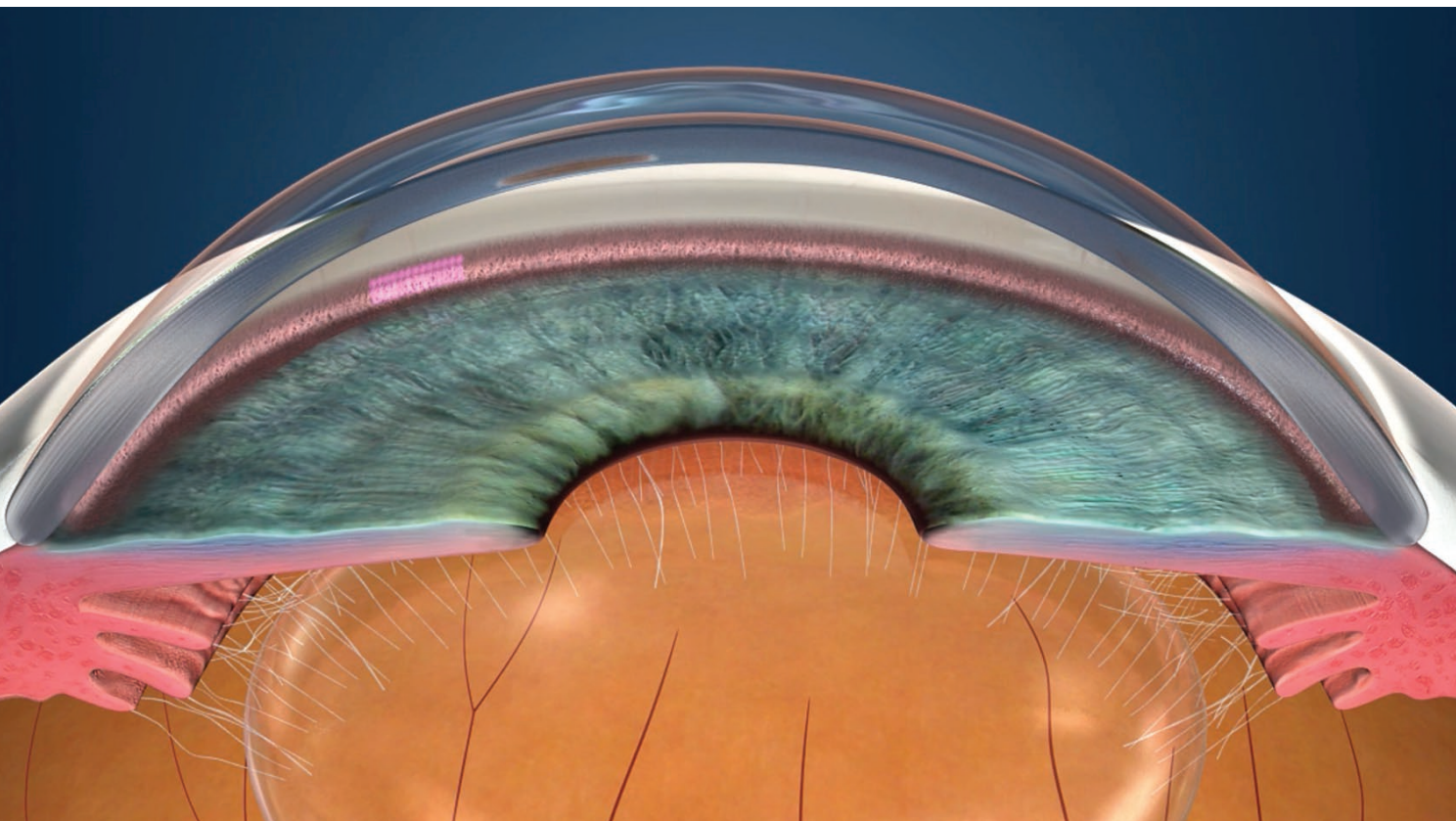


Glaucoma

TODAY



PSLT OFFERS BENEFITS OVER SLT FOR GLAUCOMA PATIENTS

Physicians share experiences using Pattern Scanning Laser Trabeculoplasty (PSLT)
for the treatment of open-angle glaucoma.

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BY MIHO NOZAKI, MD, PHD, AND KAWEH MANSOURI, MD, MPH

PASCAL Pattern Scanning Laser Trabeculoplasty, PSLT, (Topcon) is an important breakthrough in laser treatment. It has been shown to have several benefits for treating patients with retinal conditions; for example, short pulse durations result in less heat diffusion to the inner retina and choroid, yielding less pain for patients, less lateral expansion, and less damage to the inner retina. This technology may also be of benefit in treating patients with glaucoma.

A new computer-guided treatment algorithm, PSLT, applies a sequence of laser pulses to the trabecular meshwork using the PASCAL laser with yellow (577 nm) wavelength light.

USING LASERS TO TREAT GLAUCOMA

PSLT is an advanced tissue-sparing laser treatment for open-angle glaucoma. PSLT provides a rapid, precise, and minimally traumatic (subvisible) computer-guided treatment by applying a sequence of laser patterns to the trabecular meshwork (Figure 1). Calculated alignment of each pattern ensures that consecutive treatment steps are pieced together around the trabecular meshwork without overlap or excessive gaps. Using a Gonio lens, treatment is administered in 32 steps for 360° of the trabecular meshwork with three rows of 13 spots each. The laser automatically rotates the aiming beam, allowing for precise and accurate pattern treatment of the trabecular meshwork. Laser energy delivered is under the threshold necessary to create coagulative damage but within the therapeutic boundary to disrupt the trabecula resulting in the reduction of IOP.

PSLT is similar to selective laser trabeculoplasty (SLT) in principle but with some important differences in the treatment parameters. Notably, the pulse energy is higher with PSLT (3.4 mJ) compared to the 0.8 mJ used in SLT, and pulse energy for both are considerably lower than for argon laser trabeculoplasty (ALT), which is typically 33 mJ. With PSLT, the spot size is 100 μ m. There are 13 spots in each row, and 3 rows of spots are placed with spots spaced as close together as possible.

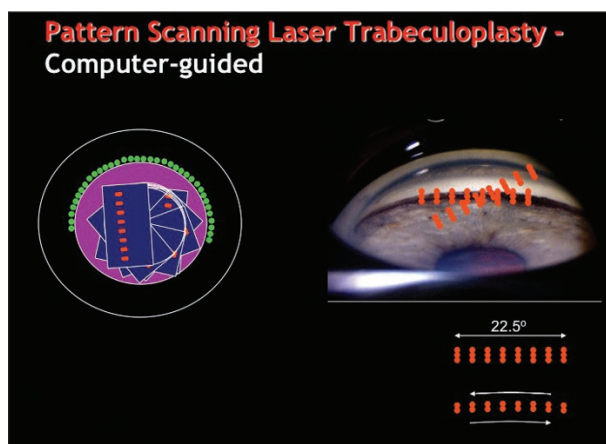


Figure 1. Calculated alignment of each pattern allows for consecutive treatment steps pieced together around the trabecular meshwork without overlap or excessive gaps.

During PSLT, the physician titrates laser power using a single spot to achieve light blanching of the trabecular meshwork, with 10 ms laser pulses applied to the inferior segment of the eye, where pigmentation is often most densely concentrated (Figure 2). After titration, power is maintained and the pulse duration is reduced to 5 ms. The pulse energy is cut in half, which makes the treatment outcome ophthalmoscopically invisible. The surgeon then selects treatment of one-half (180°) or the total area (360°) for treatment. The aiming beam will automatically rotate during the treatment process to address the treatment area selected.

A CLOSER LOOK: PSLT STUDIES

A study of 47 eyes of 25 patients with primary open-angle glaucoma evaluated the effectiveness of PSLT using 532 nm wavelength light.¹ After 1 month, average IOP was reduced from 21.9 mmHg to 16.0 mmHg; at 6 months, the average IOP was 15.5 mm Hg. Overall, IOP was reduced by 24% at the end of the study.

Recently, a retrospective chart review was performed looking at 24 eyes of 21 patients with open-angle glaucoma

PSLT is not currently available in the US.

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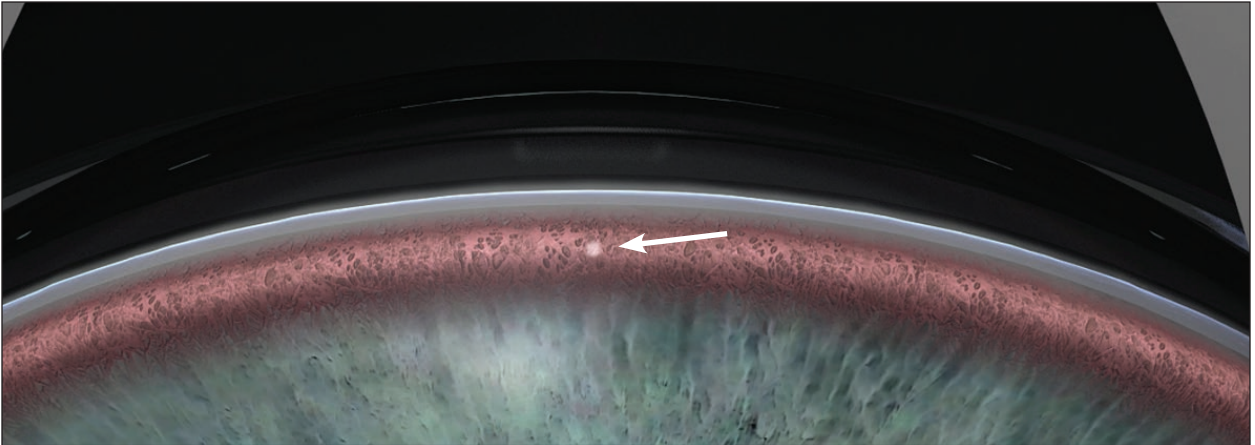


Figure 2. Laser power is titrated using a single spot to achieve light blanching of the trabecular meshwork.

The investigators concluded that PSLT was as effective as SLT in lowering IOP over a 6-month period.

comparing PSLT using a yellow wavelength (577 nm) light and SLT.² All cases were treated for 360°, and the average follow-up was 11 months in the PSLT group and 18 months in the SLT group. There were no significant differences in baseline characteristics between the groups of patients.

The PSLT group was treated with the PASCAL Streamline 577 (Topcon) using the following parameters:

- Wavelength: 577 nm (yellow)
- Average number of spots (360°): 1277
- Exposure energy: 1.5 to 2.3 mJ (average: 1.7 mJ)

The SLT group was treated with the Tango Ophthalmic Laser (Ellex) using the following parameters:

- Wavelength: 532 nm (green)
- Average number of spots (360°): 88
- Exposure energy: 0.5 to 0.9 mJ (average: 0.8 mJ)

IOP significantly decreased from 1 month to 6 months in both groups, and both exhibited greater than 20% reduction in IOP. In the PSLT group, the reduction was greater than 30% (Figure 3). The medication score (topical antiglaucoma drops and fixed-combination glaucoma agents were given a score of 2) was slightly increased in both groups. Kaplan-Meier survival curves were similar for both PSLT and SLT, and cumulative survival rate (failure rate defined as IOP reduction rate <20) at 6 months was 0.80 for the PSLT group and 0.67 for the SLT group. Three eyes in the SLT group required additional glaucoma surgery 7 months after SLT. One patient in each group experienced a transient IOP elevation of more than 5 mmHg after treatment.

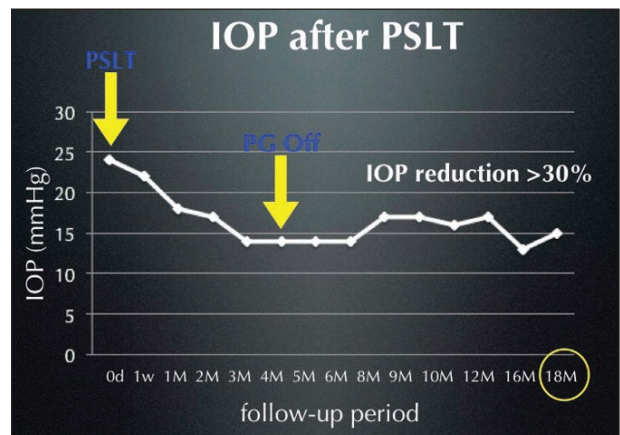


Figure 3. IOP reduction of >30% was maintained through 18 months.

In the PSLT group, the mean IOP was 21.8 mmHg at baseline and 14.3 mmHg at 6 months. In the SLT group, the mean IOP was 23.8 mmHg at baseline and 17.3 mmHg at 6 months. There was no significant difference in average reduction in IOP from baseline between the groups (33% for PSLT and 22% for SLT). The investigators concluded that PSLT was as effective as SLT in lowering IOP over a 6-month period.

STUDY COMPARING SLT TO PSLT

A study led by Dr. Kaweh Mansouri is underway at the University of Geneva, Switzerland that will compare SLT in one eye with PSLT performed in the fellow eye.³ The researchers will record 24-hour IOP measurements before and after the procedure. The objective is to compare the safety, tolerability, and 24-hour IOP-lowering efficacy of the two treatment modalities.

The study will enroll 60 eyes of 30 patients with primary open-angle or pseudoexfoliative glaucoma. Patients will undergo 24 hours of monitoring with a contact lens

sensor that monitors IOP indirectly. This study is still underway, but results are available for 25 patients.

For the eyes randomized to SLT, the Ellex Tango SLT/YAG device was used. All four quadrants were treated in a single session. On average, there were 92 pulses, and the average energy level was 1.1 mJ. Average total procedure time, including placement of patients at the laser device and adjustment of the Gonio lens, was 9.4 minutes. For the eyes randomized to PSLT, the PASCAL Streamline 577 laser was used. Again, all four quadrants were treated in a single session. On average, there were 1,248 pulses (32 x 39 spots). The average energy level was 2.8 mJ. This procedure time was significantly shorter compared with SLT (average 4.5 minutes).

There were no serious adverse events reported in either group among these initial cases. Two eyes treated with SLT and one eye treated with PSLT experienced an IOP spike of more than 10 mmHg, but in all cases, the spike resolved after 24 hours. Using a visual analog scale, patients reported their comfort level after the procedure; the average value for SLT eyes was 49 mmHg, which is in the moderate pain range. The average value for PSLT eyes was 25 mmHg ($P = 0.0001$), indicating a significantly lower level of patient discomfort.

The preprocedure IOPs were similar between treatment groups: 20.9 mm Hg versus 20.3 mmHg for the SLT and PSLT groups, respectively. One month after laser treatment, there was a reduction to 14.9 mmHg among eyes treated with SLT (-28%) compared with 15.4 mm Hg among eyes randomized to PSLT (-24%); however, the difference was not statistically significant.

The study employed the use of a Triggerfish sensor, a contact lens device that measures expansion of the ocular circumference as a biomechanical measure of pressure changes (this device is not cleared for use by the US Food and Drug Administration but is cleared for use in Europe). The sensor provides a curve showing IOP changes over a 24-hour period, producing a pattern corresponding to pressure diurnal pressure fluctuations. In the study, prior to treatment, there was good correlation in pressure patterns between the two eyes. One month after the procedures, among eyes in the SLT group, the daytime rhythm did not change much; however, at night, there was a slight flattening of the curve. Among eyes in the PSLT group, there was a similar effect on the nighttime IOP profile. While this is encouraging, it is too early to know the clinical applicability or relevance of this data.

CASE PRESENTATION

Miho Nozaki, MD, PhD

A 52-year-old woman with primary open-angle glaucoma presented to our clinic. The IOP in her right eye was

PSLT is a safe and effective treatment for glaucoma in certain patients.

26 to 30 mmHg while on timolol/dorzolamide (Cosopt; Oak Pharms). Prior to consultation, her medication was changed to travoprost/timolol (DuoTrav), which is not approved for use in the United States, and brinzolamide (Azopt; Alcon), but the IOP in her right eye remained at 24 to 26 mmHg. At the time of referral, her IOP was 24 mmHg and visual acuity in her right eye was 20/20; central corneal thickness was 483 μ m.

This patient was relatively young, and she did not want to use a prostaglandin analog. Her cornea was thin, so we could have performed a trabeculectomy, but her fellow eye showed no evidence of glaucoma. Therefore, we opted to treat with PSLT. After PSLT, her IOP dropped to less than 15 mmHg. Four months later, her medication was changed from DuoTrav and Azopt to Cosopt and brimonidine. Her lower IOP was maintained for more than a year and there was no change in visual field.

CONCLUSION

These studies and case presentations demonstrate that PSLT is a safe and effective treatment for glaucoma in certain patients. It is faster and more comfortable for patients than SLT. Efficacy of PSLT is similar to SLT, both in daytime and nighttime IOP. Additional studies are needed to confirm these findings; however, PSLT seems to be a potentially intriguing option for treating glaucoma. ■

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