

## AN ASSESSMENT OF THE EFFICACY OF SELECTIVE LASER TRABECULOPLASTY (SLT) IN OPEN-ANGLE GLAUCOMA PATIENTS: A CLINICAL STUDY.

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### ABSTRACT.

#### Introduction:

*Objectives:* The present study aims to assess the efficacy of selective laser trabeculoplasty (SLT) in reducing intraocular pressure (IOP) when used as the first-line or supplementary therapy for primary open-angle glaucoma (POAG) patients.

#### Methods:

In this study conducted over one year, 1820 patients visited the Regional Institute of Ophthalmology (RIO), IGIMS, Patna, Bihar, India for SLT, averaging about 35 patients per week. The sample was bifurcated into two groups: Group A (944 patients, 1888 eyes) received SLT in addition to their existing anti-glaucomatous medications (AGM), while Group B (876 patients, 1752 eyes) comprised newly diagnosed POAG patients, for whom SLT served as the primary treatment.

#### Results:

In this study, the overall cohort displayed an average baseline intraocular pressure of  $21.3 \pm 4.8$  mm of Hg, which decreased to  $15.5 \pm 2.6$  mm Hg post-SLT. The pressure reduction was 33.5 % in Group A and 41.5 % in Group B. In some cases, when treatment with SLT alone could not give the desired intraocular pressure, both groups turned to initiating or increasing AGM. Notably, 51.3% belonging to the first group and 64.3% belonging to the second group achieved target intraocular pressure with SLT alone, and after SLT, 71.5% of first group patients and 65.3% of second group patients no longer required glaucoma medication at the last visit.

#### Conclusion:

SLT proves effective as both a primary and additional therapy for open-angle glaucoma, significantly reducing medicine usage. The IOP reduction remains consistent in both primary and adjunctive treatment groups during a year of follow-up.

#### Recommendation:

Based on the results, it is recommended to integrate SLT into glaucoma treatment protocols, exploring its potential to reduce medication reliance, and promoting extended research for a more comprehensive assessment of SLT's long-term benefits.

**Keywords:** Glaucoma, Anti-glaucoma medication, Selective laser trabeculoplasty, Intraocular pressure

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### INTRODUCTION.

Glaucoma, a medical condition of the eye, is a prevalent cause of blindness characterized by the gradual degeneration of the optic nerve. Preserving vision relies on controlling intraocular pressure (IOP), achievable

through various methods like medications, laser therapy, and surgical procedures [1, 2]. As per reports, in 2010, over 60 million people were affected by glaucoma, resulting in bilateral blindness for 8.4 million individuals [3]. Projections suggest that by 2020, millions of people (approximately 79.6 million) worldwide will be

diagnosed with glaucoma, and the majority, approximately 74%, will have open-angle glaucoma (OAG) [4].

Laser therapy is a viable glaucoma treatment. One such method, trabeculoplasty using argon laser, has cons due to the potential disruption of the eye drainage system, making it a one-time procedure [5]. Contrastingly, selective laser trabeculoplasty (SLT) acts as a better alternative, by selectively targeting trabecular cells, particularly the pigmented ones, showing no harm to the meshwork's structure, using significantly less energy than argon laser trabeculoplasty [6-8]. This procedure can be performed more than once if needed preserves the meshwork's architecture in animal models, and can serve as an initial or adjunctive therapy for glaucoma patients [9, 10]. Multiple research works have demonstrated SLT's effectiveness in reducing IOP for glaucoma-afflicted individuals recently diagnosed with primary open-angle glaucoma (POAG) [10-12].

Although anti-glaucomatous medications (AGM) are widely used, they have drawbacks, including side effects, the need for ongoing use, and variable IOP control due to patient non-compliance. They can also negatively impact the success of glaucoma surgery and ocular surface health. In this context, SLT emerges as a favorable option for initial POAG treatment, offering the potential to reduce the reliance on drugs [13-16]. This therapy alongside medications assists in reducing the prescribed drugs in eyes under medical control and potentially delaying the necessity for surgery [17].

In this prospective study, we aimed to assess the safety and efficiency of selective laser trabeculoplasty as a primary or adjunctive treatment to lower intraocular pressure in POAG-affected patients.

## **MATERIALS AND METHODS.**

### **Study design.**

A clinical study.

### **Study setting.**

The study was conducted prospectively at the Regional Institute of Ophthalmology (RIO), Indira Gandhi Institute of Medical Sciences (IGIMS), Patna, Bihar, India, and involved a comparative analysis. The study was carried out from September 2022 to October 2023.

### **Participants.**

Around 1820 patients visited the clinic for SLT (approximately 35 patients per week). This patient cohort was bifurcated into two groups, of which Group A included individuals initially treated with AGM, and those showing non-compliance or difficulties with the drug dose were treated with SLT. In this group, laser therapy was employed as an adjunctive treatment (1888 eyes from 944 patients). The other group, group B, included patients who had recently been diagnosed with POAG and had not previously used glaucoma medications. In this group, laser therapy served as the primary treatment (1752 eyes from 876 patients).

### **Study size.**

This study involved analysis of outcomes from SLT procedures performed on 3640 eyes belonging to 1820 patients having primary open-angle glaucoma.

### **Inclusion criteria.**

Inclusion criteria encompassed individuals over the age of 18, a confirmed diagnosis of POAG, a clear angle view, and no history of prior SLT therapy.

### **Exclusion criteria.**

Exclusion criteria encompassed advanced defects in the visual area detected through computer-assisted perimetry, eye operation in the past year, prior glaucoma operation, perceivable associated glaucoma, use of steroids, or having a monoproctic status.

### **Bias.**

There was a chance that bias would arise when the study first started, but it was avoided by giving all participants identical information and hiding the group allocation from the nurses who collected the data.

### **Data collection.**

Each patient's data, including age, gender, intraocular pressure (IOP), a medicine used for glaucoma, the thickness of the central cornea measurement, assessment of the visual field, as well as specifics of the selective laser trabeculoplasty (SLT) procedure, were recorded in advance.

Before laser treatment, a thorough eye examination was conducted as part of the recruitment process, which

included Goldmann applanation tonometry for IOP assessment, gonioscopy, examination by slit lamp, and ophthalmoscopy to assess the cup/disc ratio and pallor. Multiple measurements of the IOP measurements were taken preoperatively within 3 weeks preceding the laser treatment, and the average of these measurements served as the baseline for the IOP.

### Selective Laser Trabeculoplasty procedure.

The procedures were performed by a single ophthalmologist in the hospital using a laser instrument, Selecta 7000 laser. This laser, with specific parameters, was delivered through a slit-lamp, and topical proparacaine provided anesthesia. Laser spots were applied to the entire trabecular meshwork. Patients did not receive any post-procedure medications. Follow-ups occurred at various intervals, measuring intraocular pressure with a tonometer and calculating the average intraocular change and % reduction from the baseline. No long-term adverse effects were observed.

### Statistical Analysis.

SPSS software, version 22.0 was used for carrying out the data analysis. Pre- and post-operative intraocular pressures were contrasted by paired-samples t-test, while the average IOP of both groups was contrasted via independent samples t-test. A p-value lesser than 0.05 was considered significant statistically. Descriptive statistic properties were applied for age, sex, central corneal thickness, and follow-up duration within each group. To evaluate gender differences, the Mann-Whitney U test was employed.

### Ethical considerations.

The study strictly adhered to ethical guidelines. The local ethics committee provided approval for data collection

and analysis. Informed consent was diligently obtained from all patients before each procedure, and the study was conducted according to the principles outlined in the Declaration of Helsinki.

### RESULTS.

The study included 1820 participants after following strict selection criteria. The mean age of the patients was 65.4 years, from 25 to 89 years. In Group A, the mean age was 63.8 years (37 to 89 years), and in Group B, it was 65.02 years (25 to 83 years). The baseline IOP for all patients averaged  $21.3 \pm 4.5$  mm of Hg, ranging from 10 to 35 mm of Hg. Post-SLT, the average IOP for the entire cohort was identified to be  $15.5 \pm 2.6$  mm of Hg, within 8 to 22 mm of Hg. This reduction in average IOP post-SLT was significant ( $p < 0.001$ ), alongside an average percentage reduction of 33.5%.

The comparison of average pressure within the eyes between both groups revealed that Group A, involving adjunctive treatment with AGM, had a mean baseline IOP of 21.8 mm of Hg (lying between 10 to 34 mm of Hg), while Group B, with primary treatment and no prior medication use, had a corresponding value of 24.8 mm Hg (ranging from 14 to 35 mm of Hg). Notably, the baseline intraocular pressure did not differ significantly among these two cohorts.

Following SLT, the mean post-treatment IOP was measured as 14 mm of Hg (lying between 10 to 22 mm of Hg) for Group A, while it was 13.2 mm of Hg (lying between 8 to 21 mm of Hg) for Group B. These values of the 2 cohorts also did not indicate any difference of significance. However, reduction in average intraocular pressure post selective laser trabeculoplasty was statistically significant in both groups at the last medical check-in ( $p < 0.001$ ), with average % reduction being 33.5 % and 41.5 % in the first and second groups, respectively (Table 1).

**Table 1: IOP measurements in the two SLT cohorts along with their characteristics.**

Factors	Group-A	Group-B	P -value
	(n = 944)	(n = 876)	
Number of surgically operated eyes	1888	1752	
Age (yrs)	$63.8 \pm 11.6$	$65.02 \pm 12.8$	0.78
Sex (women/men)	427/517	449/427	0.37
CCT pre-SLT ( $\mu\text{m}$ )	$522.8 \pm 36.1$	$511.3 \pm 39.8$	0.09
Pre-operative SLT IOP (mm Hg)	$21.8 \pm 5.2$	$24.8 \pm 4.4$	0.31

Post-operative SLT IOP (mm Hg)	14.0 ± 2.6	13.2 ± 2.8	0.36
Follow-up period (in weeks)	50.09 ± 9.1	49.5 ± 7.2	0.64

In cases where the target IOP was not achieved through SLT, both groups initiated or increased AGM usage. Analyzing the patient outcomes of Group A, revealed 51.3% of patients reached the target intraocular pressure with SLT alone, while in the second group (group B), this

rate was 64.3% of the patient population. Following SLT, 71.5% of Group A patients and 65.3% of Group B patients did not require glaucoma medication at the last visit (Table 2).

**Table 2: Distribution of patients with successful reduction in IOP by SLT alone and in combination with other treatments.**

	Group A, n (percent)	Group B, n (percent)	Total, n (percent)
Target IOP with treatment using SLT only	968 (51.3)	1126 (64.3)	2094 (57.5)
Target IOP with treatment using SLT and adjuvant therapy	1801 (95.4)	1627 (92.9)	3428 (94.1)
Failure to reach the desired IOP	86 (3.6)	91(5.2)	177 (4.8)

## DISCUSSION.

The study results demonstrate the efficacy of SLT in mitigating intraocular pressure, whether as a primary therapy or in conjunction with AGM for patients with POAG. In this, the initial IOP, with a mean of 21.3 mm of Hg, was significantly reduced to a final intraocular pressure measurement of 15.5 mm Hg, representing a 37% reduction. Notably, no noticeable differences between the 2 groups about the average percentage of intraocular pressure reduction were observed. Importantly, SLT demonstrates consistent efficacy whether used as a primary therapy or in conjunction with antiglaucoma medication, with no significant differences in the percentage of intraocular pressure reduction observed between the two groups. These findings highlight SLT's effectiveness in managing POAG and its potential as a valuable treatment option.

In the study performed by Latina et al. [18], a 70 % efficacy rate in their study of 101 patients, with 3 mm of Hg (20 percent) or > IOP lowering, and no supplementary medicines were required six months post-SLT. Gračner [19], also applied the SLT therapy to treat fifty eyes and achieved a 22.5% reduction from an average pre-treatment intraocular pressure of 22.48 mm of Hg after six months. In a separate study involving POAG patients

uncontrolled by prescription medicines, an average intraocular pressure lessening of 15.8% at nine months and 16.6% at twelve months after SLT was reported [20]. In this present investigation, SLT as an additional therapy in the first group resulted in a 33.5% IOP decrease after an average follow-up of 50.09±9.1 weeks. This aligns with previous research [18, 19]. Importantly, the study found that SLT alone achieved the set intraocular pressure in 51.3 % of the surgically operated eyes, and when combined with AGM, success was achieved in 95.4% of these surgically operated eyes. Based on these findings, it is proven that SLT can successfully reduce the drug burden in glaucoma treated by prescription medicines, or serve as an additional therapy for medicines, possibly leading to reduced use of medicines in such patients.

Multiple studies have hinted that SLT can be used as a first-line therapeutic option for POAG [16-20]. Melamed reported an 89% success rate in eyes surgically treated using SLT as the primary/first-line therapy, alongside 30 % intraocular pressure reduction 18 months after treatment [12]. Similarly, McIlraith et al. showed that SLT in addition to latanoprost had comparable intraocular pressure lowering results in the newly diagnosed POAG cases [21]. In the current study, the average percentage lowering in intraocular pressure after treatment with SLT was higher (41.5%), which may be due in part to our

inclusion of non-complicated POAG cases since our clinic primarily handles such cases.

Moreover, the present study demonstrates that using SLT as the first-line treatment (Group B) achieved a high success rate of 65.3% during an average follow-up of 49.5±7.2 weeks. This success included reaching the desired intraocular pressure using SLT alone in 64.3 % of the patient cohort, while SLT in combination with additional AGT achieved success in 92.9 % of the cohort. These results suggest that using SLT as the initial treatment option for patients was successful in a substantial proportion of cases, either as a standalone therapy or when used in combination with AGT. This underscores the effectiveness of SLT in managing intraocular pressure and highlights its potential as a primary choice for glaucoma treatment, particularly for those patients who respond well to this approach.

### **GENERALIZABILITY.**

Our findings highlight the generalizability of Selective Laser Trabeculoplasty (SLT) as an effective treatment for reducing intraocular pressure (IOP) in various glaucoma cases. The consistent and substantial IOP reduction observed in our study underscores SLT's potential to alleviate medication burdens and enhance glaucoma management in a broad patient population. These results suggest that SLT can be a valuable approach for improving glaucoma care beyond the specific patient cohort studied.

### **CONCLUSION.**

In the current study focused on evaluating the efficiency of SLT in patients with open-angle glaucoma, SLT is identified to be an excellent option for patients who struggle with medication tolerance or compliance, both as a primary treatment and as an additional support to medication. Factors such as compliance with drug regimens, medication-related adverse effects, and associated financial expenditure are carefully weighed in these conditions. The results of our study demonstrate SLT's effectiveness as a primary treatment protocol for reducing IOP with minimal adverse effects, to reduce the burden of medicines in glaucoma patients. Additionally, it can potentially avert the need for glaucoma surgery in cases where the highest medical treatment falls short. SLT is a straightforward procedure with a strong safety record and high patient tolerance.

### **LIMITATIONS.**

The study had limitations, including a short follow-up duration and potential selection bias, given that the patient population primarily consisted of early and newly diagnosed glaucoma cases at a primary glaucoma center. Additionally, using the data collected by considering the two eyes from one individual is one of this study's constraints due to challenges in randomization in smaller clinical trials.

### **RECOMMENDATIONS.**

The study recommends the integration of Selective Laser Trabeculoplasty (SLT) into open-angle glaucoma treatment protocols, offering a primary or supplementary approach for patients facing medication challenges. SLT can effectively reduce the reliance on glaucoma medications, potentially averting the need for surgery. With its straightforward procedure and high patient tolerance, SLT presents a safe and valuable option for enhancing glaucoma management.

### **LIST OF ABBREVIATIONS.**

SLT - Selective Laser Trabeculoplasty  
IOP – Intraocular Pressure  
RIO – Regional Institute of Ophthalmology  
AGM – Anti-glaucomatous Medication  
POAG - Primary Open Angle Glaucoma

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### **CONFLICT OF INTEREST.**

No conflict of interest is declared in this study.

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