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Transscleral Diode Laser Cyclophotocoagulation: A Comparison of Slow Coagulation and Standard Coagulation Techniques

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Abstract

Purpose: To compare the outcomes of standard pop-titrated transscleral cyclophotocoagulation (TSCPC) and slow-coagulation TSCPC in the treatment of glaucoma.

Design: Retrospective case series

Subjects: This study included 78 eyes with glaucoma of any type or stage that underwent TSCPC as part of their treatment course

Methods: This study compared 52 eyes treated with slow coagulation TSCPC to 26 eyes treated with standard pop-titrated TSCPC. Patient demographics, treatment course, surgical techniques, settings and outcomes were assessed.

Main Outcome Measures: The main outcome measures were visual acuity (VA), intraocular pressure (IOP) and post-surgical complications.

Results: The initial LogMAR VA was 1.94 (0.73) [mean (SD)] in the slow coagulation TSCPC group and 1.71 (0.90) in the standard TSCPC group ($p=0.507$). Initial IOP was 37 (13) mm Hg in the slow coagulation group and 39 (13) mm Hg in the standard group ($p=0.297$). The follow-up periods were 16.36 months and 24.68 months for the slow coagulation and standard groups ($p=0.124$). VA remained better than light-perception in 71.1% of slow coagulation treated patients and 65.0% of standard TSCPC treated patients ($p=0.599$). IOP remained below 20 mm Hg in 46% of slow coagulation treated patients and 44% of standard TSCPC treated patients ($p=0.870$). The mean number of complications was higher in the standard group [1.46 (1.24)] versus the slow coagulation group [0.62 (0.75)] ($p=0.002$). The incidence of the need for a second procedure (slow coagulation- 28.8%, standard- 23.1%, $p=0.588$) and maximum number of medications needed to control IOP postoperatively ($p=0.771$) were similar between the two groups.

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Conclusions: In this case series, slow coagulation TSCPC and standard pop-titrated TSCPC resulted in similar VA and IOP outcomes in the treatment of glaucomatous eyes. The complication profiles of the techniques were also comparable, although standard TSCPC had a higher incidence of prolonged inflammation postoperatively. This study suggests that slow coagulation TSCPC may achieve equivalent control of IOP while reducing the incidence of prolonged post-operative inflammation—a feared complication of TSCPC—when compared to standard “pop-titrated” TSCPC.

Keywords

cyclophotocoagulation; CPC; diode laser CPC; glaucoma

Introduction

Cyclodestructive procedures achieve their intraocular pressure (IOP) lowering effects through damaging the secretory epithelium of the ciliary body processes, thereby leading to reduced aqueous production. Multiple methods have been used for cyclodestruction since the concept was first popularized in the 1930s, including cyclodiathermy,^{1, 2} β -irradiation,³ cycloelectrolysis,^{4,5} excision,⁶ therapeutic ultrasound,^{7,8} microwave,⁹ and cyclocryoablation. Laser cyclophotocoagulation (CPC) was first attempted using ruby laser,¹⁰ but did not gain popularity until Nd:YAG¹¹ and later diode¹² lasers were used.

A lack of consensus exists regarding the indications for diode laser cyclophotocoagulation (CPC). Traditionally, CPC has been used in the management of refractory glaucoma with uncontrolled elevation of IOP in the presence of poor vision or limited visual potential, particularly in the setting of failed previous glaucoma surgery with conjunctival scarring hindering further filtration surgery or glaucoma drainage device implantation. Pain relief for a blind painful eye is another common indication.¹³ More recently, CPC has shown promise as an initial glaucoma procedure in eyes with moderate to severe IOP elevation that are unresponsive to medical therapy alone or in eyes with a relatively good visual potential, especially in populations with limited resources or access for glaucoma filtration surgery.^{14–20} However, the prevailing view of unpredictability of results, complications, and the short-lived IOP-lowering effects of CPC, especially in light of the paucity of data supporting efficacy, predictability and reproducibility, has limited widespread utilization of this potential therapy as an initial surgery. A great need exists to determine the efficacy of CPC in a large study.

Different approaches and laser settings influence the outcome of CPC.^{21,22} One technique utilizes a G probe handpiece (Iridex, Mountain View, CA) to deliver the laser energy in an incremental fashion guided by a “pop” sound that signifies tissue coagulation and destruction to the ciliary body of the eye. The ciliary body produces aqueous humor that partly regulates IOP. Gaasterland’s slow coagulation laser settings and technique, on the other hand, utilize fixed lowenergy settings depending on degree of iris pigmentation,²³ and in our clinical experience seems to have similar IOP-lowering outcomes and minimal side effects. This study assesses this clinical observation quantitatively.

In the present study, we retrospectively review diode transscleral cyclophotocoagulation (TSCPC) cases over a 15-year period, and compare patient demographics, diode laser settings (slow coagulation vs. standard “pop” titrated settings), pain, clinical outcomes in terms of vision, IOP, need for additional laser treatments, glaucoma medications or other surgeries associated with the treatment of glaucoma after CPC treatment. The results of this study may provide information to guide optimization of CPC parameters and help lay the foundation for future prospective controlled studies to assess the feasibility of expanding the indications for diode TSCPC.

Patients and Methods

A retrospective chart review was performed of diode TSCPC cases at the Bascom Palmer Eye Institute (BPEI) from July 1, 1995 to June 30, 2015. The study was approved by the institutional review board of the University of Miami and the tenets of the Declaration of Helsinki were followed. All patients who underwent diode TSCPC during this period were eligible for inclusion, regardless of glaucoma type or stage. Exclusion criteria included major charting deficiencies and loss of follow up before six months post-TSCPC. Data collection included patient demographics, treatment course, surgical techniques, and outcomes. Outcomes of interest included visual acuity (VA), IOP, and post-procedural complications. Snellen VA measurements were converted to LogMAR VA to standardize intervals between changes in VA over time. Complications included: loss of VA, reduction of VA (change ≥ 0.2 LogMAR), prolonged postprocedural inflammation, hyphema, high IOP (defined as IOP >21 mmHg), hypotony (defined as IOP < 6 mmHg), conjunctival burns and scarring, and pain.

Inflammation was assessed by review of the documented slit lamp examination in the medical record at postoperative visits. Any degree of cell or flare documented at visits more than 1 month postoperatively was considered prolonged post-operative inflammation. Additionally, failure to taper topical steroids and need for an increase in topical steroid use were considered indicative of severe or prolonged inflammation. Conjunctival burns and scarring were assessed grossly based on the documented slit lamp examination. Pain was assessed by noting the subjective complaint of pain reported by the patient, as documented in the medical record of postoperative visits, regardless of degree.

Fifty-two patients treated with slow coagulation TSCPC and 26 treated with standard pop-titrated TSCPC were assessed. Eyes received slow coagulation versus standard pop-titrated TSCPC based on provider preferred practice patterns at the time the procedure was performed; recently, more providers at BPEI have tended to use slow coagulation settings. Diode laser was applied to the ciliary body (identified using retro-illumination technique) using the G-Probe (Iridex Corporation, Mountain View, CA) after application of topical and injected periocular anesthesia. For standard coagulation, a starting power of 1.75 W and a 2.0-second duration was used, and the laser energy was titrated such that the minimum power required to produce a “pop” was applied. The slow coagulation method was conducted as per a technique proposed by Gaasterland.²³ Power was based on iris pigmentation, which serves as an estimation of laser energy absorption in the ciliary body. For dark or light brown irises, 1.25 W and a 4.0- to 4.5second duration was used. Eyes with

other iris pigmentation received 1.5 W and 3.5- to 4.0second duration treatment. Of note, in our experience pops are not typically heard during slow coagulation TSCPC, and when heard are typically related to probe positioning (that is, not an issue with excessive power) which, when addressed, prevents additional pops. In this retrospective study, while reviewing operative notes, pops were rarely mentioned in the cases done with the slow coagulation technique. Poor documentation of a case in which a pop did occur was a concern, and therefore we do not report or analyze the incidence of pops that occurred during slow coagulation TSCPC.

Total energy applied during TSCPC sessions was calculated for the two groups using the equation: Total energy (Joules) = Power (Watts) x Time (seconds) x Number of spots. An independent t-test assuming equal variance was used to compare the total energy between the two groups.

Visual acuity and IOP measurements at baseline and final visits were compared for each of the groups using paired t-tests.

Event-triggered data analysis was used in this study. Event-triggers included whether any of the following occurred at a follow up visit: VA loss in eyes with hand motion (HM) vision or better (to LP or NLP), VA decline (loss of 2 or more LogMAR lines), IOP 15, IOP>15, IOP>21 mm Hg, need for a glaucoma surgical procedure, need for increased number of medications, and occurrence of one or more complications. Only those with baseline VA better than HM were eligible for event-triggered VA analysis. The chi-square test was used to analyze this categorical data.

For each patient, the number of post-procedural complications, number of increased medications from baseline, maximum number of medications used, and months of follow-up were noted. Comparison of these nonparametric data between the slow coagulation and standard coagulation groups was performed using the Mann-Whitney U test.

The timing of the occurrence of these events was also compared between the two groups. Six Kaplan-Meier survival analyses were performed. These compared the time after the initial TSCPC procedure until (1) VA loss (VA of LP or NLP) occurred (and only included people whose VA at the time of CPC was not LP or NLP), (2) a second TSCPC, (3) a second TSCPC or another treatment, (4) VA reduction occurred, (5) IOP increased to above 15, and (6) IOP increased to above 21.

The type and cumulative frequency of the complications that occurred in each group were also compared.

Statistics were performed using SPSS v22.0 (IBM, Armonk, NY). A p-value of 0.05 was used to determine statistical significance for all analyses comparing the two groups.

Results

Retrospective chart review identified a total of 78 eyes with glaucoma that underwent TSCPC at BPEI between July 1, 1995 and June 30, 2015 who met criteria for the study

(Figure 1). Fiftytwo of these eyes underwent slow coagulation TSCPC. These cases were compared to 26 eyes that underwent standard “pop- titrated” TSCPC. Demographic characteristics of the two groups were similar in terms of patient age ($p=0.181$) and gender ($p=0.518$). Initial VA, IOP, and baseline number of glaucoma medications of the eyes were also similar in the two groups. There was a statistically significant difference [mean (standard deviation)] between the two groups in total energy (in Joules) applied during the initial TS-CPC procedure [slow-coagulation 101.16 (28.78); standard pop 77.55 (33.99); $p = 0.002$]. Baseline demographics and characteristics of the eyes are presented in Table 1.

There was a statistically significant increase in LogMAR VA between the initial and final visits of 0.21 (0.51) LogMAR units ($p = 0.001$) in both groups combined. This increase was statistically significant in both the slow-coagulation [0.18 (0.47), $p = 0.032$] and standard pop [0.32 (0.56), $p = 0.015$] groups. The final LogMAR VA was similar between the two groups ($p = 0.592$). There was a statistically significant decrease in IOP between the initial and final visits of 17.77 (13.63) mm Hg ($p < 0.001$) for both groups combined. These decreases were statistically significant in both the slow-coagulation [17.19 (13.31), $p < 0.001$] and standard coagulation [18.86 (14.47), $p < 0.001$] groups. The final IOP at last follow up was similar between the groups [slow-coagulation 18.84 (9.46); standard pop 18.95 (12.10); $p = 0.969$]. These results are shown in table 2.

Event-triggered outcomes between the two groups were compared (Table 2). The only significant difference detected between the groups was in the incidence of complications. The slow coagulation group had fewer eyes that experienced one or more complications (48.1% versus 73.1%, $p = 0.036$). The need for additional procedures, reduction in VA (change 0.2 LogMAR), loss of vision (VA of LP or NLP), and IOP outcomes were similar between the two groups. Forty-two percent of patients in the slow coagulation group and 35% of those in the standard group did not experience a significant decrease in visual acuity throughout the duration of the follow up period. Intraocular pressure remained below or equal to 21 mmHg for the entirety of the follow up period in 46% of patients in the slow coagulation group and 44% of the standard group ($p=0.870$). Less than 30% of all patients required a second TSCPC session or other procedure, with similar rates in both groups ($p=0.588$).

The difference in the number of complications, need for increased medications, maximum number of medications, and months of follow up between the study groups are displayed in Table 2. The slow coagulation group had a significantly lower number of complications (mean 0.62 versus 1.46, $p=0.002$). The mean follow-up period was longer for the standard treatment group (mean 24.68 months versus 16.36 months) since this was procedure introduced earlier in clinical practice. Patients received an average of 0.42 additional glaucoma medications after TSCPC on last follow-up in both groups, with less than 25% of the patients included in the study requiring additional medication for IOP control after TSCPC.

The cumulative proportion of eyes with need for additional treatment, reduction in visual acuity (change 0.2 LogMAR), vision loss (VA of LP or NLP), and achievement of certain IOP ranges were analyzed with Kaplan-Meier survival analysis (Table 2). Patients in both

groups maintained visual acuity at or near their baseline for a mean duration of 23 months in both groups. For those patients that had a decrease in vision (to LP or NLP vision), this occurred after a mean period of 39.9 months in the slow group and 42.7 months for the standard group. There were no significant differences found in any of these survival analyses.

Table 3 shows the complication profile for each technique and comparison of frequencies of each complication between the groups. Inflammation was the most common complication in both groups but occurred at a significantly lower frequency in the slow coagulation group (34% versus 73%, $p=0.002$). Pain was the next most frequent complication in both groups, and the slow coagulation group trended towards having a lower incidence ($p=0.078$). The only other complication that occurred with frequency greater than 10% was hyphema in the standard group—12% of patients had post-procedural hyphema, compared to 2% in the slow coagulation group ($p=0.102$). High IOP, hypotony, conjunctival burns, and conjunctival scarring all occurred in less than 10% of patients in both groups—no statistically significant differences were detected with these complications, although the study was likely underpowered to detect small differences in these infrequent complications.

Discussion

This study compares the outcomes of eyes that underwent TSCPC with slow coagulation versus standard TSCPC diode laser settings. Primary outcome measures included visual acuity and intraocular pressure. These outcomes were largely similar in both groups. Both groups experienced clinically significant decreases in IOP from baseline to final visits. Post-procedural complications were the other primary outcome measure. The average number of complications for patients in the slow coagulation group was lower compared to the standard TSCPC group—a difference primarily driven by a reduction in prolonged post-operative inflammation in the slow coagulation group.

Study of the efficacy, safety and optimization of diode laser TSCPC is ongoing and not well reported, thereby making the present results relevant for the clinician. TSCPC has traditionally been reserved as a treatment for refractory glaucoma in eyes with poor visual acuity, poor visual potential, and blind, painful eyes associated with high IOP.²⁴ This is primarily due to a common view that TSCPC has significant complications, such as prolonged inflammation, pain, and even phthisis.²⁵ Severe complications associated with earlier cyclodestructive procedures, such as Nd:YAG TSCPC and cyclocryodestruction, are likely behind this misconception. Recent literature review and the results of this study suggest that diode laser TSCPC is a minimallyinvasive intervention that offers the potential for significant IOP reduction and a favorable complication profile in the management of refractory cases of glaucoma.^{15–17, 26, 27}

While there has been study of optimization of TSCPC settings previously, a paucity of data comparing the slow coagulation and standard TSCPC techniques exists in the literature.²⁸ A study by Alzuhairy et al. aimed to compare the outcomes of slow coagulation versus standard TSCPC techniques.²⁹ Consistent with the results of the present study, the authors found that the slow coagulation and standard techniques had comparable IOP lowering

effects; that is, no clear benefit of further IOP reduction with the slow coagulation technique was found. In terms of complications, the study reported greater inflammation in the early postoperative period for the slow coagulation group, but this difference was not seen after one year of follow up. This finding differs from the results of the present study, in which we found the slow coagulation group to have a lower incidence of post-procedural inflammation. The slow coagulation technique, using a lower amount of energy applied over a longer duration of time, is theorized to result in a decrease of tissue destruction and inflammation outside the ciliary body; thus, our results showing a significantly lower incidence of prolonged inflammation in the slow coagulation group are more consistent with what would be expected based on this theory.²³ Interestingly, we found this to be the case despite the slow-coagulation group receiving significantly more total energy during the TSCPC procedures on average. The pop sound in the standard technique is known to signify tissue coagulation to the ciliary body epithelium. To the best of our knowledge, the mechanism of action of the slow coagulation technique and the resulting pathophysiologic changes in the treated tissues have not been studied or reported in the literature. However, we hypothesize that the lack of the “pop” indicates the coagulative threshold is never reached during treatment, minimizing the possible inflammatory reaction that accompanies tissue coagulation.

This study presents several significant findings regarding the complication profile of TSCPC. As previously noted, concern over the potential complications of cyclodestructive procedures has limited more widespread use. The complication profiles seen in this study, however, are encouraging for both groups, and even more favorable in the slow coagulation group. While several eyes did experience a loss of VA, there was no net loss of VA in either group; in fact, there was a significant net gain in final VA compared to initial VA in both groups. We suspect loss of VA was in large part due to the end-stage nature of disease in many of the eyes prior to receiving TSCPC, although we cannot presume that the procedure did not play a role in the vision loss. Likewise, we do not propose that TSCPC improves vision, and suspect the net gain in vision seen in our results may be due to variation in VA measurement in eyes with end-stage disease. Incidence of conjunctival burning and scarring was very low using both techniques. In fact, no eyes in the slow coagulation group had gross conjunctival burns or scarring documented on slit lamp examination. This is important when considering the possibility of performing future filtering surgery on eyes that previously received TSCPC, which may be difficult or impossible with grossly damaged conjunctiva. We do acknowledge, however, that microscopic and/or histological changes may occur in the conjunctiva after undergoing TSCPC, and without more detailed analysis of conjunctiva after TSCPC we cannot be sure of the effect that TSCPC may have on the success of filtering surgery later on, even in the absence of gross conjunctival damage. The incidence of hypotony in this study was also very low, with only 2 out of 78 eyes experiencing this complication. TSCPC causes permanent destruction of the ciliary body tissues, making irreversible hypotony a concern. However, our results and those in the literature suggest that with the judicious application of transscleral laser energy, this potential complication can largely be avoided.³⁰ Conservative application of laser energy during initial TSCPC is advisable, as additional application can always be applied later as needed. In this study,

26.9% of slow coagulation eyes and 23.2% of standard coagulation eyes did require additional TSCPC.

Limitations of the present study include: 1) its retrospective nature introduces potential sources of bias, 2) the end-stage nature of the majority of eyes included in the study precludes the application of the results to the large population of glaucoma patients who maintain more functional vision, 3) its reliance on proper documentation in the medical record for detailed procedural reports and for outcome measures such as post-procedural inflammation and pain, and 4) the study is underpowered to detect small but potentially significant differences in a number of the outcome measures. Further studies addressing these issues may be worthwhile.

There are several reasons that further study of TSCPC is essential. There has been limited study regarding the use of TSCPC as a primary procedure.^{14, 16, 18, 19} Expanding the indications of TSCPC to include primary intervention would be particularly beneficial in managing patients in underserved communities and populations reached through community outreach programs and medical mission work, as their financial, geographic and socio-demographic situations may limit access to traditional glaucoma surgery. TSCPC does not require an expensive operating room and can be performed in a clinic setting, making it a very feasible alternative.

At present, minimally invasive glaucoma surgery (MIGS) is an area of significant research interest, with numerous new devices and techniques recently introduced and currently in trials. Study of the efficacy of these MIGS procedures compared to TSCPC would be worthwhile, as TSCPC may provide an even less invasive (perhaps the only true non-invasive glaucoma procedure currently available), low cost, and efficacious alternative. TSCPC has also been investigated as a treatment option for glaucomatous eyes with good visual acuity and potential—cases in which MIGS procedures have become quite popular.^{17, 20, 31} The VA outcomes of TSCPC in these studies are promising. Micropulse TSCPC is another, newer approach to the application of CPC that is important to mention, as it has shown promising results when compared to continuous-wave TSCPC, which was used in this study.^{31, 32} Of note, to our knowledge, micropulse TSCPC has yet to be compared to slow coagulation, continuous wave TSCPC.

Conclusions

The results of this study are significant in that they: 1) add to the current literature demonstrating diode TSCPC as a non-invasive method of reducing IOP with limited post-procedural complications in the treatment of refractory glaucoma, regardless of the technique used, and 2) provide evidence that using the slow coagulation technique may reduce the incidence of postprocedural complications while maintaining similar VA and IOP outcomes in comparison to the standard technique. Further study is needed to continue to improve upon the application of TSCPC and to better define its role in the treatment of glaucoma.

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Highlights

The authors present results of standard and slow coagulation techniques of transscleral cyclophotocoagulation (CPC) in this retrospective study. They demonstrate that slow coagulation TSCPC has similar efficacy but fewer complications compared with standard “pop” TSCPC.

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Figure 1:
Patient inclusion and exclusion flowchart

Table 1:

Baseline Variables

		TSCPC method		
Variable		Slowcoagulation (n=52)	Standard pop (n=26)	p-value
Sex	male	24 (46.2%)	10 (38.5%)	0.518
	female	28 (53.8%)	16 (61.5%)	
Age	mean (SD)	57.07 (26.33)	65.07 (20.69)	0.181
Initial LogMAR Visual Acuity (VA)	mean (SD)	1.94 (0.73)	1.71 (0.90)	0.507
	median	2.3	2.3	
Initial Intraocular pressure (IOP)	mean (SD)	37.0 (13.0)	39.0 (13.0)	0.297
	median	36	38	
Initial Number of Medications	mean (SD)	3.62 (1.37)	3.62 (1.47)	0.887
	median	4	4	
Total Energy Applied During Initial TSCPC (Joules)	mean (SD)	101.16 (28.78)	77.55 (33.99)	0.002

Table 2:

Outcome variables in slow coagulation and standard groups

		TSCPC method				
Variable		Slowcoagulation (n=52)	Standard pop (n=26)	p-value		
Comparisons of Events						
Patient Needed Second TSCPC	No	38 (73.1%)	20 (76.9%)	0.714		a
	Yes	14 (26.9%)	6 (23.1%)			
Patient Needed Second TSCPC or other treatment	No	37 (71.2%)	20 (76.9%)	0.588		a
	Yes	15 (28.8%)	6 (23.1%)			
Patient Needed Increased Number of Medications	No	40 (76.9%)	20 (76.9%)	1.000		a
	Yes	12 (23.1%)	6 (23.1%)			
Patient had one or more complications	No	27 (51.9%)	7 (26.9%)	0.036	*	a
	Yes	25 (48.1%)	19 (73.1%)			
Patient experienced VA loss (VA of LP or NLP) f	NO	27 (71.1%)	13 (65.0%)	0.636		a
	YES	11 (28.9%)	7 (35.0%)			
Patient experienced reduced VA (change => 0.2 LogMAR) f	NO	16 (42.1%)	7 (35.0%)	0.599		a
	YES	22 (57.9%)	13 (65.0%)			
Patient experienced IOP below 15 mmHg	NO	22 (44.0%)	8 (32.0%)	0.317		a
	YES	28 (56.0%)	17 (68.0%)			
Patient experienced IOP above 15 mmHg	NO	12 (24.0%)	4 (16.0%)	0.425		a
	YES	38 (76.0%)	21 (84.0%)			
Patient experienced IOP above 20 mmHg	NO	23 (46.0%)	11 (44.0%)	0.870		a
	YES	27 (54.0%)	14 (56.0%)			
Comparisons of Amounts						
Number of complications	mean (SD)	0.62 (0.75)	1.46 (1.24)	0.002	**	c
	median	0	1			
Number of Increased Medications	mean (SD)	0.42 (0.94)	0.42 (0.95)	0.989		c
	median	0	0			
Maximum number of medications	mean (SD)	4.04 (1.14)	4.04 (1.34)	0.771		c
	median	4	4			
Months of Follow-up	mean (SD)	16.36 (20.1)	24.68 (28.58)	0.124		c
	median	11	16			
Comparisons of Time-to-Events						
Survival Time to second TSCPC (months)	mean (SE)	44.4 (4.8)	49.6 (7)	0.642		d
	median (SE)	62.1 (32.7)	e			
Survival Time to second TSCPC or another treatment (months)	mean (SE)	42.7 (4.9)	49.6 (7)	0.504		d
	median (SE)	62.1 (32.8)	e			
Survival Time (months) to VA loss f	mean (SE)	39.9 (8)	42.7 (7.2)	0.466		d
	median (SE)	24.1 (1.3)	43.9 (7.3)			
Survival Time (months) to VA reduction f	mean (SE)	23 (5.2)	23 (6.8)	0.998		d

		TSCPC method				
Variable		Slowcoagulation (n=52)	Standard pop (n=26)	p-value		
	median (SE)	12.6 (4.9)	4.9 (7.4)			
Survival Time (months) to IOP above 15 mmHg	mean (SE)	7.9 (1.4)	5.4 (1.8)	0.290		d
	median (SE)	2.8 (0.8)	1.6 (0.2)			
Survival Time (months) to IOP above 21 mmHg	mean (SE)	28.5 (4.7)	30.3 (6.9)	0.926		d
	median (SE)	7.8 (3.6)	6.5 (2.6)			
Visual Acuity and Intraocular Pressure Outcomes						
Final VA	mean (SD)	2.05 (0.81)	1.90 (0.94)	0.592		h
Increase in VA from baseline	mean (SD)	0.18 (0.47)	0.32 (0.56)			i
Final IOP (mmHg)	mean (SD)	18.84 (9.46)	18.95 (12.10)	0.969		h
Decrease in IOP from baseline (mmHg)	mean (SD)	17.19 (13.31)	18.86 (14.47)			i

*** p-value <= 0.001,

**
p-value <= 0.01,

*
p-value <= 0.05

a - chi square test; c - Mann Whitney test; d - Kaplan-Meier log rank test survival analysis; e - no estimate of the median was possible; f - includes only cases with initial VA better than LP; g - any time after initial surgical date; h - paired t-test; i - final VA and IOP for each group were compared to baseline values with paired t-tests (see text); TX = treatment

Table 3:

Comparison of the rates of complications

Variable	TSCPC method		p-value
	Slow-coagulation [number(%)] (n=52)	Standard pop [number(%)] (n=26)	
Patient experienced reduced VA (change => 0.2 LogMAR)	22 (57.9%)	13 (65.0%)	0.599
Patient experienced VA loss (to VA of LP or NLP)	11 (28.9%)	7 (35.0%)	0.636
Prolonged Inflammation	18 (34)	19 (73)	0.002
Hyphema	1 (2)	3 (12)	0.102
High IOP (>21 mmHg) at final follow up visit	5 (9)	1 (4)	0.658
Conjunctival burn	0 (0)	2 (8)	0.106
Pain	8 (15)	9 (35)	0.078
Hypotony (IOP<6 mmHg)	2 (4)	0 (0)	1
Conjunctival scarring	0 (0)	2 (8)	0.106