extremely subluxated lens and an incomplete mydriasis, leading to a relatively small and excentric capsulorhexis. Additionally, damage to the capsular bag may occur when iris hooks are used to stabilise the capsular bag position or during suturing of the tension ring or other surgical manoeuvres.[4 5] Any tearing or notching of the anterior continuous curvilinear capsulorhexis or defect in the capsular bag should be primarily considered as a contraindication for the relatively rigid capsular tension ring made of polymethyl methacrylate, because rupture of the whole capsular bag can be induced during or after implantation of the tension ring owing to the strong mechanical forces acting on the capsular bag. Especially in young children with Marfan's syndrome, who were not the focus of Bahar *et al*'s study, there is the added problem that the Cionni ring, with its fixed size and rigidity, may not fit a malformed or even colobomatous infantile lens, thus increasing the risk of accidental rupture of the capsular bag during surgical manoeuvres. A valuable surgical alternative in these cases could be the use of differently sized capsular tension ring segments with fixation eyelets, as proposed by Hasanee and coworkers.[6] This approach simplifies implantation while minimising mechanical stresses on the capsular bag and the loosened zonulae. Regardless of the devices used, the correct placement and suturing of the fixation eyelets requires an intact and sufficiently large anterior capsulorhexis, a very experienced surgeon and sufficient patience for a relatively time-consuming procedure compared with conventional IOL implantation. It should also be noted that little is known about possible long-term problems with the non-resorbable suture securing the Cionni ring—or, for that matter, with sclerally sutured IOLs—in young patients. Theoretically, the lifetime of these sutures should be long enough, but Cionni and co-workers have reported an incidence of nearly 10% for broken sutures after a median follow-up of 18 months, leading to their recommendation that sutures stronger than Prolene 10-0 be used.[2] In practice, even Prolene sutures well buried in the sclera can become visible after years and can even cause conjunctival erosion and possible suture-induced infection.

With so many questions remaining unanswered, we have to acknowledge that many options—even visual rehabilitation with contact lenses or glasses rather than IOL[7]—can produce satisfactory long-term results after lentectomy in hereditary lens subluxation, and we would recommend that decisions on surgical planning be made on an individual basis.

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REFERENCES

1 **Cionni RJ**, Osher RH. Management of profound zonular dialysis or weakness with a new endocapsular ring designed for scleral fixation. *J Cataract Refract Surg* 1998;**24**:1299–306.
2 **Cionni RJ**, Osher RH, Marques DM, *et al*. Modified capsular tension ring for patients with congenital loss of zonular support. *J Cataract Refract Surg* 2003;**29**:1668–73.
3 **Bahar I**, Kaiserman I, Rootman D. Cionni capsular tension ring implantation in Marfan's syndrome. *Br J Ophthalmol* 2007;**91**:1477–80.
4 **Lam DSC**, Young AL, Leung ATS, *et al*. Scleral fixation of a capsular tension ring for severe ectopia lentis. *J Cataract Refract Surg* 2000:609–12.
5 **Moreno-Montanes J**, Sainz C, Maldonado MJ. Intraoperative and postoperative complications of Cionni endocapsular ring implantation. *J Cataract Refract Surg* 2003;**29**:492–7.
6 **Hasanee K**, Butler M, Ahmed IIK. Capsular tension ring and related devices: current concepts. *Curr Opin Ophthalmol* 2006;**17**:31–41.
7 **Anteby I**, Isaac M, BenEzra D. Hereditary subluxated lenses. Visual performances and long-term follow-up after surgery. *Ophthalmology* 2003;**110**:1344–8.

Anterior segment imaging for glaucoma

Anterior segment imaging for glaucoma: OCT or UBM?

Hiroshi Ishikawa

Ultrasound biomicroscopy and anterior segment optical coherence tomography both have their own pros and cons in imaging

Ultrasound biomicroscopy (UBM) had played the dominant role in objective imaging of the anterior chamber angle until anterior segment optical coherence tomography (ASOCT) was introduced in 2003. Although ASOCT provides a higher axial resolution (18 μm in commercial ASOCT device vs. 25 μm in 50 MHz UBM), this is not ASOCT's major advantage. The true advantage of ASOCT is its non-contact scanning method that is performed in the sitting position, whereas UBM requires a plastic or silicone eyecup to hold a coupling medium (methyl cellulose or saline solution), which requires supine position scanning. Therefore, when it comes to patients' compliance and comfort in daily clinical settings, ASOCT is a clear winner. However, from the clinicians' viewpoint, the first and most important question is whether ASOCT provides clinically useful information like that which made UBM famous and popular (eg, angle opening distance, angle recess area, trabecular-iris angle, etc).

Li *et al*'s[1] study to investigate the repeatability and reproducibility of anterior chamber angle measurements using ASOCT answers part of this question ***(see page 1490)***. Their study showed that ASOCT could measure the anterior chamber angle with a high intra- and inter-session repeatability/reproducibility (intraclass correlation coefficient 0.95–0.98 for intra-session and 0.89–0.95 for inter-session). In comparison with the modest UBM angle-measurement reproducibility,[2–5] these results were impressive.

However, Li *et al* chose only two angle parameters for their study: the angle opening distance and the trabecular-iris angle introduced by Pavlin *et al*.[6] Both parameters are notorious for their dependency upon variable iris surface undulation. Ishikawa *et al* proposed angle recess area or ARA to overcome these parameters' shortcomings,[7] and later Radhakrishnan *et al* introduced a modified version, the trabecular-iris space area (TISA), specifically for ASOCT images.[8] The basic idea behind these parameters is to measure an area where the aqueous contacts the trabecular meshwork, which is less influenced by variable iris surface curvature. Since many reports dealing with quantitative anterior chamber angle assessment using either ASOCT or UBM used both angle

opening distance and ARA/TISA,[9–14] the inclusion of ARA or TISA in the study would have been more desirable. In fact, Radhakrishnan *et al* reported the ASOCT reproducibility of ARA and TISA as being comparable with those using UBM.[8] They used a prototype ASOCT unit, whereas Li *et al* used a commercially available unit.

A unique aspect of Li *et al*'s study is that they assessed the measurement reproducibility under both light and dark conditions. In glaucoma clinics, their good reproducibility results assure us that dark-room provocative imaging can be performed without compromising the measurement reproducibility. One limitation is that they enrolled only healthy subjects. It would be helpful to know the reproducibility of eyes with a narrow angle or angle closure.

Li *et al* also pointed out the general limitation of both ASOCT and UBM, which is the lack of easy-to-use but reliable software to perform quantitative measurements. Only simple caliper tools are provided, so the development of custom software is necessary for semiautomation and improved operation precision.

Other factors have to be considered for evaluating these technologies in terms of clinical usefulness. What they are able to visualise is the most fundamental question. Both modalities provide the same scanning speed (8 frames/s) and comparable field of view (sulcus to sulcus in one scan). As Li *et al* pointed out in their discussion, one of the major limitations of the ASOCT is its inability to visualise ciliary body or structures behind the iris. Using UBM, many studies have reported that plateau iris and iridociliary cysts are more common than had previously been thought.[15–18] However, due to the aforementioned limitation, ASOCT is not capable of visualising these conditions.

On the other hand, the non-contact scanning of ASOCT provides us a near-perfect tool for evaluating filtering blebs. Although there are many studies regarding filtering blebs using UBM, the procedure has some risk of bleb wall damage and infection, owing to the use of eyecups.[19–21] We can perform ASOCT immediately after surgery because nothing touches the eye for scanning. This advantage is reflected in the recent increase in the number of published studies about filtering blebs observed with ASOCT.[22 23]

To summarise the pros and cons, UBM has clear advantages in visualising the structures behind the iris, which is important for ruling out plateau iris and angle closure caused by iridociliary cysts. ASOCT, on the other hand, is much easier on patients, owing to its non-contact scanning, and it is safe to scan eyes with filtering blebs. Both are equally capable of detecting angle closure under variable lighting conditions. In terms of measurement reproducibility, ASOCT may have a slight edge over UBM, but further investigations of the various anterior segment measurement parameters are required.

So, which imaging modality we should have in our glaucoma clinics? The current ideal solution is to have both so that they complement each other.

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REFERENCES

1 **Li H**, Leung CKS, Cheung CYL, *et al.* Repeatability and reproducibility of anterior chamber angle measurement with anterior segment optical coherence tomography. *Br J Ophthalmol* 2007;**91**:1490–2.
2 **Urbak SF**, Pedersen JK, Thorsen TT. Ultrasound biomicroscopy. II. Intraobserver and interobserver reproducibility of measurements. *Acta Ophthalmol Scand* 1998;**76**:546–9.
3 **Urbak SF**. Ultrasound biomicroscopy. I. Precision of measurements. *Acta Ophthalmol Scand* 1998;**76**:447–55.
4 **Spaeth GL**, Azuara-Blanco A, Araujo SV, *et al.* Intraobserver and interobserver agreement in evaluating the anterior chamber angle configuration by ultrasound biomicroscopy. *J Glaucoma* 1997;**6**:13–7.
5 **Tello C**, Liebmann J, Potash SD, *et al.* Measurement of ultrasound biomicroscopy images: intraobserver and interobserver reliability. *Invest Ophthalmol Vis Sci* 1994;**35**:3549–52.
6 **Pavlin CJ**, Harasiewicz K, Foster FS. Ultrasound biomicroscopy of anterior segment structures in normal and glaucomatous eyes. *Am J Ophthalmol* 1992;**113**:381–9.
7 **Ishikawa H**, Esaki K, Liebmann JM, *et al.* Ultrasound biomicroscopy dark room provocative testing: a quantitative method for estimating anterior chamber angle width. *Jpn J Ophthalmol* 1999;**43**:526–34.
8 **Radhakrishnan S**, Goldsmith J, Huang D, *et al.* Comparison of optical coherence tomography and ultrasound biomicroscopy for detection of narrow anterior chamber angles. *Arch Ophthalmol* 2005;**123**:1053–9.
9 **Memarzadeh F**, Li Y, Chopra V, *et al.* Anterior segment optical coherence tomography for imaging the anterior chamber after laser peripheral iridotomy. *Am J Ophthalmol* 2007;**143**:877–9.
10 **He M**, Friedman DS, Ge J, *et al.* Laser peripheral iridotomy in eyes with narrow drainage angles: Ultrasound biomicroscopy outcomes. The Liwan Eye Study. *Ophthalmology*. In press.
11 **Dada T**, Gupta V, Deepak KK, *et al.* Narrowing of the anterior chamber angle during Valsalva maneuver: a possible mechanism for angle closure. *Eur J Ophthalmol* 2006;**16**:81–91.
12 **Gazzard G**, Friedman DS, Devereux JG, *et al.* A prospective ultrasound biomicroscopy evaluation of changes in anterior segment morphology after laser iridotomy in Asian eyes. *Ophthalmology* 2003;**110**:630–8.
13 **Esaki K**, Ishikawa H, Liebmann JM, *et al.* Angle recess area decreases with age in normal Japanese. *Jpn J Ophthalmol* 2000;**44**:46–51.
14 **Breingan PJ**, Esaki K, Ishikawa H, *et al.* Iridolenticular contact decreases following laser iridotomy for pigment dispersion syndrome. *Arch Ophthalmol* 1999;**117**:325–8.
15 **Razeghinejad MR**, Kamali-Sarvestani E. The plateau iris component of primary angle closure glaucoma: Developmental or acquired. *Med Hypotheses* 2007.
16 **Badlani VK**, Quinones R, Wilensky JT, *et al.* Angle-closure glaucoma in teenagers. *J Glaucoma* 2003;**12**:198–203.
17 **Azuara-Blanco A**, Spaeth GL, Araujo SV, *et al.* Plateau iris syndrome associated with multiple ciliary body cysts. Report of three cases. *Arch Ophthalmol* 1996;**114**:666–8.
18 **Pavlin CJ**, Ritch R, Foster FS. Ultrasound biomicroscopy in plateau iris syndrome. *Am J Ophthalmol* 1992;**113**:390–5.
19 **Piette S**, Canlas OA, Tran HV, *et al.* Ultrasound biomicroscopy in uveitis-glaucoma-hyphema syndrome. *Am J Ophthalmol* 2002;**133**:839–41.
20 **Negri-Aranguren I**, Croxatto O, Grigera DE. Midterm ultrasound biomicroscopy findings in eyes with successful viscocanalostomy. *J Cataract Refract Surg* 2002;**28**:752–7.
21 **Grigera D**, Moreno C, Fava O, *et al.* Ultrasound biomicroscopy in eyes with anterior chamber flattening after trabeculectomy. *Can J Ophthalmol* 2002;**37**:27–32.
22 **Singh M**, Chew PT, Friedman DS, *et al.* Imaging of trabeculectomy blebs using anterior segment optical coherence tomography. *Ophthalmology* 2007;**114**:47–53.
23 **Leung CK**, Yick DW, Kwong YY, *et al.* Analysis of bleb morphology after trabeculectomy with Visante anterior segment optical coherence tomography. *Br J Ophthalmol* 2007;**91**:340–4.