant eye. “These patients are coming away with very good range of vision with distance, intermediate, and near,” he said.

Caveat. A limiting factor with the Symphony, said Dr. Shafer, is the risk of a distinct positive dysphotopsia. “The lens’ classic visual artifact is a starburst phenomenon. But in my experience,



even though patients tend to notice it, they tolerate the dysphotopsia well and aren’t typically bothered by it.” Nonetheless, you should counsel candidates about this ahead of time, he said.

Vivity. Alcon’s Vivity utilizes a proprietary technology to offer a non-diffractive option for extended range of vision. “What you can see when you first look at the Vivity is a central bump,” said Dr. Shafer. “Rather than splitting light, this bump condenses all of the light rays into an elongated pattern for favorable intermediate vision.” It’s very much a disruptive technology, he added, because it allows the surgeon to implant an EDOF lens in eyes that would

Options for Preoperative Decision-Making

Your ability to choose the best IOL for your patients might soon get a boost from technology overseas. “In Europe, we’re at a point where we have almost 40 different variations of premium lenses,” said Boris Malyugin, MD, PhD, at the S. Fyodorov Eye Microsurgery Federal State Institution in Moscow. “It can be quite confusing for the cataract surgeon to pick through, so there’s a definite need for better decision-making tools when it comes to which IOL to use.”

New predictive tools are providing ophthalmologists with new ways to make more informed decisions about lens choice while allowing patients to participate in the process by seeing their new visual reality in advance.

SimVis. 2EyesVision’s SimVis out of Spain is a handheld vision simulator that allows patients to test each IOL design prior to implantation. “This not only provides a glimpse at the clarity and quality of vision that a patient can expect,” said Dr. Malyugin, “but also provides an understanding of any potential drawbacks like dysphotopsias that a patient might experience.” He noted that the technology works best for patients who are considering refractive lens exchange, as they will have no or minimal loss of the natural lens transparency. The SimVis simulates different IOLs via a tunable lens that changes shape when electric current is applied. The shape of the lens can morph quickly to simulate the blurred near vision and clear distance vision of a monofocal lens, said Dr. Malyugin, and then change again to replicate the loss of contrast and image quality that might be associated with a multifocal variety.

VAO. Another “try before you buy” option that works best for refractive lens exchange patients, said Dr. Malyugin, is the Visual Adaptive Optics (VAO) simulator from the Spanish company Voptica. Like the SimVis, the VAO allows patients to compare monofocal, EDOF, and multifocal lenses using a variety of different vision tests. In addition, the device is designed to allow the surgeon to obtain a patient’s objective and subjective refraction and customize spherical aberration and defocus to optimize their quality of vision at different distances. “With these tools, the preoperative decision-making process can now include the patient’s real-life experience with a lens alongside the ophthalmologist’s surgical experience with the product,” said Dr. Malyugin.

Vivior Monitor. Available in the United States, the Vivior Monitor is a wearable monitor that attaches to the patient’s existing glasses or a set of clear spectacles. The device performs continuous measurements for at least 36 hours while the patient goes about their daily activities. The device collects data about the wearer’s time spent looking at near, far, and intermediate distances as well as information on lighting conditions. The Vivior Monitor takes this data on patient behavior and matches it to the performance properties of different monofocal, EDOF, and multifocal IOLs to suggest the best options for fit based on the patient’s visual needs. “What’s nice with the Vivior,” said Dr. Malyugin, “is that it objectively measures more than what any interview, history, or questionnaire can provide.”

not benefit or not be suitable for diffractive technology. As a result, patients who have mild macular pathologies such as an epiretinal membrane or mild corneal pathologies such as prior LASIK or mild guttata from Fuchs dystrophy can experience the benefit of an EDOF IOL, he said.

Based on Dr. Greenwood's experience, both patients with healthy eyes and those who aren't good candidates for multifocal lenses do well with the Vivity IOL, especially for distance and intermediate. "One of the terms that's been thrown around is 'dashboard to distance,' and our patients can largely achieve that using the Vivity lens with minimal dysphotopsia or glare and halo," said Dr. Greenwood. "Even in eyes with some pathology, the results are positive. It just requires a little more chair time to explain to the patient how their near or intermediate vision might be a little bit limited."

Caveat. One important caveat with the Vivity lens is that the defocus curve is somewhat pupil dependent, added Dr. Shafer. Therefore, patients with larger pupils may not come away with as much near vision as those with smaller pupils. So it's important to consider this preoperatively for Vivity patients, he said.

Give near vision a boost. All in all, said Dr. Shafer, both the Symphony and Vivity IOLs offer patients the ability to see well at both distance and intermediate out of the box. But to give their patients' near vision a boost, cataract surgeons may want to consider a bit of mini-monovision with these lenses to expand the defocus curve to a fuller range, he said.

Multifocal IOLs

Multifocal IOLs utilize diffractive optics to create three distinct focal points. As a result, they allow for the greatest range of near, intermediate, and distance vision, said Dr. Greenwood. In the past, factors that have limited more widespread use of these lenses included patient dissatisfaction due to dysphotopsias and the experience of discrete optical zones rather than a smooth transition between focal lengths, he said. He added that today's newest multifocals are "light-years" ahead of what existed even five years ago and may be considered an optimal IOL for many patients.

PanOptix. Alcon's latest multifocal option, the PanOptix IOL, offers all three ranges of vision with minimal drop-off in between, said Dr. Greenwood, so it provides significant continuation of vision. "And what's particularly nice is that we can place the PanOptix in both eyes, whereas

historically we'd mix and match lenses to achieve a good range of vision," he said. "With a single lens type, patients' neural adaptation quickens and they're able to adjust to their new vision in much less time than with mix and match." Because both eyes are cooperating and sending the brain the same signals, this decreases the risk for both positive and negative dysphotopsias, he added.

Dr. Greenwood has had especially good success using the PanOptix lens in patients with relatively healthy eyes—meaning no corneal pathology, no retinal pathology, no glaucoma, and normal topographies. "But the IOL also performs well in patients with previous LASIK or photorefractive keratectomy procedures," he said. "My colleagues and I are working on a research study right now to quantify that a little bit more, but anecdotally, it's safe to use these lenses in patients who have had previous refractive surgery, as long as the cornea and the higher-order aberrations are within normal limits."

Tecnis Synergy. Johnson & Johnson's Tecnis Synergy IOL is a hybrid lens—part trifocal, part EDOF. Taken together, both the Synergy and the PanOptix perform well in healthy eyes, said Dr. Donaldson, but there are nuances that surgeons will better understand with experience. "For example, I've found that the Synergy lens provides significantly stronger near vision than the PanOptix so far. In my higher myopic patients who want a multifocal lens, I'm using more Synergy lenses, as opposed to just the regular emmetropic or hyperopic patient who does well with the PanOptix."

Patient selection. And because both the PanOptix and Synergy lenses utilize diffractive technology, it's critically important to focus on patient selection, said Dr. Shafer. "Patients with high corneal higher-order aberrations may not do well with these multifocal lenses and may experience increased photic phenomena or photopsia such as glare and halos," he said. "And while more than 90% of my PanOptix patients are satisfied with their lens and would have it again, many, if not most, do notice these dysphotopsias but aren't bothered by them. The same appears to be true with the Synergy lens."

Ophthalmologists should also be on the lookout for any impending macular pathology, said Dr. Shafer. Like all diffractive technology, these multifocal lenses split light to achieve the entire range of vision. So, it's important to avoid their placement in a patient with true macular pathology—some drusen or an epiretinal membrane—since the



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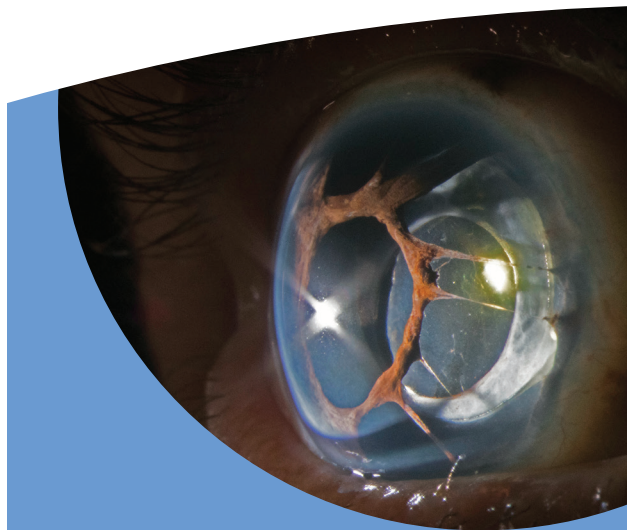
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photoreceptors won't receive the necessary light.

Patient age might also come into play, added Dr. Shafer. The PanOptix's AcrySof material may not be quite as durable as the Tecnis material from which the Synergy is made, so the surgeon should think twice when implanting the PanOptix in a younger patient. Once the PanOptix is available on the Clareon platform, this conversation may change, he said.

Final Thoughts

Whatever IOL lens you choose—monofocal, EDOF, or multifocal—be aware that more are on the way. Ophthalmologists in Europe and Asia have many new-technology lenses available to them, and U.S. surgeons can expect their options to continue to grow and can expect more companies to enter the marketplace following FDA trials, said Dr. Shafer. "It's really exciting that we have the ability to use all of these lenses to match patients, their eyes, and lens technology," he said. "This is the best time to be in the refractive cataract field, and it will only get better from here."

Meet the Experts



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Alcon: C,L; Bausch + Lomb: C; Carl Zeiss Meditec: C; Johnson & Johnson: C.



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