One Year Results of Selective Laser Trabeculoplasty in the Treatment of Primary Open Angle Glaucoma

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Objective: *To evaluate the efficacy and safety of selective laser trabeculoplasty (SLT) as a treatment of primary open angle glaucoma (POAG).*
Material and Method: *In a prospective clinical study, 21 eyes suffering from POAG were treated with SLT over inferior 180 degrees of trabecular meshwork. The intraocular pressure (IOP) was measured before and 1 hour, 1 week, and 1, 3, 6,and 12 months after the treatment. The glaucoma medications were continued on the same regimen during the study period.*
Results: *The mean preoperative IOP was 18.6 mmHg (SD 2.2). The mean IOP reduction were 4.9 mmHg (26.3%) 1 hour after SLT, 2.6 mmHg (14.0%) 1 week after SLT, 4.0 mmHg (21.5%) 1 month after SLT, 3.5 mmHg (18.8%) 3 months after SLT, 3.7 mmHg (19.9%) 6 months after SLT, and 3.3 mmHg (17.7%) 12 months after SLT. There were minimal adverse reactions including conjunctival injection and mild anterior chamber reaction.*
Conclusion: *SLT is a safe and effective procedure to reduce IOP in POAG patients.*

Keywords: *Selective laser trabeculoplasty, Primary open angle glaucoma*

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Argon laser trabeculoplasty (ALT) has become a standard option treatment of open-angle glaucoma. It was introduced in 1979 by Wise and Witter[1]. ALT can enhance the aqueous outflow via the trabecular system. However, histopathological examination revealed local and collateral damage of the trabecular meshwork treated with ALT[2-5]. Thus, ALT causes focal destruction and alters the biological activity of trabecular cells. Different types of lasers have been investigated for laser trabeculoplasty. Selective laser trabeculoplasty (SLT) is a new version of laser treatment for reduction of IOP in open-angle glaucoma. It uses a Q switched, frequency doubled Nd:YAG laser (λ = 532 nm) that produce a low power and short duration of laser energy to target the pigment trabecular meshwork cells while sparing the collateral cells and tissue[2,6,7]. The possibility of avoiding relevant damage in the trabecular meshwork makes a major advantage of SLT over conventional ALT. Consequently, SLT might be able to be performed many times in the same eyes without causing the coagulative scarring in the trabecular meshwork.

In the present study, the authors aimed to evaluate the efficacy and safety of SLT in the treatment of patients with POAG

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Material and Method

The authors studied patients who had attended the glaucoma clinic at Mettapracharak Hospital between September and December 2006. The patients were included in the present study if they had POAG and were unable to reach their clinically determined target IOP while taking the maximal tolerated medication.

Baseline characteristics including gender, age, underlying diseases, and number of glaucoma medication used were recorded. Ocular examination included visual acuity (by mean of Snellen chart), slit lamp assessment of the anterior segment of the eye, IOP (by Goldmann applanation tonometer), and

gonioscope of the angle. Trabecular meshwork pigmentation was graded according to standard scale provided by coherent (grade from 0 to 4+ where 0 = no pigment and 4+ = dense homogeneous pigment). Optic disc evaluation was performed by using 90 D lens with slit lamp examination. On the day of laser treatment, IOP was checked and one drop of brimonidine 0.15% was given 5-10 minutes before the treatment. Then SLT was performed with a 532 nm frequency double Q-switched Nd-YAG laser (Tango; Ellex, Adelaide, SA, Australia) using 50 $\pm$ 5 non overlapping application over inferior 180 degrees with a spot size of 400 μm (centered on the TM) and pulse duration of 3 ns. The initial energy performed was 0.6 mJ then it was increased or decreased until bubble formation appeared and was then decreased by 0.1 mJ and continued on that power until the treatment finished. Average power during treatment ranges from 0.5-0.9 mJ. A drop of brimonidine 0.15% was instilled in all treated eyes immediately after the laser treatment. All the treated eyes underwent slit lamp examination and applanation tonometry at 1 hour, 1 week, 1 month, 3 months, 6 months, and 12 months after treatment.

Results

Twenty-one eyes (13 patients) were included in the present study. Baseline characteristics of the patients in the present study are demonstrated in Table 1.

The mean pre-operative IOP was 18.6 (SD2.2) mmHg. The individual data and mean IOP change at all time periods are shown in Table 2. None of the eyes in this study had post-operative IOP spike at one hour after the treatment. At the following examinations, the mean IOP of all eyes was 13.7 (SD 3.8) mmHg at 1 hour, 16.0 (SD 2.7) mmHg at 7 days, 14.6 (SD 2.4) mmHg at 4 weeks, 15.1 (SD 2.9) mmHg at 3 months, 14.9 (SD 2.5) mmHg at 6 months, and 15.3 (SD 2.7) mmHg at 12 months. In summary, the mean IOP was reduced by 3.3 (SD 2.5) mmHg or 17.7% at 12 months after treatment. Fig. 1 shows the mean IOP before and after the treatment. Minimal anterior segment inflammation was detected after the treatment. Three patients complained about a little discomfort during the treatment.

Table 1. Baseline characteristics of the patients in the study

Age (SD) (years)	64.8 (8.5)
Gender:	
Male	7
Female	6
Eye treated:	
OD	10
OS	11
No. of glaucoma medication	
0	2
1	7
2	2
3	1
4	1
TM pigmentation (SD)	2.6 (0.7)

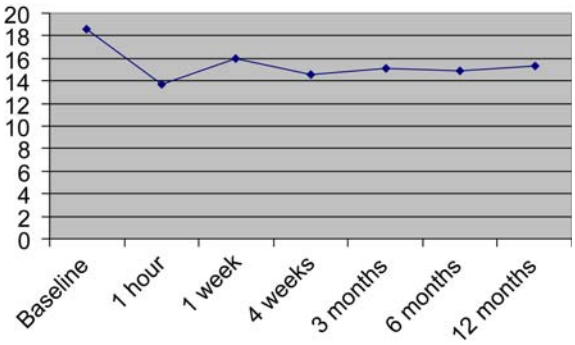

Fig. 1 Relationship between IOP and timing after SLT treatment

Discussion

ALT has been in use since 1979 when it was first introduced by Wise and Witter[1]. It has been used worldwide for medically uncontrolled glaucoma. However, the IOP reduction by ALT is usually less than 30% from baseline and the response time for this treatment is relatively slow. SLT is the new laser technique for treatment of open-angle glaucoma that was introduced in 1995 by Latina and Park[6]. SLT can selectively target pigmented trabecular cell and spare the adjacent tissue resulting in less destruction and scarring of trabecular meshwork. Noecker et al[7] reported the acute morphological changes after ALT and SLT by electron microscopic evaluation of human cadaver eyes. In the eyes treated with ALT, there was evidence of coagulative damage in the uveal meshwork and the junction of the pigmented and non-pigmented trabecular meshwork with whitening bleb formation, disruption of the collagen beams, and endothelial cells. No such evidence was found in eyes treated with SLT. The rare evidence of minimal mechanical damage was shown in eyes treated with SLT. Therefore, SLT appears to cause less destruction

Table 2. Change in IOP from baseline after the treatment (mmHg)

Eye no.	Eye	Baseline IOP	1 hr	1 week	4 weeks	3 months	6 months	12 months
1	OD	18	16	18	16	16	13	14
2	OS	20	16	21	17	18	17	16
3	OD	22	12	17	16	9	14	20
4	OS	20	9	11	10	12	15	20
5	OD	21	15	17	19	22	16	15
6	OD	16	9	13	15	14	16	17
7	OS	16	11	13	15	15	14	13
8	OD	23	23	21	15	18	17	19
9	OS	20	12	15	15	16	16	17
10	OD	20	20	16	16	13	17	15
11	OS	20	19	17	16	13	16	15
12	OD	17	10	15	15	16	18	17
13	OS	17	12	14	14	14	12	13
14	OD	20	10	17	16	17	16	17
15	OS	16	11	19	17	16	17	16
16	OS	16	14	16	13	15	16	16
17	OD	18	13	13	11	15	10	12
18	OS	18	13	15	11	17	10	11
19	OS	16	16	18	16	18	17	15
20	OD	20	17	17	12	14	16	14
21	OS	16	10	13	11	10	10	10
	Mean	18.6	13.7	16.0	14.6	15.1	14.9	15.3
	SD	2.2	3.8	2.7	2.4	2.9	2.5	2.7

to trabecular meshwork and adjacent tissue than ALT.

In the present study, all the patients were affected with open-angle glaucoma. SLT achieved an immediate response. At 1 hour after the treatment, the mean IOP was reduced by 26.3% from baseline. The therapeutic effect of SLT could be seen in the following examination until 12 months, which was the last follow-up in the present study. At 12-month follow-up, the study patients had the mean IOP decrease of 17.7% from baseline. Many studies have been conducted to evaluate the efficacy of SLT in open-angle glaucoma patients, and reported the mean IOP reduction range from 16.6-24.5% from baseline at 12 months after treatment[8-13]. The present study showed the result of 17.7%, which was very close to them.

However, the IOP was not decreased in six of 21 eyes in the present study at 12 months after the treatment. Most of them had IOP decrease at the beginning and then rising up later. Therefore, it is questionable about the efficacy of SLT at longer follow-up period.

Some studies reported the adverse reactions of SLT such as conjunctival injection, mild anterior chamber reaction, patient discomfort, and transient pressure spike[13,14]. Some patients in the present study had a little discomfort during the procedure and minimal anterior chamber reaction. None of the patients in the present study had postoperative IOP spike.

In conclusion, SLT seems to be a safe and effective treatment for open-angle glaucoma. It can provide an immediate effect in IOP reduction after the treatment. Further studies should be carried out to evaluate the safety and efficacy of the primary treatment and re-treatment of this procedure.

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ประสิทธิภาพของการใช้เลเซอร์ selective laser trabeculoplasty ในการรักษาต้อหินชนิดมุมม่านตาเปิด

ดวงดาว ทัศณรงค์, ธนนท์ พกสุนทร, จตุพร งามจิตติอำไพ

วัตถุประสงค์*: เพื่อศึกษาประสิทธิภาพ และความปลอดภัยของการรักษาต้อหินชนิดมุมม่านตาเปิดด้วยวิธี selective laser trabeculoplasty (SLT)*

วัสดุและวิธีการ*: เป็นการศึกษาในผู้ป่วยต้อหินมุมม่านตาเปิดจำนวน 21 ตา ผู้ป่วยได้รับการรักษาด้วยวิธี SLT ครอบคลุมบริเวณ 180 องศา ของมุมม่านตาด้านล่าง หลังจากนั้นผู้ป่วยจะได้รับการติดตามผลการรักษาด้วยการวัดความดันลูกตาที่เวลา 1 ชั่วโมง, 1 สัปดาห์, 1 เดือน, 3 เดือน, 6 เดือน และ 12 เดือนหลังการรักษา โดยไม่มีการปรับยาต้อหินใด ๆ ตลอดการศึกษา*

ผลการศึกษา*: ค่าความดันลูกตาเฉลี่ยก่อนการรักษาเท่ากับ 18.6 mmHg (SD 2.2) ค่าเฉลี่ยความดันลูกตาที่ลดลงหลังการรักษาเท่ากับ 4.9 mmHg (26.3%) ที่ 1 ชั่วโมง, 2.6 mmHg (14.0%) ที่ 1 สัปดาห์, 4.0 mmHg (21.5%) ที่ 1 เดือน, 3.5 mmHg (18.8%) ที่ 3 เดือน, 3.7 mmHg (19.9%) ที่ 6 เดือนและ 3.3 mmHg (17.7%) ที่ 12 เดือนตามลำดับ พบผลข้างเคียงจากการรักษาได้แก่ เยื่อบุตาแดงอักเสบเล็กน้อย และการอักเสบภายในช่องม่านตาเพียงเล็กน้อย*

สรุป*: SLT มีความปลอดภัยและมีประสิทธิภาพในการลดความดันลูกตาในต้อหินชนิดมุมม่านตาเปิด*