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Transitioning From Cataract Surgery to Refractive Cataract Surgery

A short course on mastering trifocal IOLs.

BY FLORIAN T.A. KRETZ, MD, FEBO

ransitioning from cataract surgery to refractive cataract surgery—where the focus shifts to postoperative refractive accuracy—requires commitment, but it is one that any ophthalmologist can make when time is taken to understand the available lens-based refractive correction options and how to best utilize them for their patients. This article will focus specifically on trifocal optics and include discussion on patient selection and education and long-term outcomes with the AT LISA tri (Carl Zeiss Meditec).

PATIENT SELECTION

The most important consideration in refractive cataract surgery is patient selection. You must take time to focus on each individual patient by getting to know his or her specific visual requirements, lifestyle needs, and personality type. Some patients are focused on near tasks such as reading or handcrafting. Others desire optimized intermediate focus for computer work. And of course others want an overall excellent quality of vision without spectacle correction. Likewise, consider the light conditions that patients typically work under. Individualized treatment is the key to success with refractive

- How much spectacle independence do you require?
- · How accepting would you be of dysphotopsias?
- What distance or distances of vision are most important to you in your daily life?

cataract surgery. Ask your patients the following questions:

 What light conditions do you typically work in or perform your hobbies in?

You must also diagnose and treat any ocular surface disease before proceeding with refractive cataract surgery, as its presence will not only affect preoperative measurements and IOL power calculation but also complicate the healing process and influence postoperative outcomes. Patients with severe, uncontrolled dry eye disease and those with a concomitant disease that limits visual outcomes are contraindications for a trifocal IOL.

When transitioning to refractive cataract surgery with trifocal IOLs, the easiest patients to start with are presbyopic hyperopes. Emmetropes, on the other hand, can be difficult because they may lose some distance vision.

"The AT LISA tri and tri toric expand the range of patients in whom I can safely and effectively perform refractive cataract surgery."

SETTING EXPECTATIONS

The second most important aspect of refractive cataract surgery is setting the right expectations with your patients. Most of our cataract patients are used to a high level of glare due to the opacification of the crystalline lens, but they won't be used to halos. Instead of highlighting the possibility that they could experience halos with a trifocal IOL, emphasize to them that their focus will be sharper and that they will no longer experience glare. You must mention that halos are possible, but lead with those other points I just mentioned. Also, explain to patients that this lens will better compensate for their overall vision.

I also find it helpful to use a halo and glare simulator. Patients are shown images with average values of halos and glare and are asked, "Can you live with it? Do you think that would bother you?" And usually patients are happy to exchange that glare for some halos. Explain to patients that they will need good light, especially if they want to do near tasks under dim light conditions, and that there will be a period of neural adaptation while their brain learns the new optical system. I always try to underpromise and overdeliver. (Editor's note: For more pointers on talking to patients and explaining the AT LISA tri surgical experience, see Dr. Daponte's article on pg 10.)

LONG-TERM STABILITY

We recently performed a 3-year follow-up study to determine the functional outcomes with the AT LISA tri and the AT LISA tri toric. The study enrolled 109 men and 142 women with high myopia and high hyperopia with significant astigmatism. The median age was 62 years.

TABLE 1. REFRACTIVE RESULTS WITH THE AT LISA tri								
AT LISA tri 839 MP	[median] [range]	3 months	12 months	24 months	36 months			
	Sphere (D)	+0.25	+0.50	+0.50	+0.50			
		-1.50 to 1.00	-1.00 to +1.75	-0.75 to +1.75	-0.75 to +1.75			
	Cylinder (D)	-0.50	-0.50	0.00	-0.50			
		-1.75 to 0.00	-1.50 to 0.00	-1.50 to 0.00	-1.50 to 0.00			
	Spherical Equivalent (SE) (D)	0.00	+0.125	+0.125	+0.125			
		-2.375 to 1.00	-1.125 to +1.50	-1.125 to +1.00	-1.125 to +1.00			
	Spherical Equivalent Delta (D)	+0.375	+0.125	0.00	0.00			

TABLE 2. REFRACTIVE RESULTS WITH THE AT LISA tri TORIC								
AT LISA tri toric 939 MP	Median (D)	3 months	12 months	24 months				
	Sphere (D)	0.00	+0.25	+0.50				
		-3.00 to +1.50	-1.25 to +2.50	0.75 to +2.50				
	Cylinder (D)	-0.50	-0.50	-0.75				
		-2.25 to 0.00	-2.25 to 0.00	-2.25 to 0.00				
	Spherical Equivalent (SE) (D)	-0.125	+0.0625	+0.125				
		-3.125 to +1.125	-1.50 to +1.375	-1.25 to +1.375				
	SE Delta (D)	-0.125	-0.1875	0.0625				

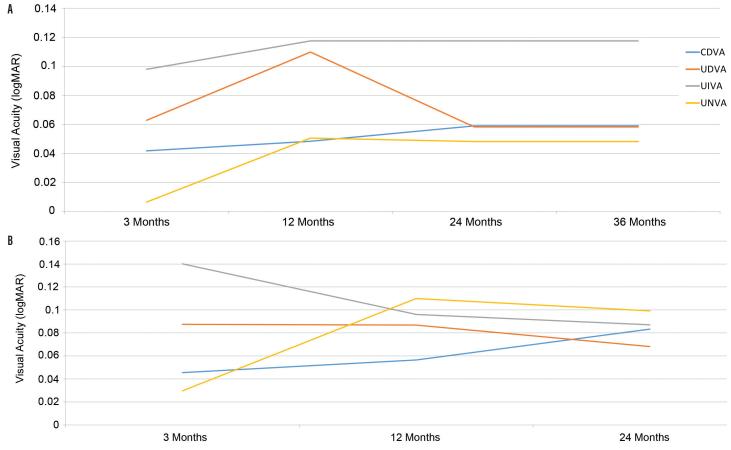


Figure. Functional results with the AT LISA tri (A) and AT LISA tri toric (B).

The refractive results with the AT LISA tri are found in Table 1. The results with the toric version at 2 years, found in Table 2, were similar. What we found is that both lenses had excellent functional results and long-term stability (Figure). UCVA for distance, intermediate, and near vision stayed the same over the 3-year period with the AT LISA tri and a 2-year period with the AT LISA tri toric.

CONCLUSION

The AT LISA tri and tri toric expand the range of patients in whom I can safely and effectively perform refractive cataract surgery. Further, the long-term outcomes with this lens are excellent, and there is a high level of patient satisfaction. For those surgeons who are ready to transition to refractive cataract surgery, a great place to start is with the AT LISA tri IOL.

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AT LISA tri: Safe, Effective, and Well Tolerated

This lens provides excellent visual acuity at all distances and a high level of spectacle independence.

BY AANCHAL GUPTA, MD

rifocal IOLs have become a popular option with patients because of their potential to enhance visual quality at near, intermediate, and distance. All trifocal IOLs follow the same basic principle, which is to combine two diffractive step-widths to create near, intermediate, and distance foci. Each trifocal lens is unique in its design details, and slight variances exist in their safety and efficacy.

I conducted a small study comparing performance outcomes with two diffractive trifocal IOLs, the AT LISA tri (Carl Zeiss

Meditec) and the AcrySof PanOptix (Alcon). This article overviews my results.

BACKGROUND

The AT LISA tri has a central diffractive trifocal zone. It has covering all distances and an outer bifocal zone to enhance distance and near vision under low light conditions. The intermediate and near focus planes are 80 cm and 40 cm, respectively. The light distribution is 50% for distance, 20% for

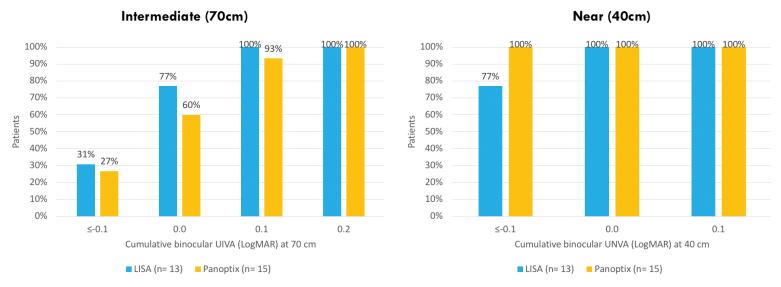


Figure 1. Binocular uncorrected intermediate and near visual acuities with the AT LISA tri and PanOptix IOLs.

"I am confident when recommending the AT LISA tri IOL because it provides excellent distance, intermediate, and near visual acuities, and it offers a high level of spectacle independence."

intermediate, and 30% for near. The PanOptix IOL, which has a central diffractive trifocal zone and an outer refractive distance zone, has similar light distribution, with 50% for distance and 25% for each intermediate and near. The intermediate focal point of the PanOptix is 60 cm and the near focal point is also 40 cm.

We recently conducted a single-center, prospective study to determine the performance outcomes of the AT LISA tri and AcrySof PanOptix IOLs. Twenty-eight patients were included in the study, 13 in the AT LISA tri group and 15 in the PanOptix group. All patients underwent routine cataract surgery or refractive lens exchange to target emmetropia, and the Barrett Universal II formula was used for IOL power calculation.

Patients in both groups had similar axial lengths, mean keratometry readings, and corneal astigmatism. There was a slightly higher incidence and range of anterior corneal astigmatism in the AT LISA tri group.

STUDY OUTCOMES

The results discussed here are from 3 months postoperative. Generally speaking, the two lenses performed very well. The refractive outcomes were similar between the AT LISA tri and PanOptix groups in terms of sphere and spherical equivalent (mean spherical equivalent, -0.053 D vs 0.042 D, respectively). However, the AT LISA tri provide slightly superior distance visual acuity as well as intermediate visual acuity at 70 cm.

In terms of patients' functional vision (Figure 2), when we looked at monocular distance UCVA, about 70% of all patients achieved 6/6, with slightly better values in the AT LISA tri group (69%) compared to with the PanOptix group (63%). Nearly 100% of patients achieved 6/7.5 and 6/9.5. Results for monocular distance BCVA were similar.

We also compared intermediate vision with the lenses. selecting a midpoint of 70 cm to achieve a head-to-head comparison. In the AT LISA tri group, nearly 80% of patients had excellent (0.0) uncorrected intermediate visual acuity, compared with 60% in the PanOptix group (Figure 1). The latter improved at the manufacturer-specified distance of 60 cm. When we looked at the near data at 40 cm, again both lenses did very well, with all patients achieving N 4.5 (Figure 1). Presbyopic patients in the study were among the most satisfied with this gain in near visual acuity.

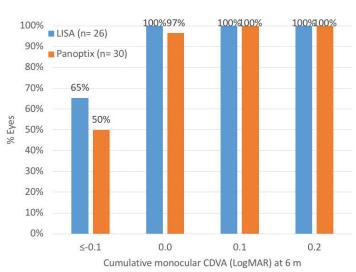
Refractive outcomes were comparable to those in other published studies. About 90% of all patients enrolled in the study were within ±0.50 D of the target refraction, and 60% to 70% were within ±0.25 D. Both lenses did very well in terms of toric accuracy and residual cylinder; again about 90% of patients in both groups were within ± 0.50 D.

100%97% ■ LISA (n= 26) 81% 83% Panoptix (n= 30) 80% 69% 70% 63% 60% 50% 40% 30% 23% 20% 13% 10% 0% 0.0 ≤-0.1 0.1 0.2 Cumulative monocular UDVA (LogMAR) at 6 m

Uncorrected

Figure 2. Uncorrected and corrected distance visual acuity with the AT LISA tri and PanOptix IOLs.

Corrected



PATIENT SATISFACTION

Also, both groups achieved a very high level of spectacle independence for distance, intermediate, and near vision. The only difference between the two lenses seemed to be for intermediate vision, and in our study a larger percentage of AT LISA tri patients compared with PanOptix patients achieved 0.0 uncorrected intermediate visual acuity (80% vs 60%, respectively) at 70 cm. It is therefore important in choosing the appropriate IOL for a patient that their intermediate distance requirement be considered.

An overwhelming majority of patients in both groups (90%) were completely or very satisfied with their postoperative vision, and 95% said they would choose the same IOL again. Further, more than 90% of patients would recommend the lens they received to family or friends.

Also factoring into patient satisfaction was the low incidence of halos and glare in each group. When asked about the occurrence of halos and glare, 100% of AT LISA tri patients responded that they never or only occasionally experienced glare.

TAKE-HOME POINTS

There are three points that we learned through this study. No. 1: Aim for zero refractive error. In particular with trifocal IOLs, it is important to minimze refractive errors in order to achieve optimal distance vision.

No. 2: Good light is crucial for near and intermediate vision tasks. Trifocal IOLs split the light into three focus planes, making only a fraction of the light effectively available for different focus distances. Patients must therefore be educated that they may need sufficient light for certain tasks, such as reading without spectacles at near or intermediate distances.

No. 3: When selecting a trifocal IOL, it is best to consider the patient's intermediate distance requirements. For

instance, the AT LISA tri is a great choice for individuals who do a significant amount of office work, as computer desktops are typically located at a distance of around 70 cm.

CONCLUSION

As shown in our study, both lenses provide patients with good outcomes. The key difference, however, was in intermediate vision at 70 cm, with more patients in the AT LISA tri group achieving 0.0 uncorrected intermediate visual acuity. The AT LISA tri also provided slightly superior distance visual acuity, and our result is in line with previous studies. Both lenses provided excellent near visual acuity, with a slight advantage with the PanOptix.

In my personal experience, AT LISA tri patients experience a spectacular wow factor the day after surgery, with most reporting a drastically enhanced clarity of vision and seamless vision. The difference in optical quality, based on the material and optical concept of the AT LISA tri, as well as my patients' positive outcomes, have confirmed in my mind that this lens is the best choice for even my most demanding cataract surgery and refractive lens exchange patients.

We must always consider patients' visual requirements when selecting the appropriate IOL. I am confident when recommending the AT LISA tri IOL because it provides excellent distance, intermediate, and near visual acuities, and it offers a high level of spectacle independence. In my experience, this lens is a reliable solution to achieve excellent patient satisfaction.

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- = Financial disclosure: None acknowledged

IOL Decentration and Postoperative Outcomes

A lesson on angle kappa and centration for trifocal IOLs.

BY BENJAMIN RICHARD LAHOOD, MBCHB, PGDIPOPHTH, FRANZCO

ostoperative outcomes play an integral role in the success of surgery with multifocal and trifocal IOLs and in producing happy patients. Today, we know that IOL decentration and angle kappa can influence postoperative outcomes. The topic of angle kappa can be challenging to understand, mainly because there are so many different terms to describe often theoretical optical axes and angles. In short, angle kappa is the angular separation between visual and pupillary axes (Figure 1), and its magnitude can impact postoperative outcomes and potential side effects with certain types of IOLs. Even that statement takes some background knowledge to understand. Instead, consider that we are talking about a mismatch between the center of an IOL, the pupil, and a line joining the fovea with a target of fixation.

We recently conducted a study to determine the effect of decentration for the AT LISA tri 839MP (Carl Zeiss Meditec). Our results are presented in this article.

BACKGROUND

Decentration of any IOL can degrade image quality. The amount of decentration needed to impact vision for a monofocal IOL is quite extreme and usually the consequence of a surgical complication. A monofocal, neutral aspheric IOL is the most forgiving to decentration, with negative aspheric and spherical monofocal IOLs being slightly less immune. With a diffractive IOL, significant decentration can cause light to hit some of the rings at an unusual angle. In that situation, the pupil aperture can limit light to the rings, creating asymetrical diffractive patterns and unwanted visual symptoms.

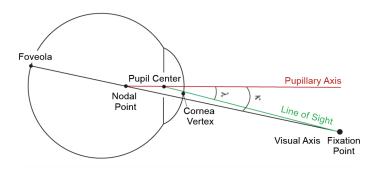


Figure 1. A depiction of angle kappa.

"At normal physiological angle kappa or CWC values...the amount of IOL decentration does not appear to be detrimental to the outcome of implanting the AT LISA tri or AT LISA tri toric."

Each diffractive optic has a different level of tolerability to decentration. In most eyes with minimal angle kappa, the two potential candidates for centration—pupil center and visual axis—are virtually superimposed and make positioning an easy decision. A higher angle kappa means that the center of the pupil does not fall on a line connecting the fovea to fixation. Therefore, the surgeon must decide between the more cosmetically appealing centration on the pupil and the potentially more functional centration on the visual axis. Moving the IOL too far from the pupil center creates problems with the pupillary aperture interfering with the diffraction process, and this has been blamed for giving patients waxy vision. In simple terms, with a high angle kappa, even when the lens is perfectly centered on either the pupil or the visual axis, a functional decentration could result, which can reduce image quality just the same as a decentered IOL in a more normal eye.

MEASURING ANGLE KAPPA, PLACING THE IOL

Angle kappa is difficult to define and even trickier to measure. A more modern and functional equivalent is the Chang-Waring chord (CWC), also known as chord mu. It is a two-dimensional vector measured across the corneal surface from the center of the pupil to the coaxially sighted, subject-fixated corneal light reflex. This measurement is possible with the IOLMaster 700 (Carl Zeiss Meditec). This device will also provide coordinates of the iris center, which relates to angle alpha and the center of the capsular bag, where an IOL will most likely settle.

Views have been divided on whether an IOL can stay positioned where it is placed or whether it goes where the capsule pushes it; however, there is clinical evidence that IOLs generally show long-term stability with decentration of

0.1 to 0.3 mm.¹⁻³ There is no definite cutoff value of chord mu above which a diffractive multifocal IOL should not be used. Theoretical optical bench studies and in vivo testing indicate that if chord mu is greater than 0.6, 0.75, or 0.5 mm, respectively, patients with a diffractive lens are more likely to experience noticeable visual phenomena.³⁻⁵ Therefore, proper centration of the lens is crucial. With a nontoric IOL, it may be possible to rotate the lens within the mildly oval capsular bag so that haptic alignment allows more natural centration.

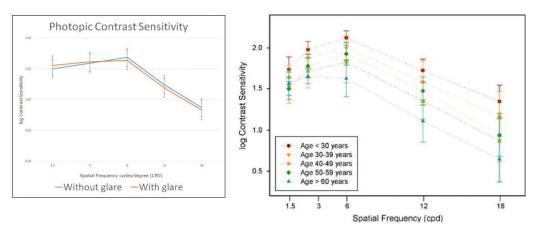


Figure 2. Contrast sensitivity with the AT LISA tri in mesopic and photopic conditions with and without glare stimuli.

Diffractive trifocal IOLs like the AT LISA tri are particularly sensitive to residual astigmatism and will most commonly be used as a toric model in patients with 1.00 D of cylinder or more. This restricts the use of a rotational centering technique to let the capsule position the IOL naturally. In these cases, more effort needs to be made to remove OVD from behind the IOL and maximize capsular contact for permanent positioning. With a large CWC or angle kappa, positioning of a diffractive trifocal IOL becomes much more important. One compromise is to center the IOL between the Chang-Waring corneal light reflex and the pupil center.

Another consideration in terms of IOL decentration is implanting a trifocal IOL in a highly myopic eye with a large capsule. This is because the relatively small IOL can become more easily decentered (often inferiorly). The four-haptic design of the AT LISA tri, compared to C-loop haptic designs, has been shown to be more stable long term in such eyes.^{6,7}

STUDY

We recently conducted a study looking at decentration, contrast sensitivity, and long-term visual acuity in 51 eyes implanted with the AT LISA tri. At 1-year postoperative, IOL centration remained within normal limits for all eves: visual acuity at near, intermediate, and distance remained excellent; and subjective refraction was stable.

Decentration. At 1-year postoperative, the average decentration in all different directions was 0.25 ±0.21 mm. Most importantly, there was no statistically significant correlation between the decentration relative to the pupil or the corneal vertex compared to contrast sensitivity, UCVA and BCVA, or higher-order aberrations.

Contrast sensitivity. We also found no correlation between contrast sensitivity and decentration in mesopic and photopic conditions with and without glare stimuli (Figure 2). Our contrast sensitivity results in patients were equivalent to those

of phakic patients a decade younger. There has been a lot of talk about the loss of contrast sensitivity with diffractive trifocal lenses, but our study clearly showed that, compared to a phakic person of a decade younger, patients with the AT LISA tri are actually doing very well. There is a tradeoff with any diffractive technology because light must be split, affecting contrast sensitivity. However, the advantages of this lens appear to make up for any downside in most people.

Long-term visual data. Patients had excellent BCVA and UCVA at all distances. Notably, patients' binocular distance UCVA was particularly good. And as you would expect, the binocular visual acuities were better than monocular due to binocular summation.

CONCLUSION

At normal physiological angle kappa or CWC values that would be expected in a normal population of cataract patients, the amount of IOL decentration does not appear to be detrimental to the outcome of implanting the AT LISA tri or AT LISA tri toric. Further, our study indicated that the AT LISA tri is a robust lens that can be beneficial in a wide variety of eyes.

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- = Financial disclosure: None acknowledged

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My Cataract Surgery Experience

I elected to have the AT LISA tri implanted in my own eyes, and I couldn't be happier.

BY PABLO DAPONTE, MD

am the first to admit that I'm not the best patient. I'm very obsessive and demanding. I have very high expectations.

And I am very active and especially enjoy water sports like surfing, kite surfing, and scuba diving. But in March 2019, at age 54, I underwent cataract surgery with implantation of the AT LISA tri IOL (Carl Zeiss Meditec), and I couldn't be happier.

My motivation to have the surgery as early as I did was that I wanted to be more comfortable in the OR and in my personal life. I wanted to see through the microscope oculars as clearly as possible, and I wanted to see what was happening with the waves while standing on the surf board.

When I decided to undergo cataract surgery, I had already been implanting the AT LISA tri in my patients for about 3 years, and I was continually impressed with their results. I couldn't believe how soon most reached 20/20 visual acuity, and very rarely did patients complain about visual phenomena or poor vision at night. I knew I wanted a lens that would work just as well outdoors as indoors, and I decided that the AT LISA tri was the best lens that I could choose.

THE PROCEDURE

Before surgery, I was hyperopic in both eyes, and my near vision was very poor. Measurements from my preoperative examination are found in Figures 1 through 4. My dominant right eye, which had an axial length of 25.04 mm, an

"At some point in our careers, we will all require cataract surgery. When that time comes, I recommend picking a lens that you truly believe in, like I do with the AT LISA tri."

anterior chamber depth (ACD) of 3.48 mm, and keratometry (K) readings of 41.11 and 41.41, was operated on first, and a 19.00 D AT LISA tri was implanted. I usually operate on the dominant eye first in my patients because I think it helps the brain best decide how to read and to choose far and near distance with the new optical system.

Surgery in my left eye, which had an axial length of 25.07 mm, ACD of 3.61, and K readings of 40.91 and 41.26, was performed 1 week later, and in that procedure an 18.50 D AT LISA tri was implanted. I had very little astigmatism, so I did not require a toric lens in either eye.

Right after surgery, I couldn't believe how well I could read. And I continue to maintain that quality of vision. Now, in the OR and in my personal life, I no longer need glasses.

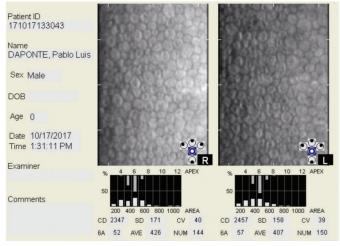


Figure 1. Dr. Daponte's endothelial cell count measurements.

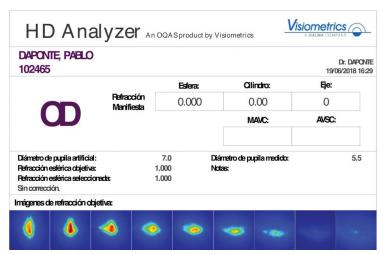
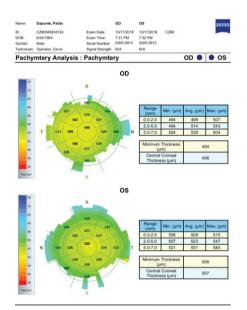


Figure 2. Dr. Daponte's measurements from the HD Analyzer (Visiometrics).



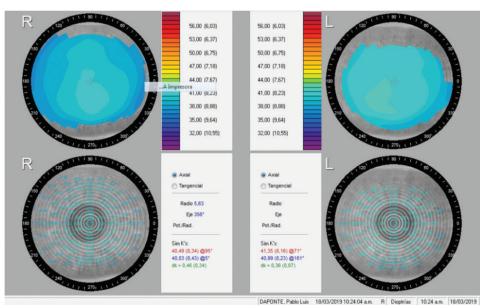


Figure 3. Preoperative pachymetry analysis for Dr. Daponte.

Figure 4. Preoperative keratometry readings in Dr. Daponte's right and left eyes.

ENHANCING THE PATIENT CONNECTION

Having had cataract surgery, I can now relate completely to my patients' hopes and fears of surgery, and sharing my experience with them has helped to enhance the surgeon-patient connection. I reassure my patients by explaining what I went through pre- and postoperatively, and I tell them that I don't use glasses anymore.

I share that I am now 20/20 and J1 OU and that even the first day after surgery my vision was crisp and clear. I also tell them that I experience halos in both eyes, but over time my brain has learned how to adapt to them. However, I tell them, the older you get the less you will experience halos. By about 60 years, most people do not experience halos at all. (Also, as a trained cataract surgeon who has performed more than

80,000 procedures, I was consciously looking for halos. This is different from most patients.)

CONCLUSION

At some point in our careers, we will all require cataract surgery. When that time comes, I recommend picking a lens that you truly believe in, like I do with the AT LISA tri. If it's good enough for my patients' eyes, it is good enough for mine. More than 1 year after my cataract surgery, I am still very happy with my decision.

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