Maximizing IOL Outcomes with UBM Technology

UBM offers a complete image of the sulcus, adding key information for IOL implantation.

By David R. Hardten, MD, FACS

When my colleagues and I started using UBM several years ago, we were very confident in our ability to visualize IOLs, the natural lens, and the iris using a slit lamp. We didn't feel a strong need to supplement our direct observational findings. But we quickly saw from the perspective of a corneal and lens-based anterior segment surgical practice that UBM technology has many advantages. Added to the other technologies we use, including the slit lamp, Scheimpflug imaging and OCT testing, UBM improves decision-making and follow-up for IOL implantation surgery.

Phakic IOL Screening – Old and New Methods

Because patients with very high myopia often come into my practice, 3 to 5% of my refractive surgeries are phakic IOLs. Original clinical trials for approval of these lenses only suggested that we use central anterior chamber depth, white-to-white length and slit lamp angle assessment to screen for phakic IOL eligibility. However, even though these original criteria typically were good enough for most patients, some patients experienced complications based on issues related to anterior chamber characteristics.

The white-to-white length does not fully discover the sulcus-to-sulcus dimensions. When choosing the length of a posterior chamber phakic IOL such as the STAAR Visian implant, if the sulcus dimensions are different than the typical relationship between the white to white and the sulcus, an implant that is too long or too short for the eye may be suggested. If for example, the implant is too long for the eye, this can result in plateau iris, angle closure, endothelial cell loss and high IOP. I now follow a patient with a Visian implant who had a very shallow anterior chamber postoperatively and despite anterior chamber taps, viscoelastic deepenings and multiple peripheral iridotomies, developed iris ischemia, a subtle anterior subcapsular cataract, as well as endothelial cell loss.

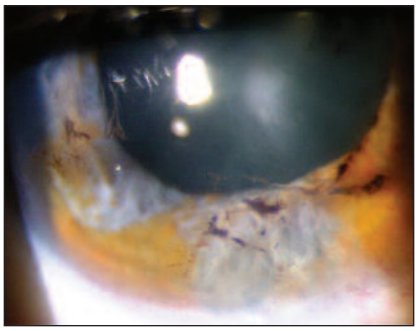


Figure 1. The implant in this patient was too long, resulting in plateau iris, angle closure, endothelial cell loss and high IOP. Despite anterior chamber taps, viscoelastic deepenings and multiple peripheral iridotomies, the patient developed iris ischemia, a subtle anterior subcapsular cataract, as well as endothelial cell loss.

Even if the anterior chamber is deep enough for placement of a phakic IOL, it is possible for the iris configuration to be such that an anterior chamber phakic IOL can be problematic. I followed a patient with a Verisyse implant (AMO). Although he fit the parameters used

for the clinical trial, he had a high crystalline lens/iris rise combined with a very tight inclination that pushed the Verisyse implant down onto the iris and caused posterior synechia.

With a third phakic IOL likely to be approved in the United States next year and a toric version of the Visian near approval in the United States, it is clear that we need to use more advanced clinical tools to guide the use of phakic IOLs.

Planning for "Safety Distance"

With anterior chamber angle-fixated phakic IOLs, we want to create a safety distance of at least 1.5 mm between the edge of the implant and the endothelium. Many anterior chamber angle-fixated IOLs were removed from the market in Europe because they were associated with high levels of progressive endothelial cell loss. Keeping a larger distance between the IOL and the endothelium reduces the chances of endothelial cell loss over time. Screening based only on central anterior chamber depth that doesn't look at the mid-peripheral iris or the distance from the implant to the endothelium is less likely to identify irregularities in some patients.

Complications despite using standard parameters

Even using the preoperative parameters used in phakic IOL clinical trials, such as anterior chamber depth and slit lamp examination, you can have complications. The addition of UBM technology for sulcus imaging can reduce the chances of these problems.

When we implant a phakic IOL in the posterior chamber without adequate space, it doesn't touch the endothelium, but it does push the iris forward. We want to ensure that if it does, we still have the appropriate safety distance. And the lens does move forward about 20 microns per year, so we also have to plan for the future when we're preparing for surgery.

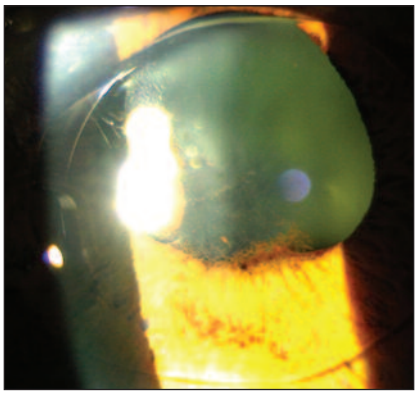


Figure 2. This patient has a fairly high crystalline lens rise combined with a very tight enclavation that pushes the implant down onto the iris and causes posterior synechia.

In the past, we used a variety of different imaging techniques for Verisyse and Visian planning. OCT or Scheimpflug imaging is very useful for placing anterior chamber angle-fixated IOLs because we can see all of the important structures. But right now, most of the phakic IOLs used in the United States are posterior chamber implants. OCT isn't as helpful for these implants because it doesn't provide you with an accurate sulcus image for length or presence or absence of iris cysts.

Scheimpflug imaging shows us the angle and anterior chamber depth. Both OCT and Scheimpflug can show us if a narrow angle configuration would make it impractical to implant the IOL because it would be close to the endothelium or move the iris too close. Neither of these imaging techniques provides enough information about the sulcus, which is helpful in phakic IOL planning, especially for posterior chamber implants.

The Phakic IOL Workup

In my practice, the current phakic IOL workup for Visian and Verisyse lenses includes UBM imaging.

For the Visian lens, we assess the central anterior chamber depth using Scheimpflug imaging, A-scan ultrasound and high-resolution B-scan ultrasound. We measure mid-peripheral anterior chamber depth with Scheimpflug imaging and high-resolution B-scan ultrasound. We still measure the white-to-white distance and compare that to the sulcus-to-sulcus measurement from the high-resolution anterior segment ultrasound.

For Verisyse patients, we also utilize the Verisyse planning software on the Pentacam Scheimpflug camera (Oculus) because it provides a 360° scan of mid-peripheral dimensions. We verify these same mid-peripheral distances with the high-resolution B-scan ultrasound.

We have found that standardizing the image scans improves reproducibility with any IOL scan. Our technicians follow this standardized protocol for using the UBM for any IOL screening or postoperative exam:

- Full scan vertically (right to left)
- Full scan horizontally (superior to inferior)
- Find the longest scans horizontally and vertically
- Save scans
- Measure anterior chamber depth
- Measure iris to endothelium at

a 6 mm OZ at a 45-degree angle
- Measure sulcus to sulcus
- Evaluate the scans for cysts or other abnormalities
- Print the scans and their measurements for the horizontal and vertical scans

We still use white-to-white as our primary method of determining the length of the Visian, but we verify it with the more accurate sulcus-to-sulcus dimension on the UBM. If the sulcus-to-sulcus dimensions on ultrasound are 0.4 millimeters or more different than the white-to-white, then we adjust the number that we put into the Visian formula by 0.5. For example, if the white-to-white is 11 mm and the ultrasound measures 11.6 mm, then we adjust the number entered into the Visian planning software to 11.5 mm (or do the reverse if the ultrasound measurement is lower).

Additionally, the evaluation for iris cysts is very important. Iris cysts are common, and can cause some segmental elevation of the iris in different areas, so we need to be aware of these when we're planning. We really can't image these with the other commonly used technologies of Scheimpflug, OCT or slit lamp evaluation. If there are a few cysts in one meridian, we can rotate the implant to avoid those cysts. If many large cysts are present, then we avoid posterior chamber phakic IOL implantation in that patient.

By utilizing both UBM and Scheimpflug imaging, we can improve the accuracy of our measurements to increase the ability to allow adequate clearance of the IOL to the endothelium when implanting an IOL. The goal is to leave 1.5 mm of long-term clearance, so we typically leave an initial 1.8 mm clearance to allow some room for aging.

More Applications for IOLs

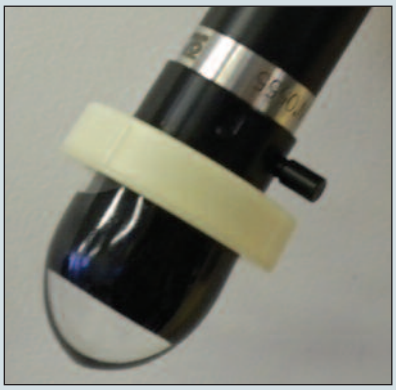
In my practice, I use UBM for many IOL complications that have occurred in the anterior and posterior segment, as well as for preoperative planning. We see patients with IOLs that are displaced or where the IOLs are not easily visualized before corneal transplants. Without UBM, it may not be possible to determine whether the implant is stable in the sulcus or in the capsular bag.

With one-piece IOLs, if the haptic is touching the iris or ciliary body, it may cause pigment dispersion or inflammation. The IOL may vault forward with misplaced haptics, or from asymmetric capsular contraction. UBM helps me plan for keratoplasty or anterior segment reconstruction with clear images of the structures so the proper procedure can be determined.

UBM is very useful for practices that have patients with corneal, glaucoma or anterior segment problems.

UBM: Clean and Easy

In the past, the problem with using traditional ultrasound in our practice was "the mess." The old water bath technology limited ultrasound in most practical scenarios.



Our technicians found it technically challenging, were very concerned about an open shell with a moving nub and they were not able to directly visualize where the corneal surface was located. They were worried about sterility, too, and of course the shell was uncomfortable for the patient.

The ClearScan probe cover changed all that. Now a plastic bag that sits and is moved around directly on the cornea protects the moving nub. The patient is more comfortable, and the technician is more confident about safety and doesn't have to worry about the probe touching the eye. The process is much more sterile as well, and delivers images that are equivalent to what you get with the shell. The ClearScan cover makes UBM clean and easy as well as effective.

Dr. Hardten is a founding partner of Minnesota Eye Consultants and director of its Clinical Research Department.