International Journal of Ophthalmology & Vision Research

Research Article

Selective Laser Trabeculoplasty 1 and 2 Year Pressure Reduction -

Mathilde Boiche, Jean Baptiste Conart and Toufic Maalouf*

Department of Ophthalmology CHU Nancy-Brabois, France

***Address for Correspondence:** Toufic Maalouf, Department of Ophthalmology CHU Nancy-Brabois, France, Tel: +333-831-530-39 / +336-112-742-48; E-mail: t.maalouf@chru-nancy.fr

Submitted: 20 February 2019; **Approved:** 05 March 2019; **Published:** 08 March 2019

Cite this article: Boiche M, Conart JB, Maalouf T. Selective Laser Trabeculoplasty 1 and 2 Year Pressure Reduction. Int J Ophthal Vision Res. 2019;3(1): 007-012.

ISSN: 2640-5660

ABSTRACT

The objective of this study was to observe the 1-year and 2-year pressure reduction in an active population of glaucoma patients treated by selective laser trabeculoplasty.

We carried out a retrospective study of all patients treated in our department between January 2015 and March 2016. Patients who had already undergone Laser Trabeculoplasty (ALT or SLT) in the past were excluded from the study. Treatment was performed with a Q-Switched, frequency doubled Nd: YAG laser (Solutis - Quantel Medical, France), over 180° or 360° of the trabecular meshwork. The mean decrease in intraocular pressure and the success rate, defined as a decrease in intraocular pressure superior to 20% without increasing the medical treatment, were calculated. The impact of the different clinical and technical characteristics on the decrease in pressure was also studied by multivariate analysis.

One hundred and seventeen eyes, in 74 patients, were included. The mean decrease in IOP from baseline was 4.35 mmHg (20.6%) at 1 year and 3.74 mmHg (16.7%) at 2 years. The success rate was 49% at 1 year and 33.3% at 2 years. Selective trabeculoplasty is currently a therapeutic option called-upon at different stages in the progression of glaucoma. The duration of efficacy of this laser therapy, and the retreatment frequency are yet to be defined.

Keywords: Selective laser trabeculoplasty; Intra ocular pressure

INTRODUCTION

Glaucoma treatment is designed to achieve a lasting and effective reduction in Intraocular Pressure (IOP) in affected patients, in order to prevent the progressive and irreversible loss of optic nerve fibres. To this end, in addition to medical and surgical techniques, laser techniques to weaken the trabecular meshwork have been developed since the 1980s, following the pilot study by Wise and Witter [1].

In 1998, a study by Latina demonstrated that it is possible to target only the pigmented cells in the trabecular meshwork, by using a low-power pulsed laser. This marked the start of Selective Laser Trabeculoplasty (SLT) [2,3].

The technique was soon proven to be effective [4], with results indicating a reduction in IOP of between 16 and 32% of the baseline value at one year [5]. However, the effects of SLT on IOP are not permanent, and can vary depending on the indications and the technical characteristics of the trabeculoplasty process.

The aim of our study was to assess pressure reduction at one year and two years in an active population of glaucoma patients treated with SLT. The secondary aims were to determine the treatment's success rate, to ascertain whether SLT helps reduce the number of topical treatments, and to identify the technical and clinical characteristics that may have an impact on the efficacy of the treatment.

MATERIALS AND METHODS

This was a retrospective, observational, single-centre study of 117 eyes in glaucoma patients treated with SLT between January 2015 and March 2016.

Population

The inclusion criteria were: aged over 18 years, with chronic open-angle glaucoma suitable for laser treatment (primary open-angle glaucoma, pigmentary or pseudoexfoliative glaucoma, traumatic glaucoma, steroid-induced glaucoma). Laser treatment could be used for the following reasons: changes in central visual field or IOP that remained poorly controlled despite well-conducted medical treatment or filtration surgery, intolerance to or failure to comply with topical drug therapy, or primary therapy to delay the initiation of topical treatment in young patients. Both eyes could be included.

- ➢ The exclusion criteria were a history of argon laser trabeculoplasty or SLT.
- ➢ The treatment was indicated once patients had given their oral informed consent.

Pre-trabeculoplasty data

A full eye examination was conducted in all patients prior to the trabeculoplasty. The following criteria were assessed: patient demographic characteristics (age, sex, ethnicity); glaucoma type (primary, pigmentary, pseudoexfoliative, traumatic, steroid-induced); reason for treatment; extent of iridocorneal angle pigmentation (graded 0 to 4 based on the SCHEIE classification system); IOP, measured using the Goldmann applanation tonometer; corneal thickness; number of pressure-lowering drugs used topically; and history of filtration surgery.

Technique used

The treatment was carried out under topical anaesthesia with Oxybuprocaine hydrochloride 0.4% and using a Latina contact lens. The solutis laser (Quantel Medical®, France) was used, which can deliver pulses of 0.2 mJ to 2.0 mJ. The initial pulses were fired at the trabecular meshwork at the device's lowest energy level, which was then gradually increased to reach the lowest energy level required to create a bubble upon impact. The treatment was then performed over 180° or 360°, at the physician's discretion, comprising fifty pulses for each half of the trabecular meshwork. The technical parameters used for each patient were recorded (energy level and circumference treated: 180° or 360°).

Preoperative pressure-lowering treatment was continued and a topical NSAID treatment (Bromfenac) was added for 10 days, at a dose of one drop four times daily.

4.4. Post-trabeculoplasty data

The post-SLT data collected at one year and two years included IOP measured by applanation tonometer, number of pressure-lowering drugs used topically, and adverse effects linked to the treatment (early hypertonia, anterior chamber inflammation, macular oedema, corneal oedema).

The primary endpoint studied was pressure reduction at one and two years in the general population, and we also carried out a subgroup analysis based on the therapeutic indications ("primary therapy", "poor compliance and poor tolerance" and "progression under well-conducted treatment").

Treatment success, defined as a decrease in pressure greater than or equal to 20% of the baseline value with no increase in drug therapy, was assessed in our population at one and two years. We then studied the impact of SLT treatment on the reduction in the number of topical pressure-lowering drugs. Finally, we looked for any factors that could predict treatment success.

Statistical analysis

The quantitative data were expressed as mean and standard deviation. Since the variables were not normally distributed, the Wilcoxon signed-rank test was used to compare pre- and post-trabeculoplasty IOP and the number of topical treatments pre- and post-trabeculoplasty. Bivariate and multivariate analysis based on logistic regression models was used to look for factors predictive of treatment success.

- Statistical significance was set at $p < 0.05$

RESULTS

Demographic characteristics

We studied 117 eyes in 74 patients. The demographic characteristics of these patients are described in table 1.

Clinical characteristics prior to trabeculoplasty

The clinical characteristics recorded prior to the treatment are described in table 2. In terms of aetiology, the majority of patients had primary glaucoma (88%).

Reason for SLT treatment

Selective laser trabeculoplasty treatment was chosen due to progression of the disease despite well-observed topical treatment (IOP not controlled, progression of central visual field or structural changes) in 85 patients (72.6%) and poor tolerance of or poor compliance with topical treatment in 24 patients (20.5%), while 8 patients (6.8%) were given SLT as primary therapy after glaucoma was diagnosed.

Technique used

The technical characteristics of the treatment (circumference of treated trabecular meshwork and energy level used during the procedure) are described in table 3. Results of the 117 eyes included in the study, 100 were examined at 1 year (average follow-up 11 ± 2.6 months).

At 2 years (average follow-up 23 ± 3.3 months), just 87 eyes were assessed: 9 eyes (7.7%) were excluded from the statistical analysis due to subsequent filtration surgery being performed and 1 eye was excluded due to a second course of SLT treatment, while 20 patients were lost to follow-up.

A significant improvement in IOP was observed at each follow-up stage. At 1 year, IOP had decreased by 4.35 mmHg on average, corresponding to 20.6% (± 22.2) of the baseline value. At 2 years, IOP had decreased by 3.74 mmHg on average, corresponding to 16.7% (± 22.5) of the baseline value (Table 4).

When the patients were assessed in subgroups based on the reason for the treatment, the mean pressure reduction remained significant at one and two years for the "poor compliance and poor tolerance" and "progression under well-conducted treatment" groups. However, it was not significant for the group of patients who received SLT as primary therapy (Table 5).

Based on the definition used for the study, the treatment success rate was 49.0% at 1 year and 33.3% at 2 years. For patients with a history of filtration surgery, this was 55.6% at 1 year and 57.1% at 2 years.

Table 1: Description of population characteristics.

	N	% / mean	Standard deviation	Min.	Max.
Age (years)	117	62	12.1	23	89
Sex					
M	59	50.4			
F	58	49.6			
Side					
Right	64	54.70%			
Left	53	45.30%			
Ethnicity					
Caucasian	114	97.40%			
Hispanic	3	2.60%			

Table 2: Description of clinical characteristics of studied eyes.

	N	% / mean	Standard deviation	Min.	Max.
Glaucoma type					
Primary	101	88.00%			
Pigmentary	4	3.40%			
Pseudoexfoliative	1	0.90%			
Traumatic	5	4.30%			
Steroid-induced	4	3.40%			
Iridocorneal angle pigmentation					
Data missing	57				
0	2	3.30%			
1	10	16.70%			
2	35	58.30%			
3	10	16.70%			
4	3	5.00%			
Corneal thickness (µm)	85	540.8	43.6	410	643
No. of topical drugs prior to SLT	117	2.1	1.1	0	4
History of filtration surgery	10	8.50%			
IOP prior to SLT (mmHg)	116	20	5	11	42

Table 3: Technical characteristics of SLT treatment.

	N	%
Treated circumference		
Data missing	12	
180°	24	22.9
360°	81	77.1
Energy level used (mJ)		
Data missing	42	
0.8	2	2.7
1.1	1	1.3
1.2	41	54.7
1.3	9	12
1.5	16	21.3
2	6	8

Table 4: Mean pressure reduction at the two assessment points.			
	N assessed	**Mean reduction**	***p* - value**
Absolute in mmHg			
Between T1 and T0	100	4.35 (± 5.29)	< 0.0001
Between T2 and T0	87	3.74 (± 5.24)	< 0.0001
Relative as percentage of baseline IOP			
Between T1 and T0	100	20.6% (± 22.2)	< 0.0001
Between T2 and T0	87	16.7% (± 22.5)	< 0.0001
T1 = 1 year; T2 = 2 years.			

Table 5: Mean pressure reduction at 1 and 2 years, assessed based on reason for treatment.			
	N	**Mean reduction**	***p - value***
Absolute in mmHg			
Between T1 and T0			
Primary therapy	8	0.25	0.773
Poor eye drop tolerance/compliance	23	6	< 0.0001
Progression	69	4.28	< 0.0001
Between T2 and T0			
Primary therapy	8	0.25	0.844
Poor eye drop tolerance/compliance	19	5.11	0.0008
Progression	60	3.77	< 0.0001
Relative as percentage of baseline IOP			
Between T1 and T0			
Primary therapy	8	8.00%	0.727
Poor eye drop tolerance/compliance	23	28.10%	< 0.0001
Progression	69	20.40%	< 0.0001
Between T2 and T0			
Primary therapy	8	4.10%	0.906
Poor eye drop tolerance/compliance	19	21.70%	0.001
Progression	60	17.20%	< 0.0001
T1 = 1 year; T2 = 2 years.			

There was no evidence of a reduction in the number of pressure-lowering treatments used topically. The average number of drugs was 2.1 (± 1.1) prior to the SLT and 2.0 (± 1.1) at 1 year and 2 years.

Our multivariate analysis identified a significant link between the likelihood of SLT treatment success and high initial IOP, with an OR of 1.2 at 2 years (p = 0.0047), as well as age above the median (63 years), with an OR of 3.6 (p = 0.0320).

The bivariate and multivariate analysis of the impact of different clinical parameters on reduction in IOP at 1 year and 2 years found no statistically significant links for sex, ethnicity, corneal thickness, glaucoma type, iridocorneal angle pigmentation, number of topical treatments prior to SLT, reason for treatment, treated circumference or energy level used.

Only one minor adverse effect was found in our population: a reduction in visual acuity caused by pigment dispersion. This occurred immediately after the laser treatment and resolved spontaneously.

DISCUSSION

Selective laser trabeculoplasty is well known to effectively reduce intraocular pressure in the short term, but its efficacy remains difficult to assess over the longer term. In our population, we demonstrated its therapeutic efficacy in both the short and medium term. We found a mean reduction in IOP of 19.6% at 1 year and the trabeculoplasty success rate-defined as a reduction in IOP of at least 20% of the baseline value-was 49%. These figures are comparable to those of other similar study populations in the literature. The percentage reduction in IOP in the various prospective and retrospective studies assessing SLT efficacy at one year ranges from 16.9% to 31.6% of the baseline value [5]. Using the same definition of success, in patients not controlled by medical treatment. Sayin et al., found a one-year success rate of 64,5% [6], Hodge et al., recorded 60% [7], Kontic et al., report 64.58% [8] and Schlote et al., report 59.09% [9]. These success rates are slightly higher than that observed with our patients. This is partly due to the fact that we did not exclude from the study any patients at an advanced stage of the disease, particularly those with a history of filtration surgery.

It is now accepted that the effect of SLT diminishes over time. We therefore wanted to continue our analysis after two years of follow-up, in order to assess the durability of the treatment in the medium term in our patients. The treatment remained effective for a good length of time in our study, since the two-year success rate was 33.3% compared to rates of 11.1% to 41% in the literature [10,11]. The mean reduction in IOP at 2 years was 3.74 mmHg, corresponding to 16.7% of the baseline value. In a population of 269 patients, Best et al., found a reduction in IOP of 12.1% at 2 years [12].

Certain studies with a low number of subjects found that the treatment remained effective for up to 12 months after it was performed [13,14].

There is no consensus around the discontinuation of drug therapy after trabeculoplasty. Certain authors achieve a significant reduction in medical treatment, which can be explained by a different treatment protocol, characterised by a wash-out period prior to the SLT and the resumption of topical treatment on a case-by-case basis depending on the IOP measured at post-laser check-ups [10]. In our patient population, the number of topical treatments did not decrease significantly at one year and two years. Since the patients treated for glaucoma in our department are often difficult to stabilise, trabeculoplasty was used as an adjuvant treatment to medical treatment, which was systematically continued, unless intolerance or poor compliance were an issue.

Different clinical, therapeutic and technical factors have been suggested as predictors of the success of this treatment. We found a significant link between the IOP value prior to trabeculoplasty and the likelihood of treatment success, which corroborates the data in the literature [7] [15-19]. We also found a link between advanced age and SLT treatment success, which has again been described previously [19].

Certain epidemiological factors, such as African ethnicity, appear to have a positive impact on the efficacy of SLT, but were not found in our study, due to the demographic characteristics of our population [20].

In terms of therapeutic factors, the use of a prostaglandin prior to SLT appears to be a factor in weaker efficacy (18). This could be linked to a common mechanism of action within the Schlemm's canal epithelial cells [21]. The number of responders appears to be higher in patients who used none or few pressure-lowering drugs prior to treatment [22].

We did not find that the trabeculoplasty technical parameters had any significant impact on the efficacy of the treatment. At present, there is no consensus as to the appropriate circumference to be treated. The majority of authors find no significant differences in pressure reduction between 180° and 360° treatment [23,24]. However, higher energy pulses could potentially correlate with a higher success rate [19] [25]. Lee et al., place the optimal total treatment energy at 226.1 mJ [26]. Wong et al., estimate that pressure reduction is greater with 160 pulses over 360° than with 120 pulses over the same circumference [27].

This easy-to-use technique [28] is associated with few adverse effects. The most commonly cited adverse effect in the literature is an early IOP spike, generally transient, which affects between 2% and 26% of treated patients [29]. Other reported complications include uveitis, hyphema, macular oedema and corneal complications (haze, corneal oedema, transient reduction in endothelial density [30,31]. One case of bilateral choroidal effusion was recently reported [32]. In our population, we observed just one case of transient reduced visual acuity due to pigment dispersion.

Since several studies have shown that SLT is no worse than drug therapy, laser treatment is increasingly offered as primary therapy for newly diagnosed patients [33]. This avoids the adverse effects of eye drops and can improve patient quality of life [34], as well as saving money [35,36].

A randomised, multi-centre clinical trial including 718 patients is currently being conducted to establish whether SLT is superior to drug therapy in glaucoma patients who have yet to receive any treatment [37]. In our cohort, the pressure reduction was not statistically significant for patients treated with SLT as primary therapy, which can be explained by the very small number of patients in this subgroup.

SLT also tends to be particularly effective as a replacement therapy for effective topical treatment, even where this is well tolerated. De Keyser et al., managed to fully replace drug therapy 18 months after SLT in 77% of patients out of a cohort of 143 eyes with well controlled glaucoma [38]. Replacing effective drug therapy with SLT is particularly relevant in clinical situations where topical drugs can prove dangerous, such as during pregnancy: SLT has been shown to effectively control the disease during this period [39].

When performed alongside optimal medical treatment, SLT can delay the need for surgery as a result of uncontrolled glaucoma [8]. Sayin et al., achieved a 64.5% success rate in a cohort of patients whose glaucoma remained uncontrolled despite well-conducted optimal drug therapy [6]. SLT also appears to effectively reduce pressure in eyes that have undergone previous filtration surgery: Sharpe et al., found no differences in terms of 1-year success rate in eyes with and without a history of glaucoma surgery [40]. Our results corroborate this, with a success rate of 55.6% at 1 year and 57.1% at 2 years in the patient group with a history of filtration surgery.

Since the reduction in pressure achieved by SLT fades over time, several studies have attempted to assess the efficacy of a second SLT treatment. Several authors have found that the efficacy of the second treatment is lower than that of the first [41], while others have found no difference in efficacy between the two treatments [42]. In all cases, the second treatment does not appear to result in worse adverse effects.

Our study confirms the value of using this recent treatment to manage all types of glaucoma patients in an ophthalmology department-provided the iridocorneal angle offers sufficient access to the trabecular meshwork-regardless of the stage of the disease.

CONCLUSION

SLT is a safe and effective technique for reducing IOP. It can be used at any stage of the disease and fully merits its inclusion in the therapeutic options for chronic open-angle glaucoma. Among our patients, the success rate was 49% at 1 year and 33.3% at 2 years. Due to the depletion of the pressure-lowering effect over time, it would be valuable to study the change in IOP over the longer term and in a larger number of patients, as well as the efficacy of retreatment.

REFERENCES

1. Wise JB, Witter SL. Argon laser therapy for open-angle glaucoma. A pilot study. Arch Ophthalmol. 1979; 97: 319-322. https://goo.gl/m4QsBR
2. Latina MA, Park C. Selective targeting of trabecular meshwork cells: in vitro studies of pulsed and CW laser interactions. Exp Eye Res. 1995; 60: 359-371. https://goo.gl/KDgviS
3. Latina MA, Sibayan SA, Shin DH, Noecker RJ, Marcellino G. Q-switched 532-nm Nd:YAG laser trabeculoplasty (selective laser trabeculoplasty): a multicenter, pilot, clinical study. Ophthalmology. 1998; 105: 2082-2088; discussion 2089-2090. https://goo.gl/ot9J5t
4. Damji KF, Bovell AM, Hodge WG, Rock W, Shah K, Buhrmann R, et al. Selective laser trabeculoplasty versus argon laser trabeculoplasty: results from a 1-year randomised clinical trial. Br J Ophthalmol. 2006; 90: 1490-1494. https://goo.gl/KgecWd
5. Wong MOM, Lee JWY, Choy BNK, Chan JCH, Lai JSM. Systematic review and meta-analysis on the efficacy of selective laser trabeculoplasty in open-angle glaucoma. Surv Ophthalmol. 2015; 60: 36-50. https://goo.gl/E1F29o
6. Sayin N, Alkin Z, Ozkaya A, Demir A, Yazici AT, Bozkurt E, et al. Efficacy of selective laser trabeculoplasty in medically uncontrolled glaucoma. ISRN Ophthalmol. 2013; 2013: 975281. https://goo.gl/7Y1pMM
7. Hodge WG, Damji KF, Rock W, Buhrmann R, Bovell AM, Pan Y. Baseline IOP predicts selective laser trabeculoplasty success at 1 year post-treatment: results from a randomised clinical trial. Br J Ophthalmol. 2005; 89: 1157-1160. https://goo.gl/1C9FEL
8. Kontic M, Ristic D, Vukosavljevic M. Hypotensive effect of selective laser trabeculoplasty in patients with medically uncontrolled primary open-angle glaucoma. Srp Arh Celok Lek. oct 2014; 142: 524-528. https://goo.gl/3hb8eE
9. Schlote T, Kynigopoulos M. Selective Laser Trabeculoplasty (SLT): 1-year results in early and advanced open angle glaucoma. Int Ophthalmol. 2016; 36: 55-61. https://goo.gl/LWFGvy
10. Lee JW, Shum JJ, Chan JC, Lai JS. Two-year clinical results after selective laser trabeculoplasty for normal tension glaucoma. Medicine (Baltimore). 2015; 94: 984. https://goo.gl/97ukpr
11. Zaninetti M, Ravinet E. Two-year outcomes of selective laser trabeculoplasty in open-angle glaucoma and ocular hypertension. J Fr Ophtalmol. 2008; 31: 981-986. https://goo.gl/Cgpnhx
12. Best UP, Domack H, Schmidt V. Long-term results after selective laser trabeculoplasty -- a clinical study on 269 eyes. Klin Monatsbl Augenheilkd. 2005; 222: 326-331. https://goo.gl/YyppT5
13. Lai JS, Chua JK, Tham CC, Lam DS. Five-year follow up of selective laser trabeculoplasty in Chinese eyes. Clin Experiment Ophthalmol. 2004; 32: 368-372. https://goo.gl/T27nGf

14. Giocanti Auregan A, Abitbol O, Bensmail D, Bensaid A, Lachkar Y. Selective Laser Trabeculoplasty in the treatment of chronic open-angle glaucoma: retrospective analysis 12 years after treatment in a cohort of 28 patients. J Fr Ophtalmol. 2014; 37: 812-817. https://goo.gl/CWGwWf

15. Miki A, Kawashima R, Usui S, Matsushita K, Nishida K. Treatment outcomes and prognostic factors of selective laser trabeculoplasty for open-angle glaucoma receiving maximal-tolerable medical therapy. J Glaucoma. 2016; 25: 785-789. https://goo.gl/ppG3Z7

16. Pillunat KR, Spoerl E, Elfes G, Pillunat LE. Preoperative intraocular pressure as a predictor of selective laser trabeculoplasty efficacy. Acta Ophthalmol. 2016; 94: 692-696. https://goo.gl/PbwaBB

17. Lee JW, Liu CC, Chan JC, Wong RL, Wong IY, Lai JS. Predictors of success in selective laser trabeculoplasty for primary open angle glaucoma in Chinese. Clin Ophthalmol. 2014; 8: 1787-1791. https://goo.gl/QRL4cb

18. Bruen R, Lesk MR, Harasymowycz P. Baseline factors predictive of SLT response: a prospective study. J Ophthalmol. 2012; 2012: 642869. https://goo.gl/VHCBnH

19. Ayala M, Chen E. Predictive factors of success in Selective Laser Trabeculoplasty (SLT) treatment. Clin Ophthalmol. 2011; 5: 573-576. https://goo.gl/k2PNmc

20. Goosen E, Coleman K, Visser L, Sponsel WE. Racial differences in selective laser trabeculoplasty efficacy. J Curr Glaucoma Pract. 2017; 11: 22-27. https://goo.gl/qVwLRD

21. Alvarado JA, Iguchi R, Juster R, Chen JA, Shifera AS. From the bedside to the bench and back again: predicting and improving the outcomes of SLT glaucoma therapy. Trans Am Ophthalmol Soc. 2009; 107: 167-181. https://goo.gl/KLVuZf

22. Bonnel S, Fenolland JR, Marill AF, Gaillard R, Rosenberg R, Theillac V, et al. Selective laser trabeculoplasty: Effect of number of preoperative topical glaucoma medications on pressure lowering and success rate. J Fr Ophtalmol. 2017; 40: 22-28. https://goo.gl/u6QKMd

23. Goyal S, Beltran Agullo L, Rashid S, Shah SP, Nath R, Obi A, et al. Effect of primary selective laser trabeculoplasty on tonographic outflow facility: a randomised clinical trial. Br J Ophthalmol. 2010; 94: 1443-1447. https://goo.gl/5SXjnh

24. Nagar M, Ogunyomade A, O'Brart DP, Howes F, Marshall J. A randomised, prospective study comparing selective laser trabeculoplasty with latanoprost for the control of intraocular pressure in ocular hypertension and open angle glaucoma. Br J Ophthalmol. 2005; 89: 1413-1417. https://goo.gl/ySCJFL

25. Habib L, Lin J, Berezina T, Holland B, Fechtner RD, Khouri AS. Selective laser trabeculoplasty: Does energy dosage predict response? Oman J Ophthalmol. 2013; 6: 92-95. https://goo.gl/TaYMT6

26. Lee JW, Wong MO, Liu CC, Lai JS. Optimal selective laser trabeculoplasty energy for maximal intraocular pressure reduction in open-angle glaucoma. J Glaucoma. 2015; 24: 128-131. https://goo.gl/WUHde8

27. Wong C, Tao LW, Skalicky SE. A retrospective review comparing the safety and efficacy of 120 versus 160 applications of selective laser trabeculoplasty. J Glaucoma. 2018; 27: 94-99. https://goo.gl/Eg7M1E

28. Greninger DA, Lowry EA, Porco TC, Naseri A, Stamper RL, Han Y. Resident-performed selective laser trabeculoplasty in patients with open-angle glaucoma. JAMA Ophthalmol. 2014; 132: 403-408. https://goo.gl/i1T6S2

29. Zhou Y, Aref AA. A review of selective laser trabeculoplasty: recent findings and current perspectives. Ophthalmol Ther. 2017; 6: 19-32. https://goo.gl/7odTfF

30. Ornek N, Ornek K. Corneal endothelial changes following a single session of selective laser trabeculoplasty for pseudoexfoliative glaucoma. Int Ophthalmol. 2018; 38: 2327-2333. https://goo.gl/Wx1m7b

31. Song J. Complications of selective laser trabeculoplasty: a review. Clin Ophthalmol. 2016; 10: 137-143. https://goo.gl/Hf2ord

32. Hernández Pardines F, Molina Martín JC, Fernandez Montalvo L, Aguirre Balsalobre F. Bilateral choroidal effusion after selective laser trabeculoplasty. Arch Soc Espanola Oftalmol. 2017; 92: 295-298. https://goo.gl/YuHJFK

33. McIlraith I, Strasfeld M, Colev G, Hutnik CML. Selective laser trabeculoplasty as initial and adjunctive treatment for open-angle glaucoma. J Glaucoma. 2006; 15: 124-130. https://goo.gl/XSppEv

34. De Keyser M, De Belder M, De Groot V. Quality of life in glaucoma patients after selective laser trabeculoplasty. Int J Ophthalmol. 2017; 10: 742-748. https://goo.gl/92V5B5

35. Lee R, Hutnik CM. Projected cost comparison of selective laser trabeculoplasty versus glaucoma medication in the Ontario Health Insurance Plan. Can J Ophthalmol. 2006; 41: 449-456. https://goo.gl/Wzqhri

36. Seider MI, Keenan JD, Han Y. Cost of selective laser trabeculoplasty vs topical medications for glaucoma. Arch Ophthalmol. 2012; 130: 529-530. https://goo.gl/Yh7uYC

37. Gazzard G, Konstantakopoulou E, Garway Heath D, Barton K, Wormald R, Morris S, et al. Laser in Glaucoma and Ocular Hypertension (LiGHT) Trial. A multicentre, randomised controlled trial: design and methodology. Br J Ophthalmol. 2018; 102: 593-598. https://goo.gl/2kbCjj

38. De Keyser M, De Belder M, De Belder J, De Groot V. Selective laser trabeculoplasty as replacement therapy in medically controlled glaucoma patients. Acta Ophthalmol. 2018; 96: 577-581. https://goo.gl/Usz9zx

39. Vyborny P, Sicakova S, Florova Z, Sovakova I. Selective Laser Trabeculoplasty - Implication for Medicament Glaucoma Treatment Interruption in Pregnant and Breastfeeding Women. Cesk Slov Oftalmol. 2017; 73: 61-63. https://goo.gl/CBGvBB

40. Sharpe RA, Kammerdiener LL, Williams DB, Das SK, Nutaitis MJ. Efficacy of selective laser trabeculoplasty following incisional glaucoma surgery. Int J Ophthalmol. 2018; 11: 71-76. https://goo.gl/8zTP3i

41. Khouri AS, Lari HB, Berezina TL, Maltzman B, Fechtner RD. Long term efficacy of repeat selective laser trabeculoplasty. J Ophthalmic Vis Res. 2014; 9: 444-448. https://goo.gl/6xB1y6

42. Polat J, Grantham L, Mitchell K, Realini T. Repeatability of selective laser trabeculoplasty. Br J Ophthalmol. 2016; 100: 1437-1441. https://goo.gl/jp5o9u