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Anterior segment imaging

AS-OCT vs. UBM vs. endoscope; case-based approaches

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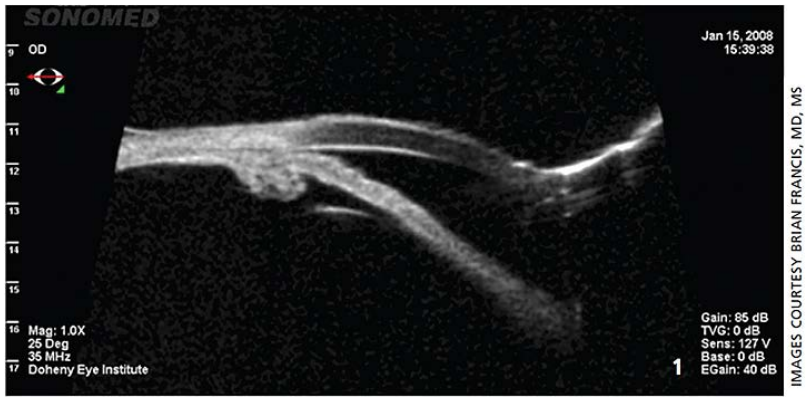
Currently, numerous imaging modalities are available to the anterior segment specialist to assist in the accurate diagnosis and management of patients, both medically and surgically. Progressing from slit lamp photography, we now have ultrasound biomicroscopy (UBM), anterior segment ocular coherence tomography (AS-OCT) and the ability to obtain intraoperative endoscopic images and video. Here, we will take a case-based approach to demonstrate the advantages of each modality and how to utilize their strengths.



CASE 1: Figure 1. UBM image showing continued narrow angle approach with plateau iris conformation. Note the anterior placed ciliary processes that are prominent in both width and height.

CASE ONE

A 58-year-old female presented with a history of intermittent angle closure. A peripheral laser iridotomy (LPI) was performed; however, postoperatively she had a persistent narrow angle and continued appositional angle closure.

Due in part to the negligible effect of the LPI, the diagnosis of plateau iris was made. She subsequently underwent cataract extraction with IOL implant combined with an endoscopic cycloplasty (ECPL). ECPL was selected in order to shrink her large and anteriorly rotated ciliary processes that were seen on UBM.

In this case, both UBM and endoscopic imaging were used. The UBM was the most important clinical imaging modality available due to its ability to not only image the insertion of the iris root but also the ciliary body. UBM also allowed for the viewing of the decreased size of the ciliary processes postoperatively. The 20-gauge endoscope (Beaver Visitec, Inc. and Endo Optiks) has the advantage of incorporating a camera, aiming beam and treatment laser into the same instrument. The combination of these three components allows for ECPL to be carried out through one incision. ECPL is beneficial in opening the angle in these severe plateau iris cases since it directly decreases the ciliary process width, thickness, area and the iris' ciliary process contact length.[1]

CASE 1: Figure 2a. Intraoperative endoscopic image taken from the surgical video. The left side shows whitening and retraction of the ciliary processes that have been treated with laser. The right-hand side shows the pretreatment large ciliary processes responsible for the anterior rotation of the iris and secondary angle closure.

CASE 1: Figure 2b. Ciliary processes prior to treatment as seen through the endoscope. Figure 2c. Immediately following treatment with the endoscopic laser, significant shrinkage and flattening of the ciliary processes demonstrated. Figure 3. Postop UBM that demonstrates significant shrinkage of the ciliary processes after ECPL and a wide-open angle.

CASE TWO

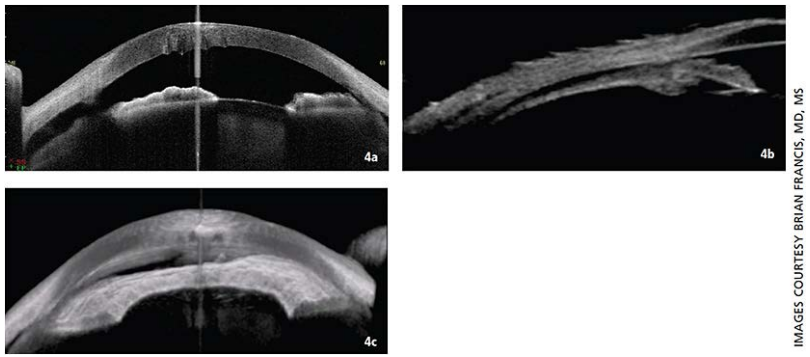
49-year-old male presented with post-blunt-force trauma from an airbag deployment during a motor vehicle accident. Upon clinical exam, he was counting fingers at two feet and his IOP was zero. Slit lamp exam showed a rupture of Descemet's membrane, corneal edema, a shallow anterior chamber, iridodialysis, traumatic mydriasis and choroidal folds.

The decision was made to do a direct cyclopexy to close the cyclodialysis cleft surgically.

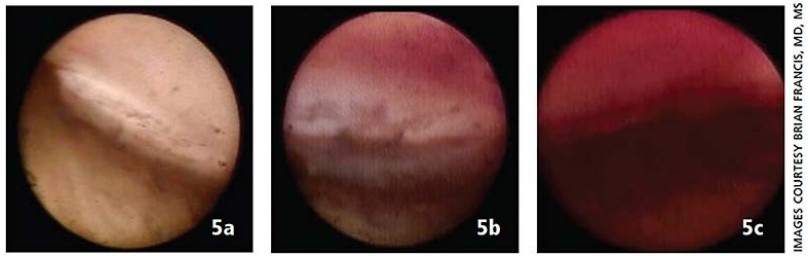
UBM and AS-OCT preoperatively helped make the diagnosis of a cyclodialysis cleft. The SS-AS-OCT allowed for complete viewing of the cyclodialysis cleft opening, which assisted in surgical planning.

Using the endoscope to directly view the cleft during surgery ensured appropriate apposition had been achieved before the surgery was concluded.

The endoscope has been shown to be beneficial in multiple types of anterior segment surgeries including: angle procedures — goniosynechialysis, goniotomy, goniopuncture, excimer laser trabeculotomy, and trabeculotomy; ciliary sulcus procedures — hypotony evaluation and treatment, aqueous tube shunt placement, secondary IOL implantation, verification of IOL position and capsular support; and evaluation and treatment of the uveitis glaucoma hyphema syndrome.[2]

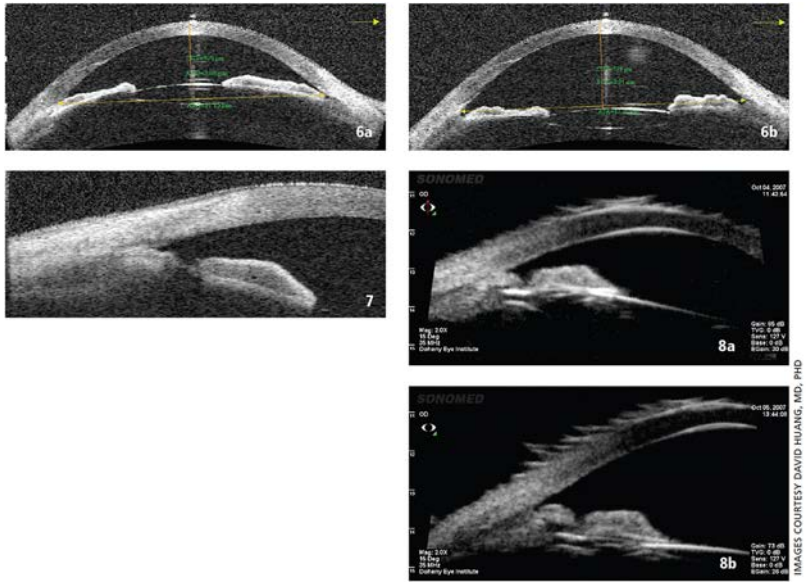


CASE 2: Figure 4a. Anterior segment OCT demonstrates disinsertion of the iris root and fluid in the suprachoroidal space. An advantage of AS-OCT is its higher resolution. You can see the areas of Descemet folds and corneal edema anterior to each fold. Figure 4b. UBM shows fluid in the suprachoroidal space entering through the cleft. The UBM also shows that the ciliary body is detached in addition to the iris root. Figure 4c. Swept Source AS-OCT combines multiple AS-OCT images to create a three-dimensional view of the cyclodialysis cleft.



CASE 2: Figure 5a. Intraoperative view with the endoscope shows a direct view of the cyclodialysis cleft. Figure 5b. Once suturing was completed, the cyclodialysis cleft was again examined with the endoscope, and it was noted that the anterior

portion of the cleft remained open. Figure 5c. Additional suturing was performed, and the cyclodialysis cleft was examined with the endoscope once more. This image shows that the cleft is now completely closed.



CASE 3: Figure 6a. AS-OCT in the dry state – Note the anterior bowing of the lens iris diaphragm. Figure 6b. AS-OCT after atropine – Note the now flatter appearance of the lens iris diaphragm and the deepening of the anterior chamber. Figure 7. AS-OCT – Demonstrates that the LPI is full thickness through the iris. Figure 8a. UBM in the dry state – Shows the anterior lens capsule in suspected direct apposition with the posterior aspect of the LPI. Figure 8b. UBM on atropine – Shows that there is now a potential space between the anterior lens capsule and the posterior aspect of the LPI.

CASE THREE

58-year-old male presented with narrow angles. He had a history of a short axial length, previous peripheral laser iridotomy and cataract extraction with IOL insertion. The patient was noted to have a myopic shift of three diopters depending on whether he was cycloplegic (emmetropic) or not (-3.00 sph).

Measurements taken from the AS-OCT demonstrated a change in his anterior chamber depth of 0.33 mm between the two states. (Images and calculations courtesy of David Huang, MD, PhD.)

There was a concern for aqueous misdirection; however, the problem persisted after a pars plana vitrectomy. Imaging was then performed to specifically look at the peripheral iridotomy and assess its integrity as well as whether anything blocked it anteriorly or posteriorly.

This case demonstrates one limitation of the AS-OCT. While it was able to image the anterior segment structures and demonstrate patency of the iridotomy, it could not image the structures posterior to the iris. The UBM images demonstrate that the patient was actually suffering from capsular block of his LPI when he was in a non-cycloplegic state. After atropine, his lens iris diaphragm moved posteriorly enough to allow the capsule to move away from the LPI, thereby removing the resistance to outflow and allowing the deepening of the anterior chamber. The recommendation for the patient was to have a second peripheral iridotomy performed in a different location and to ensure that the laser

energy not only went through the iris, but the capsule as well. The patient subsequently did well and was emmetropic without the need for chronic cycloplegia.

In conclusion, with the imaging equipment that we have available to us today, we are able to more accurately diagnose and treat our patients. Knowing the limitations and the best uses of the equipment makes us better clinicians and surgeons. **OM**

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