New Light Adjustable Lens Leading the Evolution of Cataract Surgery

This lens is designed to enable cataract surgeons to deliver individualized, predictable refractive outcomes.

BY VANCE THOMPSON, MD

Predictable and accurate refractive outcomes have long been indispensable to ensuring patients are satisfied after cataract surgery. Until recently, I had never encountered an IOL that consistently delivered the refractive accuracy that my premium patients demand. Now, as an investigator in the phase 3 study of the Light Adjustable Lens (LAL; Calhoun Vision), I have worked with technology that has the potential to meet and even exceed the expectations of these patients. It holds promise for changing the way cataract surgery is conducted in the United States because refractive errors can be corrected after the lens has been implanted and the eye has healed and achieved refractive stability.

This revolutionary lens is designed to be the only IOL in the world that can be implanted without concern for its ultimate position in the bag and the healing variables associated with the cataract procedure, because later adjustments will remove any residual refractive error. It eliminates the need to mark the eye prior to astigmatic correction or to use intraoperative aberrometry, since the axis of astigmatism can be readily determined and corrected for at the time of adjustment.

HOW THE LAL WORKS

The three-piece, foldable, silicone LAL (Figure 1) is, in many respects, similar to standard, familiar monofocal IOLs. The LAL, however, contains unique monomers, called *macromers*, that are sensitive to ultraviolet light of a certain wavelength. When a targeted area of the lens is irradiated by UV light, emitted by the Light Delivery Device (Figure 2), the macromers in that area undergo photopolymerization, and that part of the lens is therefore depleted of macromers. To reestablish equilibrium within the lens mass, macromers from the nonirradiated

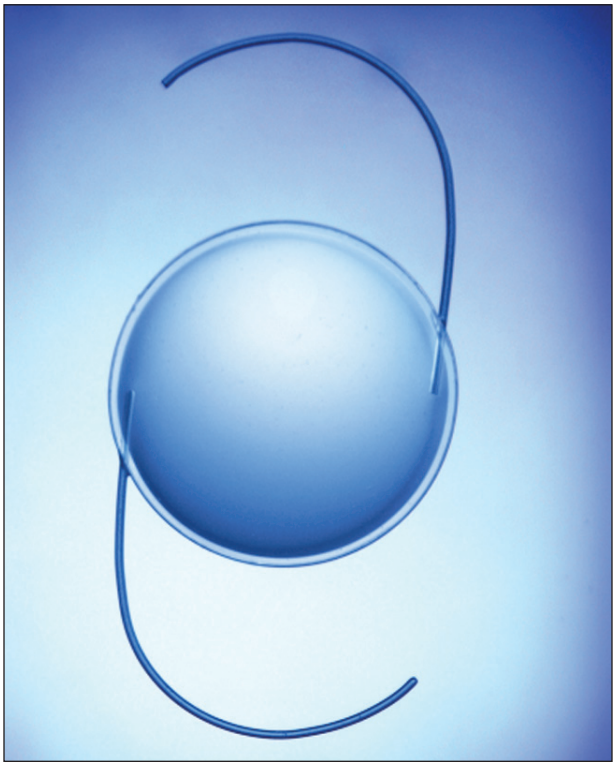

Figure 1. The LAL.

Figure 2. The Light Delivery Device.

area physically diffuse into the photopolymerized portion of the lens, swelling the lens and changing its curvature.

For example, if it is necessary to add power to the lens to correct for hyperopia, the central portion of the lens would be selectively irradiated, causing untreated macromers from the outer portion of the lens to diffuse into the central area, swelling the center of the lens and thus increasing its power (Figure 3). The lens can be adjusted a second time if the surgeon and patient so determine. After achieving the desired power adjustment, the surgeon irradiates the entire lens to polymerize the remaining unreacted macromers and lock in the new lens power.

The LAL received CE Mark approval in Europe more than 6 years ago. Surgeons there have found they can very accurately and predictably modify the refractive power of an implanted LAL by adding or subtracting spherical power, eliminating astigmatic error, or creating multifocality for optimal functional vision at all distances.[1]

THE PROCEDURE

The LAL is implanted in the patient's eye using conventional cataract surgical techniques. After implantation, he or she is provided with stylish UV-protective glasses and is required to wear them at all times until the final lock-in is complete. These glasses prevent unanticipated changes in the power of the lens, which may result from normal day-to-day UV exposure. Seventeen to 21 days after surgery, the surgeon performs the first adjustment of the LAL to improve the patient's visual acuity. Three to 5 days later, either an additional adjustment is performed, or the surgeon will perform the first lock-in based on the subject's refraction. Three to 5 days after the first lock-in, the patient returns for a final lock-in of the LAL. Twenty-four hours later, he or she may discontinue wearing the UV-protective glasses. I have found the LAL light treatments to be straightforward, quick, and noninvasive and to be well tolerated even by elderly patients.

PHASE 3 STUDY

The LAL phase 3 study involves 400 LAL implants and 200 control lens implants. The study is intended to demonstrate that the LAL provides good distance vision without the need for additional surgery or glasses in subjects with preexisting corneal astigmatism of at least 0.75 D. Vance Thompson Vision is one of 18 sites that have been selected to participate (Figures 4 and 5).

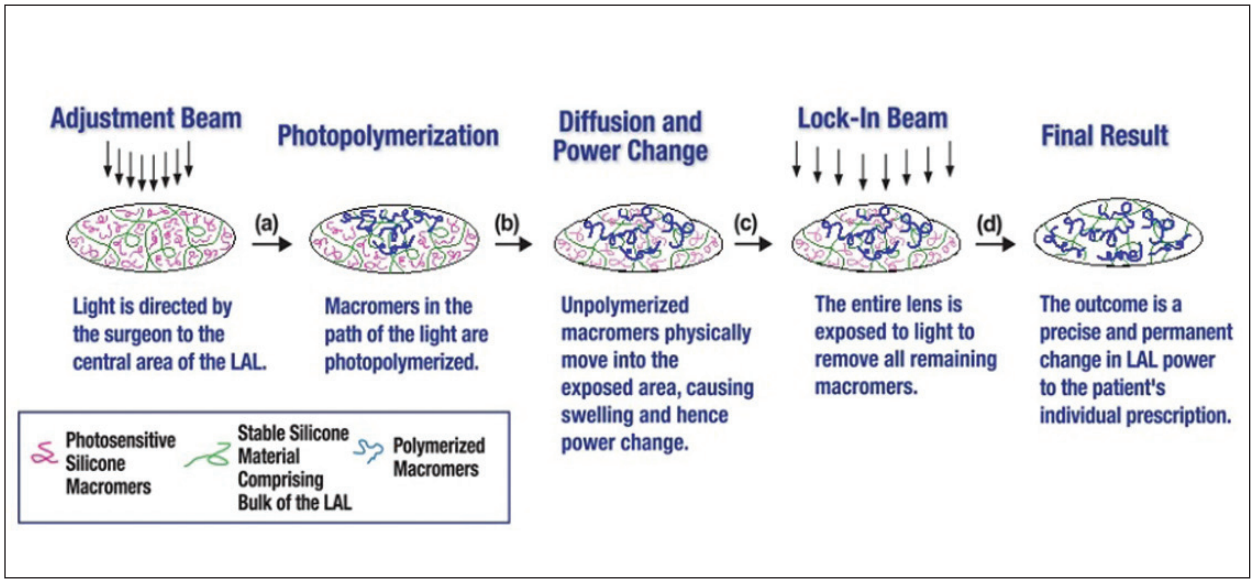

Figure 3. The mechanism of action: adding power to the LAL.

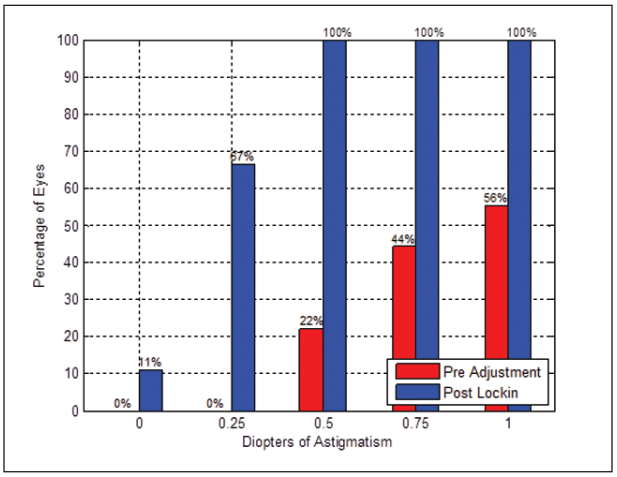

Figure 4. Astigmatic correction: preadjustment versus 1 week postlock-in; 100% of eyes with at least 0.75 D of preoperative corneal astigmatism have 0.50 D of astigmatism or less after lock-in.

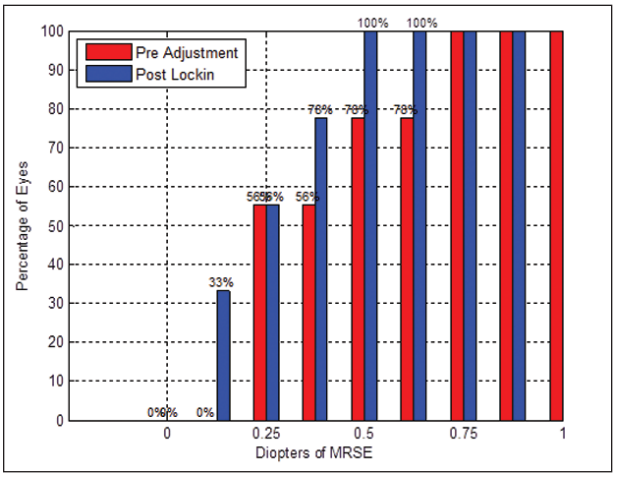

Figure 5. Refractive accuracy results with the LAL: 100% of eyes are within 0.50 D of the targeted manifest refraction spherical equivalent of plano.

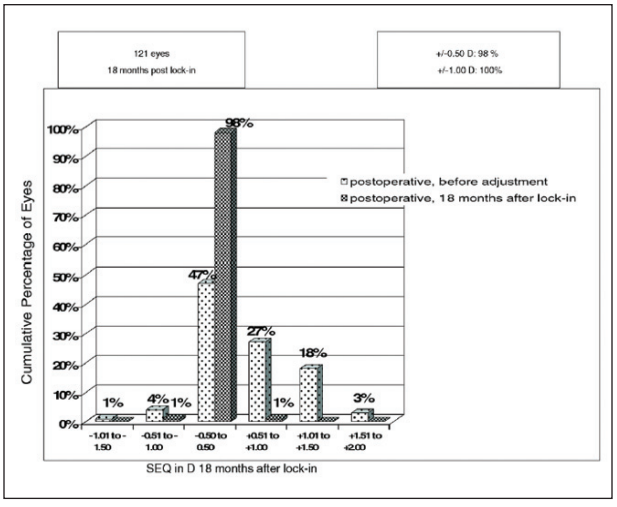

Figure 6. Accuracy of spherical equivalent refraction (121 LAL eyes, 18 months after lock-in). (Source: Hengerer et al.[1])

My experience with the LAL in the current study has been excellent thus far. Of the LAL eyes I have treated in the study (n = 9), 100% achieved a level of residual astigmatism of 0.50 D or less, and 100% are within 0.50 D of the targeted manifest refraction spherical equivalent of plano. The results I have achieved support previously published international results on the effectiveness of the technology in treating astigmatism.[2] They also reflect the excellent outcomes my fellow investigators in the phase 3 study are witnessing.[3] In addition, refractive predictability at this level easily outperforms results with contemporary preoperative and intraoperative measurement systems for cataract surgery procedures.[4]

CONCLUSION

Both my experience and that of my patients who have been implanted with the LAL are positive. The ability to customize the power of the LAL to each subject after implantation allows me to deliver individualized, predictable refractive outcomes not possible with other IOLs and technology. My preliminary findings in this ongoing study are promising and appear to validate the outstanding results seen in commercial practice outside the United States (Figure 6). I am very excited to see what this technology may offer to surgeons and our cataract patients, and I look forward to its commercial availability in the United States. ■

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