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THE COMPLETE PICTURE

Experiences with the ALADDIN system

ALADDIN

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Advantages of The Aladdin

How this all-in-one optical biometer edged out the IOLMaster in a personal comparison of technologies.

BY CHRISTOPHER KISS, MD

For years, the IOLMaster (Carl Zeiss Meditec) was the only noncontact optical biometer on the market. Needless to say, most ophthalmologists owned one and considered it the gold standard for IOL power calculations. Several other technologies were released along the way, and surgeons began to diversify their portfolio for preoperative measurements. Today the IOLMaster has some stiff competition, with the main opponent being the Aladdin (Topcon). Recently we decided to purchase a new optical biometer, and below I recount why it was the Aladdin I chose to incorporate into my clinical practice, based on results from a personal comparison of technologies.

COMPARISON

Overview. I recently compared the previous gold standard of care, the IOLMaster, to three other biometry technologies on the market, the Lenstar LS 900 (Haag-Streit), the AL-Scan (Nidek Co.), and the Aladdin, to decide which to purchase for our clinic. The latter technology includes an optical biometer and a Placido-ring topographer, thus allowing surgeons to calculate IOL power and evaluate corneal topography in a single device. The Aladdin can be used to obtain measurements of axial length, corneal radii/keratometry (K readings; Figure 1), anterior chamber depth, cylindrical power, corneal astigmatism, corneal aberrations, and white-to-white. It can also be used to detect corneal diseases, to perform pupillometry, and to conduct a Zernike analysis for extra assessments (Figure 2).

Corneal topography and pupillometry. The biggest advantage that we found in our comparison is that the Aladdin offers topography of the cornea. This is unique to other diagnostic systems on the market. With the other systems, K readings are acquired based on various measurement points, the least of which is surveyed with the IOLMaster. The AL-Scan includes 36 measurement points plus two circles, resulting in some of the more accurate K readings compared with the IOLMaster and the Lenstar LS 900. But the most accurate K readings were obtained with the Placido-disc topography system included with the Aladdin, as

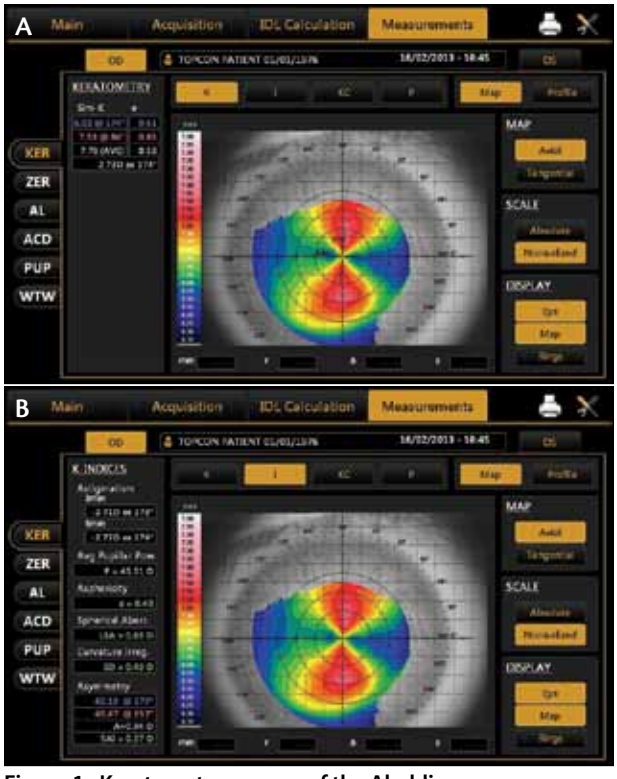

Figure 1. Keratometry screens of the Aladdin.

demonstrated in Figure 1. This system uses 15 concentric lines to seamlessly map the cornea, which is very good for toric IOLs or post-LASIK eyes. But the reason we finally chose the Aladdin was that it also offers dynamic pupillometry, which is also quite unique for biometers.

Ease of use. We also found that the Aladdin was extremely handy and easy to use. The other three biometry devices were also intuitive, but the Aladdin was among the fastest in terms of acquisition of the scan. This is what prompted us to closely analyze this device and consider replacing the IOLMaster with it.

MAKING A DECISION

All the machines are very good at what they do, which is measure the eye and predict the best IOL for each patient. At the end of our analysis, we were left decid-

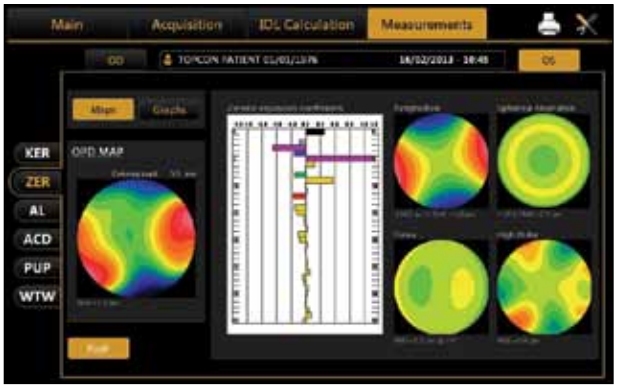

Figure 2. The Aladdin can be used for Zernike analysis, providing additional preoperative assessments.

ing between purchasing the AL-Scan and the Aladdin. We had ruled out the Lenstar LS 900 because it was the slowest and it was also the only system that would have required us to purchase a laptop, as there is no integrated computer. We use a lot of Alcon products, and the company had wanted us to use ray tracing with the Lenstar; however, this was still not enough to convince us to purchase that system.

Biometry is especially important for a practice like ours, doing refractive cataract surgery with multifocal and toric IOLs. We also do a lot of LASIK and LASEK and so the availability of pupillometry with the Aladdin seemed like an appropriate choice for us. In the end, we decided that the Aladdin best fit the specific needs of our clinic. The thing that we were most interested in was keratometry, which in my opinion, is best obtained with topography. However, pupillometry is a close second requirement for our clinic. Paired with the fast acquisition speed and ease of use, the Aladdin was the clear winner in our assessment. Simply put, it was the best fit for a refractive practice like ours.

In addition to biometry, topography and pupillometry are especially important for cataract surgery procedures that include implantation of a multifocal or toric IOL. The charming thing about the Aladdin is that this is all incorporated into one device.

POSTREFRACTIVE CASE STUDY

A patient who previously underwent radial keratotomy presented for cataract surgery. The patient had an extremely flat cornea (K readings, 9.99 and 9.86 mm) and a long eye (27.46 mm). We performed his preoperative assessment using only the Aladdin. The big advantage of using this machine in this case is that the Camallin-Calossi post-LASIK IOL calculation formula is built into the system. When we used the SRK-T IOL power calculation formula, there was a 3.00 D difference from the IOL power suggested by the Camallin-Calossi formula. We chose to use the post-LASIK formula plus the measurements from the Aladdin and decided to implant a 23.00 D SN60WF IOL (Alcon).

After performing cataract surgery and IOL implantation, the patient ended up plano—a most impressive result considering the patient's challenging refractive issues. We didn't really expect it, but we were happy when we saw the results.

CONCLUSION

Performing refractive cataract surgery in a patient with severely reduced visual acuity preoperatively who achieves quality vision postoperatively, the choice of biometry and the refractive result is not as important. But today this is only a handful of the patients we see. Any time we perform refractive cataract surgery in patients who see 20/20 before surgery, they will not be happy unless they achieve a UCVA of 20/20 afterward. There is no exception, and this is the reason that we chose the Aladdin as a biometer. With a built-in topographer, we can get very accurate refractive results. At the moment, our results are within 0.25 to 0.50 D of intended correction. ■

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The Clinical Importance of Topography for Cataract Surgery

The Aladdin has optical biometry and topography in one easy-to-use unit.

BY CLAUDIO CARBONARA, MD

I have been involved in biometry for many years. I started studying the basics in 1990 and by 1994 I abandoned contact biometry for immersion biometry. Following courses organized by the American Academy of Ophthalmology (AAO) and the American Society of Cataract and Refractive Surgery (ASCRS), I was able to learn about the intricacies of biometry from Sandra Frazier Byrne, MD; Jack T. Holladay, MD; and my good friend Kenneth J. Hoffer, MD, who are the most important names in ocular ecobiometry.

Figure 1. The Aladdin has a built-in corneal topographer.

After 6 years of using immersion biometry with excellent results, I learned that Carl Zeiss Meditec was about to launch the IOLMaster. I bought the first model immediately and continued to upgrade each time a new version of the software was released. The latest unit that I purchased was the IOLMaster 500. But even the newest optical biometers are not always able to measure the size of the eye. In eyes with excessive lens opacities, for example, the interferometer laser cannot image the retina. For this and other reasons I found it necessary to have an ultrasound biometer as well.

A few years ago Topcon asked me to contribute to the development of the Aladdin (Figure 1), which is the only optical biometer that comes with a topographer. I started using the prototype about 2 years ago, when the instrument required an external Windows-compatible computer. Later, the manufacturer took steps to integrate a computer into the device, which has made it even better and easier to use.

ADVANTAGES

My decision to buy the Aladdin was an easy one. This instrument is extremely fast, both in acquiring and processing data and it allows the examiner to obtain a good deal of information with a single measurement. More importantly, however, is the presence of a corneal topographer. This has become the fundamental reason for its use in my practice. By performing corneal topographer with the Aladdin, I can reduce the time it takes for my patients to undergo preoperative screening because with one measurement I can obtain a lot of valuable information.

Another nice thing about the Aladdin is that it can store all the preoperative data necessary to determine the corneal power to be used for IOL calculation, not just the axial length and anterior chamber depth (Figure 2). It also stores the measurements for spherical aberration induced by the corneal measurement the Kappa angle; and the size and position of the pupil, which is analyzed in its mesopic, scotopic, and dynamic forms.

Acquiring the above data is an integral component of modern biometry. Without the Aladdin, the surgeon is forced to resort to a second examination with a topographer. This essentially doubles the examination time and carries a serious risk of the examiner wrongly transcribing data that might consequently result in a biometric error. I do not think there is an ophthalmologist in the world who has not had some undesired postoperative refractive surprise; it is best if we can avoid its occurrence due to a simple error in transcribing preoperative data.

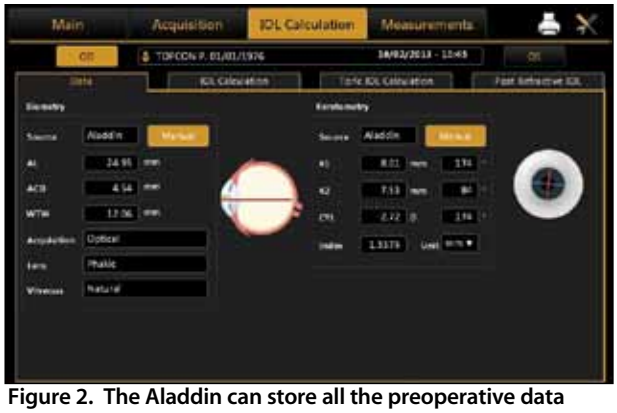


Figure 2. The Aladdin can store all the preoperative data necessary to determine the corneal power to be used for IOL calculation.

Another consideration I made when purchasing the Aladdin is that not all topographers can provide useful information about the size of the pupil and its position. Some topographers, especially older ones, do not measure the Kappa angle or the spherical aberration of the cornea at all. For this reason, we are obliged to use other devices, and that can result in further loss of time and an additional risk of error.

TOPOGRAPHY FOR CATARACT SURGERY SCREENING

Compared to the early 2000s, when the aim of biometric calculation was to obtain emmetropia and an error up to 1.00 D was considered acceptable, today's patients are more demanding and expect perfect results. Although ophthalmologists have at their disposal all the tools they need to obtain excellent visual results with premium IOLs, many neglect to perform preoperative topography. This can lead to undesirable postoperative surprises, especially in eyes with corneal disease.

The use of a topographer/pupillometer can reveal relevant corneal diseases (eg, keratoconus), which is sometimes interpreted as nothing more than astigmatism. The presence of corneal disease can cause significant complications in cataract surgery if it is not taken into consideration. For example, pellucid marginal degeneration (PMD) involves significant thinning of the corneal peripheral tissue and simultaneous presence of irregular astigmatism. However, PMD is difficult to detect with a slit-lamp examination or on a manual or automatic ophthalmometer. But a topographer would easily detect the corneal thinning and irregular astigmatism in an eye with PMD, and the surgeon could plan his or her strategy accordingly.

Another essential function of topography for cataract surgery is its ability to calculate the average pupillary power of the optical zone of the cornea. This measurement corresponds to the area in front of the pupil and must be entered into the IOL power calculation formula instead of a keratometry (K) reading. It often happens that the pupil is decentered to the point that two K readings overlap a portion of the iris instead of the pupil (Figure 3), causing an erroneous corneal power reading. The best method is to introduce the average pupillary power, which is the average of all measured points in the 3-mm diameter of the corneal optical zone—the zone of the cornea that the eye uses to see. Only on this value can we base our biometric calculations; otherwise, the risk of error increases.

USING THE ALADDIN WHEN IMPLANTING ASPHERIC AND SPHERIC IOLs

Pupillometry has become of the utmost importance in biometry for many reasons. One problem involving the interaction between the pupil and a premium IOL can occur as a result of erroneous assessment of the pupil's position, often leading to an underestimation of the Kappa angle. This is probably the leading cause of patient dissatisfaction, usually occurring when the Kappa angle is greater than 0.5 mm.

In recent years, many IOL manufacturers have marketed aspherical IOLs with various levels of spherical aberration correction. When topography is not performed to obtain the spherical aberration data, selecting the most appropriate IOL to correct the spherical aberration of the cornea is difficult, as each cornea has a unique spherical aberration value.

On average, spherical aberration in the cornea is about 0.27 µm; but we must remember that this is only an average and there are eyes with lower or higher values. For these out-of-range eyes, the surgeon must select the appropriate IOL according to the patient's required spherical aberration correction. Additionally, in eyes that have previously undergone hyperopic refractive surgery, spherical aberration values are often outside the standard and tend to become negative value. In these cases, it is necessary to implant a spherical IOL.

Using the Aladdin to perform dynamic pupillometry allows the surgeon to select the appropriate IOL for the patient. For example, a patient with a pupil that is not very reagent will do well with a variety of IOLs, as the correction of spherical aberration is only important if the pupil has a diameter of at least 6.0 mm. The same is true for an elderly diabetic patient who is unlikely to have a large dynamic pupil. On the other hand, in a young patient with a very active pupil, this measurement is essential.

IOL SELECTION

Dynamic pupillometry with the Aladdin is useful when choosing the IOL design. If the pupil is small, the use of a refractive multifocal IOL is contraindicated.

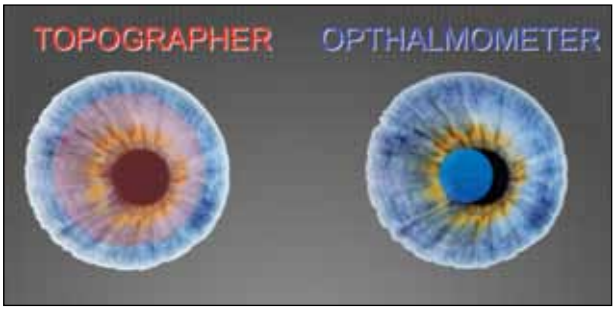
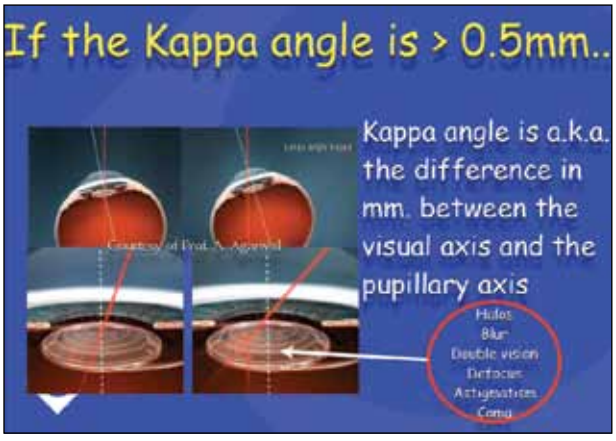


Figure 3. If the pupil is decentered too much, two K readings overlap a portion of the iris instead of the pupil.



Courtesy of Amar Agarwal

Figure 4. Implantation of a multifocal IOL in an eye with high Kappa angle can result in postoperative complications.

When a patient with a large pupil desires good intermediate and distance vision, a refractive IOL can be implanted in the dominant eye.

If the patient asks me to implant a multifocal IOL, I must look carefully at the value of the Kappa angle to avoid postoperative problems. Implantation of a multifocal IOL in an eye with high Kappa angle can trigger disorders such as halos, blurring, double vision, defocus, astigmatism, and coma (Figure 4).

If the corneal cylinder in the eye is less than 1.00 D, generally I will use the average pupillary power as a reference value and insert it in the most suitable biometric formulas according to the axial length of the eye. I then decide on what model and brand of IOL to use in order to obtain a total spherical aberration that is as close as possible to 0.10 µm.

When I want to implant a toric IOL, I use the toric calculation software included in the Aladdin. In Europe, Topcon is the exclusive distributor of Oculentis IOLs; having the software embedded directly into the Aladdin saves me time, because I avoid needing to look on the Internet.

CONCLUSION

My complete work-up for a candidate for cataract surgery can now be done with one device, the Aladdin. I take into account the following criteria: (1) corneal topography to detect the average pupillary power, (2) measurement of the corneal spherical aberrations, (3) measurement of the Kappa angle, (4) measurement of the mesopic, scotopic, and dynamic pupil, and (5) the patient's request for a multifocal, toric, or multifocal toric IOL.

I have been doing biometry for more than 20 years, and I believe that the Aladdin system is the best choice for my preoperative examination needs, because it not only allows me to obtain crucial data in a single measurement but it also has a built-in corneal topographer, which is essential in my clinic to reduce preoperative screening times and increase patient satisfaction. ■

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Topographic Evaluation for Toric and Multifocal IOLs

Placido-ring integration is especially important for premium IOL technologies.

BY THIERRY AMZALLAG, MD

With the evolution of cataract surgery into a refractive procedure, precise IOL power calculations have grown increasingly important. Pair that with the extremely high patient demands of today, and the correct selection of an appropriate IOL is more crucial than ever before. In order to achieve maximal refractive outcomes postoperatively, it is our duty as surgeons to accurately measure the biometric parameters of the eye including axial length, keratometry, anterior chamber depth, and white-to-white.

Luckily, we have exceptional optical biometers to aid in our preoperative assessments, including the Aladdin (Topcon). This device is one step above devices like the IOLMaster (Carl Zeiss Meditec), the Lenstar LS 900 (Haat-Streit), and the AL-Scan (Nidek Co.) for many reasons, the most distinguishing of which is that keratometry (K) readings are performed using Placido-disc–based topography. The combination of an optical biometer and topographer is a unique combination that enables surgeons to calculate IOL power and evaluate corneal topography with the same device. Other beneficial factors include its speed, accuracy, and ease of use.

Using optical low-coherence interferometry and analyzing approximately 1,000 data points at a 3-mm diameter, the Aladdin can measure almost any eye, regardless of the type or grade of cataract. Whereas other topographers use only K values to assess cylindrical power of the cornea, the Aladdin also determines if corneal astigmatism is regular or irregular, it identifies corneal aberrations, and it can detect if previous corneal refractive surgery such as LASIK or PRK was previously performed. Several of my colleagues have assessed the accuracy and reproducibility of biometry performed with the Aladdin and compared it with the accuracy and reproducibility of biometry performed with other devices on the market. For an overview of one assessment, see the article by Christopher Kiss, MD, on page 2.

I have been using the Aladdin for 6 months. In this time, I carried out my own comparative study between the Aladdin and the IOLMaster 500 and found that the Aladdin produced very comparable measurements to the IOLMaster. The difference, however, is that I was able to make a lot of measurements at once with the Aladdin, and it was faster, more reliable, and more efficient than the IOLMaster. Below I discuss how I use the Aladdin for toric and multifocal IOLs.

PLACIDO-RING INTEGRATION, PUPILLOMETRY

The Aladdin is very useful as a biometer because you can simultaneously measure the axial length, corneal biometry, anterior chamber depth, white-to-white, corneal topography, and pupillary diameter. For toric IOLs, you can measure keratometry, axial length, corneal topography, and spherical aberration. This device makes it convenient to calculate and measure toric IOLs because I can do everything on the same machine and therefore I no longer have to copy the measurements to a different machine or onto an online calculator.* With the Aladdin, you have everything you need with one click, on the same machine. In this sense, not only is it faster but it is also more reliable.

The Aladdin also integrates Zernike analysis into the topographical exam. I use this to calculate the proper amount of spherical aberration for the IOL. Another nice thing about the Aladdin is that I can calculate the toric IOL power using any one of six different models, including the SRK II, SRK/T, Holladay 1, Hoffer Q, Haigis, and Camellin-Calossi. This last formula is used for post-LASIK eyes. The Aladdin also includes a specific program to detect keratoconus and keratoconus suspect, which is a contraindication for toric IOLs.

I also appreciate that the Aladdin automatically performs pupillometry, which is especially useful when screening patients for premium IOLs like multifocals. What is really intriguing is that everything with this system is automatic.

TYPICAL WORKFLOW

I use the Aladdin in 100% of my cataract surgery patients. I may use the IOLMaster as a confirmation, but it really is not necessary. In our study, we found very close results with the Aladdin and the IOLMaster 500,

and in 95% of patients the results for axial length was within ±0.25 D of intended correction with the Aladdin.

I like the machine because it is fast. I can captivate all of the measurements that I need within 3 seconds. In my study, I found axial length and keratometry values very close to what I get with the IOLMaster 500, and this was important to me. With the Aladdin, I know that I can be quite precise. It is the only machine that uses measurements of axial length and corneal topography to directly calculate all that you need for selection of multifocal and toric IOLs.

CONCLUSION

The Aladdin represents the latest advancement in optical biometry. Having a corneal topographer built into the biometer is the most exciting addition to available biometry devices. Not only do I enjoy its speed of acquisition of measurements, but I also appreciate that pupillometry and Zernike analysis are automatically performed during the measurement. The Aladdin is undoubtedly my first choice for an optical biometer. In the future, I believe that more surgeons will incorporate its use into the selection of premium IOLs. ■

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* LENTIS Toric Lens Calculator integrated