Objective: To evaluate changes in anterior segment anatomy after laser iridotomy for pigment dispersion syndrome.

Methods: Ultrasound biomicroscopy was performed on 7 eyes of 7 untreated patients with reverse pupillary block and pigment dispersion syndrome. A radially oriented image with the probe perpendicular to the eye in the superior meridian was obtained before and at least 1 week after laser iridotomy in each eye. We assessed changes in angle recess area and iris-lens contact distance.

Results: Mean±SD patient age was 31.3±5.7 years and mean±SD refractive error was −5.0±3.9 diopters. Angle recess area (mean±SD, 0.78±0.28 vs 0.35±0.11 mm²; P=0.001, paired t test) and iris-lens contact distance (2.05±0.28 vs 0.79±0.13 mm; P<0.001) decreased following iridotomy. Central anterior chamber depth did not change.

Conclusion: Flattening of the iris following laser iridotomy for pigment dispersion syndrome causes a decrease in iris-lens contact and angle width while lens position remains constant.

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RESULTS

Seven eyes of 7 patients (5 men, 2 women) were enrolled (Table 1). Mean patient age was 31.3±5.7 years (range, 23-37 years). All patients were white. There were 5 left eyes and 2 right eyes. The mean spherical equivalent refractive error was −5.0±3.9 diopters (range, plano to −10.75 diopters). Mean axial length was 26.1±2.1 mm (range, 24.1-29.0 mm). Before iridotomy, all irides had a concave configuration between the iris root and the point of peripheral contact with the anterior lens capsule (Figure 2).

Mean angle recess area decreased from 0.78±0.28 mm² before laser iridotomy to 0.35±0.11 mm² after laser iridotomy (P=.001) (Table 2). Iris-lens contact distance decreased from 2.05±0.28 mm to 0.79±0.13 mm after laser iridotomy (P<.001). There was no significant change in central anterior chamber depth before (3.4±0.2 mm) vs after (3.3±0.2 mm) iridotomy.

This article is also available on our Web site: www.ama-assn.org/ophth.
SUBJECTS AND METHODS

All patients with pigment dispersion syndrome who had undergone ultrasound biomicroscopic imaging at the New York Eye and Ear Infirmary, New York, both before and after laser iridotomy were included. All patients had had elevated intraocular pressure with or without glaucomatous damage. The use of topical medications other than cholinergic agonists was not grounds for exclusion. Informed consent was obtained from all patients using forms approved by the institutional review board of the New York Eye and Ear Infirmary. Argon laser iridotomy was performed within 1 clock hour of the 12-o’clock meridian in the peripheral iris. The size of the aperture attained was approximately 100 µm in diameter.

Ultrasound biomicroscopy (Humphrey Systems Inc, San Leandro, Calif) was performed using a 50-MHz transducer with tissue penetration of 4 to 5 mm. All scanning was done with the patient in the supine position, while room illumination, fixation, and accommodation were held constant by having the patient fixate with the fellow eye on a ceiling target. A radially oriented image in the superior meridian was obtained before and at least 1 week after laser iridotomy. Anterior chamber depth was obtained by A-scan ultrasonography (Auto Ref-Keratometer RK2; Canon, Tokyo, Japan). Recorded data included age, sex, race, refractive error, axial length, and central anterior chamber depth.

Captured image files were exported as PCX-formatted data via floppy disks into a personal computer. Images were analyzed using a software program of our own design running on Microsoft Windows95 (Microsoft Corp, Seattle, Wash). The position of the scleral spur was defined as the innermost point of a line separating ciliary muscle and scleral fibers and localized on the ultrasound biomicroscopic image by the observer. Angle recess area was defined as the triangular area bordered by the most anterior point of the iris, corneal endothelium, and a line perpendicular to the corneal endothelium drawn from a point 750 µm anterior to scleral spur to the iris surface (Figure 1). This parameter improves on simple measurement of the angle in degrees by taking irregularities of anterior iris contour into account. Angle recess area was automatically calculated following localization of scleral spur by the observer.

Iris-lens contact distance was measured along the iris pigment epithelium from the pupillary border centrally to the point at which the iris can be discerned to separate from the anterior lens capsule. Anterior chamber depth was also measured along a single A-scan line that penetrated the center of the cornea and the pupil. These 2 variables were measured using a caliper provided in the ultrasound biomicroscopic software.

Postoperative changes in anterior segment anatomy were evaluated statistically using the paired t test. All values are given as mean±SD.

Table 1. Patient Data*

<table>
<thead>
<tr>
<th>Patient No./Age, y/</th>
<th>Eye</th>
<th>Axial Length, mm</th>
<th>Refractive Error, D†</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/23/M</td>
<td>Left</td>
<td>26.2</td>
<td>−1.25</td>
</tr>
<tr>
<td>2/36/M</td>
<td>Left</td>
<td>NA</td>
<td>−8.00</td>
</tr>
<tr>
<td>3/33/M</td>
<td>Right</td>
<td>NA</td>
<td>Plano</td>
</tr>
<tr>
<td>4/37/M</td>
<td>Left</td>
<td>26.0</td>
<td>−5.00</td>
</tr>
<tr>
<td>5/29/F</td>
<td>Right</td>
<td>29.0</td>
<td>−10.75</td>
</tr>
<tr>
<td>6/25/F</td>
<td>Left</td>
<td>25.2</td>
<td>−7.25</td>
</tr>
<tr>
<td>7/36/M</td>
<td>Left</td>
<td>24.1</td>
<td>−3.00</td>
</tr>
</tbody>
</table>

*All patients were white. D indicates diopters; NA, not applicable.
†Spherical equivalent.

COMMENT

Pigment dispersion syndrome is an autosomal dominant disorder in which iridozonular friction resulting in disruption of the posterior pigment epithelium of the iris is facilitated by a concave iris configuration,4,5 which is accentuated by accommodation6,7 and reversed by inhibition of blinking,7 miotic therapy,8 or laser iridotomy.5,8 The epithelial disruption, the dispersion of pigment within the anterior chamber, and pigment deposition on anterior segment structures result in the classic triad of midperipheral, slitlike, radially oriented transillumination defects, Krueger spindle, and dense trabecular pigmentation. The iris concavity is believed to result from reverse pupillary block due to increased aqueous pressure or volume in the anterior chamber relative to the posterior chamber.13,14 We have hypothesized that blinking results in transfer of a bolus of aqueous humor into the anterior chamber10 and that subsequent equilibration between the 2 chambers is prevented by an increased iridolenticular contact distance,14 which might possibly result from a disproportion in the size of the iris relative to that of the anterior segment.12 Alternatively, the reverse pupillary block itself might flatten the iris against the lens surface.

Figure 1. Anterior segment anatomy in pigment dispersion syndrome. The cornea (C), iris (Ir), sclera (S), anterior chamber (AC), scleral spur (arrow), ciliary body (CB), lens capsule (LC), anterior chamber angle (white arrow) and angle opening distance are shown. Iris-lens contact distance (white line) and angle recess area (ARA) are shown.
Eyes with forward pupillary block have a smaller than normal anterior segment; relative pupillary block typically occurring in hyperopic eyes, which have a shorter than average axial length; a more shallow anterior chamber; a thicker lens; a more anterior lens position; and a smaller radius of corneal curvature.\textsuperscript{13-17} Eyes with pigment dispersion syndrome are usually myopic and have a greater than normal anterior chamber depth and volume.\textsuperscript{18} Eyes with forward pupillary block have a convex iris configuration and decreased iridolenticular contact. After iridotomy, the angle width increases, iris configuration becomes planar or even concave, and iridolenticular contact increases (Figure 3).\textsuperscript{2,3} If reverse pupillary block is analogous to forward pupillary block, the angle width should decrease, the iris configuration should become planar, and iridolenticular contact should decrease, which is what we have found. In both disorders, iridotomy creates a communication between the anterior and posterior chambers, equalizing pressures across the iris (which can be analogized to an impermeable membrane between 2 solutions) leading to a planar configuration and decreased iridolenticular contact. We found no significant effect of iridotomy on central anterior chamber depth, similar to what has been reported in forward pupillary block.\textsuperscript{19}

Although our knowledge as to why relative pupillary block develops in pigment dispersion syndrome is incomplete, all evidence supports the concept that a “flap valve” effect allows aqueous to move in a forward direction only. Whether the increased iridolenticular apposition is due to an abnormality of iris size or iris rigidity remains to be elucidated. The development of software to measure iris volume under varying circumstances should facilitate further understanding.

Table 2. Anterior Chamber Anatomy Before and After Laser Iridotomy\textsuperscript{*}

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Before Laser Iridotomy</th>
<th>After Laser Iridotomy</th>
<th>% Change</th>
<th>(P), Paired (t) Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC depth, mm</td>
<td>3.4 ± 0.2</td>
<td>3.3 ± 0.2</td>
<td>1.2 ± 2.4</td>
<td>.4</td>
</tr>
<tr>
<td>ARA, mm(^2)</td>
<td>0.78 ± 0.28</td>
<td>0.35 ± 0.11</td>
<td>53.0 ± 10.0</td>
<td>.001</td>
</tr>
<tr>
<td>Anterior chamber angle, degrees</td>
<td>58.4 ± 9.5</td>
<td>42.9 ± 10.7</td>
<td>27.4 ± 9.9</td>
<td>.0001</td>
</tr>
<tr>
<td>Angle opening distance, mm</td>
<td>1.1 ± 0.3</td>
<td>0.5 ± 0.2</td>
<td>50.0 ± 8.4</td>
<td>.00017</td>
</tr>
<tr>
<td>Iris-lens contact distance, mm</td>
<td>2.05 ± 0.28</td>
<td>0.79 ± 0.13</td>
<td>61.7 ± 6.4</td>
<td>&lt;.000</td>
</tr>
</tbody>
</table>

\*Data are presented as mean ± SD unless otherwise indicated. AC indicates anterior chamber; ARA, angle recess area.

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REFERENCES


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