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CASE OF THE MONTH

Real-World Outcomes of a Spiral Optic IOL

Compared with a Diffractive Trifocal

By James Myerscough, MD

The factors that make a patient a suitable candidate for simultaneous vision intraocular lenses (SV IOLs) at the time of cataract or presbyopic lens exchange (PreLEX) surgery are well reported. As more SV IOLs become available, however, it can be difficult to decide what lens to use for what patient, and it is important to understand how new technologies compare with established optics. In particular, an increasing number of extended depth of focus (EDoF) IOLs based on spherical aberration (SA) modulation are available, and, most recently, spiral optics emerged as a new category of SV IOLs. Deciding what type of EDoF IOL to use is quite intuitive. Measuring SA is relatively straightforward. Based on the value it is not difficult to decide whether modulating the SA (and by how much) is the most appropriate optical solution, and which lens will deliver the correct degree of SA. Spiral optics, however, are a less familiar optical concept for most ophthalmologists. Therefore, selecting patients appropriately is not necessarily as intuitive as with other lenses.

The Rayone Galaxy IOL (Rayner) is a refractive lens engineered with a spiral design that produces a smooth, progressive variation in power, with the idea being extension of the depth of focus whilst minimizing dysphotopic symptoms. I evaluated the performance of the Galaxy IOL in my first 80 cases, which included both cataract and PreLEX cases, and then compared results in the Galaxy PreLEX subgroup with those in a set of my PreLEX patients who received the AT LISA® tri 839MP IOL (Carl Zeiss Meditec AG).

Real-world outcomes

All of the Galaxy IOLs were implanted targeting emmetropia. Results at 3 months postop showed the refractive spherical equivalent (SE) was ±0.5 D of target in 96% of eyes. However, only 16% of eyes achieved uncorrected distance visual acuity (UDVA) ≥20/20. There was a tendency for residual myopia, which was easily attributable to the use of an A constant that was not yet fully optimized since the lens was not yet widely available on the UK market. Indeed, the A constant has since been optimized reflecting these early myopic outcomes. It was unusual, however, when comparing the UDVA and corrected distance visual acuity (CDVA) data, residual refractive error did not fully explain the suboptimal UDVA results.

In particular, when looking at the impact of residual astigmatism, as expected, astigmatism impacted negatively upon UDVA (Figure 1A). However, even when this astigmatism was corrected (Figure 1B), the CDVA remained suboptimal, suggesting that residual astigmatism with this lens may not be a purely lower-order phenomenon.

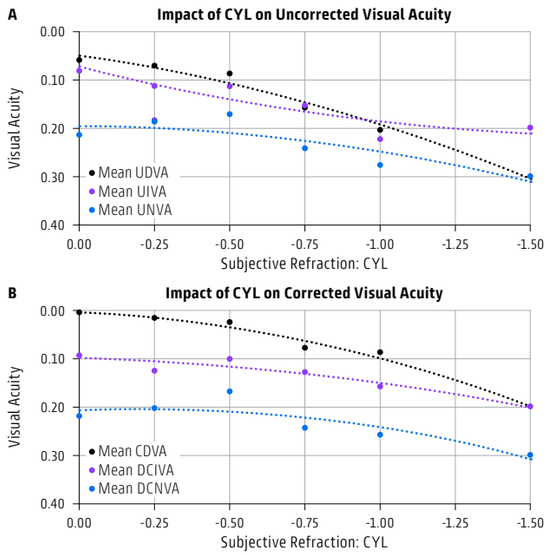

Figure 1: Impact of residual astigmatism on UDVA (A) and CDVA (B)

Outcomes in PreLEX patients compared with cataract surgery patients provide the ultimate test of SV IOL performance because of the relative superiority of preoperative CDVA that outcomes are benchmarked against. Accordingly, to better examine the outcomes, we looked at the subgroup of patients undergoing PreLEX, some of whom had expressed dissatisfaction with their vision. Analyzing data from this subgroup of 24 PreLEX eyes, the refractive predictability was excellent with all eyes ±0.5D of target. However, only 62% of eyes achieved UDVA ≥ 20/20, and again, UDVA did not consistently improve after correcting residual refractive error. Furthermore, although the numbers were relatively small, losses of CDVA were observed, with a loss ≥2 lines in 4.2% of eyes and of 1 line in 25%.

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In trying to put these findings in context, I compared them with the 3 month postop outcomes in an equivalent recent group of 28 PreLEX eyes implanted with the AT LISA tri. There were no AT LISA tri eyes with CDVA loss, and compared with the Galaxy IOL group, the AT LISA tri patients had significantly better uncorrected and corrected near (40 cm) and distance VA both in monocular and binocular testing (P <0.03 for all comparisons) (Figure 2). Monocular uncorrected intermediate VA (at 70 cm), however, was consistently superior in the Galaxy group versus the AT LISA tri group (logMAR 0.20 ± 0.09 vs 0.14 ± 0.05; P <0.01), which is in keeping clinically with the high level of satisfaction Galaxy patients report with their intermediate vision.

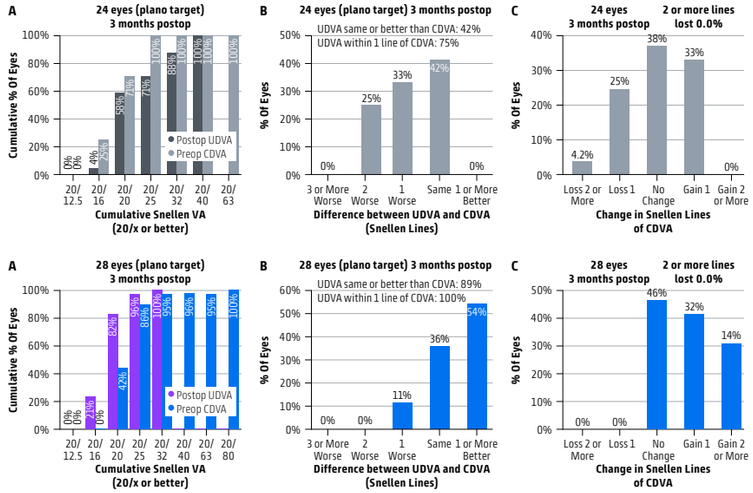

Figure 2: Standard graphs for reporting visual acuity outcomes with 3 months follow up after PreLEX, comparing outcomes for Galaxy IOL (above) vs AT LISA tri (below) group. Graph (A) and (B): Efficacy (relative to preoperative CDVA for 24 eyes in the Galaxy and 28 eyes in the AT LISA tri group). Graph (C): Safety (% of eyes losing 2 or more lines).

The defocus curves for the two lenses were consistent with the VA outcomes. The Galaxy defocus curve shows less drop off between the distance and reading peaks than the AT LISA tri, and better performance in the intermediate range, but at the expense of poorer distance vision (Figure 3).

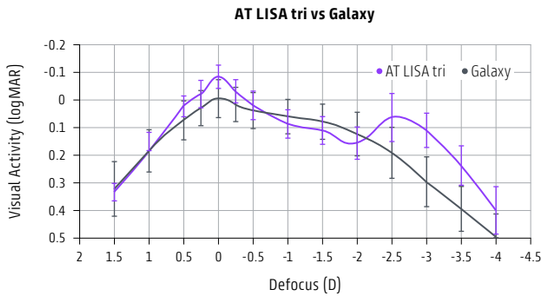

Figure 3: Defocus curve at 3 months: AT LISA tri vs Galaxy

Tenets for SV IOL success

Carefully identifying and optimizing any ocular comorbidity preoperatively, such as ocular surface dysfunction, is a given in patients undergoing lens-based surgery. Corneal topography is mandatory, not just to establish astigmatic magnitude and axis; but to quantify any asymmetric component, and therefore what degree of residual astigmatism is anticipated postoperatively. Furthermore, since many SV IOLs are conceptually based around modulation of higher order aberrations, corneal topography is imperative in identifying higher order aberrations to direct lens selection decision making.

Conclusion

As desirable as it may be, no single lens exists as the best solution for all refractive lens surgery. In patients desiring complete spectacle independence, there is no free lunch, and we need to decide with each patient what optical trade-off they are willing to accept to achieve maximal spectacle independence. To achieve complete spectacle independence with EDoFs, some degree of anisometropia is invariably necessary, and not the best solution for all. To reliably deliver reading performance without anisometropia, some degree of multifocality is often required.

In clinical practice, we need to be data driven so we can be clear explaining what trade-offs our patients are making when selecting an IOL. Data from PreLEX should be presented using the standard refractive reporting graphs so meaningful comparisons can be made between different lenses. From this (admittedly limited) sample of patients, whether dysphotopsia matters more or less than reliable distance vision is a central point in my preoperative discussion with each patient. I still find trifocality the most predictable and appreciated refractive solution in many patients seeking maximal spectacle independence. However, as newer optical concepts emerge, continued collection and transparent reporting of real-world outcomes will remain essential to defining the role of each technology and identifying the patients most likely to benefit.

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