

# Results of Selective Laser Trabeculoplasty Treatment for Patients with Open-Angle Glaucoma during a 2-year Period

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## ABSTRACT

**Purpose:** To describe the results of selective laser trabeculoplasty for patients with open-angle glaucoma during a 2-year period.

**Study design:** Descriptive, retrospective, and longitudinal study.

**Method:** A descriptive, retrospective, and longitudinal study was conducted among 40 eyes of 20 patients who underwent selective laser trabeculoplasty from 2012 to 2015 and received topical antiglaucoma medication. The following variables were measured: uncorrected visual acuity, best-corrected visual acuity, and intraocular pressure before treatment and during monitoring controls after 1 day, 7 days, 1 month, 3 months, 6 months, 12 months, and 24 months.

**Results:** No significant differences were identified between uncorrected visual acuity preoperatively and at 1 year ( $p=0.091$ ) or between preoperative uncorrected visual acuity preoperatively and at 2 years ( $p=0.827$ ). Best-corrected visual acuity preoperatively and at 1 year showed no statistical significance ( $p=0.125$ ); however, best-corrected visual acuity preoperatively and at 2 years had statistical significance ( $p=0.007$ ). Mean  $\pm$  standard deviation of preoperative intraocular pressure at 2 years had decreased from  $17.28 \pm 5.7$  to  $13.05 \pm 2.4$  mm Hg (statistically significant;  $p=0.00$ ) and the success rate was 75%. Although the mean  $\pm$  standard deviation of preoperative for drug use at 2 years decreased from  $1.90 \pm 1.1$  to  $1.65 \pm 1.3$ , no significant difference ( $p=0.058$ ) was identified. No complications were identified.

**Conclusions:** Selective laser trabeculoplasty is an effective and safe treatment that reduces intraocular pressure as well as the number of drugs required by patients with open-angle glaucoma.

**Keywords:** intraocular pressure, selective laser trabeculoplasty, open-angle glaucoma, uncorrected visual acuity, best-corrected visual acuity.

Characteristic	N	Percentage
Eyes	40	100.0
Patients	20	100.0
<b>Sex</b>		
Female	12	60
Male	8	40
Right Eyes	20	50
Left Eyes	20	50

Table 1. Baseline characteristics of subjects included in the study

Diagnosis	Eyes	Percentage
Open-Angle Glaucoma	36	90
Pseudoexfoliation Glaucoma	4	10

Table 2. Total percentage of eyes with open-angle glaucoma and pseudoexfoliation glaucoma

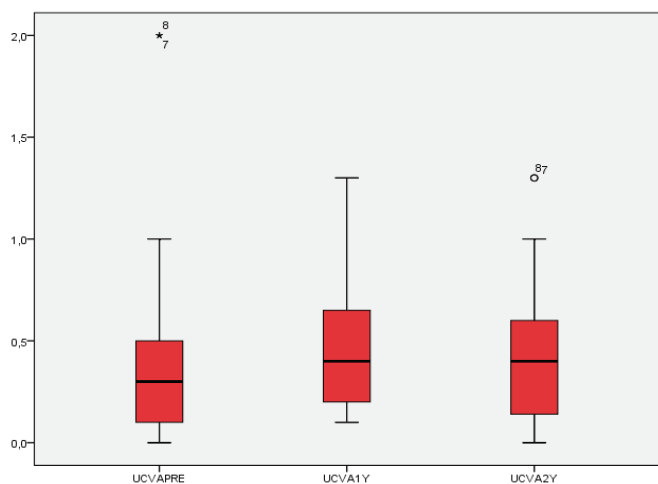


Figure 1. Uncorrected visual acuity (UCVA) before (pre) selective laser trabeculoplasty (SLT) and UCVA at 1 and 2 years after SLT

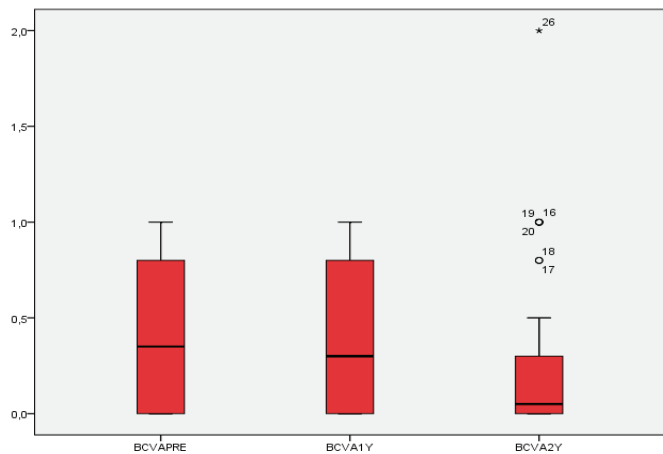


Figure 2. Best-corrected visual acuity (BCVA) before (pre) selective laser trabeculoplasty (SLT) and BCVA at 1 and 2 years after SLT

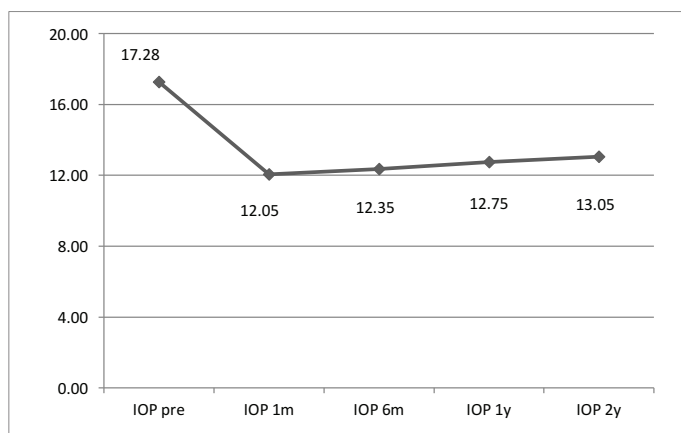


Figure 3. Reduction of intraocular pressure (IOP) before (pre) and 2 years after the procedure

## INTRODUCTION

The argon laser trabeculoplasty (ALT) was introduced in 1979 by Wise and Witter, during a pilot study that showed positive results. It quickly became a standard option in the clinical management of primary open-angle glaucoma<sup>1-4</sup>

In 1995, Latina and Park discovered the 532-nm frequency doubled Q-switched Nd:YAG laser for selective laser trabeculoplasty (SLT). This type of laser is selectively absorbed by pigmented cells of the trabecular meshwork without causing any type of structural damage. Unlike Argon laser trabeculoplasty, it has histologically proven the presence of fibrosis and abnormal migration of corneal endothelial cells aligning at the uveoscleral meshwork.<sup>5-8</sup>

Thermolysis, that is the endothermic reaction that occurs when measuring the amount of heat to be submitted in the trabecular meshwork with argon laser trabeculoplasty, causes more damage, since this value is greater to the amount of heat that is released with SLT<sup>6,9</sup>

An increase of monocytes and macrophages (in comparison with normal eyes), which clean the pigment granules in the trabecular meshwork, has been reported.<sup>10</sup>

This type of procedure is currently performed throughout the world as a first-line therapy, because it has been identified that intraocular pressure (IOP) is controlled for 3 to 4 years. In a cost-benefit study, the use of latanoprost and SLT was compared. The results showed that the latanoprost group had adhesion loss of 25%.<sup>11</sup>

Glaucoma is the second most common cause of blindness worldwide, followed by cataracts. It is estimated that there will be 79.6 million cases of glaucoma by 2020, of which 74% will be primary open-angle glaucoma.<sup>12,13</sup>

SLT is the first-line treatment for these patients. It has been proven efficient for controlling IOP because patients can return to work the next day, it does not affect their vision, and it can be repeated (with less success per retreatment).<sup>14-16</sup>

## METHODS

A descriptive, retrospective, and longitudinal study was conducted from 2012 to 2015 at the Instituto de Ojos Oftalmológico Salud in Lima, Peru. All patients considered for the study signed an informed consent form that was approved by the institute and followed the standards established by the Declaration of Helsinki.

### Patients

Inclusion criteria:

- Patients with open-angle glaucoma treated with drugs;
- Patients older than 20 years, patients who had not undergone filtering surgeries,
- Patients with no previous laser surgery.

Patients with the following characteristics were also excluded: primary closed-angle glaucoma, inflammatory glaucoma, history of uveitis, history of synechia, history of neovascularization, and patients that did not attend all medical appointments during the 2-year period.

Using medical histories, we obtained information for the following variables: uncorrected visual acuity (UCVA), best-corrected visual acuity (BCVA), IOP (Goldmann tonometry), and number of antiglaucoma medications used.

SLT was conducted using a 360° Q-switched NdYAG laser for all patients and in both eyes on the same day with initial energy of 0.3 mJ, which was modified according to the pigmented progression of the angle and the existence of bubbles. The preoperative treatment consisted of Pilocarpine twice every 15 minutes and Brimonidine 30 minutes before the procedure. The postoperative treatment consisted of Brimonidine (1 drop every 12 hours for 15 days) and Nepafenac (1 drop every 6 hours for 15 days). Patients attended the monitoring appointment after 1 week, 1 month, 3 months, 6 months, 1 year, and 2 years. During the postoperative process, UCVA, BCVA, IOP, and the number of antiglaucoma medications used after 1 month, 6 months, 1 year, and 2 years were determined.

The success rate was defined as the reduction of IOP in 20% and was evaluated at 6 months, 1 year, and 2 years.

### Statistical Analysis

Statistical analysis results were obtained using SPSS Statistics v21. The Wilcoxon signed-rank test was used to obtain visual acuity results. The paired samples test was used for descriptive analysis of drugs.

### RESULTS

Of 50 patients included in the study, 20 (100%) patients, 40 (100%) eyes of a total of 12 (60%) women and 8 (40%) men, were those that met the criteria established for the study. There were 36 (90%) eyes with primary open-angle glaucoma and 4 (10%) eyes with pseudoexfoliation glaucoma (Table 1 and 2).

When evaluating UCVA, no significant difference was evidenced before the procedure compared to at 1 year ( $p=0.091$ ) or at 2 years ( $p=0.827$ ). BCVA before the procedure compared to at 1 year ( $p=0.125$ ) showed no significant difference. However, BCVA before the procedure compared to at 2 years ( $p=0.007$ ) showed a significant difference (Figures 1 and 2).

Regarding the statistical results of IOP, mean  $\pm$  SD preoperatively was  $17.28 \pm 5.7$  mmHg; after 2 months it was  $12.05 \pm 2.1$  mmHg, after 6 months it was  $12.35 \pm 2.1$  mmHg, after 1 year it was  $12.75 \pm 2.2$  mmHg, and after 2 years it was  $13.05 \pm 2.4$  mmHg. IOP reduction was statistically significant for all cases ( $p < 0.01$ ) (Figure 3).

Drug treatment showed a mean  $\pm$  SD of  $1.90 \pm 1.1$  for preoperative drug use; after 1 month it was  $1.40 \pm 1.4$ , after 6 months it was  $1.68 \pm 1.4$ , after 1 year it was  $1.63 \pm 1.35$ , and after 2 years it was  $1.65 \pm 1.3$  (Figure 4).

A statistically significant difference was identified between preoperative treatment and 1 month ( $p < 0.001$ ), preoperative treatment and 6 months ( $p = 0.027$ ), and preoperative treatment and 1 year

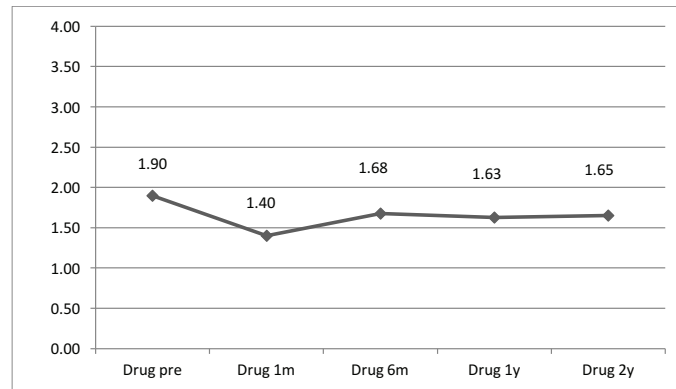


Figure 4. Reduction of mean preoperative drug use during the 2-year evaluation period

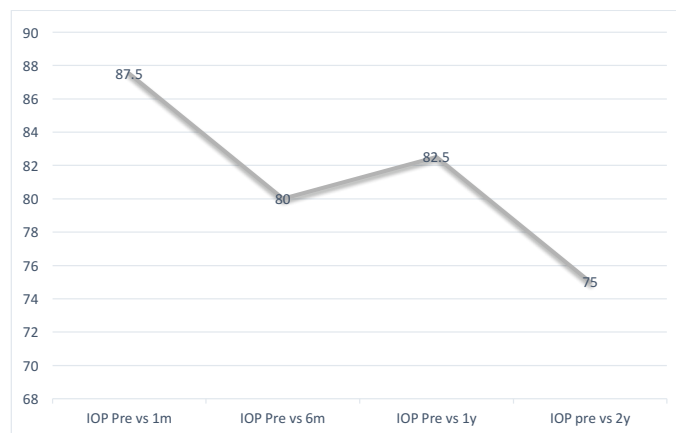


Figure 5. Success rates for intraocular pressure (IOP) during the 2-year evaluation period

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( $p=0.039$ ); however, no significant difference was found after 2 years ( $p=0.058$ ).

The success rate preoperatively at 1 month was 87.5%; 6 months was 80.0% at 1 year it was 82.5% and at 2 years it was 75%. No difficulties were found. (Figure 5)

## DISCUSSION

IOP is the most important factor for the diagnosis and monitoring of glaucoma; therefore, it is the most important variable to control. Lai et al and Nagar et al showed a 20% reduction in pressure with a success rate of 55% to 82% after 1 year. We identified a reduction in IOP of 20% in 80% of patients after 6 months, in 82% after 1 year, and in 75% after 2 years; these were significant differences during the 2 years of evaluation.<sup>17</sup> Kennedy et al identified similar results with an IOP reduction of 20% in 66.7-75% after 6 months, 58-98% after 1 year, and 38-74% after 2 years.<sup>18</sup>

Zhang et al evaluated patients with primary open-angle glaucoma and observed that mean preoperative IOP was 21.3 mmHg. After 2 years of monitoring, mean IOP decreased to 16.2 mmHg, with a success rate of 77.7%. We identified a mean preoperative IOP of 17.28 mmHg and a mean postoperative IOP of 13.05 mmHg after 2 years.<sup>19</sup>

The reduction of IOP varies over time per patient, especially those using the maximum therapy. It has been observed that when there is high IOP, the reduction percentage is greater. This can be caused by a greater pressure gradient through the trabecula and the greater outflow through the trabecular mesh.<sup>20</sup>

We identified a significant difference in the amount of drugs used by patients after 6 months and 1 year; however, after 2 years, there was no significant difference in the amount of drugs used. This may be because some patients needed to use drugs 1 year after SLT to maintain adequate intraocular pressure.

Chen et al investigated a group of patients using antiglaucoma medication and realized that it increased the risk of dry eye if used with prostaglandin analogs, beta blockers, and alpha-agonists. Stein et al performed a cost-effectiveness analysis of prostaglandins. They observed that patients who adequately used prostaglandin analogs had an IOP reduction of 30%; however, it was observed that many of these patients forgot to use the medication or, due to lack of training, did not use the medication adequately, which reduced the effectiveness to 25%. This was compared with the effectiveness of SLT, which reduces IOP by 20%. When cost benefits were analyzed for both treatments, it was observed that treatment with prostaglandins on an annual basis is more expensive than SLT, and patients stated that they had a better quality of life after SLT. In conclusion, we identified that SLT is an effective and safe treatment to control IOP and to reduce the number of drugs used during the study period. ■