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PSLT Lowers IOP with More Comfort Than SLT

Physicians share Pattern Scanning Laser Trabeculoplasty treatment experience, study data, and patient case studies.

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Pattern Scanning Laser Trabeculoplasty, PSLT, (Topcon) represents a giant leap forward in the ability to safely and effectively lower IOP, in patients with open-angle glaucoma. PSLT is a computer-guided treatment algorithm, exclusive to PASCAL laser systems, that provides rapid, precise, and minimally traumatic sub-visible computer-guided treatment, with exact abutment of the patterns. The patterns readily align to the trabecular meshwork (TM), allowing faster and easier applications compared to other laser modalities. PASCAL's PSLT can be compared to other laser technology that is associated with minimized TM tissue disruption, but PSLT's computer-driven benefits and advantages are unique to this platform.

PSLT has achieved an average IOP reduction of 31% in clinical studies, which is similar to SLT's IOP lowering effects.[1] Other important benefits associated with PSLT include a user-friendly interface and brief learning curve; tissue sparing treatment methods that result in less tissue damage; and a quick application process that has been linked to increased patient comfort and treatment tolerability in practice, as well as in clinical studies.[2]

PSLT provides an aiming (633 nm) and therapeutic (532 nm and 577 nm) continuous wavelight, and uses a gonioscope lens to project and align the laser patterns onto the trabecular meshwork. Physicians can choose to treat either half or all of the TM; and treatment is administered in 16 steps for 180° or 32 steps for 360° treatment of the angle. An automated computer-guided rotation of consecutive patterns ensures that treatment steps are precisely placed without overlap or excessive gap.

Each pattern consists of three rows of 13 spots. The use of shorter pulse duration makes it possible to titrate the power for blanching at 10 ms; and treating at 5 ms results in sub-visible effects on the TM, which reduces thermal diffusion and associated unintended tissue damage. The PSLT algorithm enables the surgeon to achieve better control of tissue effects, precise placement of spots, faster treatment, and reduced patient discomfort.

PSLT applications are delivered below levels where conventional photocoagulation occurs, but within the therapeutic range of TM response. This culminates in cellular healing without scarring or coagulative damage.

The physician titrates the laser power using a single spot to achieve light TM blanching with 10 ms laser pulses in the inferior segment of the eye where pigmentation is highest. Once the appropriate setting is selected, power is maintained, but the pulse duration is decreased to 5 ms, which reduces the pulse energy by half making the treatment effect ophthalmoscopically invisible. The computer-guided pattern scanning algorithm simplifies and speeds up the procedure, and provides accurate alignment of the invisible treatment spots. The sequence and alignment of the patterns on the TM ensures that consecutive treatment steps are pieced together around the TM, which minimizes TM scarring, and also reduces post-laser anterior chamber inflammation and damage to the endothelial cells.

When PSLT is compared to SLT, it is fair to say that PSLT is more efficient because the computer-guided pattern facilitates a quicker treatment, and with PSLT the surgeon knows which parts of the TM have been treated because the automated system ensures precise spot placement. This precision reduces the risk of overexposing the tissue unnecessarily, culminating in less tissue damage.

Other efficiencies include posttreatment record maintenance. The software provides detailed printed summaries of each PSLT procedure, along with details of each laser setting, parameters and locations of the patterns. Automated documentation of patient treatment, pattern placement and system parameters offers added security for record maintenance.

EARLY PSLT STUDIES

Turati et al carried out a study of 47 eyes of 25 patients with primary open-angle glaucoma to evaluate the effectiveness of PSLT using 532 nm wavelight.[3] Average IOP was reduced from 21.9 mm Hg to 16.0 mm Hg after 1 month, and at the 6-month follow-up mark, the average IOP was 15.5 mm Hg. A 24% reduction in IOP was achieved by the close of the study. Later, Nozaki and colleagues performed a retrospective chart review comparing PSLT to SLT. They looked at 24 eyes of 21 patients with open-angle glaucoma and found that IOP significantly decreased from 1 month to 6 months in both groups, and both exhibited greater than 20% reduction in IOP.[4] The researchers reported that there was no significant difference in the average reduction of IOP from baseline between the groups and concluded that PSLT was as effective as SLT in lowering IOP over 6 months.

RANDOMIZED STUDY: PSLT VS SLT

More recently, Kaweh Mansouri, MD, led the first randomized controlled trial comparing the safety, tolerability and IOP lowering efficacy of PSLT with that of SLT.[1] The study, which was carried out at Geneva University Hospitals, looked at fellow eyes of untreated patients with glaucoma. Inclusion criteria demanded that participants have uncontrolled IOP and/or intolerance to medical IOP treatment. Fifty-eight eyes of 29 participants with secondary open-angle glaucoma were randomized to undergo PSLT or SLT in each eye. PSLT was performed using the Topcon PASCAL 577, and for eyes randomized to SLT, the Tango/YAG (Ellex) device was used. Comfort level in response to treatment was assessed using a Visual Analogue Scale (VAS).

All PSLT eyes received a single session of 360° laser treatment. A PSLT gonioscopy lens (Ocular Latina 1X Indexing PSLT Lens; Ocular Instruments) was used to project and align the laser patterns onto the TM. Laser power was titrated by placing a single laser spot (100 x 1 m in diameter) in the inferior quadrant at 10 ms exposure duration. A starting power of 500 mW was used for all cases, and then power was increased or reduced until a barely visible lesion was achieved.

Starting power for SLT eyes was set at 0.6 mJ and titrated to produce cavitation bubbles. It was then reduced to 0.1 mJ increments until bubbles were observed occasionally.

Pretreatment for all patients comprised of two drops of pilocarpine 2%. One drop of apraclonidine 1% was instilled in all eyes after laser treatment. Post laser treatment also included one drop of ketorolac tromethamine 0.5% four times daily for 4 days and brimonidine twice daily for 4 days. Nonsteroidal topical anti-inflammatory drops are typically used to prevent anterior chamber inflammatory reaction, although that reaction is less likely to happen when using these laser procedures.

In both groups, the IOP reduction from baseline was statistically significant at all time points: 1 hour, 1 week, 3 months, and 6 months. At 6 months, there were no differences between PSLT and SLT groups in the absolute mean reduction of IOP, which was 3.3 vs 3.1 mm Hg, respectively, or in the percentage of reduction in IOP, which was 19.1% vs 18.5%, respectively. The study concluded that over 6 months the PSLT outcomes were similar to SLT in terms of IOP lowering efficacy and both lasers had similar safety profiles. However, PSLT was perceived as more comfortable by patients based on the VAS, a pain measurement scale that let patients subjectively score their comfort level. The VAS scale was 23.9±20.5, with a range of 0 to 82 in PSLT eyes and 50.4±25.3, with a range 0 to 98 in SLT eyes.

Sandra Belalcazar, MD, is facilitating an ongoing prospective study comparing the safety and IOP lowering efficacy of PSLT vs SLT at Fundación Oftalmológica Nacional. The study began in 2015 and patient recruitment has been extended and remains open. Study participants have open-angle glaucoma or ocular hypertension, IOP of 20 mm Hg or

TABLE. PROSPECTIVE STUDY: PSLT VS SLT

LASER	n	GENDER	MEDICATION	VERTICAL C/D	EXTENT
PASCAL	11	5 male; 6 female	2,09	0,7	360º
SLT	11	1 male; 10 female	2,73	0,7	360º

Source: Sandra Belalcazar, MD. Fundacion Oftalmologica Nacional

Table. Prospective study shows PSLT helped reach and maintain target IOP.

more, and have been treated with one or more medications. So far 22 patients have been recruited, with 11 randomized to either PSLT or SLT. The mean IOP was initially 22.9 mm Hg for the PSLT group and 25.9 mm Hg for the SLT group. Initial findings indicate that after 3 months, IOP reduction for the PSLT group was 31% and 35% for the SLT. At 6 months, IOP reduction continued to be 31% for PSLT and was 32% for the SLT group. The outcomes are similar in both groups. Patients continued to receive the same amount of medication and have achieved lower IOP, which was the therapeutical aim of the study. The study focused on PSLT as adjunctive therapy to medications in patients who were not reaching target IOP with one or more medications. The findings suggest that PSLT delays surgical procedures, because as an adjunctive therapy along with medication target pressures were able to be reached. Therefore, the findings support the adjunctive use of PSLT (Table). As the study progresses, data will reveal if PSLT enables the reduction of medication in patients who continue to rely on it for adjunctive therapy.

Dr. Belalcazar reports that her anecdotal findings indicate that incorporating PSLT into her practice has helped some of her open angle glaucoma patients delay surgical procedures. As adjunctive therapy in combination with medications, PSLT has helped these patients reach and maintain target IOP. She finds that PSLT's automated guided pattern—where the number of applications is less and the energy delivered is reduced by half—makes the procedure more friendly and tolerable for her patients.

CASE PRESENTATIONS

Kaweh Mansouri, MD: Patient Case Study

A 69-year-old female white patient with primary open-angle glaucoma and uncontrolled IOP (21 mm Hg OD, 16 mm Hg OS) in both eyes was referred for PSLT treatment.

The patient presented with early glaucoma OD and advanced (paracentral scotoma) glaucoma OS. Central corneal thickness was 505 microns and 501 microns, respectively. Target IOP was established at below 17 mm Hg OD and below 13 mm Hg OS. The patient refused treatment with prostaglandin analogues due to risk of iris color change. At presentation, she was on once-daily timolol 0.5%. Previous treatment with brimonidine and carbonic anhydrase inhibitors were not well tolerated and discontinued by the patient. Therefore, indication for laser trabeculoplasty was established. Standard SLT had been attempted by her referring physician in OD, but had to be interrupted after treatment of one quadrant due to patient discomfort.

After application of three drops of pilocarpine 2% over 10 minutes and one drop of iopidine 0.5%, PSLT was performed in OD. Energy level was set at 550 mW after titration (light blanching of the trabecular meshwork was observed). All four quadrants were treated in one session. After treatment, patient was asked to grade her comfort level using the Visual Analogue Scale. She indicated "3" which equates to "reasonable comfort." IOP was controlled one hour after treatment to exclude an IOP spike. The patient was put on nepafenac four times daily for 4 days.

One week later, OS was treated using the same PSLT settings and with a similar comfort level.

At week 6 follow-up after PSLT, IOP was 15 mm Hg OD and 12 mm Hg OS. Therefore, treatment was considered successful. Timolol was stopped in OD, but maintained in OS. IOP was checked 1 month later and remained controlled at 16 mm Hg OD and 11 mm Hg OS.

The patient has been informed that laser treatment duration is 1 to 2 years on average and may need to be repeated, if the effect should wane over time.

Sandra Belalcazar, MD: Patient Case Studies

Case Study 1

A 76-year-old female Hispanic patient, with a history of open-angle glaucoma, who has been followed for 5 years presented for reassessment. She had been treated with fixed combination of dorzolamide 2% plus timolol 0.5% (Cosopt; Akorn) twice daily and latanoprost (Xalatan; Pfizer) once daily. Her IOP was 20 mm Hg OD and 16 mm Hg OS. Vertical cup-to-disc ratio on both of her eyes was 0.8.

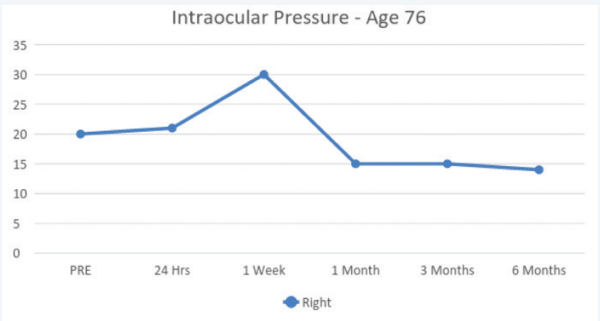

Figure 1. A 76-year-old female Hispanic patient with a history of open-angle glaucoma returned for a 5-year assessment. Six month after adjunctive PSLT, her IOP was 14 mm Hg. *Source: Sandra Belalcazar, MD*

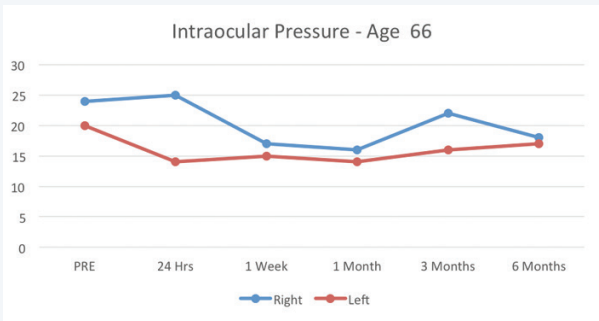

Figure 2. This graph represents a 66-year-old male patient with open-angle glaucoma who presented for treatment. Six months after PSLT, the patient's IOP was 18 mm Hg OD and 17 mm Hg OS. The patient's IOP was reduced by approximately 25%. *Source: Sandra Belalcazar, MD*

Her target pressure was not being reached with three medications on her right eye. Laser trabeculoplasty was considered as adjunctive therapy. Trabeculoplasty was performed with the PASCAL Laser in 360° using 3.4 mJ of average pulse energy. She continued her medications throughout the follow-up period.

Her IOP was 21 mm Hg at the first 24 hour check-up following the PSLT procedure. IOP was 30 mm Hg at the first week and 15 mm Hg at the first month follow-up. Three months after PSLT the patient's IOP remained at 15 mm Hg, and at the 6-month follow-up, her IOP was 14 mm Hg. PSLT as adjunctive therapy enabled us to reach target IOP and avoid surgical intervention (Figure 1).

Case Study 2

A 66-year-old male patient with open-angle glaucoma presented for treatment. He had been taking two medications for 12 months: timolol 0.55 and brimonidine 0.2%. His IOP was 24 mm Hg OD and 20 mm Hg OS, and vertical cup-to-disc ratio was 0.7 OD/0.6 OS.

We decided to treat with laser trabeculoplasty as adjunctive therapy and performed PSLT with the PASCAL laser in 360° with 3.7 mJ of average pulse energy. His IOP 24 hours after PSLT was 25 mm Hg OD and 14 mm Hg OS.

At the 1-week follow-up, IOP was 17 mm Hg OD and 15 mm Hg OS. The patient's IOP at 1 month was 16 mm Hg OD and 14 mm Hg OS; after 3 months, IOP measured 22 mm Hg OD and 16 mm Hg OS. Six months after PSLT, the patient's IOP was 18 mm Hg OD and 17 mm Hg OS (Figure 2). The patient remained on medications through follow-up, and just as my study indicates, PSLT works as if another medication has been added to the regimen, thereby delaying surgical intervention without the added cost or compliance issues associated with an additional medication.

CONCLUSION

PASCAL PSLT software was developed specifically for treating the trabecular meshwork. With that in mind, lower energy is concentrated to a smaller volume allowing use of lower powers and shorter pulse durations and this results in minimally traumatic treatment. Prospective, retrospective and randomized studies, as well as anecdotal clinical evidence, indicates that PSLT is safe, and comparable to standard SLT in terms of IOP lowering efficacy, while introducing the added benefits of minimized tissue damage, reduced treatment time, and improved patient comfort. ■

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