Iridotomy with red krypton laser

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SUMMARY Iridotomy with red krypton laser instead of blue-green argon laser was performed on 68 eyes with various types of angle-closure glaucoma. Patent iridotomy was obtained in all the eyes, mostly in one working session. In eight eyes secondary closure by pigment needed reopening with a few applications at the iridotomy site. There were no immediate or late complications of importance, the main advantage of the technique being the avoidance of the corneal epithelial and endothelial burns which commonly occur during argon laser iridotomy, particularly when the anterior chamber is shallow.

Laser iridotomy has successfully replaced surgical iridectomy as a therapeutic procedure in patients with angle-closure glaucoma.^{1,4} The results reported were satisfactory both when the cool-mode, pulsed lasers and the continuous wave argon laser² were used. The most popular technique employed is treating the iris periphery with 50 µm spots, at intensities of 800–1200 milliwatts and exposure time of 0.1–0.5 second, until a through-and-through hole in the iris is obtained.^{3,4}

A different technique with the continuous wave, blue-green argon laser has been advocated by Yassur and his coworkers.⁵ This involved the delivery of high laser power (3–4 watts) in short exposures of 0.01–0.04 second. The main advantage of this method is the reduction of heat dissipation during the procedure.

More recently the introduction of YAG lasers (Q-switched and mode-locked) provided ophthalmologists with a new tool which has a real cutting effect. Iridotomy was shown to be obtained with a relatively low energy (3–5 millijoules) after one or two applications.^{6,7}

We present here our experience in the last two years with the alternative technique for iridotomy as previously described⁵ but using the red krypton laser instead of the argon laser.

Material and methods

OPERATIVE TECHNIQUE

The instrument used was the argon-krypton laser

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photocoagulator made by Lasertek, Finland. The red krypton laser was set for maximum power (800–1000 milliwatts at the cornea). Spot size was 50 µm and exposure time 0.01–0.04 second. The iridotomy site was around the 12 o'clock meridian, 1–3 mm from the limbus. Pre- and postoperative care was as described for argon laser iridotomy⁵; it included pilocarpine 2% prior to the laser applications and three to four instillations of an antibiotic-steroid compound eye drop during the 24 hours after the iridotomy. The laser applications were delivered through an Abraham's contact lens, and the intraocular pressure was monitored for two to four hours postoperatively. If during this period an increase in pressure of more than 5 mmHg was detected, acetazolamide was administered orally and the pressure monitored for the next 24 hours.

PATIENTS

A total of 68 eyes were treated by this technique and the patients followed for at least six months. The diseases for which the iridotomy was indicated were the following: acute angle-closure glaucoma, 21 eyes; fellow eyes of patients after acute angle-closure, 37 eyes; chronic angle-closure glaucoma, 10 eyes; total, 68 eyes.

Of these 68 eyes 61 were in patients with dark irides and seven in patients with pale irides. All the patients were followed up for 6–24 months.

Results

In all 68 eyes a patient iridotomy was obtained. The number of applications necessary to obtain a 200–400

μm iridotomy ranged from a minimum of 22 to a maximum of 168, mean 52. When a wider iridotomy was required, more applications were carried out. The exposure time was 0.01 s in 16 eyes, 0.02 s in 22 eyes, and 0.03 s in 24 eyes. Only six eyes needed 0.04 s exposure, and none of the eyes needed a longer exposure time than 0.04 s.

In 59 eyes the iridotomy was accomplished in one session and in nine eyes a second session was necessary. Secondary closure of the iridotomy by pigment occurred in eight eyes (seven dark and one blue) and it was reopened by 1–10 applications. Occasionally a slightly dragged-up pupil at the end of the procedure was noticed, and the pupils regained their round shape spontaneously, within a few days to two weeks after the operation.

The most important feature of the technique was that no visible damage to the cornea was observed, except in two eyes in which a mild, transitory, local stippling of the endothelium was noticed. In all the other eyes the endothelium remained clear even when the iridocorneal space was very narrow at the iridotomy site.

A transient increase in pressure and/or iritis were noted as frequently as with argon laser iridotomy by the high-power short-exposure technique.⁵

Focal lenticular opacity was noticed in 21 eyes. These never expanded, and soon either disappeared or became less intense during the follow-up period.

No choroidal or retinal damage could be detected in any of the treated eyes.

Discussion

Robin and Pollack recently reported⁶ that YAG laser iridotomies were superior to argon laser iridotomies for several reasons: less energy used, fewer pulses, less endothelial damage, less focal cataracts, and less secondary cataract. On the other hand severe complications after YAG laser iridotomy irradiation have also been reported. Khodadoust and his co-workers⁸ reported on severe corneal damage from the YAG laser even when the focus of the laser was 3.5 mm away on either side of the cornea.

Awaiting more experience with the YAG laser, many ophthalmologists have not purchased it yet, while many of those who have are still hesitant about using it for iridotomies, particularly in phakic eyes. Thus at present argon laser iridotomy remains the procedure preferred by most. Quite often, however, corneal epithelial and endothelial burns occur during argon laser iridotomy, and the transient opacities which accompany these burns may interfere with visibility and jeopardise the achievement of the iridotomy in that session. This is apt to occur in patients with pre-existing peripheral corneal

opacities, which dictate the use of higher argon laser power, and in eyes which have a very shallow peripheral anterior chamber, which is not uncommon in patients with angle closure.

The theoretical considerations which guided us to use red krypton laser for this procedure rather than argon laser were based on the physical properties of spectral red light as shown in absorption, scatter, and transmission curves. It is readily transmitted through human cornea, and it is less scattered or absorbed by corneal opacities^{9,10} than the argon laser. It is also well absorbed by the uveal pigment.^{11,12}

These properties, which enable red light to reach the iris pigment more efficiently, enable us to achieve patent iridotomy quite easily by using less energy than with the argon laser. When a patent iridotomy is not obtained in a single session with the red krypton laser, the failure is not due to focal corneal opacity at the iridotomy site but to other causes, such as the patient's failure in compliance or the surgeon's attempt to avoid the tendency to transient pressure elevation, as in chronic angle-closure glaucoma.

We therefore recommend that, whenever continuous-wave laser iridotomy is preferred to the neodymium-YAG laser, the red krypton laser should be used instead of the argon laser. This technique may enable the surgeon to achieve a patent iridotomy by using less energy and causing less corneal damage, which, although it is transitory, may be troublesome when iridotomy at one session is aimed for, and in eyes with a very shallow anterior chamber.

This study has been partly supported by a grant from the Middle East Eye Research Institute, Ben-Gurion University, Beer-Sheva, Israel.

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Accepted for publication 19 July 1985.