Iridotrabecular Contact Observed Using Anterior Segment Three-Dimensional OCT in Eyes With a Shallow Peripheral Anterior Chamber

Koichi Mishima,1 Atsuo Tomidokoro,2 Pitipong Suramethakul,3 Naomi Matakı,4 Naoyuki Kurita,5 Chihiro Mayama,6 and Makoto Araie4

1Department of Ophthalmology, Tokyo Teishin Hospital, Tokyo, Japan
2Higashinakano Tomidokoro Eye Clinic, Tokyo, Japan
3Department of Ophthalmology, Mettapracharak Hospital, Bangkok, Thailand
4Department of Ophthalmology, Kanto Central Hospital, Tokyo, Japan
5Department of Ophthalmology, Saitama Red Cross Hospital, Saitama, Japan
6Department of Ophthalmology, University of Tokyo, Graduate School of Medicine, Tokyo, Japan

Correspondence: Koichi Mishima, Department of Ophthalmology, Tokyo Teishin Hospital, 2-14-23 Fujimi, Chiyoda-ku Tokyo, 102-8798, Japan; koichimishima-dky@umin.ac.jp.
Submitted: October 30, 2012
Accepted: May 28, 2013
Citation: Mishima K, Tomidokoro A, Suramethakul P, et al. Iridotrabeular contact observed using anterior segment three-dimensional OCT in eyes with a shallow peripheral anterior chamber. Invest Ophthalmol Vis Sci. 2013;54:4628–4635. DOI:10.1167/iovs.12-11250

PURPOSE. To evaluate the prevalence and range of iridotrabecular contact (ITC) in eyes with a shallow peripheral anterior chamber (AC) by using anterior segment swept-source optical coherence tomography (AS-SS-OCT) and to compare the results with those obtained with ultrasound biomicroscopy (UBM) and gonioscopy.

METHODS. Forty-three shallow peripheral AC eyes in 43 consecutive patients underwent gonioscopy. Cross-sectional images throughout the angle circumference (i.e., 360°) were obtained with AS-SS-OCT (SS-1000 noncontact, noninvasive three-dimensional imaging system) and those of the peripheral AC at the 3, 6, 9, and 12 o’clock positions were obtained with UBM (UD-1000).

RESULTS. ITC evaluated with AS-SS-OCT included all gonioscopically identified peripheral anterior synechia (PAS) in the area. With AS-SS-OCT, at least one ITC was found in 40 (93.0%) and 42 (97.7%) of the 43 eyes under light and dark conditions, respectively, whereas with UBM, at least one ITC was found in 22 (51.1%) and 36 (83.7%) of the 43 eyes under light and dark conditions. The prevalence of ITC in eyes with AS-SS-OCT was significantly higher than that with UBM under light conditions, but not under dark conditions (P = 0.0001, 0.07, respectively, sign test). The PAS-positive eyes had a significantly greater ITC range than the PAS-negative eyes under light conditions (P = 0.006), but not under dark conditions (P = 0.08).

CONCLUSIONS. AS-SS-OCT detected all PAS and the prevalence of ITC detected by AS-SS-OCT in narrow angle eyes was markedly higher than previously thought. A relationship between the ITC range under light conditions and future PAS formation was suggested.

Keywords: anterior segment OCT, iridotрабecular contact, UBM, primary angle closure glaucoma

Primary angle closure glaucoma (PACG) is one of the major causes of blindness and poor vision in East Asia.1–5 PACG is responsible for approximately 90% of the bilateral blindness due to glaucoma in China.6 Evaluation of the anterior chamber configuration is very important in the diagnosis, treatment, prophylaxis, and prediction of the final outcome in patients with PACG or related conditions, including primary angle closure (PAC) and suspected PAC. Although gonioscopy is still the standard method for angle evaluation, it suffers from several shortcomings, including the need to contact the eye and illuminate the eye, the dependence on a subjective evaluation, and unavoidable pressure on the anterior chamber. Ultrasound biomicroscopy (UBM)7 enables qualitative and quantitative imaging of the anterior ocular segment and has led to many new findings in eyes with a narrow anterior chamber angle.8–11 However, it is still necessary for the eye to contact the eyecups with this technique, and it requires the supine position and skill to perform. Furthermore, it is not practical to examine the entire 360° range of the anterior chamber angle with UBM in one attempt.

Optical coherence tomography (OCT),12 a light-based imaging technology, has enabled us to noninvasively evaluate both the posterior segment of the eye and the anterior chamber configuration in the habitual sitting position.13,14 Time-domain anterior segment OCT (TD-AS-OCT) provides a cross-sectional image of the entire anterior chamber angle in the sitting position, whereas UBM allows measurements only in the supine position; however, because TD-AS-OCT covers the entire 360° range in only four radial scans, it leaves most of the area unobserved. Anterior segment swept-source OCT (AS-SS-OCT), which was developed recently, has greater resolution and a much faster imaging speed based on Fourier-domain technology, making it possible to sequentially analyze a greater...
range of the angle. However, analyses of the entire range of the angle using AS-SS-OCT have been reported only rarely. In eyes with a shallow peripheral anterior chamber, peripheral anterior synchiae (PAS) and appositional (or functional) angle closure can be differentiated using intentional pressure during gonioscopy. Since these conditions are barely distinguishable using anterior segment imaging analysis, including UBM or TD-AS-OCT, the concept of iridotrabecular contact (ITC) has been proposed, because it involves both PAS and appositional angle closure. Kunimatsu et al. found appositional angle closure with UBM in 57.5% of eyes with a shallow peripheral anterior chamber in which PAS was not present. Using TD-AS-OCT, Nolan et al. detected ITC in 66.7% of the eyes with open or narrow angles. It is of greater clinical importance to analyze ITC over the entire range of the anterior chamber angle effortlessly, rather than only a few sections. In this study, we estimated the prevalence and range of ITC in eyes with a narrow peripheral anterior chamber using AS-SS-OCT and compared the results with those obtained using UBM and gonioscopy.

METHODS

Patients

This study enrolled consecutive patients who were seen between March and December 2009 at the outpatient clinic of the Department of Ophthalmology, Graduate School of Medicine, University of Tokyo (Tokyo, Japan) and satisfied the inclusion criteria in at least one eye. The inclusion criteria were (1) a peripheral anterior chamber (AC) depth of one-quarter of the peripheral corneal thickness or shallower according to the van Herick method, on the temporal side; (2) no history of ocular surgery, including laser procedures; (3) no history of acute primary angle closure, corneal diseases, or iritis; and (4) no use of topical medications. When both eyes were eligible, the data for the right eye were analyzed. The patients first underwent gonioscopy, and at the same time of the day on a different day within 7 days of gonioscopy, they underwent anterior ocular segment imaging, including AS-SS-OCT and UBM in this order. The central AC depth (including the central corneal thickness) and axial length were evaluated with an optical biometer (IOLMaster; Carl Zeiss Meditec, Dublin, CA). The study protocol followed the tenets of the Declaration of Helsinki and was approved by the institutional ethics board. Written informed consent was obtained from all patients.

Gonioscopy

Gonioscopy was performed by an experienced ophthalmologist (AT) with a narrow slit-lamp beam, while avoiding having light enter the pupil under dim light. First, the peripheral AC angles in four quadrants (superior, temporal, inferior, and nasal) were graded according to Shaffer’s grading system using a Goldmann two-mirror gonioscope (Haag-Streit, Köniz, Switzerland) or Sussman four-mirror gonioscope (Ocular Instruments, Bellevue, WA), avoiding inadvertent compression. The presence of PAS exceeding the scleral spur (SS) was confirmed using a compression technique, when necessary. The range and height of PAS were recorded on the gonioscopic PAS chart. A quadrant with more than one point of PAS exceeding the SS was defined as a PAS-positive quadrant.

AS-SS-OCT Examination

The AS-SS-OCT (SS-1000 CASIA; Tomey, Nagoya, Japan) was performed in room light (1000 lux, measured with an IM-2D illuminometer [Topcon, Itabashi, Tokyo, Japan]) by an experienced ophthalmologist (KM) who was masked to the gonioscopic findings, and was repeated in the same manner 5 minutes after the room was darkened to approximately 3 lux. In cases in which both eyes were eligible, the right eye was measured first and included in the analysis, and only the eligible eye was measured in cases with one eligible eye. AS-SS-OCT is based on optical swept-source imaging technology. The light source had a center wavelength of 1300 nm, which enabled greater penetration of the ocular tissue than that achieved with the 830-nm light source used in conventional OCT. The three-dimensional (3D) structure of the anterior chamber was determined using an angle analysis protocol consisting of 128 radial B-scans (512 A-scans of 16 mm length, each) centered on the center of the pupil. This scan protocol included 65,536 A-scans in total and took 2.3 seconds. During the examination, the patients were encouraged to open their eyes as widely as possible; if necessary, the examiner gently helped the eye to stay open, using his fingers. Inadvertent pressing of the eye was avoided carefully. An eyelid speculum was not used, because its use makes it difficult to exclude inadvertent pressure on the eye. When any eye movement or nictation, which was monitored carefully during the examination, was noted, the examination was repeated up to three times, and the best image was analyzed.

The ITC analysis was performed using the newly developed OCT analysis software installed in the AS-SS-OCT system (SS-1000 CASIA; Tomey). The position of the SS and the ITC end point (EP), which was the central-most point where the iris plane and corneal endothelium plane were in contact, were identified by an experienced ophthalmologist (PS) on 32 equally spaced representative images from among 128 radial B-scan images. SS and EP on the remaining B-scan images (Figs. 1a, 1b) were also identified manually with the aid of software installed in the SS-1000 CASIA (Tomey) that automatically indicates probable SS and EP sites based on the images of 32 manually identified SS and EP sites. All images were reviewed by the ophthalmologist to correct any misalignment of the positions of ITC and the EP. When the EP was located more anteriorly than the SS, ITC was judged as positive (Figs. 1a, 1b). In the quadrant-based study, when there was at least one ITC in the quadrant, the quadrant in question was defined as an ITC-positive quadrant. The following parameters of ITC were calculated: unobservable range (UR; the range of angles in degrees that could not be analyzed because of low image quality that prevented SS or EP from being identified or the absence of the angle image, mainly due to the upper or lower eyelid) and ITC range (the ratio of angle degree of ITC excluding the UR; i.e., ITC-positive range(°)/[360(°) – UR range(°)] × 100) (Fig. 1c). The software installed in the SS-1000 CASIA (Tomey) also determined the values of the parameters in each quadrant.

UBM Examination

Cross-sectional images of the peripheral anterior chamber at four positions were obtained by an experienced ophthalmologist (NM) using UBM (UD-1000; Tomey) with a 40-MHz transducer probe; observations were made at the 12 (superior), 3 (nasal or temporal), 6 (inferior), and 9 (temporal or nasal) o’clock positions of both eyes of each subject placed in the supine position. After applying topical anesthesia, an eye cup containing hydroxyethyl cellulose and physiologic saline was mounted on the globe, and the transducer was applied gently to the limbal area, taking care to avoid compression of the globe. UBM was assessed in room light (1000 lux) and repeated in the same manner 3 minutes after the room had been darkened to approximately 3 lux. The lateral and axial resolutions were both 50 μm. A 9 × 6-mm field was imaged and

Downloaded From: http://iovs.arvojournals.org/pdfaccess.ashx?url=/data/journals/iovs/932985/ on 10/16/2017
FIGURE 1. ITC analysis using anterior segment swept-source OCT. Representative images of ITC-positive (a) and -negative (b) angles. Red x, SS; yellow cross, end point (EP). After the ITC analysis, the amount and position of ITC were described in a chart (c). The blue dashed lines indicate the distance from the scleral spur. The ITC area is shown as the light blue zone. The unobservable range is delineated with the green dotted line and was omitted from the analysis of the ITC range.
Prevalence of the narrowest grade by eye (%) 10/43 (23.3%) 29/43 (67.4%) 4/43 (9.3%) 0/43 (0%)
Total (%) 13/172 (7.6%) 64/172 (37.2%) 79/172 (45.9%) 16/172 (9.3%) 20/172 (11.6%)

Inferior (%) 1/43 (2.3%) 20/43 (46.5%) 21/43 (48.9%) 1/43 (2.3%) 4/43 (9.3%)
Temporal (%) 1/43 (2.3%) 7/43 (16.3%) 27/43 (62.8%) 8/43 (18.6%) 3/43 (7%)
Superior (%) 9/43 (20.9%) 29/43 (67.4%) 5/43 (11.6%) 0/43 (0%) 8/43 (18.6%)

2.6 mm Hg. All images measured with UBM could be analyzed.

With UBM, at least one ITC was found in 22 (51.1%) and 36 (83.7%) of the 43 eyes under light and dark conditions, respectively. In the PAS-positive eyes, at least one ITC was found in seven (70%) and nine (90%) of the 10 eyes under light and dark conditions, respectively. In PAS-negative eyes, at least one ITC was found in 15 (45.5%) and 27 (81.8%) of the 33 eyes under light and dark conditions, respectively (Table 3).

Prevalences of ITC by UBM in four positions are summarized in Table 2. The prevalence of ITC in the PAS-negative eyes differed significantly between the light and dark conditions, whereas that in the PAS-positive eyes did not (P = 0.0005 and P = 0.5, respectively, sign test).

The prevalence of ITC in eyes (with at least one quadrant of ITC in an eye) with AS-SS-OCT was significantly higher than that with UBM under light conditions, but not under dark conditions (P = 0.0001 and P = 0.07, respectively, sign test).

Comparison of the cross-sectional images of the peripheral anterior chamber at four positions (the 12 [superior], 3 [nasal or temporal], 6 [inferior], and 9 [temporal or nasal] o’clock positions) with UBM and AS-SS-OCT in the AS-SS-OCT non-UR showed that both methods yielded the same results for the presence or absence of ITC in 74.3% or 104/140 (72.1% or 101/140) of the cases with \( \chi^2 \) statistics of 0.28 and 0.44 in the light and dark, respectively. Figure 2 shows representative images of both methods, in which ITC was detected only with OCT (Figs. 2a, 2b) and with UBM (Figs. 2c, 2d). There was no significant difference in the total number of ITCs detected between AS-SS-OCT and UBM under light and dark conditions (P = 0.24 and P = 0.11, respectively, sign test).

Quantitative Analysis of ITC Evaluated With AS-SS-OCT

In the AS-SS-OCT assessment, the entire circumference of the angle could be analyzed for 19 eyes in the dark and 14 eyes in the light.
the light, whereas 24 eyes in the dark and 29 eyes in the light had the range of angles that could not be analyzed. The UR averaged 35.4 ± 41.2°, 9.8 ± 13.1°, 18.3 ± 31.9°, and 12.3 ± 15.7° in the superior, temporal, inferior, and nasal quadrants in the dark, and 37.2 ± 38.4°, 10.4 ± 15.1°, 24.6 ± 35.8°, and 123 ± 16.7° in the light, respectively. To estimate the influence of the UR on whether the entire ITC range was detected, the ITC range was compared between the UR-negative and UR-positive eyes. There was no significant difference in age, refraction, central AC depth, or Shaffer grade in the superior, temporal, inferior, or nasal quadrants between the UR-negative and UR-positive eyes (P = 0.07, 0.06, and 0.14, Mann–Whitney test, and 0.31, 0.57, 0.60, and 0.43, χ² test in the dark, P = 0.44, 0.98, and 0.53, Mann–Whitney test, and 0.14, 0.46, 0.14, and 0.34, χ² test in the light, respectively). There was also no significant difference in the ITC range between the UR-negative and UR-positive eyes in dark and light conditions (P = 0.33 in the dark, P = 0.25 in the light, Mann–Whitney test), suggesting that the presence of the UR in our subject eyes had no substantial effect on the ITC range averaged in the subject eyes (Table 4).

On comparing the PAS-negative and PAS-positive eyes, the PAS-positive eyes had a significantly greater ITC range than that of the PAS-negative eyes in the light (46.9 ± 24.5° vs. 21.9 ± 20.9°, P = 0.0006, Mann–Whitney test), but not in the dark (61.6 ± 26.4° vs. 44.4 ± 24.0°, P = 0.08) (Table 5).

In 11 eyes, we could assess the entire circumference of the angle under both dark and light conditions. Of these 11 eyes, one was PAS-positive and 10 were PAS-negative. The ITC range in each quadrant of the 10 PAS- and UR-negative eyes is shown in Table 6; the ITC range was greater in the dark than the light in each quadrant (P < 0.04, Wilcoxon signed-rank test).

**DISCUSSION**

This study estimated the prevalence and range of ITC in narrow angle eyes using AS-SS-OCT, a high-speed Fourier-domain 3D AS-OCT. In this study, the prevalence of ITC in eyes (with at least one ITC) with AS-SS-OCT significantly higher than that with UBM under light conditions, but not under dark conditions (P = 0.0001 and P = 0.07, respectively, sign test). The comparison of cross-sectional images at four positions (12 [superior], 3 [nasal or temporal], 6 [inferior], and 9 [temporal or nasal] o’clock positions) with UBM and AS-SS-OCT revealed that these two methods agreed when judging ITC in 104 (74.3%) and 101 (72.1%) of 140 angle images with κ statistics of 0.274 (P = 0.0005) and 0.444 (P < 0.0001) under light and dark conditions, respectively. No significant difference in the prevalence of ITC at the four positions was seen between the two methods under both light and dark conditions (P = 0.24 and P = 0.11, respectively, sign test). The modest conformity observed is thought to be attributable to the difference in the two methods: for the UBM measurements, the subjects were in a supine position and an eye cup was mounted on the globe, whereas for the AS-SS-OCT measurements they were in a sitting position with the eye lids gently opened by the examiner’s fingers. The AS-OCT scanning protocol used in this study consisted of 128 radial B-scans and could quickly cover the entire circumference because of the high scanning speed. Consequently, the prevalence of ITC by quadrant or by eye determined with AS-SS-OCT should be higher than that determined with the single-section analysis using UBM.

**Table 3.** Prevalence of ITC Evaluated by Ultrasound Biomicroscopy in 43 Narrow Angle Eyes

<table>
<thead>
<tr>
<th>Quadrant</th>
<th>PAS-Negative</th>
<th>PAS-Positive</th>
<th>P*</th>
<th>Total</th>
<th>P†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Superior, 12 o’clock</td>
<td>15/35 (42.9%)</td>
<td>4/8 (50%)</td>
<td>0.5</td>
<td>19/43 (44.2%)</td>
<td>&lt;0.0008</td>
</tr>
<tr>
<td>Dark</td>
<td>27/35 (77.1%)</td>
<td>7/8 (87.5%)</td>
<td>0.46</td>
<td>34/43 (79.1%)</td>
<td></td>
</tr>
<tr>
<td>Temporal, 3 or 9 o’clock</td>
<td>2/40 (5%)</td>
<td>3/3 (100%)</td>
<td>0.0008</td>
<td>5/43 (11.6%)</td>
<td>0.13</td>
</tr>
<tr>
<td>Dark</td>
<td>8/40 (20%)</td>
<td>2/3 (66.7%)</td>
<td>0.13</td>
<td>10/43 (23.3%)</td>
<td></td>
</tr>
<tr>
<td>Inferior, 6 o’clock</td>
<td>8/39 (20.5%)</td>
<td>2/4 (50%)</td>
<td>0.23</td>
<td>10/43 (23.5%)</td>
<td>0.0007</td>
</tr>
<tr>
<td>Dark</td>
<td>22/39 (56.4%)</td>
<td>3/4 (75%)</td>
<td>0.44</td>
<td>25/43 (58.1%)</td>
<td></td>
</tr>
<tr>
<td>Nasal, 9 or 3 o’clock</td>
<td>3/38 (7.9%)</td>
<td>2/5 (40%)</td>
<td>0.1</td>
<td>5/43 (11.6%)</td>
<td>0.012</td>
</tr>
<tr>
<td>Dark</td>
<td>10/38 (26.3%)</td>
<td>4/5 (80%)</td>
<td>0.032</td>
<td>14/43 (32.6%)</td>
<td></td>
</tr>
</tbody>
</table>

* P value for the difference in the prevalence of ITC between PAS-negative and -positive quadrants at the same o’clock position (Fisher’s exact test).
† P value for the difference in the ITC range between light and dark conditions (sign test).
‡ When at least one ITC was detected in any quadrant of a given eye using AS-SS-OCT or UBM, the eye was defined as ITC-positive.

**Table 4.** Comparison of the ITC Range Evaluated by Swept-Source Anterior Segment Optical Coherence Tomography Between UR-Negative and UR-Positive Eyes

<table>
<thead>
<tr>
<th>Quadrant</th>
<th>UR-Negative</th>
<th>UR-Positive</th>
<th>P*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light</td>
<td>43.2 ± 25.9%</td>
<td>52.5 ± 24.7%</td>
<td>0.25</td>
</tr>
<tr>
<td>Dark</td>
<td>21.0 ± 17.5%</td>
<td>30.9 ± 36.2%</td>
<td>0.33</td>
</tr>
</tbody>
</table>

* P value for the difference in the ITC range between UR-negative and UR-positive eyes (Mann–Whitney test).
In this study, the gonioscopic examinations showed that only 23.3% of the eyes had a Shaffer grade 0 angle, which indicates gonioscopic appositional closure, whereas the prevalence of ITC per eye with AS-SS-OCT or UBM was much higher. This is probably due to the fact that inadvertent exogenous influence on the globe is more likely with gonioscopy than in AS-SS-OCT or UBM.

In the 43 narrow angle eyes studied, a range of angles could not be assessed in 24 eyes in the dark and 29 eyes in the light (UR). The UR averaged 75.9 ± 83.9° of the 360° in the dark and 82.2 ± 83.4° in the light. The UR tended to be greater in the superior and inferior quadrants than that in the temporal and nasal quadrants, probably due to the higher prevalence of eyelid coverage during the measurements. A comparison of the ITC range between UR-negative and UR-positive eyes revealed that the ITC range is not substantially affected by the presence of UR, suggesting the validity of the analysis using the ITC range in our eyes with a shallow peripheral anterior chamber (Table 4).

Kunimatsu et al.17 studied ITC with UBM at four positions, and our ITC results using UBM were consistent with theirs. Furthermore, the prevalence of ITC by eye detected using AS-SS-OCT was unexpectedly high in the light, and did not differ significantly from that in the dark, whereas a previous report of UBM and our UBM results indicated a lower prevalence of ITC per eye under light conditions.17 Given the same position, the prevalence of ITC did not differ significantly between the two methods. The difference in the ITC prevalence by eye between

![Figure 2](image-url) Representative images that contain a discrepancy between the AS-SS-OCT and UBM results. Images of the peripheral anterior chamber angle measured by AS-SS-OCT (a) and UBM (b) for the superior quadrant (in the dark) in a 61-year-old female. AS-SS-OCT image (a) shows the presence of ITC, whereas the angle is open in the UBM image (b). Images of the peripheral anterior chamber angle measured by AS-SS-OCT (c) and UBM (d) for the nasal quadrant (in the dark) in a 66-year-old male. The OCT image (c) revealed the absence of ITC, whereas the UBM image (d) indicated its presence.

<table>
<thead>
<tr>
<th>Table 5. ITC Range Evaluated by Swept-Source Anterior Segment Optical Coherence Tomography in 43 Narrow Angle Eyes</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAS-Negative, n = 33</td>
</tr>
<tr>
<td>Light</td>
</tr>
<tr>
<td>Dark</td>
</tr>
</tbody>
</table>

* \( P \) value for the difference in ITC range between PAS-negative and PAS-positive eyes (Mann-Whitney test).
† \( P \) value for the difference in ITC range between light and dark conditions (Wilcoxon signed-rank test).
ITC Observed With Anterior Segment 3D-OCT

TABLE 6. ITC Range Evaluated by Swept-Source Anterior Segment Optical Coherence Tomography in 10 UR-Negative and PAS-Negative Eyes

<table>
<thead>
<tr>
<th>Region</th>
<th>Dark</th>
<th>Light</th>
<th><em>P</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>Superior</td>
<td>52.2 ± 34.8%</td>
<td>28.0 ± 28.7%</td>
<td>0.02</td>
</tr>
<tr>
<td>Temporal</td>
<td>10.6 ± 10.9%</td>
<td>4.7 ± 5.3%</td>
<td>0.04</td>
</tr>
<tr>
<td>Inferior</td>
<td>54.4 ± 26.1%</td>
<td>25.1 ± 23.7%</td>
<td>0.004</td>
</tr>
<tr>
<td>Nasal</td>
<td>15.7 ± 15.9%</td>
<td>5.1 ± 4.6%</td>
<td>0.04</td>
</tr>
</tbody>
</table>

*P* value for the difference in the ITC range between light and dark conditions (Wilcoxon signed-rank test).

UBM and AS-SS-OCT is probably attributable to the fact that AS-SS-OCT provides 32 B-scan images per quadrant, whereas UBM gives only one B-scan image per quadrant with the current protocol.

AS-SS-OCT enabled the quantitative analysis of ITC. The ITC range was greater in the dark than that in the light (Tables 5, 6). This finding is comparable to the ITC prevalence determined with UBM under light and dark conditions (Table 3). Moreover, in the AS-SS-OCT analysis comparing PAS-positive and PAS-negative eyes, only the ITC range under light conditions was significantly different (Table 5); that is, the range of ITC in light was much greater in the eyes with preexisting PAS. An eye with a greater contact range of the iris with trabecular meshwork, even under light conditions, might be more likely to develop PAS in the future. Whether the ITC range in light is related to future PAS formation in a narrow angle should deserve further longitudinal studies with prospective follow-up.

One limitation of this study is that the subjects studied were patients who visited our university hospital, a referral hospital in a city. It is likely that because of the high risk for developing PAS or angle closure, patients who had a very shallow anterior chamber or large amounts of PAS had been treated prophylactically in a previous clinic or hospital before visiting our hospital. Therefore, the shallow anterior chamber eyes in our study might not represent all shallow anterior chamber eyes. Another limitation is that this study included only Japanese patients. Given the significant differences in the prevalence of PACG among ethnic groups, the prevalence and range of ITC observed here with AS-SS-OCT might not apply in other ethnic groups. Nevertheless, our finding that the prevalence of ITC by eye with AS-SS-OCT was higher than that previously reported using UBM is likely of clinical importance. Angle AS-SS-OCT measurements are more likely to fail in the superior and inferior quadrants, where the angle is more likely to be narrower because of the upper or lower eye lid. This technical drawback might be dealt with by using a device that facilitates eye lid opening, but at the possible price of inadvertent exogenous influence on the globe.

In summary, this study demonstrated that compared with UBM, AS-SS-OCT detected a much higher prevalence of ITC per eye in narrow angle eyes, suggesting the usefulness of AS-SS-OCT for the untouched evaluation of ITC. Although no significant difference was found in the prevalence of ITC with AS-SS-OCT between light and dark conditions, the range of ITC was significantly greater in the dark than that in the light. Moreover, PAS-positive eyes had a significantly greater ITC range than PAS-negative eyes in the light.

Analyses of the range of ITC over the entire circumference of the anterior chamber angle are important when studying PACG and related conditions.

Acknowledgments

The authors thank the two professional editors, both native speakers of English, who checked the English in this document (under certificate http://www.textcheck.com/certificate/ew0VMC).

Disclosure: K. Mishima, None; A. Tomidokoro, None; P. Suramethakul, None; N. Mataki, None; N. Kurita, None; C. Mayama, None; M. Arai, None

References


