Pinpoint Identification of Filtration Opening on the Scleral Flap Margins Created by Trabeculectomy

Toohiro Inoue, Takahiro Kawaji, Riyo Matsumura, Utako Kuroda, Kei-Ichi Nakashima, Hidenobu Tanikara
Department of Ophthalmology, Faculty of Life Sciences, Kumamoto University, Japan.

BACKGROUND

The recent development of anterior segment optical coherence tomography (AS-OCT) has allowed information on internal morphology to be obtained in noninvasive manner. Previous studies using two-dimensional (2D) AS-OCT have suggested that a thick bleb wall with low reflectivity and reduced opacities and internal reflectivity are associated with reduced IOP values. However, detailed information on internal bleb morphology has been difficult to see because the C-scan image plane did not agree with the scleral plane.

METHODS

We used 3D AS-OCT and custom software to identify filtration openings, which were defined by pinpoint structures with identical features in both horizontal and vertical raster and corresponding features in en-face OCT images of several flap margins. These filters were obtained in a noninvasive manner.

PURPOSE

To elucidate the potential of 3D AS-OCT for identifying filtration openings where aqueous humor flows from the scleral flap into the subconjunctival space.

Typical examples of blebs with different types of filtration openings.

Photographs (left-upper images and vertical (right-upper images), horizontal (left-lower images), and C-scan (right-lower images) 3D AS-OCT images. Arrows point to pits and troughs in fluid-filled cavities. Red and blue lines indicate horizontal and vertical axes of AS-OCT, respectively. Yellow lines indicate the Z axis of the AS-OCT data, corresponding to the C-scan image.

Characteristics of Patients and Filtiration Blebs.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Type F1</th>
<th>Type F2</th>
<th>P-value</th>
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<tbody>
<tr>
<td>Total number of eyes</td>
<td>51</td>
<td>51</td>
<td>0.42</td>
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<tr>
<td>Age (years, mean ± SD)</td>
<td>66.5 ± 13.1</td>
<td>65.9 ± 11.1</td>
<td>0.68</td>
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</tbody>
</table>
| IOP (mmHg, mean ± SD) | 14 ± 5.6 | 18.8 ± 1.1 | 0.001*
| Number of glaucoma eyes used | 23 | 22 | 0.6 |
| Occurrence of subconjunctival microcysts | 20 (39.2%) | 14 (27.5%) | 0.51 |
| Occurrence of subconjunctival separation | 12 (23.5%) | 18 (35.3%) | 0.19 |
| Occurrence of multilayer structures in bleb walls | 20 (39.2%) | 15 (29.4%) | 0.32 |
| Total bleb height (mm, mean ± SD) | 1.02 ± 0.50 | 0.80 ± 0.34 | 0.04 *
| Fluid-filled cavity height (mm, mean ± SD) | 0.34 ± 0.33 | 0.24 ± 0.18 | 0.001**
| Bleb wall thickness (mm, mean ± SD) | 0.70 ± 0.41 | 0.57 ± 0.27 | 0.001**
| Intensity of bleb wall (optical density, mean ± SD) | 136.9 ± 49.5 | 151.1 ± 46.3 | 0.001**

Difference in TFD between right and left sides of scleral flap margins.

Among 28 eyes with Type F2 blebs, 25 had filtration openings on both (right and left) sides of the scleral flap margins, and the graph shows the difference in the TFD between both filtration openings in these eyes. The 3D technique allows complete evaluation of surgical wounds and internal structures of the filtration blebs, which suggests the clinical usefulness of 3D AS-OCT in treatment decision making after trabeculectomy.

SUMMARY

In most eyes with functional filtration blebs, we could identify the precise filtration openings from the scleral flap margin into the bleb space with the use of 3D AS-OCT and our new custom software.

The 3D technique allows complete evaluation of surgical wounds and internal structures of the filtration blebs, which suggests the clinical usefulness of 3D AS-OCT in treatment decision making after trabeculectomy.