

# Deep Visualization: Ultrasound Biomicroscopy for the Anterior Segment

This tool can enhance your efficiency and patients' outcomes in clinical practice.

BY DAVID R. HARDTEN, MD

**C**lear and accurate visualization of the ocular structures is crucial for a safe, successful, and efficient clinical practice. This is particularly true for the management of corneal diseases, lens-based procedures, and cysts and tumors. From the slit lamp to Scheimpflug imaging to optical coherence tomography, we eye care specialists have a wide variety of diagnostic tools for assessing anterior segment conditions. Each of the tools, however, features distinct disadvantages (or limitations) that can subsequently detract from our ability to evaluate and manage our work in the anterior segment. In areas where some devices fail, others prevail.

## WHAT ULTRASOUND BIOMICROSCOPY DOES

Ultrasound biomicroscopy (UBM) is a noninvasive diagnostic tool that provides in vivo imaging of the anterior segment in high resolution and with great depth of penetration. The greatest advantage of UBM is that it, unlike many other imaging technologies, enables the user to obtain a real and true visualization of the structures behind the iris, including the ciliary sulcus, the portions of the peripheral lens behind the iris, as well as implants in those areas. With UBM, it is possible to visualize the entire cornea, iris, and iridocorneal angle; as a result, images of the anterior segment are much more complete, enabling better diagnoses and management of diseases.

### Refractive Procedures

UBM technology is particularly useful for surgical planning for phakic IOL implantation. Although it is recommended that we use anterior chamber depth, white-to-



Figure 1. This patient had prior Descemet stripping endothelial keratoplasty (DSEK) and IOL implantation. Fibrosis at the intersection of the DSEK tissue and the iris likely led to the implant's dislocation.

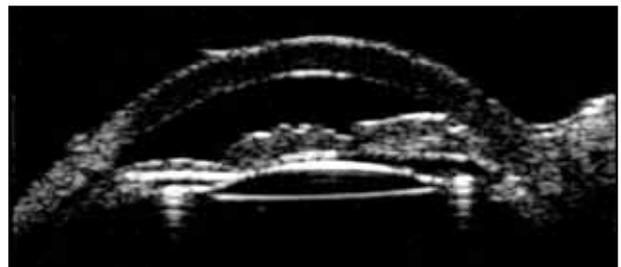
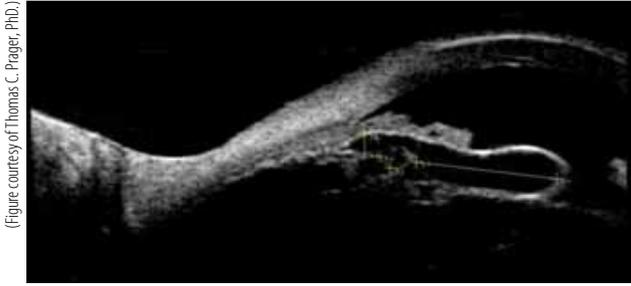


Figure 2. The same eye as in Figure 1; this orientation shows dislocated DSEK corneal tissue and a dislocated IOL.

white length, and slit-lamp angle assessment to screen for phakic IOL eligibility, even patients who fit these criteria can experience complications associated with the characteristics of the anterior chamber. The selection of phakic lenses can be made more precisely with UBM and sulcus-to-sulcus measurements to verify white-to-white dimensions, thus avoiding inadequate or excessive vaulting.<sup>1</sup> The



(Figure courtesy of Thomas C. Prager, PhD.)

**Figure 3.** Iris cysts are quite common.

(Figure courtesy of Thomas C. Prager, PhD.)

**Figure 4.** The ClearScan cover on the ultrasound allows for ease of use without the need for an open water-filled shell.

improved accuracy of measurements increases the ability to ensure adequate clearance of the endothelium after IOL implantation. In addition, dislocated or malpositioned IOLs can be accurately measured with UBM, aiding significantly in surgical revisions (Figures 1 and 2).

Without UBM, it is

sometimes not even possible to determine if an implant is in the sulcus or in the capsular bag or whether the IOL's haptic is in contact with the iris or ciliary body.

### Corneal Procedures

For the corneal specialist, in cases of edematous or densely opaque corneas, UBM makes it possible to visualize behind the cornea, enabling better planning for treatment. UBM is particularly useful for the evaluation and management of iris cysts (Figure 3), which can be quite difficult to visualize with other imaging technologies. UBM makes it possible to measure such structures and surrounding tissues accurately, and it aids in the surgical planning of excision or to avoid cysts when implanting lenses.

### MY EXPERIENCE

In my clinical practice, my colleagues and I have tried a variety of different ultrasound systems, and we have settled on the Aviso 4.0 (Quantel Medical Inc.). This 50-MHz UBM probe uses linear scanning technology, which offers the greatest signal intensity and provides superior anterior chamber image quality because the probe is always perpendicular to the tissues. The software features are very user friendly, and the learning process for the tech-

nicians and myself has proved to be a short one. The system starts up quickly and allows for efficient image storage and patient data entry. These seemingly small factors are key components to successful and efficient clinical practice, which has an impact on our roles as clinicians and the comfort of our patients.

The machine and probes are compatible with the new ClearScan (ESI, Inc.) covers (Figure 4). Additionally, the variety of probes and probe frequencies available for the Aviso system means that we can use the same machine for posterior and anterior segment work. This significantly reduces the footprint of our clinical devices, which can be hugely important in smaller settings. It also makes it easier to use; I only need to switch the probe frequencies to alternate from looking at the structures directly behind the iris pigment epithelium to those structures at the back of the retina. One machine means only one system needs to be learned, which can be very important for training.

### CASE EXAMPLE

A 73-year-old woman had previously undergone cataract surgery and DSEK. The procedure was complicated by a shallow anterior chamber during the case, which the referring doctor noted had occurred during air placement after the corneal tissue had been inserted. Upon referral, the cornea was very edematous with a very difficult to view anterior chamber. When planning for the subsequent repair of this eye, it was important to know the location of the prior DSEK tissue and the IOL. Additionally, the relationship of the iris tissue to the other structures would be important. As seen in an image obtained with UBM, the DSEK tissue was scarred into the angle with iris adhesions. Additionally, the implant was slightly tilted and appeared to be in the ciliary sulcus with some decentration of the IOL (Figures 1 and 2). These findings were confirmed during the subsequent surgery with visualization of dense fibrosis of the tissue to the iris. An IOL exchange and pupilloplasty were performed, as well as repeat DSEK, with successful results.

### CONCLUSION

The Aviso system has great clinical utility in the anterior segment practice. ■

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1. Dougherty PJ, Rivera RP, Schneider D, et al. Improving accuracy of phakic intraocular lens sizing using high-frequency ultrasound biomicroscopy. *J Cataract Refract Surg.* 2011;37(1):13-18.