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CATARACT SURGERY IN CHALLENGING CASES
Choosing the CT LUCIA 621P IOL to optimize success in eyes with compromised zonules

By Andreas F. Borkenstein, MD

CASE HISTORY

A 79-year-old man with a history of pseudoexfoliation and traumatic injury to the right eye 12 years earlier presented with a senile mature cataract. Findings on examination (OD) were: decimal BCDVA 0.2, IOP 19 mmHg (on medication), phacodonesis with zonulolysis. Biometry measurements acquired using the IOLMaster® 500 (Carl Zeiss Meditec AG) are: axial length 23.52 mm, K1 41.87 D, K2 42.46 D, cyl 0.59 @ 149°. Surgery was planned with implantation of the single-piece monofocal aspheric CT LUCIA® 621P IOL (Carl Zeiss Meditec AG). Using the SRK/T formula and a refractive target of emmetropia, the selected IOL power was 24.0 D. Surgery was completed uneventfully. At 48 hours postop, the IOL was well centered. At 6 weeks and 12 weeks postop, refraction was stable (-0.75/0.50/125), decimal BCDVA was 0.9+, and IOP was 16 and 17 mmHg, respectively.

Why did you choose the CT LUCIA 621P ("CT LUCIA") IOL? Careful consideration to IOL selection is critical in eyes with compromised zonules and pseudoexfoliation that are at risk for increased capsular phimosis considering the challenges for achieving IOL centration and maintaining long-term positional stability.

Earlier in my career, I routinely implanted a 3-piece IOL in eyes with compromised zonules. My preference at that time was guided by the opinion of experienced colleagues who believed that with its broad rigid haptics, a 3-piece IOL would have better centration and better positional stability than a "soft", acrylic single-piece implant.

It is crucial to understand that not all single-piece IOLs are alike. Times have changed because of developments in IOL technology and so has my approach. The CT LUCIA is now my IOL of choice in these challenging cases because it is engineered for excellent in-the-bag stability and to deliver quality optical performance that is tolerant to decentration (Figure 2).

What explains the in-the-bag stability? The CT LUCIA is designed with a thick rigid optic-haptic junction and step-vaulted C-loop haptics that maximize optic-capsule contact. We have confirmed these characteristics in bench studies (Figure 1), which also show differences in the optic-haptic junction configuration and capsular bag contact between the CT LUCIA and single-piece monofocal IOLs from competing manufacturers. Scanning electron microscopy analysis reveals that the CT LUCIA has a thicker and wider optic-haptic junction and different haptics design than the other single-piece monofocal IOLs. Placing the IOLs inside rings of various diameters to simulate capsular bag sizes of hyperopic and myopic eyes, we found that haptic contact area and the angle of contact were maximal with the CT LUCIA, which suggests it would provide optimal refractive stability across the range of capsular bag dimensions encountered in clinical practice.

Figure 1: Bench analysis to evaluate the capsular bag contact. Publication by Andreas F. Borkenstein in progress.

What is important about optic design in eyes at risk for IOL decentration? IOL decentration remains a risk in eyes with zonular compromise, even when the surgery is done perfectly. With its novel aspheric technology, the CT LUCIA also has an advantage compared to other aspheric lenses for having greater tolerance to the negative impact of decentration on visual quality.

The CT LUCIA optic features the patented ZEISS Optic (ZO) Asphericity Concept that is described by a central (~3.5 mm) spherical aberration (SA)-correcting zone surrounded by an annular region in which the SA changes from negative in the center to positive moving outward to the peripheral edge. Other aspheric IOLs on the market have optics that are either SA-correcting, having varying amounts of negative SA, or SA neutral. Results of previously published studies show that when properly aligned, aspheric IOLs provide better mesopic vision and contrast sensitivity than spherical IOLs. However,

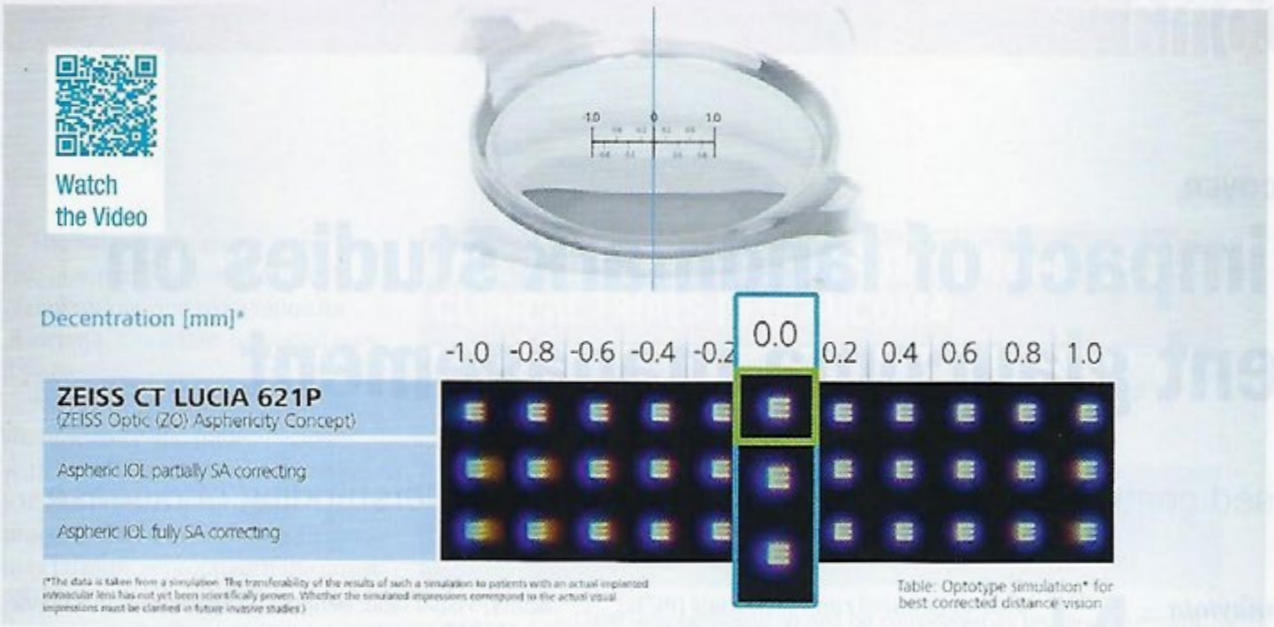

Figure 2: Simulated visual acuity under decentration with CT LUCIA 621P

decentration or tilt of an SA-correcting IOL leads to deterioration of optical performance.[1] Assuming they have good visual acuity, pseudophakic patients with a misaligned SA-correcting IOL might not recognize any significant impact on their vision in situations where there is good lighting. However, they are more likely to notice reduced quality of vision under mesopic conditions when the pupil is larger. This is especially likely if the patient is a myope who was implanted with a lower power lens that induces more positive SA.

We have also done bench studies examining the impact of decentration and tilt on optical quality with the CT LUCIA and other monofocal IOLs of different optic designs.[2] In these studies we measured the modulation transfer function and Strehl ratio values at aperture sizes of 3.0 and 4.5 mm. We also assessed the United States Air Force target images. The results showed that SA-correcting IOLs performed best when they were perfectly centered, but their optical performance was degraded by misalignment. In contrast, the CT LUCIA performed well even in the setting of decentration and tilt. You can call the CT LUCIA less sensitive or more forgiving to decentration.

Is there anything you would point out about the implantation behaviour? The CT LUCIA comes fully preloaded in the BLUESERT™ injector that allows consistent release and unfolding of the IOL into the capsular bag. To facilitate delivery of the haptics in a planar fashion and complete implantation of the IOL in the capsular bag, I slightly rotate the injector in a clockwise direction just before releasing the lens and then advance it as the leading haptic emerges from the tip. Occasionally, I find a need to move the trailing haptic into the capsule using a second instrument. This assisted implantation adds no more than 2 seconds to the case and does not pose any risk for damaging the capsule or corneal endothelium. Because of its thicker and wider optic-haptic junction, the CT LUCIA unfolds slower and in a slightly different manner than other single-piece hydrophobic acrylic IOLs. I do not see these unfolding characteristics as a downside. Rather I am reminded while watching the lens unfold that its unique optic-haptic junction and haptics design provides centration and stability benefits, which are what matter.

You are a surgeon, working in a private clinic. Why are you doing these in vitro studies and analysis? My responsibility as a surgeon is to provide my patients with the best. Therefore, when manufacturers introduce new IOL models, I have always felt it important to subject them to my own research to collect objective data. Then I can make an informed decision about whether an IOL has features that make it a valuable addition to my surgical practice. My laboratory investigations with the CT LUCIA show there are interesting differences among monofocal IOLs. The results confirm that the lens has unique design elements that have implications for intraocular behavior and long-term optical performance.

Based on my research and clinical experience, the CT LUCIA is a reliable choice for achieving excellent outcomes after cataract surgery in routine cases and is especially suitable for patients with pseudoexfoliation or other issues that create challenges for achieving in-the-bag centration, positional stability, and good quality vision as decentration may occur.

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