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ORIGINAL RESEARCH

Effect of prior cataract surgery on the long-term outcome of selective laser trabeculoplasty

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Tarek A Shazly[1]
Mark A Latina[2]
John J Dagianis[3]
Satyakant Chitturi[4]

[1]Ophthalmology, Massachusetts Eye and Ear Infirmary/Harvard Medical School, Boston, MA, USA; [2]Reading Health Center, Reading, MA, USA; [3]Nashua Eye Associates, Nashua, NH, USA; [4]Andhra Medical College, Visakhapatnam, India

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Objective: To determine if pseudophakia affects selective laser trabeculoplasty (SLT) intraocular pressure (IOP) lowering effect.

Methods: A retrospective chart review was performed on 94 eyes of 75 consecutive patients who underwent SLT as primary treatment for ocular hypertension and primary open-angle glaucoma between 2002 and 2005 and completed at least 30 months follow up. Patients were excluded if they required additional glaucoma medications, laser, or ocular surgery during the follow-up period. Patients were categorized as phakics or pseudophakics. Independent-samples *t*-test was performed to compare the mean percentage of IOP reduction at 3, 6, 12, 18, and 30 months after SLT between the phakic and pseudophakic groups.

Results: Seventy-six phakic and 18 pseudophakic eyes were included. IOP reduction in phakic group was 27.4% (2 week), 29.8% (3 months), 27.7% (9 months), 27.4% at (12 months) and 27.3% at (30 months). In pseudophakic patients, the mean IOP reduction was 19.8% (2 weeks), 26.5% (3 months), 23.2% (9 months), 22.5% (12 months), and 25.9% (30 months). An independent-sample *t*-test compared the percentage of IOP reduction between the phakic and pseudophakic groups and revealed higher percentage of IOP reduction in the phakic group at 2 weeks by 7.6% ($P = 0.01$). *P* value for difference was 0.34 (3 months), 0.25 (6 months), 0.18 (9 months), 0.12 (12 months), 0.36 (18 months), and 0.7 (30 months) after SLT.

Conclusions: SLT response was delayed in pseudophakic compared to phakic patients, while the long-term effectiveness of SLT is the same in both groups.

Keywords: intraocular pressure, pseudophakic, cataract surgery

Introduction

Medical treatment, laser trabeculoplasty, and surgery can be used to control intraocular pressure (IOP) in patients with ocular hypertension (OHT) and primary open-angle glaucoma (POAG).

Latina et al demonstrated that a 532-nm Q-switched Nd:YAG laser with nanosecond pulse duration is capable of selectively targeting pigmented trabecular meshwork cells without collateral thermal damage to the adjacent nonpigmented trabecular meshwork cells and underlying trabecular beams.[1–3]

SLT can also be used to lower the IOP in high-risk OHT patients and patients with pseudoexfoliation glaucoma.[4,5]

Clear corneal phacoemulsification (CCP) is associated with a statistically significant and sustained reduction in IOP in normal subjects[6–9] as well as in patients with POAG.[10–13] The exact mechanism by which cataract extraction lowers IOP is unclear.

Correspondence: Tarek A Shazly
20 Pond Meadow Dr Ste 203,
Reading, MA, US 01867, USA
Tel +1 781 315 3814
Fax +1 781 942 9877
Email shazlyt@gmail.com

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It is plausible that CCP and SLT may share a common pathway involving inflammation, prostaglandin release, and interleukin-1α release. This lead us to the hypothesis that the IOP response to SLT may be different in pseudophakic eyes compared to phakic eyes due to partial or completely activation of pathways common to SLT response and CCP-mediated IOP-lowering effect in the former group.

A prior study by Werner et al compared outcome of SLT as a secondary treatment for glaucoma in pseudophakic versus phakic patients.[14] We know of no prior study in the literature that evaluates the effect of primary SLT on IOP in pseudophakic eyes.

The purpose of this study is to determine if pseudophakia affects the IOP-lowering effect of primary SLT in patients with OHT and POAG.

Methods

This is a retrospective study, which included all patients who had SLT performed by Dr Latina between February 2002 and December 2005. The aforementioned data were gathered from the postoperative visits at week 2 and 3, 6, 9, 12, 24, and 30 months. Inclusion criteria included having SLT done as a primary therapy, having either OHT or POAG, and the recording of all data at all time points. The patients included in the study were either first diagnosed with high-risk OHT or mild-to-moderate POAG. Patients were excluded if they received an OHT medication or had an intraocular surgery performed during the 30 months following SLT. Patients with history of recent cataract surgery (within 6 months), complicated cataract surgery or prior laser trabeculoplasty (LTP) were excluded.

Patients were categorized as phakics if the crystalline lens was present, or pseudophakics if a posterior chamber IOL (PCIOL) was present. All pseudophakic patients had their cataracts removed via uneventful phacoemulsification with insertion of a foldable hydrophobic PCIOL in the capsular bag by the same surgeon (MAL) under retrobulbar anesthesia. All pseudophakic patients were treated postoperatively with a topical prednisolone acetate 1% four times daily with gradual taper for 8 weeks, topical antibiotics and topical nonsteroidal anti-inflammatory eyedrops three times daily for 3 weeks.

The laser procedure was performed in a standard fashion in all cases. An initial power setting between 0.6 mJ and 0.9 mJ was selected. The procedure was then completed for 180 degrees. The endpoint was to visualize fine bubble(s) at the laser treated area, and the intended number of spots was between 55 and 70. Patients received topical apraclonidine 0.5%, 15 minutes before the procedure. Patients were treated with ketorlac tromethamine 0.4% two times daily for 2 days following the procedure.

The statistical analysis was performed using the Statistical Program for the Social Sciences (Version 16.0; SPSS Inc, Chicago, IL).

Independent-samples *t*-test was performed to compare the mean percentage of IOP reduction at 3, 6, 12, 18 and 30 months after SLT between the phakic and pseudophakic groups. Independent-samples *t*-test was performed to compare the mean baseline IOP at the time of doing SLT between the phakic and pseudophakic groups. An Institutional Review Board was not required as the authors studied retrospectively existing data recorded by the authors in such a manner that subjects cannot be identified directly or through identifiers linked to the subjects.

Results

The age and sex of the 75 patients were consistent with a glaucomatous population (Table 1). POAG comprised the primary indication (60.6%) for the procedure, while ocular hypertension represented 39.4% of the patients undergoing SLT. Seventy-six of included eyes were phakic (80.9%) and 18 were pseudophakic (19.1%).

The baseline IOP for the phakic group was 24.1 ± 3.3 mmHg (range, 17–31 mmHg), while the baseline IOP for the pseudophakic group was 22.6 ± 3.8 mmHg (range, 14–32 mmHg). Baseline IOP was not significantly different between the 2 groups ($P = 0.13$).

Mean IOP reduction in the phakic group was 27.4% ± 11.5% at 2 weeks, 29.8% ± 13.1% at 3 months, 28% ± 13.4% at 6 months, 27.7% ± 13.1% at 9 months, 27.4% ± 13.5% at 12 months, and 27.3% ± 12.9% at 30 months. Mean IOP reduction in the pseudophakic group was 19.8% ± 10.3% at 2 weeks, 26.5% ± 12.6% at 3 months, 24.3% ± 11.8% at

Table 1 Baseline characteristics of sample (n = 94 eyes of 75 patients)

Characteristic	
Age (SD)	66.63 (10.36) years
Sex	63.8% women
Baseline IOP (SD) (mmHg)	23.84 (3.4)
Procedure parameters	
Average energy per shot (W) (SD)	0.90 (0.17)
Average number of shots (SD)	76.82 (34.2)
Average total energy (W) (SD)	68.19 (41.44)
Glaucoma diagnosis in eyes (no. of patients)	
Primary open-angle glaucoma	57 (45)
Ocular hypertension	37 (29)

Abbreviations: IOP, intraocular pressure; SD, standard deviation.

6 months, 23.2% ± 12.3% at 9 months, 22.5% ± 10.8% at 12 months, and 25.9% ± 4.2% at 30 months (Table 2).

An independent-samples *t*-test was performed to compare the mean percentages of IOP reduction between the phakic and pseudophakic groups. The test revealed higher mean percentage of IOP reduction in the phakic group at 2 weeks (7.6%; $P = 0.01$). The differences in mean percentage of IOP reduction between the phakic and pseudophakic groups were not statistically significant at 3–30 months post-SLT. The *P* value for difference was 0.34 (3 months), 0.25 (6 months), 0.18 (9 months), 0.12 (12 months), 0.36 (18 months), and 0.7 (30 months) after SLT (see Table 2).

Discussion

Review of literature showed that SLT is a viable option as a primary or adjuvant treatment for patients with OHT, POAG, and pseudoexfoliation glaucoma.[5,15–18] SLT is not only as effective as medical treatment, but also a more economic treatment option.[19] Johnson et al showed that the 2-week visit post-SLT predicted the 4-week and 3-month visits in the same eye if the 2-week visit demonstrated a decrease in IOP.[20] Different studies showed the predictive value of the baseline IOP as a predictor of success following SLT.[21–22] It was shown that SLT not only lowers the IOP in the treated eye, but also has a short-term IOP-lowering effect in the untreated eye.[23]

Clear corneal phacoemulsification (CCP) is associated with a statistically significant and sustained reduction in IOP, both in normal subjects[6–9] as well as in patients with POAG.[10–13] The exact mechanism by which cataract extraction lowers IOP is not yet fully understood.

Many hypotheses have been postulated in the literature,[12] namely 1) hyposecretion of aqueous humor secondary to ciliary body inflammation, 2) increased outflow of aqueous humor via increased endogenous prostaglandins secretion, production of interleukin-1α by trabecular meshwork, and finally 3) mechanical irrigation during phacoemulsification flushes the trabeculum, thereby decreasing outflow resistance,[12] or by the widening effect of lens extraction on the anterior chamber angle.

It is plausible that CCP and SLT may share a common pathway involving inflammation, prostaglandin release and or interleukin-1α release.

Our study shows that the percentage of IOP reduction following SLT in pseudophakic eyes is significantly less than that of SLT in phakic eyes at 2 weeks. However, from the 3-month visit until the end of the follow-up period (30 months), the mean percentages of IOP reduction following SLT was slightly lower in the pseudophakic group, but was not statically significant (Table 2). This may be at least partially explained by the possibility that SLT and CCP share common pathways possibly involving inflammatory mediators.

Thus, in pseudophakic eyes, the IOP-lowering effect of SLT may not be completely achieved at 2 weeks post-SLT. It may be too early to judge SLT success at this point. Instead, the 3-month IOP should be used. Starting glaucoma medications, repeating SLT, or doing a glaucoma surgery in these patients based on their 2-week visit IOP may not be appropriate.

The results of this study concurs with a prior study by Werner et al showing equivalent effect outcome of SLT as a secondary treatment of glaucoma in phakic and pseudophakic patients.[14] Martow et al showed that pseudophakia doesn't predict SLT success or failure in OHT and POAG patients undergoing SLT as an adjunctive treatment.[24] Our study demonstrates no negative effect of prior cataract surgery with PCIOL implantation on the outcome of primary SLT in patients with OHT and POAG.

Further studies are required to explore the relationship between the IOP-lowering effect of cataract extraction and that of SLT.

Table 2 Percentage of IOP reduction following SLT

		Phakic group (n = 18)		Pseudophakic group (n = 76)		*t*-test *P*-value
		Mean	SD	Mean	SD	
Percentage of IOP reduction following SLT	At 2 weeks	27.4	11.5	19.8	10.3	0.01*
	At 3 months	29.8	13.1	26.5	12.6	0.34
	At 6 months	28.0	13.4	24.3	11.8	0.25
	At 9 months	27.7	13.1	23.2	12.3	0.18
	At 12 months	27.4	13.5	22.5	10.8	0.12
	At 18 months	26.2	13.3	22.8	13.8	0.36
	At 30 months	27.3	12.9	25.9	14.2	0.7

Note: *Statistically significant difference at $P < 0.05$.
Abbreviations: IOP, intraocular pressure; SD, standard deviation; SLT, selective laser trabeculoplasty.

Conclusion

Phakic patients with POAG and OHT showed a significantly higher percentage of IOP reduction at 2 weeks after SLT compared to pseudophakic patients. No statistically significant difference in percentage of IOP reduction was found between the 2 groups at 3–30 months after SLT. These findings suggest that, SLT response seems to be delayed in pseudophakic compared to phakic patients, while the long-term effectiveness of SLT is the same for phakic and pseudophakic patients. More time should be allowed to judge the success of SLT in pseudophakic patients.

Disclosure

Drs Shazly, Dagianis, and Chitturi report no conflicts of interest in this work. Dr Latina has a financial interest in SLT technology and receives patent royalties related to SLT technology.

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