# DIODE LASER CYCLOPHOTOCOAGULATION

**BY**

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## ABSTRACT:

***Purpose:*** To evaluate diode laser trans-scleral contact cyclophtocoagulation in refractory advanced glaucomas concerning intraocular pressure (IOP), corneal affection, and postoperative complications.

***Patients and method*:** Eighteen eyes of fourteen patients were included in this study. Seven were males and seven were females. Ages ranged from 42-70 years, mean 60.07 (± 8.67). Eight eyes (44.4 %) had neovascular glaucoma (NVG) due to diabetes. One eye (5.5%) had previous penetrating keratoplasty (PKP). Another eye (5.5%) was silicone filled. Follow –up period was eight months. Repeated procedures were needed in four eyes (22.2%).

***Results:*** Mean IOP after one week was 16.6 mm Hg (+/-3.2), and 23 mm Hg (+/-3.7) after eight months. This was found highly significant ($P<0.001$). Success rate was 94.4% after one week and 77.8% after eight months, showing highly significant results ($P<0.001$).

***Conclusion:*** diode laser cyclophotocoagulation is a safe, rapid, tolerable and effective procedure although often needs repetition.

Cyclophotocoagulation is applied when filtration surgery is likely to fail, failed or not feasible. Trans-scleral diode laser cyclophotocoagulation (TDLCP), using glaucoma probe is the cyclodestructive procedure of choice because of the reduced incidence of complications, compared to other cyclodestructive methods (1).

Cyclodestructive procedures for refractory terminal glaucomas using cyclocryotherapy have been applied for several decades. Associated complications included severe pain, uveitis, phthisis, elevated intraocular pressure (IOP) which created potential for optic nerve damage (2). Several laser procedures have been developed hoping to minimize side effects. These procedures included laser cyclophotocoagulation of ciliary processes applied during vitrectomy or lensectomy. Requirements of aphakia, large pupil, and clear media made its application limited. Trans-scleral cyclophotocoagulation has been lately the method of choice for ciliary body destruction by most glaucomatologists. This is divided into "contact" where a probe comes in direct contact with conjunctiva and sclera, and "non-contact" where energy is directed to the sclera at the slit lamp in conjunction with a lens that helps to minimize conjunctival burns (3).

Cyclophotocoagulation treatments provoke inflammatory reaction in the eye with substantial IOP lowering effect, possibly like when eyes with uveitis have decreased aqueous production. Cyclophotocoagulation may selectively target structures involved in aqueous production. Laser energy is absorbed by melanin present in ciliary stroma and epithelium. Laser is also absorbed by blood; this possibly produces thrombosis rendering the ciliary body ischemic (4).

Lasers suitable for cyclophotocoagulation are Nd:YAG laser with continuous thermal mode, and lately diode laser. It has been suggested that sympathetic ophthalmia might occur following Nd: YAG laser cyclophotocoagulation (5). Scleral thinning also has been found in another study (6).

The use of cyclodestructive procedures is of particular concern in eyes having undergone PKP. This is due to the induced inflammatory reaction, possibly associated with corneal graft rejection. This has been reported in one study after Nd:YAG laser application where 38.4% developed corneal graft decompensation (7). A theoretical potential exists that laser treatment may accelerate the process in patients with early graft decompensation. Many patients who receive cyclophotocoagulation already have keratopathy. Diode laser cyclophotocoagulation is now currently used and efficacy of contact method has been well established (8).

## PATIENTS AND METHODS:

This study included 18 eyes of 14 patients. Four were bilateral. Seven were males and 7 females. Ages ranged from 42-70 years, mean 60.07 (±8.67). IOP ranged from 35-50 mm Hg, mean 42.4 (±5.3) with full medical treatment. All eyes had refractory advanced glaucomas. Table (1) shows etiology of glaucomas.

**Table (1): Etiology of glaucomas**

| Aetiology | No. of eyes | Percentage (%) |
|---|---|---|
| Secondary ACG | | |
| * NVG | 8 | 44.4 |
| * Intumesc cat. | 2 | 11.11 |
| Secondary OAG: | | |
| * Aphakia | 4 | 22.2 |
| * Pseudophakia | 1 | 5.5 |
| * Silicone filled | 1 | 5.5 |
| * PKP | 1 | 5.5 |
| Neglected 1 ry OAG | 1 | 5.5 |

There were eight eyes (44.4%) having NVG in diabetic patients. Two of them were pseudophakic. One silicone filled eye was also pseudophakic.

One eye with previous PKP was aphakic. No glaucoma surgery had been previously done to any eye. Figure (1) shows an eye with NVG, and figure (2) shows a pseudophakic eye with secondary open angle glaucoma.

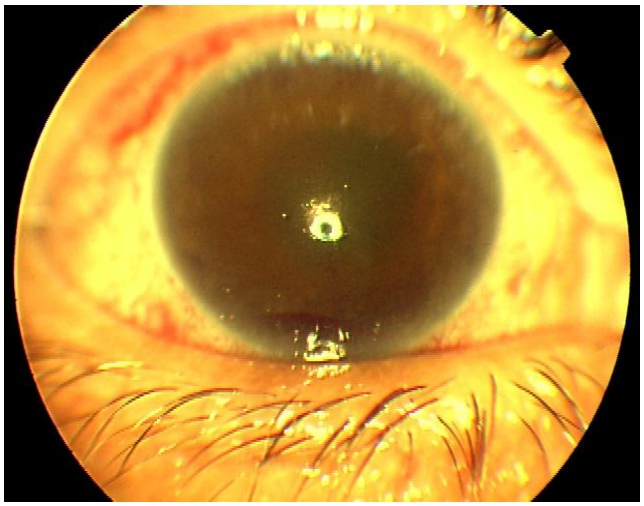

Fig.( 1): Neovascular glaucoma with hyphema

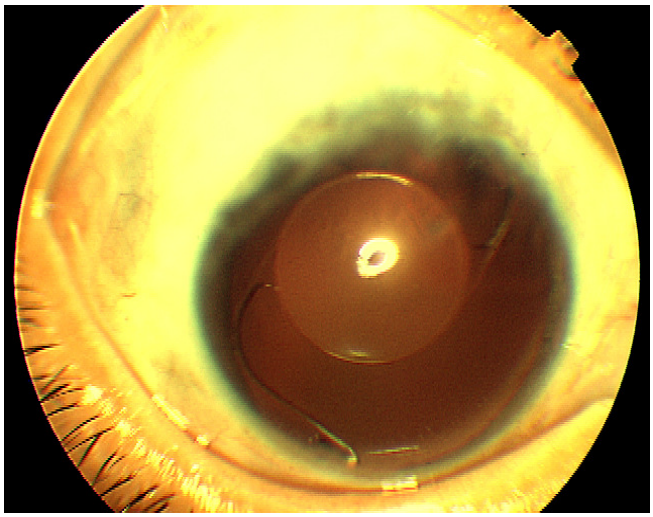

Fig. (2): Pseudophakic glaucoma

Table (2) shows preoperative visual acuities ranging from no perception of light (No PL), to counting fingers (CF) 80 cm.

**Table (2): Preoperative visual acuity**

| Visual acuity | Number | Percentage (%) |
|---|---|---|
| No PL | 6 | 33.33 |
| PL | 5 | 27.7 |
| HM | 6 | 33.3 |
| Better | 1 | 5.5 |

Seven eyes showed diffuse stromal edema. Four eyes had bullous keratopathy. These included: one eye with PKP, one silicone filled, a third with intumescent cataract and a fourth eye with NVG.

**Preoperative preparation:**

*Full ophthalmological examination was done to all eyes.
*Actively inflamed eyes were treated first.

**Surgical technique:**

*All eyes had peribulbar anaesthesia, and sedation.

*Diode laser was applied in the upper 180 degrees. This was 1-1.5 mm from the limbus with the probe directed posteriorly.

*Sixteen to twenty effective applications were applied.
* Power ranged from 1.5 - 3.0 watts, of one second duration and repetition rate of 0.5 second.
* Three to nine o'clock meridian was not treated to avoid the long posterior ciliary nerves (9,10).

**Postoperative findings and follow-up:**

*Patients were discharged on the same day.
*Topical antibiotic-steroid eye drops and ointment were applied usually for one week.
* Systemic analgesics were given.

* Preoperative antiglaucoma medication was continued for one week.

* Patients were examined on the first and second postoperative days, one week, weekly for one month then monthly for eight months . Success was defined as postoperative IOP of 21 mmHg or less (9,10).

Statistical analysis was done through paired t-test. $P<0.05$ was considered significant, $P<0.01$ was considered highly significant.

## RESULTS:

No complications like severe pain, severe inflammation, shooting of IOP, phthisis or reduced vision occurred. Hyphemas were found on the first postoperative day in 3 eyes of diabetic patients. These resolved completely within one week.

Mean IOP on the second postoperative day was 21.7 mm Hg ($\pm$5.1). This showed to be highly significant ($P<0.001$). Success rate was 77.8 %, this was statistically highly significant ($P<0.001$). Table (3) shows mean pre and postoperative IOP. IOP reached the lowest values one week postoperatively, 16.6 mm Hg ($\pm$3.2), with success rate 94.4 %. Bullous keratopathy disappeared within the first week.

**Table (3): Mean IOP and success rate**

| | IOP | 2nd day | 1 W | 1 M | 4 M | 6 M | 8 M |
|---|---|---|---|---|---|---|---|

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Mean<br>ST.DEV.<br>T-TEST<br>Success Rate | 42.4<br>5.3<br><br>0 | 21.7<br>5.1<br>0.000<br>77.8 % | 16.6<br>3.2<br>0.000<br>94.4 % | 19.0<br>2.9<br>0.000<br>94.4 % | 24.3<br>7.8<br>0.000<br>77.8% | 22.1<br>4.8<br>0.000<br>77.8% | 23.0<br>3.7<br>0.000<br>77.8% |

Diode laser cyclophotocoagulation needed to be repeated in four eyes (22%), after 3.5 months in 2 eyes and after 4 months in another 2 eyes. Three of these (75%), had NVG in diabetic patients and the fourth was silicone filled pseudophakic eye. The procedure needed to be repeated again in a diabetic patient 2 months later.

Both mean IOP and success rate throughout the follow-up period proved to be highly significant (P<0.001).

## DISCUSSION:

In the present study, mean preoperative IOP was 42.2 mm Hg (±5.3) . Mean postoperative IOP reached the lowest values one week after surgery; 16.6mm Hg (±3.2), and success rate reached 94.4% in the same period, both showing high significant (P<0.001). Eight months after surgery mean IOP reached 23mm Hg (+/-3.7), and success rate reached 77.8%. In a recent study mean IOP was 20.3 mm Hg (±13.2) at one year follow-up, with success rate 72.7 % at nine months (9). In another study the success rate was 72.4% at one year follow-up (11). In an earlier study mean IOP was 20.3 mm Hg (±8.7) after 18 months (10). Success rate in another study was 48 % in a mean follow-up period of 13 months (±6) (13).

In the present study, the eye with previous PKP had IOP 14mm Hg after one week, and 20 mm Hg after 8 months, with complete clearing of bullous keratopathy and improved vision from Pl to CF 80 cm. In an earlier study on eyes with previous PKP, 38.46% developed graft decompensation after Nd:YAG contact cyclophotocoagulation (7).

In the present study, 4 eyes (22.2%) needed repetition of treatment, one of which needed a third session to reach the previously defined success

parameters. In a previous study repetition was done in 16 % (9). In another study, number of laser sessions reached 1.9 per eye (11).

In this study no serious postoperative complications were encountered. Three eyes (16.6%) of diabetic patients with NVG had hyphemas (fig. 3) which resolved completely during the first week. No phthisis bulbi occurred. In a previous study phthisis occurred in 1.9 % of eyes using diode laser treatment (10) . No declination in vision of seeing eyes was noticed in the present study. In a previous study, one eye (3.7%), had declined vision from PL to no PL (12).

After finishing this current study, during the last few years, DLCP has been gaining expanding indications.

Lai et al, in 2005, have used DLCP as primary treatment for primary OAG. Effect on postoperative visual acuity (VA) was variable. VA improved in 15.5% of cases, deteriorated in 38.5% and was unchanged in 46%. Mean IOP dropped to 50% at the end of two years follow up. Relative success was reached in 92% of eyes (14).

Comparing the effect of DLCP in POAG and NVG, it was found that mean IOP drop was 29% in POAG versus 36% in NVG, and VA drop by two or more lines occurred in 36% of cases in POAG versus 50% in NVG (15).

DLCP proved to be safe and effective in POAG, refractory glaucoma, pseudoexfoliation and malignant glaucoma after phacoemulsification

( 16,17).

DLCP proved effective in both aphakic and posttraumatic glaucoma. Repetition was applied after four weeks, when IOP remained more than 21 mmHg. DLCP was successful in 48% of cases in aphakic versus 40% in post-traumatic glaucoma. It was repeated in 85% of eyes after aphakic versus 74% after post-traumatic glaucoma. This technique was found to be unaffected by previous glaucoma surgeries (18).

Several studies showed diminished success rates and higher repetition rates in pediatric glaucomas. In 2001, Schlote et al, showed success rate

of 55% in patients younger than fifty years of age, but reaching 83% in elder patients above fifty (11).

Hamard et al, in 2000, called the results in paediatric glaucoma disappointing, having uncontrolled IOP during the first three months in 21% of cases, inflammation in 25%, diminished visual acuity in 14%, and phthisis in 3.5%.

Furthermore success rate dropped at the end of the first year from 72% to 37%. Average repetition rate was 2.3 times per case reaching eight times in some cases (19).

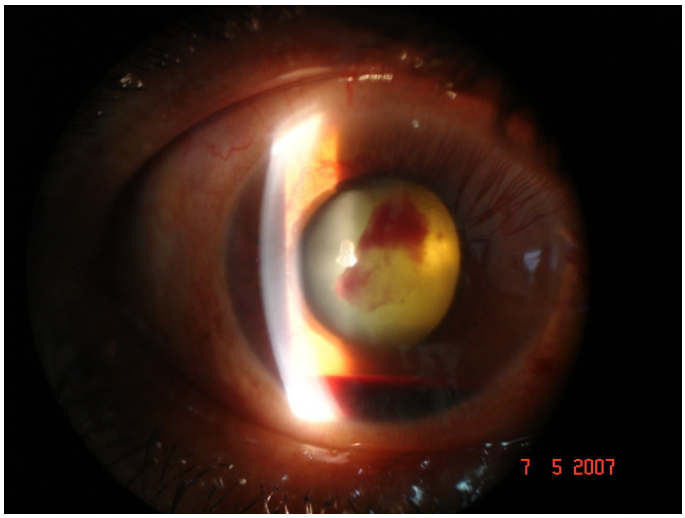


Fig. (3): Post-laser hyphema

DLCP could be applied as an adjunctive to shunt operations to reduce IOP, medications, and repetition with fewer complications. DLCP can also be applied as an alternative to shunt procedures but with more stable success rates inspite of needing repetition. It is a safer, considered a minor actually non surgical procedure (20).

## Conclusion:

Diode laser trans-scleral cyclophotocoagulation in a safe, rapid, minor well tolerated procedure providing significant lowering of IOP, with no adverse effects on corneal clarity, although repetition is often needed. Conservative energy application has fewer serious complications.

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