ORIGINAL ARTICLE

Comparison of Intraocular Pressure Reduction of Initial and Adjunct Selective Laser Trabeculoplasty for Primary Open Angle Glaucoma in Nigerians

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ABSTRACT

Objective: The objective was to compare the intraocular pressure (IOP) lowering effect of selective laser trabeculoplasty (SLT) as initial and adjunct therapy in primary open angle glaucoma (POAG). **Subjects and Methods:** Retrospective chart review of POAG patients who had SLT either as initial or adjunct therapy over a period of 1-year. Each patient had SLT done in 360° of the anterior chamber angle. IOP measurement with the Goldmann applanation tonometer was done at baseline, 60 min post procedure, days 1, 7, 30, 90, and 180. **Results:** Mean baseline IOP was 15.4 ± 3.5 mmHg and 17.5 ± 5.5 mmHg for initial and adjunct, respectively (P = 0.153); not significant. Mean IOP at 90 days was 10.5 ± 1.8 mmHg and 16.2 ± 6.3 mmHg for initial and adjunct, respectively (P = 0.013); statistically significant. Records at 180 days revealed mean IOP of 14.1 ± 3.9 mmHg and 15.7 ± 7.7 mmHg (P = 0.465) for initial and adjunct, respectively; not significant. The maximal mean IOP reduction in both groups was at 7 days. 70% of patients in the initial had IOP reduction of >20% compared to 63.5% of adjuncts throughout the study period. Initial sustained mean reduction of ≥3 mmHg from day 1 to 90, while the adjunct was till day 30. **Conclusion:** Initial SLT showed a sustained reduction in IOP, compared to adjunct with marginally lower measurements.

Keywords: Adjunct, initial, primary open angle glaucoma, selective laser trabeculoplasty

INTRODUCTION

The glaucomas are a diverse group of disorders that cause a characteristic optic neuropathy, resulting in loss of neuroretinal rim tissue, distinctive optic nerve head cupping, and visual field loss.[1]

Globally, glaucoma is presently the leading cause of irreversible blindness worldwide with a projected estimate of 79.6 million cases by the year 2020.[2] In Nigeria, glaucoma is the leading cause of irreversible blindness,[3] blindness prevalence rate is 0.7%.[4] It is also the most common cause of low vision in adults over 40 years (26.5%) in Nigeria.[4]

Primary open-angle glaucoma (POAG) is the most common type of glaucoma, with its highest prevalence in Africans.[5]

Intraocular pressure (IOP) is a modifiable risk factor for glaucoma. Reduction of IOP, through medical, surgical, and laser treatment modalities, remains the mainstay of therapy for the disease.[6] The choice of modality is dependent on several factors. The treatment regimen that lowers IOP below a level that is likely to produce further damage to the nerve with the lowest risk, fewest adverse effects, and least disruption of the patient's life, taking into account the cost implications of treatment, should be the one employed.[7]

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First line treatment of POAG has commonly been medical, with surgical and laser therapy undertaken only if medical treatment fails or is not well tolerated. However, the use of medical therapy can be associated with adverse effects, might not be cost-effective and may be associated with a significant disruption in lifestyle. Studies have also shown poor compliance and adherence to medical therapy to be common, ranging from 5% to 80% among glaucoma patients.[8,9]

A wide range of surgical therapeutic options are available for glaucoma treatment and vary from trabeculectomy to the adjunctive use of antifibrotics, tubes and shunts, to more recently, minimally invasive surgical procedures.[10,11] Evidence from the collaborative initial glaucoma treatment study has shown that initial surgical therapy achieved better IOP control than does initial medical therapy in the treatment of POAG. However, this did not translate into better visual field stabilization, and there was a higher risk of cataract development in the long-term.[12]

Based on this study and current practice, most clinicians defer filtration surgery as secondary therapy for POAG, after the failure of medical therapy. However, surgical uptake in the management of POAG in Africa and Nigeria is reportedly poor.[13-15] The uptake in Nigerians has been shown in clinical studies to range from as low as 8%[16] to 32%.[15]

Selective laser trabeculoplasty (SLT), a procedure in which the trabecular meshwork is targeted using frequency-doubled, Q-switched neodymium yttrium aluminum garnet laser at a spot size of 400 nm. This prompts the release of cytokines, which bind with the Schlemm's canal endothelial cells, compromising the barrier, increasing aqueous outflow and thus causing a reduction in IOP.[17,18] This treatment modality was developed after the argon laser trabeculoplasty and studies have shown it has many advantages over the former.[19]

Initially, laser trabeculoplasty was a secondary treatment option for POAG patients who refused surgical therapy, had previous surgical failures or were poor surgical candidates. However, at present, open angle glaucoma patients are being offered laser therapy earlier in the therapeutic sequence. This was necessitated by the typically high incidence of ocular surface disease in glaucoma patient population, aggravated with increasing age and increasingly severe with topical medication administration.

Majority of the drops are preserved in benzalkonium chloride, which predisposes or even aggravates ocular surface disorders. A means of reducing exposure to benzalkonium chloride is by substituting some of the medication with SLT or even administering SLT as primary therapy.

Selective laser trabeculoplasty offers other advantages as a treatment modality in terms of compliance, cost savings, efficacy, safety, less side-effects, and simplicity of the technique.[20]

In the course of our practice, there was the question of whether SLT should be offered earlier in the therapeutic sequence for patients with POAG, with the problem of ocular surface disease associated with the use of topical medication. The study was thus conceptualized to improve knowledge in this area.

The aim of this study was to determine the outcome of IOP reduction by SLT as initial therapy and when initiated as adjunctive therapy in the treatment of POAG.

The study objectives were to determine the IOP lowering effectiveness of SLT when used as initial therapy, as adjunct therapy and to compare both parameters over a period of 3 months.

SUBJECTS AND METHODS

The study was a retrospective chart review of patients treated with SLT from June 2011 to June 2012 at the glaucoma clinic of the hospital.

Eighty-nine eyes of 54 subjects were included in the study. Inclusion criteria were newly diagnosed POAG patients who had SLT as their initial therapy and patients with uncontrolled IOP who had SLT as adjunctive therapy.

Information recorded included the age, sex, number of preoperative medications, class of preoperative medications, and preoperative (baseline) IOP. The SLT protocol consisted of 100 applications in 360° of the anterior chamber angle with 25 spots per quadrant and energy level of 0.8–1.2 mJ. Patients were pretreated with a drop of Gutt Brimonidine (Alphagan®) 0.2%. All patients were treated by the same ophthalmologist. Patients were placed on Gutt Diclofenac (Voltaren ophtha®) 8 hourly for 3 days post-SLT. IOPs were measured postoperatively at 1 h, 1 week, 1 month, 3 months, and 6 months using the Goldmann applanation tonometer. The number and class of postoperative medications were also recorded.

The main outcome measure was the IOP reduction at the various time points. Success was defined as mean

IOP reduction of ≥3 mmHg or percentage IOP reduction of ≥20%.

The information obtained was analyzed and tabulated using the Statistical Package for Social Sciences version 16 software (SPSS Inc, Chicago IL, USA). The unpaired *t*-test was used for comparison of the means with $P < 0.05$ considered as significant. Data were presented in tables and graphs.

RESULTS

Demographics

A total of 89 eyes were reviewed of which 50.6% (45) were males and 49.4% (44) were females. The mean age was 50.4 ± 16.1 years (range, 22–82 years). 14.6% (13) were in the initial SLT group while 85.4%, (76) were in the adjunctive group. The mean age was 30.2 ± 9.4 years in the initial SLT group and 53.8 ± 14.4 years in the adjunctive SLT group [Table 1].

Changes in intraocular pressure

Pre-SLT treatment, the mean IOP was 15.4 ± 3.5 mmHg in the initial group and 17.5 ± 5.5 mmHg in the adjunctive group. There was no statistically significant difference in the mean IOP of the two groups at baseline ($P = 0.153$).

At 24 h post-SLT treatment, the IOP had significantly dropped in both groups to 11.9 ± 5.1 mmHg in the initial group and 13.1 ± 9.4 mmHg in the adjunctive group.

However, there was no statistical difference in the IOP in both groups ($P = 0.449$). At 1-month post therapy, the mean IOP in the initial group was 11.7 ± 2.5 mmHg in the primary group and 13.6 ± 9 mmHg in the adjunctive group. The IOP recorded in both groups were not statistically different ($P = 0.166$).

At 3 months post-therapy, the mean IOP in the initial group (10.5 ± 1.8 mmHg) was significantly lower than the adjunctive group (16.2 ± 6.3 mmHg), ($P = 0.013$). At 6 months post-SLT therapy, the mean IOP in the primary group (14.1 ± 3.9 mmHg) was not statistically different from that of the adjunctive group (15.7 ± 7.7 mmHg), ($P = 0.465$) [Table 2 and Figure 1].

Intraocular pressure reduction

The initial SLT group achieved a mean IOP reduction of ≥ 3 mmHg from day 1 to 3 months post-SLT treatment. In the adjunctive SLT group; a mean IOP drop of ≥ 3 mmHg was noted from the immediate post-SLT to 1-month post-SLT [Table 3 and Figure 2].

The mean percentage IOP reduction was > 20% from day 1 to 3 months post-SLT in the initial group. The adjunctive group had a mean IOP reduction > 20% from immediate post-SLT to 1-month post treatment.

The maximal mean IOP reduction in both groups was achieved at 1-week post-SLT treatment [Table 4 and Figure 3].

About 70% of patients in the initial SLT group had achieved IOP reduction of at least 20% during the duration of the study compared with 63.5% of patients in the adjunctive group achieving the same result.

DISCUSSION

Selective laser trabeculoplasty is an acceptable treatment modality for POAG , either as initial or adjunctive therapy. To the best of our knowledge, this

Table 1: Demographics

	Initial SLT	Adjunctive SLT
Age (mean age±SD)	30.2±9.4 years	53.8±14.4 years

SD: Standard deviation, SLT: Selective laser trabeculoplasty

Table 2: Mean IOP changes with time, values in mmHg

	Initial SLT	Adjunctive SLT
Baseline	15.4	17.5
Immediate postoperative	13.1	14.5
1st day postoperative	11.9	13.1
1 week postoperative	11.5	12.8
1 month postoperative	11.7	13.6
3 months postoperative	10.5	16.2
6 months postoperative	14.1	15.7

IOP: Intraocular pressure, SLT: Selective laser trabeculoplasty

Table 3: Mean IOP drop, values in mmHg

	Initial SLT	Adjunctive SLT
Day 0	2.7	3.2
Day 1	3.3	3.7
Day 7	3.9	4.3
Day 30	3.6	4.3
Day 90	3.5	1.9
Day 180	2.8	2.7

IOP: Intraocular pressure, SLT: Selective laser trabeculoplasty

Table 4: Percentage IOP reduction, values in percentage

	Initial SLT	Adjunctive SLT
Day 0	17.5	18.7
Day 1	21.4	21.6
Day 7	25.3	25.1
Day 30	23.3	25.1
Day 90	22.7	11.1
Day180	18.2	15.8

IOP: Intraocular pressure, SLT: Selective laser trabeculoplasty

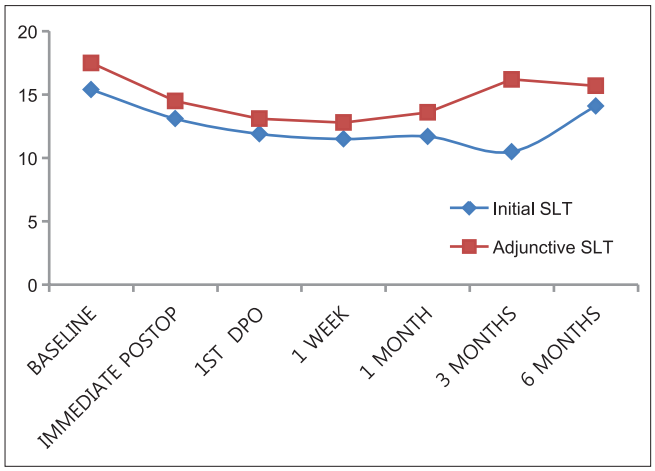

Figure 1: Mean intraocular pressure changes with time

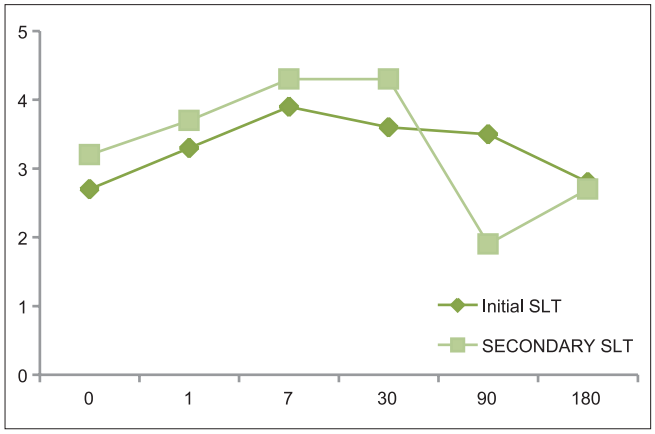

Figure 2: Mean intraocular pressure drop

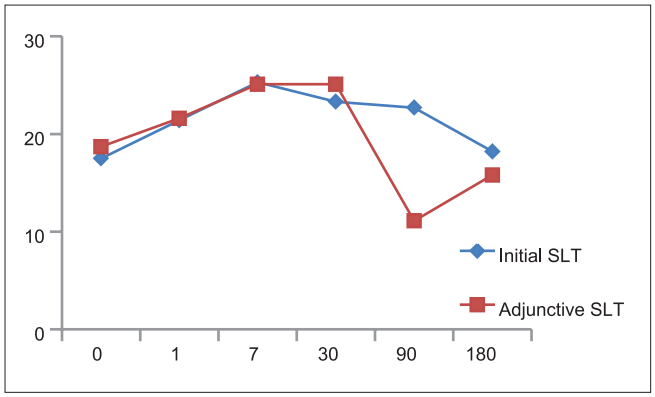

Figure 3: Percentage intraocular pressure reduction

is the first study to compare the outcome of SLT, in IOP reduction, as primary and adjunctive therapy.

The study showed that SLT was effective in IOP reduction from baseline in both the primary and adjunctive groups. Both groups achieved the target success of reduction in IOP by 20% or 3 mmHg by the 1st day post-SLT and had attained a maximal reduction by 1-week post-SLT.

The mean IOP post-SLT therapy, in both groups, was consistently lower than the baseline mean IOP throughout the period of the study.

Abdelrahman and Eltanamly[21] in a study in African patients found that 70% of patients that received SLT as initial and adjunctive therapy achieved an IOP reduction of 20% or more and that IOP had a tendency to rise after SLT. These findings were similar to those of our study. McIlraith *et al*.[22] found that SLT was equally effective as initial and adjunctive therapy.

However, a study by Golez *et al*.[23] showed that the mean duration of effectiveness of SLT was longer in the initial group This is similar with the trend in our findings, in which there was an initial similar reduction in IOP in the two groups, which was sustained for a longer duration in the primary group. However, other studies have shown the equal efficacy of SLT as initial or adjunctive therapy.[22,24,25] The trend observed in our study may be due to the short duration of follow-up as well poor compliance to topical medication in the adjunctive group.

The treatment modality met the success criteria (mean IOP reduction of ≥3 mmHg or >20% IOP drop from baseline) from 1st day post-SLT to day 90 in the initial group and from day 0 to day 30 in the adjunctive group. Other studies have shown a higher, longer sustained percentage reduction of IOP from baseline.[21,22,26] This may be due to a lower baseline IOP in our study. Higher baseline IOP has been shown to have higher IOP reduction.[27-29]

The limitations of this study were the retrospective nature, which resulted in the disproportionate number in the two groups and the short duration of follow-up.

CONCLUSION

This study shows that SLT is effective in lowering IOP, both as initial and adjunctive therapy. The IOP lowering effect seems to be greater and longer lasting as primary therapy. Retreatment may be needed in both groups. A prospective and larger study with a longer duration of follow-up is being recommended among Nigerian patients.

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