Retinal Burns From Experimental Laser Iridotomy

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ABSTRACT
Simulated argon laser iridotomy was performed in 12 cynomolgus monkey eyes to evaluate the effectiveness of the Abraham iridectomy lens in preventing inadvertent retinal burns. At 600 milliwatts, only two of the three eyes developed small retinal burns using the Abraham lens, whereas three eyes developed larger retinal burns without the Abraham lens. At 1000 milliwatts, retinal burns occurred with or without the Abraham lens, but the size and intensity of the burns were reduced with the lens.

Laser iridotomy has become the treatment of choice for patients with angle-closure glaucoma requiring iridectomy.1-8 This is due to the lower frequency and severity of complications from laser iridotomy vs. surgical iridectomy.1 However, one potentially serious complication is inadvertent laser photocoagulation of the retina. The frequency of this complication is felt to be low,1-4 but may occur more frequently than is appreciated, because of difficulties in examining the retina after laser treatment due to miosis. To reduce this risk, most authors caution against photocoagulating parallel to the visual axis, to avoid a laser burn of the macula. An additional safeguard against this complication is the Abraham iridectomy lens, which increases the area of the spot size on the retina.

In the present study, a 50-micron argon laser spot was focused on the anterior lens capsule of cynomolgus monkey eyes, simulating the enlargement stage of laser iridotomy. The effect of various power settings and the use of the Abraham lens were evaluated by measuring the area of the retinal burn produced.

MATERIALS AND METHODS
Six cynomolgus monkeys were anesthetized with ketamine hydrochloride and sodium pentobarbital. Both eyes were dilated with 1% cyclopentolate hydrochloride and 2.5% phenylephrine hydrochloride. Using a Coherent Model 900 argon laser photocoagulator, ten laser spots were focused on the mid-periphery of the anterior lens capsule. The settings were 50 microns, 0.2 second, and 600 or 1000 milliwatts. In six eyes, no lens was placed on the eye, and in the other six eyes, an Abraham iridectomy lens was used.

Fundus photographs were obtained immediately after photocoagulation, and one week and two months later. The area of the retinal burn was measured with a millimeter rule on the color transparencies. The area of the retinal burn was calculated from the formula for the area of an ellipse: Area = \( \pi r_1 r_2 \). The area of the disc for each eye was also measured and the laser burn area was expressed as a proportion of the disc area. The area of the retinal burn two months after laser photocoagulation was compared in each of four groups of three eyes each: with or without Abraham lens, and 600 or 1000 milliwatts.

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RESULTS
The average area of the retinal burn two months after laser photocoagulation in each of the four groups is listed in the Table. The small number of eyes precludes meaningful statistical analysis. The smallest area of retinal burn was noted in the group of eyes with the Abraham lens at 600 milliwatts. Only two of the three eyes developed retinal burns, which were not elevated and were slightly yellowish-white (Figure 1). Eyes with no Abraham lens at 600 milliwatts had the next largest area of retinal burn, with a slight degree of retinal elevation over the burn, and a more whitish color. At 1000 milliwatts and an Abraham lens, the retinal burns were larger and initially more white. At 1000 milliwatts and no Abraham lens, the burns were the largest of all, with marked retinal elevation of the burns, and an intense white appearance. One of these resulted in an apparent nerve fiber bundle defect (Figure 2).

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*Expressed in relative units; optic disc area = 1.0.

FIGURE 1: Retinal burn, Abraham lens, 600 milliwatts. A. Immediately post-laser. Small, yellow-white lesion is noted. B. Two months post-laser. Small area of pigmentedary change is present.

FIGURE 2: Retinal burn, no Abraham lens, 1000 milliwatts. A. Immediately post-laser. Intensely white, elevated lesion is noted. B. Two months post-laser. Large area of pigmentation is present, with apparent nerve fiber bundle defect.
thermore, the size of the burn was influenced greatly by the power setting. Thus, the Abraham lens does not entirely protect against laser retinal burns. Since the human eye is longer than the monkey eye, the laser spot would be even larger at the plane of the retina, such that the degree of retinal burn would be expected to be less in human eyes. However, a foveal burn has been reported following argon laser enlargement of an iridotomy.

The frequency of retinal burns following laser iridotomy in humans is not known. The incidence has been reported as 0-8%,1-4 but in many eyes, an adequate fundus examination cannot be performed due to inadequate pupillary dilation.

As noted by others, certain precautions can minimize the risk of inadvertent retinal burns. Use of the Abraham lens, using the least amount of power necessary for iris perforation, and aiming of the laser beam away from the visual axis are all important considerations. Retinal damage prior to iris perforation is unlikely,10 but each laser burn after perforation carries additional risk.

REFERENCES