

Efficacy of Microwave Pulse Diode Laser and Argon Laser Trabeculoplasty in Patients with Primary Open Angle Glaucoma

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ABSTRACT

Purpose: To compare the efficacy of the microwave pulse diode laser and argon laser trabeculoplasty in primary open angle glaucoma.

Study Design: Quasi experimental study.

Place and Duration of Study: Shaheed Mohtarma Benazir Bhutto Medical College Lyari and Sindh Government Lyari General Hospital, Karachi, from October, 2017 to March, 2018.

Material and Methods: One hundred and sixty patients, between 42 to 61 years with visual acuity of perception of light to 6/36 were enrolled. Patients diagnosed with POAG were included and patients with intraocular pressure of more than 40 mm Hg, previous glaucoma surgery or laser treatment and narrow angle on gonioscopy were excluded. Ophthalmic examination included visual acuity, slit lamp examination, fundus examination and visual field status using Humphrey perimeter. Patients were divided into two groups. Group A received microwave pulse diode laser (810) and Group B received argon laser trabeculoplasty. Average follow up period was 6 months. Success was assessed objectively by measuring intra ocular pressure and subjectively by visual acuity.

Results: The average time-period for each procedure was 15 ± 5 minutes. In Group A, mean IOP at first week, first month, third month and sixth month was 20.79, 16.34, 16.21 and 16.09 mm Hg respectively. While in Group B, IOP at first week, first, third and sixth month was 16.52, 15.76, 13.62, and 12.54 mm Hg at ($P < 0.001$ in both groups).

Conclusion: Both microwave pulse diode laser and argon laser trabeculoplasty are effective in lowering intra ocular pressures in patients with primary open angle glaucoma.

Key Words: Open angle glaucoma, Argon laser trabeculoplasty, Diode laser trabeculoplasty, Intra ocular pressure (IOP).

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INTRODUCTION

Glaucoma is the second most common cause of

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blindness in the world, while it is 3rd most common blinding disease in Pakistan¹⁻². According to WHO program of blindness, 16% of total blindness for year 2020 will be from glaucoma³. Glaucoma affects an estimated 67 million people, most of them are not aware of the disease⁴. Glaucoma is a threatening eye disorder in which the permanent optic nerve damage may occur and results in visual field loss⁵. Early therapeutic intervention is pivotal for stopping

complete blindness. Glaucoma is diagnosed on the basis of intra ocular pressure, visual field testing and optic nerve appearance on ophthalmoscopy. In glaucoma, retinal ganglions cells axons are lost causing thinning or atrophy of retinal nerve fiber layer in superior and inferior arcuate bundles with exposed smaller retinal vessels. Primary Open Angle Glaucoma (POAG) accounts for about 50% of glaucoma blindness⁶. The first line of treatment for glaucoma is medical therapy in the form of eye drops⁷. Several anti glaucoma medications are effective in lowering the IOP and thus preventing the optic nerve damage. Failure of medical treatment leads to interventional laser trabeculoplasty or trabeculectomy⁸.

Over the years, ophthalmologists are trying to achieve an ideal treatment for glaucoma and the role of microwave pulse diode laser trabeculoplasty (MDLT) and Argon laser trabeculoplasty (ALT) in management of POAG. It is a procedure in which tiny holes are created in trabecular meshwork with the help of laser thereby which improves the facility of out flow. Both argon and microwave pulse diode lasers have been used for this purpose. It is reported that ALT success rate is 90%⁹. A study regarding MDLT has shown success rate to be 75%¹⁰.

Purpose of our study was to compare the efficacy of ALT and MDLT in a tertiary care hospital of Pakistan.

MATERIAL AND METHODS

The study was conducted at Shaheed Mohtarma Benazir Bhutto Medical College Lyari and Sindh Government Lyari General Hospital, Karachi for duration of six months from October, 2017 to March, 2018. The study was approved from institutional review committee. One hundred and sixty patients were selected from glaucoma clinic. Patients diagnosed with POAG, both gender and age > 40 years and < 70 years were included. Patients with Intraocular pressure of more than 40 mm Hg, previous glaucoma surgery or laser treatment and narrow angle on gonioscopy were excluded from the study. Patients were divided into two groups. Group A was treated with microwave pulse diode laser while Group B was treated with Argon laser. The data regarding reduction in IOP < 21 mm Hg and efficacy were entered in already designed Proforma. All patients were evaluated by taking thorough history and examination. General physical examination was carried out in all

patients. Ophthalmic examination included, record of visual acuity, slit lamp examination of the anterior segment, Fundus examination with slit lamp using +90 D lens to assess neuroretinal rim, CD ratio, vascular status and macula. Visual field status was analyzed using Humphrey perimeter.

The procedure was explained to all the patients with its benefits and complications. Informed written consent was taken. IOP was measured before the procedure. The patients were seated comfortably. Topical Proparacaine 0.5% eye drops were instilled in the eye to be treated. Ritch trabeculoplasty lens was filled with hydroxy propyl methyl cellulose and applied. Alcon Ophthalmus 532 Eyelite frequency doubled Nd-yag laser Photocoagulator was used. The aiming beam was focused at the junction of pigmented and non pigmented trabeculum. The ideal reaction was transient blanching or the appearance of a minute gas bubble at the point of impact. Forty to sixty burns were applied at regularly spaced interval. Single drop of topical diclofenac sodium 0.1% was instilled into the eye after procedure. IOP was checked 3 hours after the procedure. All patients were prescribed diclofenac sodium 0.1% eye drops 4 times a day for 5 days to control inflammatory response.

All patients were followed up regularly at 1 week, 4 weeks and 6 months after the procedure. At each visit, IOP was measured, gonioscopy was done and fundus examination was performed with slit lamp using 90 D lens. The final outcome was monitored at 6 months. The treatment was labeled successful if IOP was < 21 mm Hg at 6th month. Cases failed to reduce to that level were labeled failed and were treated with either additional laser application sessions or anti-glaucoma drugs.

RESULTS

Male to female ratio was 2:1. Mean age of the patients was 55.69 years (range 41 – 69 years). Table 1 shows the distribution of patients by gender and age group in each intervention group. According to sample size, 80 eyes of 73 patients were examined and treated in the Group A with Microwave pulse diode laser (810). There were 57 (71.3%) males and 23 (28.8%) females in this group. The mean age of the patients in this group was 55.8 years (Range 42 – 69). The mean pre-

treatment IOP of 80 eyes (of 73 patients) was 31.8 ± 5.32 mm Hg. The mean IOP was 19.24 ± 4.9 mm Hg at 6 months postoperatively.

Group B was treated with Argon laser trabeculoplasty. There were 56 (70%) males and 24 (30%) females in this group. The mean age of patients was 55.56 years (range 41 – 69 Years). Mean pre-treatment IOP of 80 eyes (of 77 patients) was 30.6 ± 5.32 mm Hg. There was mean drop of IOP to 17.63 ± 4.6 mm Hg at 6 months postoperatively. Table 2 gives a comparison of the mean IOP before and after intervention in the two groups.

DISCUSSION

Primary argon laser trabeculoplasty has a definite role in the management of Primary Open Angle Glaucoma. It is useful in decreasing the number of medications and delays the surgical intervention¹¹. The other major advantage of argon laser trabeculoplasty in addition to intraocular pressure reduction is to reduce the spikes of the diurnal variation of intraocular pressure. Laser therapy causes shrinkage of trabecular beams and necrosis of cells resulting in widening of spaces¹². The mechanism of action of both procedures are comparable¹³.

In our study, argon laser trabeculoplasty as a primary therapy was useful in controlling the intra ocular pressure in 90% of patients after 6 months follow up. It caused mean reduction of intra ocular pressure measuring at 12.5 mm Hg at the final follow up. Agarwal⁹ in a study done in Indian population, reported a success rate of 90% at 6 months.

Odberg and Saduik¹⁴ reported from Norway that there was mean reduction in IOP of 8.8 mm Hg at 1 month after primary argon laser trabeculoplasty therapy with success rate without medication of 77% after 2 years, 67% after 5 years and 67% after 8 years. Our study showed mean reduction of IOP after six months to be 12.54 mm Hg.

Another report from India found the effect of argon laser trabeculoplasty in Indian eyes which were not controlled on maximum medical treatment¹⁵. There were 93% patients who were controlled at 3 months

Table 1: Gender Distribution in Each Group According to Age Group (n= 160, 80 in each group).

Age (Years)	Group A (n = 80)			Group B (n = 80)			Total No. of Eyes
	Male	Female	Total	Male	Female	Total	
41 – 50	18	11	29	16	08	24	55
51 – 60	25	10	35	31	09	40	56
61 – 70	12	04	16	10	06	16	49
Total	55	25	80	57	23	80	160

Table 2: Comparison of Pre Treatment and Post Treatment (After 6 Months) Intra Ocular Pressure (IOP).

	Diode Laser (Group A) Mean \pm SD mmHg (n = 80)	Argon Laser (Group B) Mean \pm SD mmHg (n = 80)
Pre-Treatment IOP	31.79 ± 5.38	30.66 ± 4.63
Post Treatment IOP (Six Months After Treatment)	19.24 ± 4.99 (P < 0.001)	17.63 ± 3.65 (P < 0.001)

and 72.7% at 1 year, but only 9.2% were controlled at the end of 4 years.

Ingvaldstad et al¹⁶ and colleagues presented a study at the 2005 ARVO meeting. They showed the results of ALT and MDLT during a three-month follow-up. They noticed similar reduction in IOP with these two procedures. There was 18.9% decrease with ALT and 18.3% with MDLT.

Diode laser produces histological changes comparable to the argon laser, and early clinical trials have shown it to be an effective instrument for performing photocoagulation of the trabecular meshwork but in current study we did not compare such changes in both groups. The similarity of lesions produced by current laser modalities, and the advantages of diode lasers regarding their portability and reliability, certainly will stimulate further interest in their therapeutic potential for the treatment of glaucoma.

We found from our study that LT yields excellent results in controlling rise in IOP. LT has its own advantages. The overlying conjunctiva does not require breaching as in trabeculectomy surgery therefore it is painless and does not cause bleeding. The risk of infection and conjunctival scarring are minimized and strict aseptic techniques are not required. Topical antibiotics or corticosteroid are not required after laser trabeculoplasty.

The disadvantages encountered with laser trabeculoplasty are that it causes iritis, transient rise in IOP and peripheral anterior synechiae. We used

topical NSAIDS to all our patients for a period of 1 week to help relieve the mild discomfort and inflammation induced by laser.

Age selection in our study was between 51 – 60 years with an average of 53 years. Other studies showed a similar age group selection¹⁴⁻¹⁶.

A study was published in American Journal of Ophthalmology¹⁷ which showed that the diode laser patients had mean intraocular pressure of 21.6 ± 2.0 mm Hg before procedure and 19.0 ± 3.3 mm Hg (or a $2.4\% \pm 16.9\%$ mean reduction) at 3 months after procedure. In the argon laser patients, mean intraocular pressure was 24.4 ± 3.5 mm Hg and 15.5 ± 1.2 mm Hg (or a $30.0\% \pm 16.5\%$ mean reduction) at 3 months after laser treatment. The difference between the two techniques in reduction of intra ocular pressure was statistically significant at 3 months ($P < 0.05$) after treatment.

Another research¹⁸ reported the results of argon laser trabeculoplasty in 211 eyes of primary open angle glaucoma. The success rate was 81% at 1 year, 48% at 5 years and only 11% at a ten years. Few other studies have also shown MDLT is not as effective as ALT. A recent study published in Acta Ophthalmologica suggested that 180° MDLT is a safe but less effective treatment in patients with open angle glaucoma¹⁹. These similar results were found in our study.

There are some studies which show that MDLT efficacy equivalent to ALT at a lower cost with less inflammation and less risk of complications. A study using sub-threshold micropulse laser protocols have reported successful outcomes for primary open angle glaucoma²⁰. Another study suggested that hypotensive effects and success rates of diode laser trabeculoplasty were comparable to argon laser trabeculoplasty (ALT)²¹.

The results shown in the current study has a larger impact as compared to other studies in our region as the occurrence of glaucoma induced blindness is higher in South Asian region. Limitation of our study is that it was a single center study and results cannot be generalized to whole population. Further research at other centers will add to the results obtained in our study.

CONCLUSION

Both ALT and MDLT are effective in controlling IOP in POAG. However, ALT is more effective in

controlling IOP then microwave diode laser trabeculoplasty.

Ethical Approval

The study was approved by the Institutional review board/Ethical review board.

Conflict of Interest

Authors declared no conflict of interest.

Authors' Designation and Contribution

Asma Shams; Senior Registrar: *Study Design and Procedures.*

Narain Das; Assistant Professor: *Compilation of data and Procedures.*

Noman Rashid; Associate Professor: *Manuscript Writing and Review.*

M. Nasir Bhatti; Professor: *Manuscript Review.*

Beenish Khan; Assistant Professor: *Statistical Analysis and Results.*

Jai Kumar; Consultant Ophthalmologist: *Data Collection.*

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