Iridotomy with a ruby laser

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Extensive experience with animals has shown that it is possible to irradiate the iris with a ruby laser without damage to the cornea, lens, or retina (Hallman, Perkins, Watts, and Wheeler, 1968, 1969). The possible use of a laser to make an iridotomy for therapeutic purposes was appreciated by Flocks and Zweng (1964), and Zweng, Flocks, Kampany, Silbertrust, and Peppers (1964) reported two attempts to perform this in human eyes. In neither case was a complete iridotomy produced, but holes were produced in two pigmented irides by Zweng, Paris, Vassiliadis, Rose, and Hayes (1970). Some success in treating a small series of cases of closed-angle glaucoma and secondary glaucoma due to iris bombé has been reported (Perkins, 1970, 1971), and this paper is an attempt to evaluate the clinical application of laser iridotomy from the results of treating more than forty eyes.

Methods

For the application of laser light to the iris a slit-lamp laser delivery system is preferred. The slit lamp provides the necessary movements and observation for the accurate placing of the focused laser beam at the selected site on the iris, and the immediate result can be observed. The laser is therefore attached to the slit lamp without interfering with normal slit-lamp function.

The ophthalmoscope ruby laser and cavity (C. Davis Keeler) which is used has a maximum energy output of 900 mJ, delivered in a single pulse of 650 μ s duration at a wavelength of 694.3 nm. The beam is approximately 6.4 mm. wide, but is not perfectly coherent and increases in width with distance from the laser.

To minimize energy losses in the delivery system, the laser beam needs to be reflected or refracted at as few surfaces as possible, and the total light path kept short. Conventional silvered or aluminized mirrors are relatively poor laser reflectors, with a reflectance of about 90 per cent. Dichroic mirrors have a reflectance exceeding 90 per cent. for the specified wavelength, and have the advantage of passing other wavelengths, which makes it possible to combine a light pathway for aiming with that of the laser. The lens system which focuses the laser beam onto the iris needs to be simple. Multi-element lenses cause energy losses and achromats are irrelevant. A simple plano convex lens with the convex surface towards the laser is considered efficient.

The majority of the patients now reported were treated with our original (Mark I) apparatus (Perkins, 1970). As a result of experience with this apparatus, a new one (Mark II) has been built in this department.

The Mark I apparatus is a converted Gambs photo-slit-lamp on which the laser is mounted in place of the camera, and the laser energy is delivered to the eye *via* the optics of the left ocular which is intended for photography. When the mirror is depressed the laser beam emerges from the objective and is focused to a circle of confusion of about 1.5 mm. coincident with the illumination system of the slit lamp. This allows placement of the focused laser beam at the desired site on the iris. Before the laser can be fired the mirror must be depressed, thus occluding the left ocular so that continuous viewing is only maintained with the right ocular. The ray paths of the laser and the aiming light from the slit lamp are not identical so that it is possible for them to be refracted differently by the cornea, which may cause disparity between the actual site of laser focus and its predicted site.

The Mark II apparatus (Fig. 1) has been designed to overcome the above limitations. The basic slit lamp is the Zeiss photo-slit-lamp which provides a rigid base for mounting the laser and the aiming light on the camera platform. The laser is mounted vertically and the beam passes downwards to be reflected horizontally by a dichroic mirror in front of the binocular microscope (Fig. 2.)

FIG. 1 *Mark II laser slit-lamp apparatus*

It is focused onto the iris by a single plano convex lens, which brings it to a circle of confusion within 1.0 mm. diameter. A filament lamp provides the aiming light, which has a final common pathway with the laser beam (Fig. 2). Light from the filament lamp is condensed onto a pinhole which then acts as a light source. The light from the pinhole is collimated and reflected vertically, parallel with the laser beam, to a silvered mirror placed behind the dichroic mirror described above. This mirror reflects the light horizontally through the dichroic mirror, which transmits light up to a wavelength of 615 nm. Thus the viewing light and laser light leave the front surface of the dichroic mirror together and will reach the same point of focus regardless of the direction taken through the cornea.

FIG. 2 Diagram of laser slit-lamp apparatus

The focused aiming light is observed on the iris with the binocular microscope, and the laser cannot be fired until built-in protective filters (Schiotz BG18) have been placed in front of each ocular. The aiming light is seen through these filters so that stereoscopic observation is maintained during firing, and exact placing of the laser lesion is obtained.

With a laser output energy of 700 mJ, a measured delivery of 400 mJ is obtained with the Mark I and of 550 mJ with the Mark II apparatus, and the latter is concentrated within a smaller area. Limited experience with the Mark II apparatus suggests an appreciably greater clinical effect, particularly upon the stroma, which is considered to be due to the greater energy density.

Preparation of the patient

No anaesthesia is required, but the pupil is contracted with pilocarpine 2 per cent. drops if it is not already miotic. One drop of predsol is instilled every 5 minutes for half an hour before lasering to reduce any inflammatory response.

The iris is inspected carefully to enable the most suitable site to be chosen for irradiation; usually this is in the upper segment. If the laser can be applied where there is a deep crypt in the iris the likelihood of successful penetration is increased.

The patient is positioned at the slit lamp and a suitable fixation point is provided so that the beam can be aimed obliquely at the desired area of iris. This is done so that, if sufficient energy were to be transmitted through the iris to cause a retinal lesion, only a peripheral part of the retina could be affected. This precaution is probably unnecessary for the first exposure provided that transillumination of the eye through the pupil shows an intact pigment epithelium in the area to be lasered. In most cases two applications to adjacent areas of the iris have been given at each sitting.

After treatment further steroid drops are instilled at half-hourly intervals for 2 hours, and three times a day for 1 week. The tension is measured 1 hour and 2 hours after lasering and if unduly raised is reduced by acetazolamide as required.

Results

(a) Effects of irradiation on the iris tissue

The immediate changes in the iris depend to some extent on the energy used but also on the colour and texture of the iris. With a light-coloured iris and the lower energy density from the Gambs apparatus, it may be impossible to recognize any change in the stroma. The more pigmented the iris, the more obvious the site of the lesion becomes, and disruption of the anterior layers of the stroma with bubble formation and the liberation of small particles of stromal tissue into the aqueous may be seen.

The pigment epithelium is always destroyed, irrespective of the colour of the iris, and a stream of fine pigment granules can usually be seen entering the anterior chamber through the pupil. Transillumination through the pupil shows a red reflex in the area treated.

With the energy levels used so far, complete penetration of a normal iris has not been achieved with one exposure. In some eyes with a drawn-up pupil after injury or complicated cataract surgery, and in some eyes with iris bombé after uveitis, a complete hole through the iris has been achieved with one exposure. Presumably the iris in these cases is stretched and thinned, making complete penetration easier.

In the three cases of incomplete peripheral iridectomy reported here, the remaining pigment epithelium has been completely disrupted with one exposure.

The procedure seems to be painless in almost all patients and the only symptom has been a pricking sensation reported by a few. Slight discomfort during the succeeding 24 hours is common.

In eyes without previous uveitis there is remarkably little inflammatory response. A rise in tension of 5–10 mm. Hg is usual in cases of closed-angle glaucoma, lasting for 1 or 2 hours after treatment. A more marked rise in tension requiring treatment with acetazolamide occurred in three patients who had previously had a uveitis, but in these cases (at the beginning of the series) pretreatment with steroid drops had not been given. A rise in tension requiring acetazolamide has occurred in a few eyes which have been subject to previous attacks of closed-angle glaucoma, but in no case has this posed a serious problem.

After 1 week the eyes appear quiet. Some stromal thinning is usually apparent and transillumination shows loss of pigment epithelium and usually some migration of pigment into the stroma in the lesion. No damage to the cornea, lens, or retina has been observed.

Repeated treatment at intervals of a week or more results in further stromal destruction and can be continued until through-and-through holes are produced or the iris bombé, either physiological or pathological, has been relieved.

(b) Therapeutic results

Patients were chosen for treatment who require a peripheral iridectomy or an iridotomy but in whom conventional surgery had been refused or considered inadvisable because of poor general health or unfavourable factors such as uveitis or an unsuccessful operation on the other eye.

The patients with glaucoma had all been investigated by the usual methods, either in the Glaucoma Clinic at the Institute of Ophthalmology or in the out-patient clinics at

Moorfields Eye Hospital. Particular attention was paid to the appearance of the angle before treatment. The patients were followed up in the Glaucoma Clinic after treatment. The patients treated can be divided into the following groups:

- (1) Eyes which had had attacks of closed-angle glaucoma.
- (2) The fellow eyes in patients who had had closed-angle attacks in one eye.
- (3) Chronic simple glaucoma with narrow angle.
- (4) Secondary glaucoma due to iris bombé.
- (5) Optical iridectomy.
- (6) Incomplete peripheral iridectomy.
- (7) Other.

(1) CLOSED-ANGLE GLAUCOMA

Assessment of the results of treatment in the glaucoma cases has been graded as follows:

Failure — no alteration in the width of the angle, as judged by gonioscopy and/or subsequent closed-angle attacks.

Improvement — definite increase in the width of the angle, but part of the angle remaining narrow; no subsequent closed-angle attacks.

Good — widening of the whole angle so that the possibility of angle closure seemed very unlikely; dark-room provocative test negative.

The presence or absence of a through-and-through hole in the iris was not used as an indication of success, as it was anticipated that destruction of the pigment epithelium alone might be sufficient to relieve physiological iris bombé. In fact most of the patients with holes were classified as showing a good result.

The results are summarized in Table I, and a brief description of the individual cases is given in Table II. Three of the five eyes classed as failures had had acute attacks (Nos. 1, 9, 22), one had an angle which was probably partly closed by permanent synechiae (No. 39), and the fifth had a light iris which showed no stromal atrophy after two applications (No. 2). It is possible that further treatment might have been successful in the last case, but the patient was on the verge of an acute anxiety neurosis and it was felt that delay was unjustified. A drainage operation was performed, but the tension was not controlled without miotics.

Table I Results in 27 cases of closed-angle glaucoma

Result	No. of eyes	Percentage
Good	9	33.3
Improved	12	44.4
Failed	5	18.5
Insufficient follow-up	1	3.7

In most of the eyes classified as improved there was thinning of the stroma in addition to loss of the pigment epithelium. In Case 16 a complete hole was produced but part of the angle remained closed. The other cases in which a hole was produced all gave good results.

The lesions produced by the Mark II apparatus have been typified by much greater stromal disturbance, probably because of the greater concentration of energy which is

Table II *Closed-angle glaucoma in 22 cases*

<i>No.</i>	<i>History and gonioscopic appearances</i>	<i>No. of treatments</i>	<i>Post-treatment findings and course</i>	<i>Period of follow-up</i>	<i>Result</i>
1	Acute closed-angle attack 1 week previously; tension reduced but angle still closed Corneal oedema	2	Doubtful transillumination Angle remained closed Iridectomy performed and followed by malignant glaucoma	1 wk	Failed
2	Subacute attacks Previous anterior uveitis Very narrow angle	2	Transillumination but little change in stroma Angle remained unchanged Drainage operation performed	4 wks	Failed
6	Closed-angle glaucoma with positive dark-room test (DRT) Very narrow angle	1	Transillumination but only slight stromal change Angle open below but narrow above DRT negative	2 yrs 7 mths	Improved
9	Acute attack L Very narrow angle	1	Transillumination but no change in angle Another acute attack 2 weeks later	2 wks	Failed
10	Closed-angle glaucoma Very narrow angle Iridectomy R	1	Good transillumination Angle well open all round	6 wks	Insufficient follow-up
11	? Closed-angle glaucoma both eyes Narrow angles	R1	Angles more open below but DRT positive although angles remained open	2 yrs	Improved
		L1	? Chronic simple glaucoma		Improved
16	Bilateral Fuchs's corneal dystrophy Bilateral closed-angle glaucoma L operated R very narrow angle	4	Definite hole in iris after fourth treatment Angle well open below and nasally, closed temporally Tension controlled on miotics and daranide	2 yrs	Improved
17	Bilateral closed-angle glaucoma Very narrow angles	R3	Atrophic scar Angle well open below, narrow above	18 mths	Good Good
		L3	Very thin area with ? small hole Angle well open below DRT negative both eyes		
19	Closed-angle glaucoma Very narrow angle	3	Very thin scar Angle narrow temporally but elsewhere well open	18 mths	Good
20	Bilateral closed-angle glaucoma L bullous keratopathy after surgery R angle very narrow	3	Very thin scar? small hole Angle well open but narrow temporally	18 mths	Good
22	L acute attack Angle closed above, just open below	1	Transillumination Angle slightly wider but another acute attack 2 months later	2 mths	Failed
23	Bilateral iridoschisis Acute attack R Angles very narrow; R appeared partly closed	R1	Very thin areas Angle open below and open but narrow above	18 mths	Improved
		L1	Lasered area oedematous Angle more open below, probably requires further treatment		Improved

Table II (Continued)

No.	History and gonioscopic appearances	No. of treatments	Post-treatment findings and course	Period of follow-up	Result
28	Bilateral closed-angle glaucoma Very narrow angles Refused operation	R4	Atrophic with small holes Angle well open	18 mths	Good
		L5	Atrophic with small holes Angle well open		Good
29	Closed-angle glaucoma R, DRT positive Very narrow angle Poor general health	3	Atrophic area with small holes Angle well open below but narrow above	18 mths	Good
30	Bilateral old interstitial keratitis and closed-angle glaucoma R operated L angle narrow with peripheral anterior synechiae	3	Definite hole in iris Angle well open except for peripheral anterior synechiae DRT negative	18 mths	Good
33	Acute attack L Angle narrow with marked iris bombé	3	Good transillumination but no hole Angle open below and medially	2 mths	Improved
39	Closed-angle glaucoma with raised tension L Very narrow angle	3	Good transillumination Angle open below but ? permanently closed above Tension still raised Drainage operation advised	1 mth	Failed
42	Acute attack R Very narrow angle	5	Very thin; possibly small hole Angle open below but narrow above DRT negative	3 mths	Improved
49	Acute attack L Very narrow angle Poor general health	1*	Good transillumination Angle appeared wider Patient died 1 month later	1mth	Improved
50	Bilateral non-congestive closed-angle glaucoma Angles very narrow On treatment for severe Parkinsonism	R3*	Very thin with ? small holes Angle well open below and over lesion	1 mth	Good
		L1*	Deep pit in stroma Less bombé, ? for further treatment	2 wks	Improved
53	Acute attack L Very narrow angle	3*	Deep pitting of stroma Angle wider	2 wks	Improved
54	? Closed-angle glaucoma both eyes Narrow angles	1*	Deep pitting, ? small hole Angle well open but tension raised ? Chronic simple glaucoma	2 wks	Improved

*Denotes new laser system

obtained with this design. Some peaking of the pupil towards the lasered area may occur, and a deep furrow is formed with traction on the surrounding iris which produces a flattening of the peripheral iris and an immediate widening of the adjacent angle.

(2) PROPHYLACTIC TREATMENT

A summary of the clinical details is given in Table III. So far the procedure has been successful in that no attacks of raised tension have occurred in these eyes, and gonioscopy suggests that the angle is unlikely to close.

Table III *Closed-angle glaucoma: prophylactic treatment to the other eye in 4 cases*

<i>No.</i>	<i>History and gonioscopic appearances</i>	<i>No. of treatments</i>	<i>Post-treatment findings and course</i>	<i>Duration follow-up</i>	<i>Result</i>
7	Acute attack R Narrow angle L	2	Thin area but no hole Angle appeared well open	4 mths	Good
9	Acute attack L Narrow angle R	1	Good transillumination but no thinning	5 mths	Insufficient follow-up
12	Acute attack R Narrow angle L	3	Atrophic area with small holes	1 year 4 mths	Good
30	Old interstitial keratitis Incomplete iridectomy, R Narrow angle L	2	Iris oedematous over area of transillumination Angle narrow in this area, otherwise open ? For further treatment	1 year 6 mths	Improved

(3) CHRONIC SIMPLE GLAUCOMA WITH NARROW ANGLE

Only two patients in this category have been treated. One has been lost to follow-up, and in the other medical treatment is still required to control the tension but the angle appears wider.

(4) SECONDARY GLAUCOMA WITH IRIS BOMBÉ

The clinical details and results in six cases are summarized in Table IV (opposite). Although in most cases it has been possible to reduce the iris bombé, leading to a reduction in tension, peripheral anterior synechiae were found to be present and the tension did not return to a normal level. In four cases the eye was virtually blind and treatment was carried out in the hope of relieving pain.

(5) OPTICAL IRIDOTOMY

Four of the cases in this group had a drawn-up pupil after complicated cataract extraction, and the remaining case had an occluded pupil after repeated needling. A full-thickness hole was easier to produce in the stretched iris of these cases and resulted in visual improvement in three. In two cases a cyclitic membrane was present behind the iris, preventing visual improvement. The cases are summarized in Table V (overleaf).

(6) INCOMPLETE PERIPHERAL IRIDECTOMY

Three eyes have been treated in which an attempt at performing a peripheral iridectomy for closed-angle glaucoma had left the pigment epithelium intact. In each case one exposure with the laser disrupted the pigment epithelium and successfully completed the iridectomy.

Table IV Secondary glaucoma with iris bombé in 6 cases

No.	History and gonioscopic appearances	No. of treatments	Post-treatment findings and course	Period of follow-up	Result
3	Long-standing uveitis with iris bombé Angle very narrow	1	Good transillumination with one very thin area Increase in uveitis with raised tension over next 3 days; then settled with less bombé Eye remained quiet with normal tension	1 year 2 mths	Improved
4	Chronic uveitis with iris bombé	1	Small slit-hole in iris; some uveal reaction Angle became wider and peripheral anterior synechiae seen below One year later tension in both eyes rose in spite of open angles, and drainage operations were necessary	1 yr 6 mths	Improved
34	Congenital defects Secondary glaucoma with iris bombé Blind painful eye	3	Complete hole achieved Bombé relieved but many peripheral anterior synechiae seen in angle Pain relieved	1 yr	Improved
38	Retinal detachment Secondary glaucoma with iris bombé Painful blind eye	3	Very thin area with retraction of treated area Some regions of angle open but loculated bombé in places Tension reduced and pain relieved	4 mths	Improved
40	Trauma followed by secondary glaucoma with iris bombé and corneal oedema	1	Complete hole achieved but no change in tension	1 mth	Technically successful but not improved
44	Retinal detachment followed by closed angle with iris bombé	5	Very thin area Bombé reduced but peripheral anterior synechiae present Tension still raised	3 mths	Improved

(7) MISCELLANEOUS CASES

The four cases in this group (Table VI, overleaf) are described briefly below:

Case 13 A patient with Eales's disease and a total vitreous haemorrhage. Laser treatment has been reported (Falkowska, Kęcik, Malinowska, and Szretter, 1968) to hasten the absorption of a vitreous haemorrhage, but two treatments in this case produced no apparent change.

Case 21 A patient with extensive peripheral anterior synechiae following multiple injuries. A slight reduction in tension followed one application, but the patient could not be followed up.

Case 32 A child with recurrent iris cyst. An attempt to make a hole in the transparent cyst wall was unsuccessful.

Case 45 A patient with rubeosis of the iris and secondary glaucoma due to extensive peripheral anterior synechiae. No improvement followed one exposure to the laser.

The results in the whole series of 49 eyes are shown in Table VII (overleaf). Although one in five were considered failures, this series includes four eyes with miscellaneous condi-

Table V *Optical iridotomy in 5 cases*

No.	Diagnosis	No. of treatments	Post-treatment findings and course	Result
5	Drawn-up pupil after complicated extraction	1	Full-thickness hole through iris but cyclitic membrane exposed No improvement in vision	Technically successful
24	Drawn-up pupil after complicated extraction Corneal scarring	1	Full-thickness hole Slight improvement in vision Fundus now visible	Improved
36	Repeated needling for congenital cataract Pupil occluded	1	Thin area produced Slight visual improvement	Improved
51	Drawn-up pupil after complicated extraction	2*	Two slit-like holes produced Vision improved from hand movements to 6/60	Improved
52	Chronic uveitis Complicated cataract extraction with drawn-up pupil	3*	Slit-like hole in iris but cyclitic membrane exposed	Technically successful

*Denotes new laser system

Table VI *Four miscellaneous cases*

No.	Diagnosis	No. of treatments	Post-treatment findings and course	Result
13	Eales's disease Total vitreous haemorrhage	2	No change in appearances	Failed
21	Multiple injuries Closed angle	1	Transillumination but no change in angle	Failed
32	Iris cyst in a child	1	No effect on transparent cyst wall	Failed
45	Rubeosis and angle closure 80 per cent. peripheral anterior synechiae	1	No improvement	Failed

Table VII *Summary of results in 49 eyes*

Result	No. of eyes	Percentage
Good	14	28.6
Improved	21	42.9
Failed	10	20.4
Technical success	2	4.1
Insufficient follow-up	2	4.1
Total	49	

Table VIII *Influence of iris colour on results*

Iris colour		Brown	Grey
Result	Good	9	2
	Improved	5	10
	Failed	4	2

tions in which the treatment was in the nature of a last resort. The other failures were mainly due to insufficient treatment.

There is some correlation between successful treatment and the colour of the iris. Table VIII shows the results for those eyes (excluding the miscellaneous cases and the partial iridectomies) in which the colour of the iris was recorded.

Discussion

Photocoagulation of the iris has been carried out previously using the conventional light coagulator or even natural sunlight (Otiti, 1969), but has usually been confined to aphakic eyes because the heat generated in the iris caused damage to the lens. The great advantage of a pulsed ruby laser is that very little of the light is absorbed by the cornea or lens, and the pulse of energy is so short (650 μ s) that the temperature rise in the iris is of short duration and conduction to adjacent structures is minimal. No damage to the lens has been observed in any of the eyes treated so far.

Anatomical studies suggest that the stroma of the iris is a loose tissue which allows free passage of fluid and that the barrier separating the anterior and posterior chambers lies at the level of the pigment epithelium. It was originally hoped that destruction of the pigment epithelium alone would be sufficient to produce a low-resistance pathway for aqueous through the periphery of the iris, and thus relieve the physiological iris bombé in closed-angle glaucoma. This concept was supported by animal experiments (Hallman and others, 1968, 1969) which showed that fluorescein injected into the posterior chamber could be seen to come through the iris stroma at the site of a single application of a ruby laser on or after the 11th day after irradiation in pigmented rabbits.

Clinical experience has shown that, although this may be true in a few cases, the most successful results have been obtained when definite thinning of the stroma has followed irradiation. In two cases we have noticed oedema of the iris after disruption of the pigment epithelium, suggesting that aqueous had penetrated the stroma from the posterior chamber but had been unable to pass freely into the anterior chamber.

In order to produce stromal thinning and/or a complete hole in the iris, it has usually been necessary to repeat the irradiation at weekly intervals, using the power available with the laser mounted on the Gambs slit lamp. The initial results suggest that the laser mounted on the Zeiss slit lamp has more effect on the stroma and that fewer applications will be required to produce a functioning iridotomy.

The necessity for several treatments is perhaps the biggest disadvantage of laser iridotomy, compared with a conventional surgical iridectomy. However, most cases of glaucoma which are suitable for treatment by iridectomy can be controlled medically for long enough to allow several applications of the laser at weekly intervals. The great advantage of laser iridotomy is that it can replace an in-patient procedure, which although relatively straightforward is not always uncomplicated, by an out-patient treatment which so far has been remarkably free from complications. Clearly laser iridotomy can only act in the same way as a conventional peripheral iridectomy, and the indications for its use in closed-angle glaucoma are the same.

An optical iridotomy can be performed successfully with the laser, but the resulting hole is small and tends to be slit-like if the pupil is drawn up. The hole could be enlarged by repeated exposures but this involves some danger of part of the beam reaching the retina through the margin of the initial hole. With a more powerful laser it would be possible to use a wider beam and obtain a larger iridotomy.

In cases of secondary glaucoma due to iris bombé following uveitis it is usually possible to relieve the bombé, but permanent peripheral anterior synechiae often remain. These cases should be treated as early as possible, and prophylactic laser iridotomy might be advisable when seclusion of the pupil is threatened.

An incomplete surgical iridectomy in which the pigment epithelium is left intact responds dramatically to a single exposure from the ruby laser.

Complications of laser iridotomy

No corneal lesions have been seen after irradiation through normal corneal tissue. In one patient with old trachomatous pannus, a small superficial grey spot was noticed after lasering.

A minute filiform capillary haemorrhage from the iris has been noted on four occasions in eyes which had had a previous uveitis. Pigment is liberated into the anterior chamber after lasering the iris and can be seen on the trabeculae below. This does not seem to cause any obstruction to outflow.

No lens changes have been seen in relation to the lasered area and no fundus lesions have been observed.

A brief rise in ocular tension is usual for a few hours after treatment, particularly if the tension is already raised before treatment. Acetazolamide has been used to reduce the tension when necessary.

Inflammatory signs have been surprisingly slight and can be further reduced by the use of steroid drops for a week after irradiation.

Summary

The use of a ruby laser mounted on a slit-lamp microscope for the out-patient treatment of closed-angle glaucoma, and some cases of secondary glaucoma, is described. Good results were obtained when marked thinning or a complete iridotomy was produced in the iris; this usually required repeated treatment at intervals of a week or more. No serious complications have been encountered and no damage to the lens or retina has been detected.

We should like to acknowledge the skilled technical assistance of Mr. M. Bass and Mr. A. L. Yerlett in building the apparatus. Part of this work was supported by a grant from the Medical Research Council.

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