Correspondence: Dr Cheung, Singapore National Eye Centre, 11 Third Hospital Ave, Singapore 168751 (gemmy.cheung.c.m@snec.com.sg). Financial Disclosure: None reported.


Indentation Slitlamp-Adapted Optical Coherence Tomography Technique for Anterior Chamber Angle Assessment

Gonioscopy remains the gold-standard method for evaluation of the anterior chamber angle. Different imaging devices have been developed to study angle anatomy, including ultrasound biomicroscopy,1 slitlamp-adapted optical coherence tomography (SL-OCT),2 and Scheimpflug photography.3 In eyes with angle closure, indentation gonioscopy is necessary to determine the underlying pathophysiology and to differentiate between appositional closure and peripheral anterior synechiae. A technique to perform indentation gonioscopy with ultrasound biomicroscopy using a small eyecup has been previously reported.4 Although SL-OCT has been used to evaluate eyes with angle closure, its clinical applicability is usually limited to measurements of angle parameters. We investigated the use of an indentation SL-OCT technique to assess the angle configuration and underlying mechanisms in eyes with gonioscopically determined angle closure. The study was approved by the institutional review board of the New York Eye and Ear Infirmary.

Report of Cases. Case 1. A 48-year-old Asian man with normal intraocular pressures and no contributory history was referred for evaluation of a narrow anterior chamber angle. Indentation gonioscopy revealed appositional angle closure without peripheral anterior synechiae. Imaging by SL-OCT (1310-nm diode laser; Heidelberg Engineering, Heidelberg, Germany) under dark room conditions demonstrated a convex iris profile and iridotrabecular contact (Figure 1A). During gentle indentation of the central cornea with a scleral depressor under topical anesthesia, the iris assumed a concave profile and the angle region reopened (Figure 1B), consistent with appositional closure due to pupillary block.

Case 2. A 64-year-old white man with chronic angle-closure glaucoma, patent laser iridotomies, and intraocular pressures in the teens who was receiving 2 glaucoma medications was noted to have peripheral anterior synechiae during indentation gonioscopy. Examination by SL-OCT showed a convex iris profile along the anterior lens capsule associated with iridotrabecular contact (Figure 1C). Although the iris moved posteriorly and assumed a concave profile during indentation, the iridotrabecular contact persisted (Figure 1D), consistent with the presence of peripheral anterior synechiae.

Case 3. A 65-year-old white woman with normal intraocular pressures and no ophthalmic history was referred for evaluation of a narrow anterior chamber angle. Gonioscopy revealed a planar iris configuration, deep anterior chamber, and iridotrabecular contact. Indentation widened the angle approach, but the peripheral iris could not be indented. Ultrasound biomicroscopy confirmed the presence of an anteriorly positioned ciliary body abutting the peripheral iris. Examination by SL-OCT showed iridotrabecular contact and a flat iris profile with an iris root that angled forward and then centrally (Figure 2A). Although the mid iris could be depressed posteriorly during indentation, the peripheral iris remained anteriorly displaced, revealing a double hump sign (Figure 2B) consistent with plateau-iris configuration.

Comment. Slitlamp-adapted optical coherence tomography is a rapid, noncontact test that images the entire anterior segment in less than 1 second. Performed in the sitting position, it is particularly suitable for in vivo imaging of anterior segment structures,2 which can be distinguished based on their varying optical characteristics (optical axial resolution <25 µm; lateral resolution 20-100 µm). These features distinguish it from ultrasound biomicroscopy technology. Because the indentation process affects the quality of the central im-
age, we focused the scans on the iridocorneal angle, which is clinically more relevant in these cases.

All of our patients had angle closure by dark-room gonioscopy. Standard SL-OCT examination documented iridotrabecular contact in all of these cases. Using an indentation SL-OCT technique, we were able not only to view the angle configuration but also to identify the corresponding angle-closure mechanisms. Identification of the causes is of utmost importance as each may have a different course and require a different treatment approach. Differentiation of appositional and synechial angle closure in eyes with iridotrabecular contact during indentation SL-OCT adds to the clinical utility of SL-OCT in the evaluation of patients with angle closure and may be particularly helpful in cases where gonioscopy was inconclusive or doubtful. Future larger studies should investigate this hypothesis.

**Figure 2.** Slitlamp-adapted optical coherence tomography from case 3.

A. Horizontal slitlamp-adapted optical coherence tomography image showing iridotrabecular contact associated with a flat iris profile in which the root angles forward and then centrally. B. Although the mid iris could be depressed posteriorly (large arrow) during indentation, the peripheral iris remained anteriorly displaced (small arrow), revealing a double hump sign consistent with plateau-iris configuration.

**Author Affiliations:** Department of Ophthalmology, Einhorn Clinical Research Center, New York Eye and Ear Infirmary (Drs Prata, Dorairaj, De Moraes, Tello, Liebmann, and Ritch) and Department of Ophthalmology, New York University School of Medicine (Drs De Moraes and Liebmann), New York, and Department of Ophthalmology, New York Medical College, Valhalla (Drs Tello and Ritch).

**Correspondence:** Dr Ritch, Department of Ophthalmology, New York Eye and Ear Infirmary, 310 E 14th St, New York, NY 10003 (ritchmd@earthlink.net).

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**COMMENTS AND OPINIONS**

**The Use of Sham Controls in Clinical Trials**

Hawkins et al should be congratulated for attempting to answer an important question: does sham treatment affect the results of clinical trials that use visual acuity as an outcome? If this cumbersome methodology does not influence conclusions, the cost and complexity of future clinical trials could be reduced significantly.

The magnitude of the placebo effect (if any) on visual acuity is unknown; however, some general principles may be relevant. The placebo effect is greatest for subjective, patient-reported responses. The placebo effect tends to be stronger for injections and procedures than for pills.

Hawkins and colleagues present mixed results. For “partially matched pairs,” the sham treatment group had better visual acuity outcomes than the no-treatment group. For the “fully matched pairs,” they found no difference in visual acuity outcomes. The authors acknowledge the limitations of comparing outcomes obtained from different studies.

The analyses by Hawkins and colleagues may not generalize to other study designs. Little is known about the duration of the placebo effect but, in some contexts, the effect is temporary. Findings at a 2-year endpoint may not be representative of shorter duration effects.

Placebo effects are heavily influenced by patient perceptions and expectations. Patients evaluated in this analysis had untreated exudative age-related macular degeneration and experienced poor outcomes. Most patients lost 3 or more lines of visual acuity. This undeniable decline could easily overshadow any expectations of benefit elicited by the sham treatment. The influence of masking might be greater when outcomes are more favorable.

The analyses by Hawkins et al ignore possible influences of masking on the active treatment groups. The perception about what treatment is received can alter the outcome in endpoints that are susceptible to the placebo effect. Patients who are certain they are receiving active treatment may respond differently than patients who are masked to the fact that they are receiving active treat-