Outcomes of Transscleral Diode Laser Cyclophotocoagulation in End-Stage Glaucoma Patients

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ABSTRACT

Purpose: The aim of the study was to determine outcomes of diode laser transscleral cyclophotocoagulation (DLTCPC) in end-stage glaucoma (ESG).

Materials and Methods: We retrospectively reviewed file recordings of 23 eyes of 23 patients with ESG (9 female, 14 male). Visual acuity, intraocular pressure (IOP) levels, number of medical agents needed (MAN), pain sensation (PS) score and complications were evaluated before and after the procedure. Measurements obtained before and on week 1and at months 1, 3 and 6 after the procedure were analyzed statistically.

Results: There was a statistically significant decrease in IOP values at all time points when compared to preoperative values. While the mean MAN was 3.91 before the laser treatment, it was 3.22 (p=0.004) at the final control visit. PS was decreased from 2.67 before laser treatment to 0.89 (p=0.004) at final control visit. There was no complication related to DLTCPC, including hypotonia.

Conclusion: In the treatment of ESG; DLTCPC treatment, which provides a significant decrease in IOP, can decrease MAN, reduce pain complaints and has low complication rates, is an effective and reliable treatment method.

Keywords: End-stage glaucoma, Diode laser transscleral cyclophotocoagulation, Intraocular pressure.

INTRODUCTION

The glaucoma is second leading cause of blindness worldwide. The term end-stage glaucoma (ESG) is used to define patients with excessive narrowing in visual field and severe reduction in visual acuity. Although there is no consensus on threshold values for ESG, it can be considered as residual visual field less than 10° and visual acuity less than 1/10 as rated by Snellen charts.[1]

Elevated intraocular pressure (IOP) is major factor facilitating progression of disease and primary treatment modality is to achieve target IOP levels in the patient. Although medical treatment is effective at early period, short-term and long-term IOP fluctuations can be seen due to several reasons including incompliance, failure of medical therapy and allergic reactions caused by drugs. Thus, surgical treatment can be considered as an alternative in eyes with ESG. Filtration surgery and cyclodestructive methods are two primary surgical techniques which could be used in this group of patient.[1]

The cyclodestructive methods aim to reduce humor aqueous production by triggering injury at epithelium of ciliary processes involved in secretion. In recent years, the energy applied to ciliary process has been decreased by advances in laser technology, allowing targeting ciliary process directly without causing damage in surrounding tissues. Thus, cyclodestructive methods have become more popular in refractory ESG. All cyclodestructive methods can cause harm in ciliary muscle, iris, ciliary epithelium and retina. Major complications of these techniques include decreased vision, pain, uveitis, hyphema, hypotonia and phthisis bulbi. All complications, particularly pain and inflammation, are less common in transscleral photocoagulation (TSPC) than cyclocryotherapy (CCT).[2-5]

In this study, it was aimed to demonstrate outcomes of

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diode laser transscleral cyclophotocoagulation in patients with end-stage glaucoma.

MATERIALS AND METHODS

The study was approved by Ethics Committee on Clinical Research of Mersin University. We retrospectively reviewed file recordings of 23 eyes of 23 patients with ESG (including 9 women and 14 men) who underwent DLTCP due to refractory IOP elevation and pain at Ophthalmology Department of Mersin University, Medicine School between May, 2017 and July, 2018.

The diagnosis of uncontrolled IOP-related ESG was due to neovascular glaucoma in 11 patients, primary open-angle glaucoma in 3 patients, pseudoexfoliation glaucoma in 3 patients, closed-angle glaucoma in 3 patients, glaucoma secondary to uveitis in one patient, post-keratoplasty glaucoma in one patient and phacomorphic glaucoma in one patient.

When anesthesia techniques were assessed, it was found that general anesthesia was performed in 6 patients while retrobulbar anesthesia was performed using lidocaine HCl injection (2 ml) in 17 patients. The contact diode laser (Supra 810, Quantel Medical, France) was performed to an area (270-360°) at 1.5 mm distant to limbus by 18-20 pulses (3-4 pulses in each quadrant) using G-Probe. No laser therapy was applied to quadrants 3 and 9 to avoid long posterior ciliary artery injury. The laser application was started at initial power of 2.7 W over 1-1.5 seconds and completed at minimum level where audible "pop" was observed. At postoperative period, 0.3% ofloxacin ophthalmic solution (4x1), 0.1% dexamethasone ophthalmic solution (5x1) and 1% cyclopentolate hydrochloride ophthalmic solution (3x1) were given over 4 weeks to provide prophylaxis against infection and relieve inflammation and ciliary pain. The control visits were scheduled on week 1 and 2, and at months 1, 3 and 6; anti-glaucomatous therapy was gradually decreased when IOP reduction recorded.

Data regarding visual acuity as rated by Snellen charts, intraocular pressure (IOP) levels as measured by applanation tonometry and pneumotonometry, number of medical agents needed (MAN), pain sensation (PS) score measured using method described by Melzack et al.[6] before and on week 1and at months 1, 3 and 6 after the procedure and preoperative and postoperative complications were analyzed.

Data were analyzes using SPPS for Windows version 17.0 (SPSS, Chicago, IL, USA). Descriptive statistics are presented as mean and standard deviation for continuous variables whereas count and percent for categorical variables. The paired-samples t test was used to compare preoperative and postoperative parameters. A p value<0.05 was considered as statistically significant. Repeated measures ANOVA was used to compare mean IOP values across time points. A p value<0.05 was considered statistically significant.

Treatment success was defined as IOP level of 8-22 mmHg with or without medication. The IOP<5 mmHg was considered as hypotonia. In 7 of 11 patients with visual acuity of negative light perception at presentation, it was failed to achieve IOP level <22 mmHg with drug therapy at final control visit. The pain was questioned in these patients; however, no additional treatment was required due to low pain score recorded. No repeated treatment was considered in patients with preoperative visual acuity of light perception or higher since IOP could be maintained at level of 8-22 mmHg.

RESULTS

Mean age was 61.48±13.43 years while mean follow-up duration was 27.30±21.83 weeks. When visual acuity was assessed, it was found that visual acuity was negative light perception in 11 patients whereas positive light perception in 2 patients, hand movement in 8 patients and finger counting at 1 meter in 2 patients before procedure. At final visit after procedure, visual acuity was improved from hand movement to finger counting at 1 meter in 2 patients, from finger counting at 1 meter to finger counting at 2 meters in

Table 1: *Mean IOP values of patients in each examination.*

	n	Minimum	Maximum	Mean± SD	p
Preoperative IOP	23	28	55	37.61±7.35	-
Postoperative IOP					
1st Week	23	6	40	20.61±9.46	p<0.001
1st Month	18	10	40	23.67±7.90	p=0.001
3rd Month	14	11	44	21.07±8.67	p=0.002
6th Month	10	11	50	20.20±11.16	P=0.007

IOP: Intraocular pressure, **SD:** standard deviation

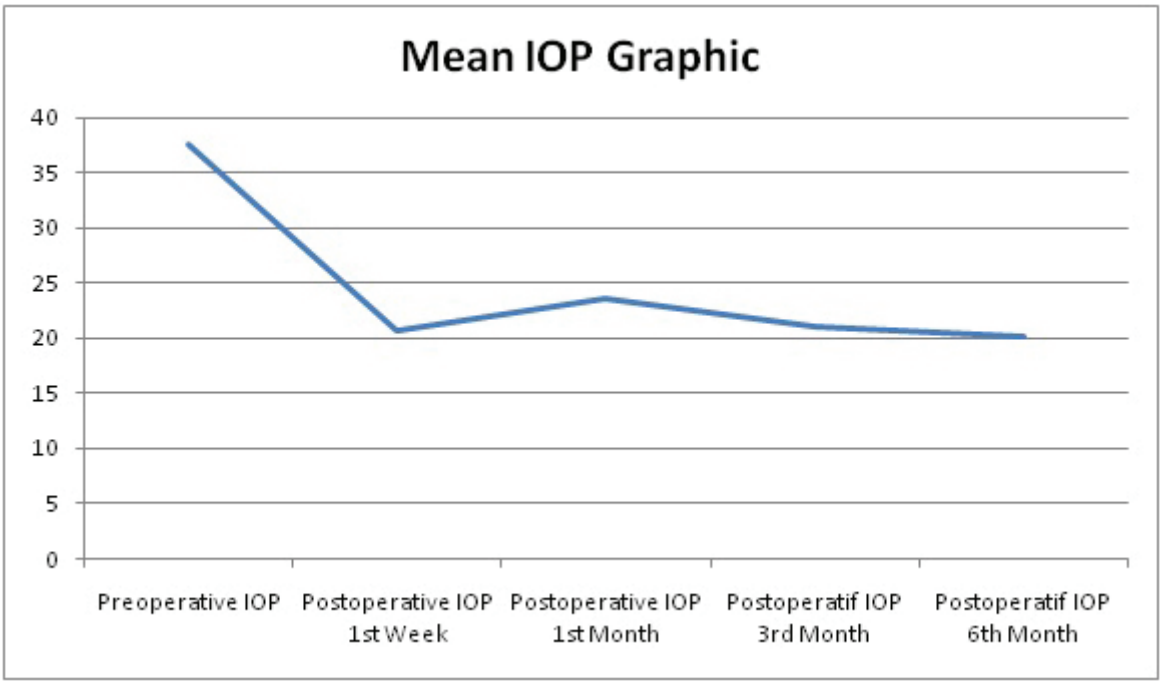

Figure 1: *Change in mean intraocular pressure.*

one patient. No change was observed in visual acuity in remaining patients.

It was found that IOP level was significantly decreased at all postoperative time points when compared to baseline (Table 1; Figure 1). It was found that IOP was at level of 8-22 mmHg in 16 patients (69.5% at final control visit. No repeated treatment was required in any patient.

The mean number of anti-glaucomatous agents needed was 3.91 before laser therapy whereas 3.22 at final control visit (p=0.004), indicating a significant reduction (Figure 2).

When pain scoring was assessed, it was found that mean PS score was 2.67 before laser therapy whereas 0.89 at final control visit (p=0004), indicating a significant decrease (Figure 2). No complication including hypotonia was observed after procedure.

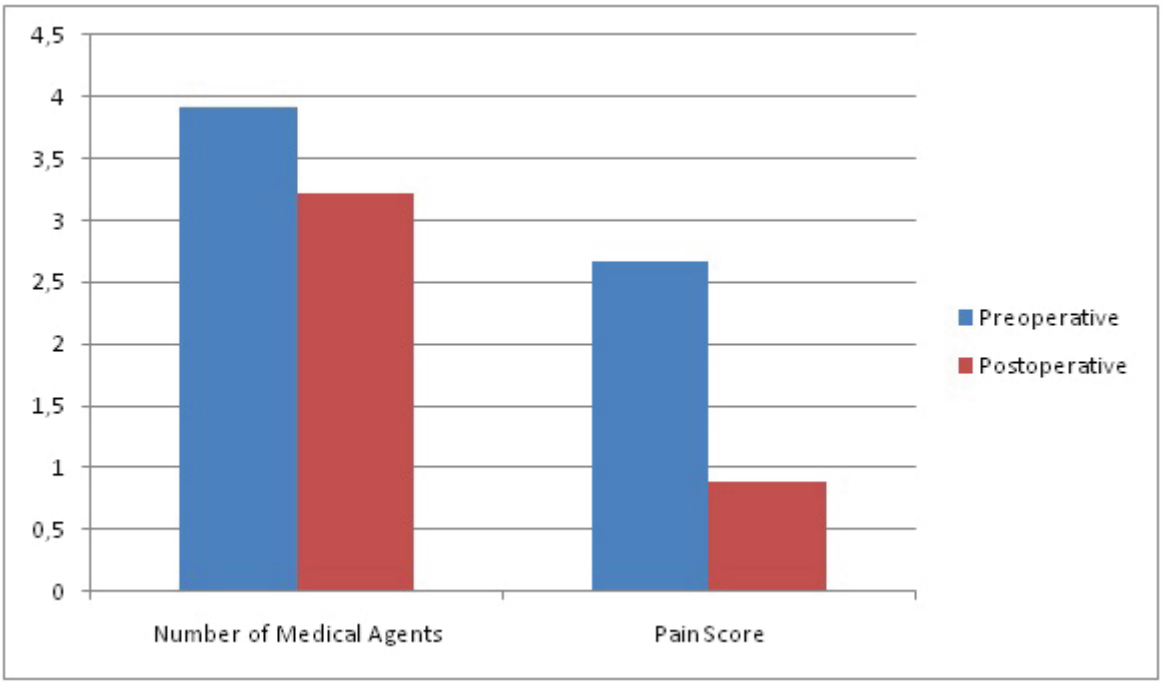

Figure 2: *Comparison of number of medical agents used and pain scores before and after diode laser transscleral photocoagulation.*

DISCUSSION

Today, the DLTSPC has become more commonly preferred cycloablation method as it is associated with lower risk for hypotonia when compared to cyclocryotherapy and Nd-YAG laser cyclophotocoagulation.[7-9] The mechanism of action is absorption of laser beam at 810 nm by melanin at pigment epithelium of ciliary body. A coagulation necrosis occurs at ciliary body and blood vessels in proportion to energy absorbed.[10] Hypotonia may occur due to inflammation within one week after procedure.[11, 12] In the literature, success rate varies from 40% to 80% for diode laser transscleral cyclophotocoagulation. The maximal IOP lowering effect is reached at month 1 and maintained over 6 months without change.[9, 13-18] In our study, success rate was found as 69.5% and the lowest IOP level was reached between week 1and month 6 in agreement with literature.

As shown in many previous studies, DLTSPC can decrease number of anti-glaucomatous agents used and improve quality of life.[14,18] In our study, number of medical agents used was significantly decreased.

In end-stage glaucoma, numerous anti-glaucomatous agent and pain are factors associated with decreased quality of life. In particular, pain is the most important factor determining treatment indication in patients with negative light perception. In our study, it was shown that mean preoperative pain score was significantly decreased after surgery.

In the literature, it is recommended to use power<5 mJ; however, duration is effective in delivering energy to ciliary body.[12] In our study, without changing duration, we started treatment at power level of 2.7 W which was gradually decreased to the minimum level where audible "pop" was observed. Thus, we attempted to apply an effective treatment with minimum complication rate while using energy as low as possible.

The diode laser transscleral cyclophotocoagulation is not used only in end-stage glaucoma but also in other types of glaucoma with better visual acuity. In a study from Africa by Abdull et al. (2018), DLTSPC was used as single surgical method in patients with primary open-angle glaucoma. It was found that IOP could be controlled in three-fourth of patients during 12-months follow-up and that vision were preserved with minimal complication.[13] Ozturk et al. showed that DLTSPC is a safe and effective procedure in lowering IOP in eyes with good vision.[19] In our patients, no reduction was seen visual acuity despite poor visual acuity at baseline; rather, vision acuity was improved in 3 patients.

In the literature, complications include conjunctival burn, perilimbal pigmentation, hyphema, vitreous hemorrhage, prolonged uveitic reaction, perioperative IOP elevation, cataract, pupil anomalies, loss of vision by more than 2 lines according to Snellen charts, scleral perforation, phthisis, choroid detachment in diode laser transscleral cyclophotocoagulation.[14,15] The most complications include prolonged uveitic reaction (0-46%), hyphema (0-26%) and loss of vision more than 2 lines (0-26%).[20] In our study, no major complication was observed.

In conclusion, it was thought that DLTSPC can be a safe and reliable treatment modality with low complication rate in end-stage glaucoma, which can provide significant reduction IOP and number anti-glaucomatous drugs and relieve pain affecting quality of life severely. Further studies with larger sample size and longer follow-up can draw more definitive conclusion in this issue

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