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Single treatment laser iridotomy

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SUMMARY A technique is described for producing an iridotomy in the treatment of closed-angle and secondary glaucoma using a single pulse from a dye laser. It was successful in 28 out of 32 eyes treated, and no significant complications were encountered.

Previous publications (Perkins and Brown, 1973; Brown, 1977) have shown that it is possible to produce a functioning iridotomy with a combination of argon and ruby lasers. This had the advantage of being an outpatient procedure, particularly useful for cases in which conventional surgery was contraindicated, but had the disadvantage that several treatments were required to achieve complete penetration of the iris. Theoretical studies (Wheeler, 1977) and animal experiments indicated that lasers with a shorter pulse, such as that from a dye laser, would produce a complete iridotomy with 1 pulse (Bass *et al.*, 1977). This method has been used on 32 eyes of 28 patients in most of whom conventional surgery was contraindicated. Four patients had both eyes treated, 1 being a case of Marfan's syndrome (Table 1).

Table 1 *Numbers of patients receiving various treatments*

Diagnosis	*One treatment*	*Two treatments*
Closed-angle glaucoma	17	4
Chronic simple glaucoma with narrow angles	7	0
Secondary glaucoma	3	0
Incomplete surgical iridectomy	1	0
Total	28	4

Table 2 *Colour of iris in treated patients*

Iris colour	*No. of eyes*
Grey	10
Blue	2
Brown	20
Total	32

Methods

Two tunable dye lasers were used: Electrophotonics Model 33 and Electrophotonics Model 43. The dyes employed to date were (1) cresyl violet, (2) rhodamine 640; both of these were in a pure methanol solution and tuned to λ 633 nm; (3) rhodamine 6G (λ 590 nm) and coumarin 102 (λ 488 nm), which were prepared initially in solution with methanol and subsequently in a methanol/water mixture of 1:1.

The maximum output of the lasers is approximately 200 mJ with a pulse duration of 1 μs, but it has been found that 60 mJ with a spot size on the iris of 250 μm diameter is adequate for most eyes, and in contrast to treatment with the ruby laser the colour of the iris is not an important factor. A grey iris can be treated as successfully as a brown iris (Table 2).

The delivery system was of our own design which incorporated slit-lamp illumination, a helium-neon laser aiming beam, safety shutters, and foot switches to activate the firing sequence. Patient and observer sit at the apparatus as for normal slit-lamp examination. No local anaesthesia has been used.

The patient sees a bright flash of light and has the sensation of something striking the eye, which often causes a reflex withdrawal of the head from the headrest. No lasting pain results, but there is a temporary blurring of vision due to pigment dispersal into the aqueous. Examination immediately after lasering shows in successful cases an iridotomy varying in size from a narrow slit to a hole comparable with that produced by a surgical peripheral iridectomy. A stream of pigment particles flows into the anterior chamber, and there is immediate flattening of any iris bombé present. A fine stream of blood from the edge of the iridotomy can be seen in some eyes, but no visible hyphaema has resulted so far.

A transient rise in intraocular pressure is usual after treatment, and prednisolone 0·3% drops 4 times

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daily are prescribed for 1 week in addition to any medical treatment being used.

Results

Thirty-two eyes have now been treated, and in 28 a successful iridotomy was achieved with 1 treatment (Table 1). In the 4 eyes in which it was necessary to repeat the treatment at another site 1 week later failure of the first treatment was due to fluctuation in the power output of the laser, so that the output energy was below the predicted level.

The indications for laser iridotomy are the same as those for surgical iridectomy, and the majority of cases treated have had closed-angle glaucoma. It has, however, been found useful for cases of chronic simple glaucoma with narrow angles before the use of sympathomimetic drugs to control the tension. Laser treatment has the advantage in such cases in that it does not cause any conjunctival scarring, so that any subsequent drainage operation which may be required is facilitated.

Laser iridotomy is particularly suitable for cases in which conventional surgery is contraindicated because of the patient's general condition or any local ocular conditions (as in Marfan's syndrome with subluxated lenses or active uveitis with iris bombé).

COMPLICATIONS

No corneal lesions were observed when dyes lasing in the red-yellow band of the spectrum were used, but small epithelial lesions were seen in 2 patients when coumarin 102, which emits in the blue at λ 488 nm, was used. No lens changes have been observed, and no retinal burns or haemorrhages have been detected. One patient whose tension was 36 mmHg at the time of treatment developed minimal macular oedema a few days after treatment when the tension had dropped to 16 mmHg. The oedema resolved in 3 weeks, with recovery of normal vision.

Discussion

These results show that an iridotomy can be achieved with a single pulse from a dye laser and that this is a practical outpatient procedure with minimal disturbance to the patient. In only 4 out of 32 eyes was a second treatment necessary, and this was due to a temporary failure of the laser to emit the required energy. No significant complications have been encountered, and although the follow-up period has been short (from 1 year to 3 months) serious complications such as lens changes or retinal burns would have become obvious soon after treatment.

Our present results suggest that the wavelength of the emitted laser light is less important than the short pulse produced by the dye laser. As small epithelial lesions were produced by the blue light from coumarin 102, and light of this wavelength is scattered more by an arcus senilis, use of this dye has been discontinued. Rhodamine 6G has the advantage of a longer life (several weeks) and seems to be the most suitable dye of those used so far. Other types of laser would probably be as effective provided they produced a pulse of a similar duration to that of a dye laser.

The apparatus in use at present is not ideal for routine clinical purposes, mainly because there is no flexible coupling between the laser and the microscope, and fine adjustment of the position of the beam has to be done by moving the patient rather than the microscope. This is a technical problem which still has to be solved in order to design a system suitable for routine clinical use.

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