Nailing the IOL Power

The benefits of the femtosecond laser for refractive cataract surgery.

BY ROBERT J. CIONNI, MD

More and more cataract surgery patients are developing expectations similar to those of refractive surgery patients. Most no longer find it acceptable to need glasses after cataract surgery. This paradigm shift is partly due to an improvement in technology and partly owing to the fact that the same patients who spurred the boom in LASIK are now undergoing cataract surgery. We ophthalmologists, therefore, must do all we can to meet patients' higher expectations. Fortunately, technology is providing us with many tools, including more precise testing instruments such as the Lenstar LS900 (Haag-Streit AG) and the IOLMaster 500 (Carl Zeiss Meditec, Inc.). Newer-generation formulas such as the Holladay II produce more accurate IOL power calculations. Plus, intraoperative aberrometers such as the ORA System (WaveTec Vision) now give us another option for calculating or confirming the correct IOL power and cylindrical correction that eliminates any effect from the crystalline lens. Finally, when used properly in appropriately selected patients, premium IOLs (eg, multifocal, accommodating, and toric) promise a level of spectacle freedom heretofore unknown.

Nonetheless, we all see patients unhappy with their residual spherical error after cataract surgery, because we still cannot accurately predict the postoperative axial position of the IOL, also known as the *effective lens position* (ELP). Warren Hill, MD, has explained that the varying size of the capsulorhexis is one of the most significant factors making the ELP difficult to predict.[1] What does this mean in terms of nailing the refractive result? Let us imagine that a surgeon uses an optimized formula and typically makes a 5-mm continuous curvilinear capsulorhexis (CCC). If a 25.00 D IOL is expected to achieve a plano result, but the CCC ends up being 4 mm instead of 5 mm in diameter, the IOL may sit more posteriorly than expected, resulting in a hyperopic error. In contrast, if the CCC measures 6 mm in diameter, the IOL may sit more anteriorly, resulting in a myopic result.[2] Although important, an optimized surgeon's formula only helps achieve the desired refractive outcome for this patient if the surgeon can make the CCC close to 5 mm in diameter. Even the most skilled and experienced of us, however, cannot make the same sized and shaped CCC each and every time.

How can we better our results? Enter the femtosecond laser. This device can make a perfectly sized and shaped CCC each and every time. The laser-created CCC should therefore produce more predictable refractive outcomes, but does it?

TABLE 1. COMPARISON OF ERRORS IN PREDICTION

	LenSx (n = 22)	Manual (n = 26)
Mean absolute error	0.26 ±0.16	0.34 ±0.21
Standard error of the mean	0.03	0.04
Mean error	0.02	0.08

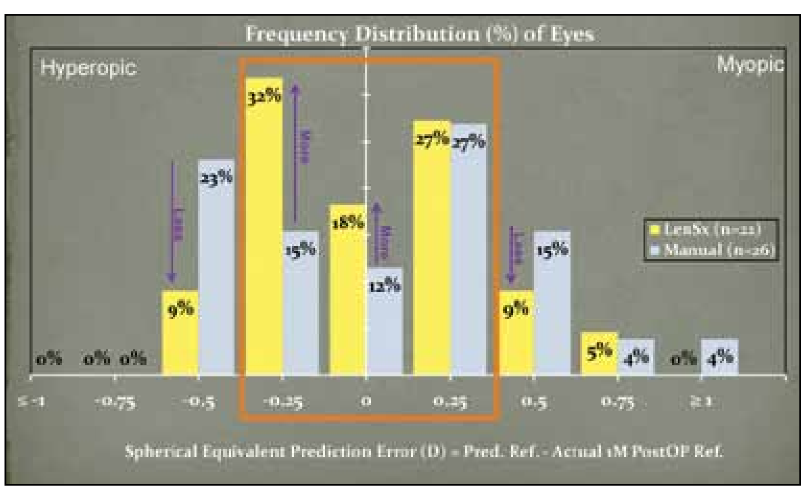

Figure 1. Distribution of errors in prediction. Significantly more patients were within 0.25 D of the target refraction in the laser group.

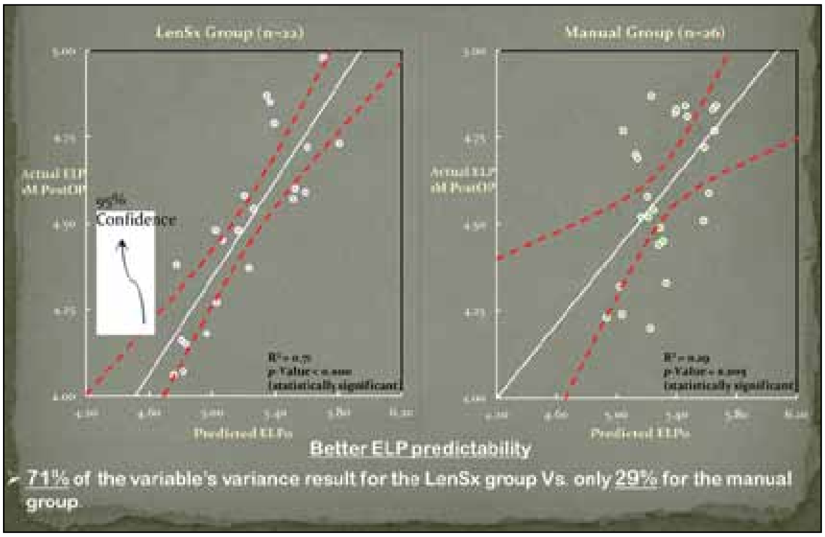

Figure 2. The laser group's actual ELP correlates with the predicted ELP. That was not the case with the manual CCC group.

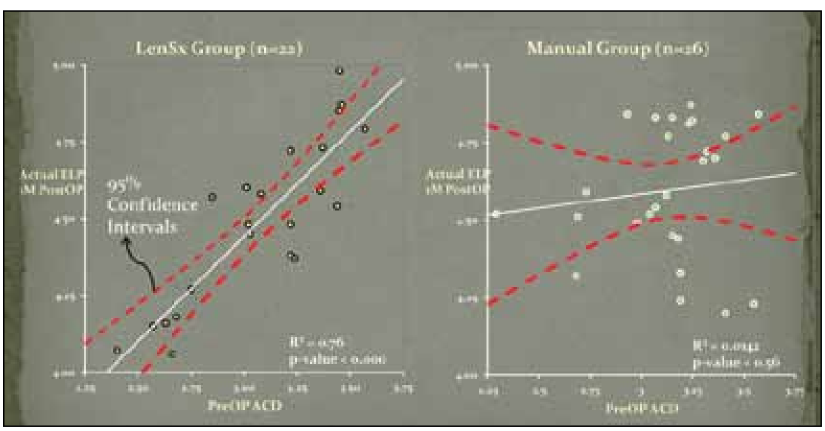

Figure 3. The postoperative ELP correlates with the preoperative ACD in the laser but not the manual CCC group.

THE DATA

Last year, I compared two groups of patients in terms of their proximity to the target refraction after cataract surgery. The groups differed only in that one had CCCs that I made manually using an optical zone marker to guide the tear, whereas I used the LenSx Laser (Alcon Laboratories, Inc.) to create the CCC in group 2.[3]

The 1-month results demonstrated a significantly improved mean absolute error and accuracy to target refraction in the laser group compared with the manual CCC group (Table 1 and Figure 1). In addition, the predicted ELP in the laser group correlated well with the true ELP, as measured by the Lenstar LS900, and with the preoperative anterior chamber depth (ACD); there was no correlation with either of these parameters in the manual group (Figures 2 and 3).

I re-evaluated the patients 6 months after surgery. In terms of distance UCVA, the laser group remained essentially stable between 1 and 6 months, whereas, as a whole, the manual group improved somewhat. This finding makes sense, because the IOL calculations were originally optimized for the procedure performed manually. The reason for the difference is that the ACD, representing the ELP, was essentially unchanged in the laser group between 1 and 6 months, whereas it changed significantly in the manual group (Table 2). We therefore might expect to find a change in the refractive result more likely in manually performed cases beyond the 1-month postoperative visit. The variability of this change was also higher in the manual group, meaning less predictability of the final ELP. The laser group still had more patients with 20/25 or better visual acuity 6 months

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TABLE 2. IOL STABILITY AT 6 MONTHS		
	LenSx (n = 22)	**Manual (n = 26)**
Mean absolute difference of ACD at 6 months and ACD at 1 month	0.05 ±0.04	0.17 ±.023
Standard error of the mean	0.01	0.05
***P* value**	.0429	
	Mean significantly different	
Abbreviation: ACD, anterior chamber depth.		

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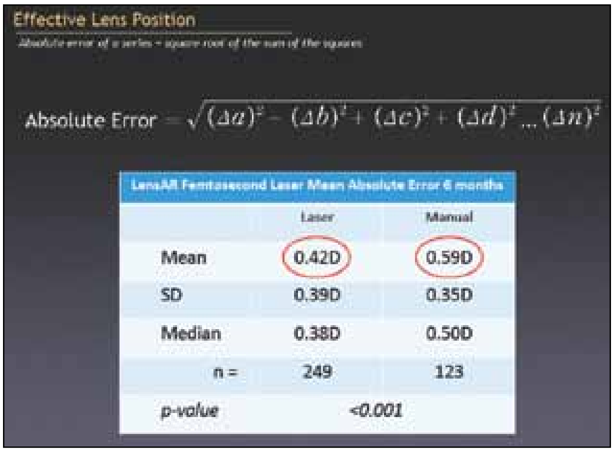


(Courtesy of Warren Hill, MD.)

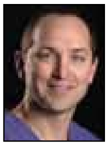
Figure 4. Dr. Hill's analysis of Dr. Uy's data shows a significantly lower mean absolute error in the laser group.

after surgery, a more predictable refractive result, and a quicker arrival at the final refractive result.

Dr. Hill recently presented similar data representing Dr. Harvey Uy's experience using the LensAR Laser System (LensAR Inc.) for 249 cases versus 123 cases with a manual capsulorhexis.[4] Six months postoperatively, the difference in mean absolute error between a manual capsulorhexis and a laser CCC was 0.17 D, corroborating a significantly lower mean absolute error in the laser group (Figure 4).

CONCLUSION

The aforementioned studies demonstrate that, with the help of a femtosecond laser, we can now create consistently sized and shaped CCCs that should produce more predictable refractive outcomes for our patients. With lasers, premium IOLs, new-generation formulas, optical biometry, and intraoperative aberrometry, we are moving ever closer to LASIK-like refractive results for our cataract patients. ■



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2. Cekiç O, Batman C. The relationship between capsulorhexis size and anterior chamber depth relation. *Ophthalmic Surg Lasers*. 1999;30(3):185-190. Erratum in: *Ophthalmic Surg Lasers*. 1999;30(9):714.
3. Cionni R. Improved precision and predictability for laser refractive cataract surgery. Paper presented at: The International Society of Refractive Surgery Annual Meeting; October 21, 2011; Orlando, FL.
4. Hill W. Effective lens positions and IOL power calculations. Paper presented at: ACOS Summit Orlando 2011; October 21, 2011; Orlando, FL.