

Original Research Article**An analysis of Nd:Yag laser iridotomies for the treatment of primary angle closure in South Indian eyes**Shibin Girish Parakandy,¹ C. Smrithi Shetty,² M. Gurudutt Kamath³¹Department of Ophthalmology, Yenepoya Medical College, Yenepoya University, Mangalore, India²Department of Physiology, A.J. Institute of Medical Sciences, Mangalore, India³Department of Ophthalmology, Kasturba Medical College, Manipal University, Mangalore, India**Abstract**

The treatment of angle closure glaucoma has benefited tremendously with the advent of the Nd:YAG laser iridotomy and has proven to be far superior than Argon laser for creating iridotomies. This prospective research was undertaken to evaluate the efficacy and complications of Nd:YAG laser iridotomy in the treatment of primary angle closure (PAC) in South-Indian eyes. This study included 30 patients presenting as PAC. They underwent iridotomy using Nd: YAG laser. All patients were followed up for a period of 3 months and analyzed regarding the patency of iridotomy, gonioscopic angles and intraocular pressure (IOP) control. Of the 30 eyes in this study which underwent iridotomy for PAC, 24 (80%) were female. 28 (93%) required a single lasing session to attain a patent iridotomy and two eyes (7%) required two sessions. All iridotomies were found to be patent throughout the follow up period. There was a median angle width increment of two Shaffer grades in 26 eyes. In all these cases, there was a permanent reduction in IOP at 1 month and 3 months follow up without any additional medical therapy. Iridotomy alone failed to lower the IOP in the remaining 4 cases due to extensive peripheral anterior synechiae (PAS). Immediate postoperative complications of laser iridotomy included a mild transient rise in the IOP (30%) and 2 eyes showed minimal bleeding. They responded well to the recommended treatment. This study emphasizes the effectiveness of Nd:YAG laser iridotomy in widening the drainage angle and reducing elevated IOP in cases of angle closure with pupillary block.

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1. Introduction

Primary angle closure glaucoma (PACG) probably accounts for half the cases of primary glaucoma worldwide.¹ Acute angle closure glaucoma has always been one of the leading causes of blindness which can be prevented if

detected early and appropriate treatment implemented. In developing countries, resources are limited and access to specialized eye care is difficult. In most cases, it is not practical to examine patients regularly and patients may not be compliant to use daily topical medication. A one time treatment of primary angle closure

(PAC) in the form of laser iridotomy is the logical alternative. Prophylactic treatment of eyes at risk of angle closure may also be worthwhile.²

Laser iridotomy has been shown to be an effective primary therapy for early PACG although advanced cases require further treatment with topical medication or filtration surgery.^{3,4} Iridotomy acts by eliminating relative pupillary block which is one mechanism underlying the development of angle closure. Laser iridotomy is advantageous over surgical iridotomy as it can be done under topical anaesthesia, the eye need not be entered, the procedure is less expensive and it can be performed as an outpatient procedure. Laser iridotomy has become the currently preferred method for relieving a pupillary block. In this study, we examined the efficacy of Nd:YAG laser iridotomy in the management of people with occluded angles, by evaluating its effectiveness in widening the angle and reducing the elevated IOP.

2. Materials and methods

This study is a prospective study conducted on all patients who have been diagnosed as PAC and have received Nd:YAG laser iridotomy at the Department of Ophthalmology, Kasturba Medical College Hospital, Mangalore and Government Wenlock District Hospital, Mangalore, India between November 2007 to August 2009, with a follow up period of 3 months. The distribution of the patients according to age and sex is shown in Table 1. All

patients were evaluated with complete ocular examination including slit lamp biomicroscopy, visual acuity with Snellens' chart, Goldmann applanation tonometry and Goldmann triple mirror gonioscopy. Patients with an acute attack were treated with anti-glaucoma medications and Nd:YAG laser iridotomy was only done when IOP was sufficiently lowered and the cornea cleared.

Patients were prepared for Nd:YAG laser iridotomy with pilocarpine 2% and proparacaine eye drops. Using Abraham contact lens, laser iridotomy was made at 11 or 1 o'clock position in the peripheral iris. Iridotomy was done using the Visulas YAG II plus machine made by ZEISS or the AppaYag machine made by Appasamy. Power settings consisted of a burst of 2 to 4 pulses, with energy levels ranging from 10 to 15 mJ. If one shot failed to create a patent iridectomy, multiple shots would be given. The iridotomy was considered patent when posterior pigment epithelium was disrupted and a through and through opening was seen in the iris with an immediate gush of posterior chamber aqueous humor through the patent iridotomy, carrying pigments with it into the anterior chamber. After treatment, the eyes were observed for any complications, such as bleeding or transient rise in intra ocular pressure (IOP). Following Nd:YAG laser iridotomy, all patients were put on dexamethasone 0.5% eye drops, 1 drop 6th hourly for a week. Patients with transient elevation in IOP post procedure were treated with timolol maleate 0.5% eye drops twice daily. Acetazolamide 250mg thrice daily was also

Table 1: Age and sex distribution of study population

Age (years)	Male	Female	Male and female total (%)
40-49	1	4	5 (16)
50-59	4	10	14 (47)
60-69	-	8	8 (27)
≥70	1	2	3 (10)
Total (%)	6 (20)	24 (80)	30

added in case of very high elevation of IOP. Follow up for these patients included IOP measurement, visual acuity and gonioscopy on the day of the iridotomy after 1 hour, 2nd day, 1 week, 1 month and 3 months. In case of failure in maintaining IOP or persistent closed angles despite laser iridotomy, filtering surgery was done.

3. Results

Total number of angle closure eyes treated with Nd:YAG laser iridotomy in this study was 30. Twenty two eyes (73%) required one to three laser shots to attain a patent iridotomy; while the remaining 8 eyes required four to six shots (Table 2). Also, 93% (28 eyes) attained penetration in one session. The remaining 2 eyes required an additional sitting to attain a patent iridotomy. The total energy required to produce iridotomy ranged from 10 to 102.5 mJ (mean of 54.59 mJ). All eyes treated showed patent iridotomies at the 3rd month of follow up. Among the immediate complications, a mild transient rise in IOP was seen in 9 cases (30%). The mean IOP increase among these 9 eyes was 3.28 mmHg. This increase in the IOP did not seem to correlate with the pre-procedure IOP. However 8 out of these 9 eyes (89%) required a total energy of more than 40mJ to create a patent iridotomy. These cases which showed post-laser iridotomy rise in IOP were treated with timolol eye drops. It subsided

by the 2nd visit. Four cases (13.33%) showed pigment dispersion after the procedure. All cases were put on topical steroids after the procedure to control any iritis. Two cases (6.66%) had micro-bleeding from the iridotomy site, which was self limiting. Twenty six eyes which had an initial pre-laser Shaffer's grade 0-I improved to grade III by the end of 1 month follow up. No successfully treated eye showed closure of angle in the post-iridotomy follow up period. In all the 26 cases, there was a permanent reduction in IOP at 1 month and 3 months follow up without any additional medical therapy. Four cases in this study were unsuccessful in opening the angle due to extensive synechial closure of 3 or more quadrants, and had to undergo subsequent trabeculectomy.

4. Discussion

The treatment of angle closure glaucoma has benefited tremendously with the advent of the Nd:YAG laser iridotomy. Over the years, Nd:YAG laser has proven to be far superior than Argon laser for creating iridotomies. Argon laser was shown to be less effective in producing iridotomies and a considerable number of cases required retreatment due to late closure of the iridotomy.

This study was done to evaluate the effect of Nd-YAG laser iridotomy on 30 patients with angle

Table 2: Energy requirements for Nd:Yag laser iridotomy

Total Energy (mJ) No. of laser shots	<50	50-100 No. of cases	>100	TOTAL
1	6	-	-	6
2	5	2	-	7
3	2	6	-	8
4	-	3	-	3
5	-	1	1	2
6	-	3	1	4
Total	13	15	2	30

closure. All the patients were followed up for a period of 3 months during which the IOP and anterior chamber angle were monitored. Incidence of primary angle closure glaucoma in our study was noted to be highest in the 6th decade (51-60 years). This coincides with the findings of Das et al., Seah et al., Lowe and Sihota et al.⁵⁻⁸ Most common indication for Nd:YAG iridotomy, in this study, was chronic angle closure, which made up 60%. Our study also showed the condition to be common among the female sex (Table 1), which again coincides with the findings of Das et al., Sihota et al., Host, Lowe and Smith.^{5,8-11} The total energy required to obtain a patent iridotomy in our study ranged between 10-100.5 mJ (mean: 54.59mJ). Naveh et al, in their study, reported using a total energy ranging between 20.8-97mJ (mean: 62.3mJ).¹²

All cases had patent iridotomies throughout the follow up period of our study. Naveh et al. reported iridotomy closure in 10% of their cases.¹² A histopathological study done by Tetsumoto et al. suggested that iris wound healing after Nd:YAG laser iridotomy occurs without induction of fibrous scars or proliferation of the iris pigment epithelium.¹³ Due to this feature, unlike Argon laser iridotomies, there is no tendency toward late closure of the iridotomy sites when using Nd:YAG laser. In this study, 9 cases (30%) had a mild elevation (within 6 mmHg) of IOP after the procedure. The rise in IOP was transient and subsided by the 2nd visit (1 day). Naveh et al. reported that 42% of the eyes showed an increase in IOP of more than 10 mmHg after the procedure.¹² In the previous studies, this increase in ocular pressure was not found to correlate with the preoperative ocular pressure, the degree of ocular inflammation, the energy requirements for iridotomy or the amount of iris bleeding.¹² A study by Fernandez-Bahamonde et al. showed that the use of apraclonidine reduced the incidence of IOP spikes after laser iridotomy.¹⁴ The mean IOP before Nd:YAG iridotomy was 20.67 mmHg. Mean IOP at 1hr post laser was 18.88 mmHg and the mean IOP 1day post laser was 13.79 mmHg.

Twenty six (87%) of the treated eyes had angles that were no longer classified as occludable. The median change in angle width after the iridotomy was an increase of two Shaffer grades. All the 4 eyes with angles that remained occluded had extensive peripheral anterior synechiae (PAS). Nolan et al. conducted a study in which, 148 of 151 (98%) iridotomy treated eyes showed widening of the drainage angle.¹⁵ In their study, of the 3 eyes which failed, one had a non-patent iridotomy, the second had a small iridotomy, and the third had extensive PAS covering the trabecular meshwork. In this study, 2 cases (7%) showed micro bleeding from the iridotomy site, which lasted only for few minutes. Naveh reported minimal bleeding from the iridotomy in 20% cases, and 5% (1 case) showed hyphema.¹² None of the cases in our study showed corneal edema or lenticular opacities corresponding to the site of laser application. Naveh et al. reported localized corneal edema in 3 cases in their study.¹² This transitory corneal damage was seen to occur in eyes in which Nd-YAG iridotomy was performed soon after resolution of an attack of angle closure glaucoma, while the eyes were still inflamed and with the anterior chamber unusually narrow.¹² Also, one case in their study developed a lenticular opacity corresponding to site of iridotomy. Nd:YAG laser iridotomy is a fairly simple and highly effective procedure, with minimal complications. All the patients who were successfully treated showed reduction in IOP and increase in the angle of anterior chamber. They could be successfully weaned off their anti-glaucoma medications with time and all patients were well stabilized by the end of the follow up period. Once extensive PAS has occurred, iridotomy alone is ineffective at controlling the IOP.

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