



VISUAL OUTCOMES AND INTRAOCULAR PRESSURE CHANGES FOLLOWING ND:YAG LASER CAPSULOTOMY FOR POSTERIOR CAPSULAR OPACIFICATION: A PROSPECTIVE OBSERVATIONAL STUDY

Ophthalmology

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ABSTRACT

Background: Posterior capsular opacification (PCO) is a common late complication after cataract surgery. Nd:YAG laser posterior capsulotomy is the standard treatment, but visual outcomes and intraocular pressure (IOP) responses may vary with PCO morphology and laser parameters. **Methods:** This hospital-based observational study included 64 eyes with clinically significant PCO treated with Nd:YAG laser capsulotomy at the Department of Ophthalmology, Gulbarga Institute of Medical Sciences, Kalaburagi, from March 2025 to April 2026. PCO was classified by morphology and grade. Best-corrected visual acuity (BCVA) and IOP were assessed before treatment and during follow-up. Laser energy and number of shots were recorded. **Results:** Sixty-four eyes were included. Elschnig pearls were present in 42 eyes (65.6%) and fibrous PCO in 22 (34.4%). Grade II PCO was present in 48 eyes (75.0%) and grade III in 16 (25.0%). Pre-laser BCVA was 6/60 or better in all eyes, with 52 eyes (81.3%) in the 6/60–6/18 category and 12 eyes (18.8%) below 6/60. After capsulotomy, 62 eyes (96.9%) achieved BCVA of 6/12–6/6 and 2 eyes (3.1%) achieved 6/36–6/18. Pulse energy ranged from 1 to 9.5 mJ and the number of shots from 5 to 40. IOP remained within the reported ranges for most eyes during the first 24 hours; one eye had an IOP >22 mmHg at 4 hours, it was found to be known case of glaucoma and managed appropriately. **Conclusion:** Nd:YAG laser capsulotomy was associated with substantial improvement in visual acuity in this series of eyes with clinically significant PCO. Early IOP changes were generally limited and manageable.

KEYWORDS

Posterior Capsular Opacification; Nd:yag Laser Capsulotomy; Intraocular Pressure; Visual Acuity; Pseudophakia; Cataract Surgery.

INTRODUCTION-

Posterior capsular opacification (PCO) remains the most common long-term complication following cataract surgery, even with advances in surgical techniques such as phacoemulsification and extracapsular cataract extraction (ECCE). Capsular opacification stems from the continued viability of lens epithelial cells that remain after removal of the nucleus and cortex. Opaque secondary membranes are formed by proliferating lens epithelial cells, fibroblastic metaplasia and collagen deposition. Although the incidence of PCO and the subsequent requirement for Nd:YAG laser capsulotomy has significantly decreased over the decades—from 50% in the 1980s to below 10% today,^{1,2} PCO continues to affect a substantial proportion of post-operative patients, impairing visual function and quality of life. Nd:YAG laser capsulotomy is a standard and effective treatment for PCO, offering a non-invasive solution to restore visual clarity with more than 95% success rate.¹ However, it is not without risks. Complications such as elevated intraocular pressure (IOP), cystoid macular edema (CME), IOL pitting, retinal detachment, and anterior hyaloid face rupture have been documented.³ Moreover, some patients may experience minimal or no visual improvement due to pre-existing retinal pathology or other complications post-capsulotomy.

Given these potential complications and the variability in outcomes based on energy levels used, type of IOL, and patient-specific factors, it becomes imperative to evaluate and document the efficacy, safety, and visual outcomes associated with Nd:YAG laser capsulotomy in a clinical setting. This study is undertaken as there is a need to better understand the risk factors influencing complications, the energy thresholds needed for different grades of PCO, and the timeline of potential adverse effects to improve patient safety and outcomes. This study aims to fill this gap by systematically analyzing parameters of the laser and visual outcomes following Nd:YAG laser capsulotomy.

Aims and Objectives

1. To describe the demographic and clinical profile of patients presenting with clinically significant PCO.
2. To classify PCO according to morphology and grade and describe the laser energy and number of shots required for capsulotomy.
3. To assess the visual outcomes following Nd:YAG laser capsulotomy in patients with PCO.

4. To evaluate IOP changes following the procedure and document procedure related complications

Materials and Methods

Patients presenting with PCO after cataract surgery attending ophthalmology outpatient department at Gulbarga Institute of Medical Sciences, Kalaburagi from March 2025 to out April 2026 were included in study. Consent of patients was taken. These patients then selected for ND:YAG capsulotomy. All eyes with complications (other than PCO) were excluded from the study.

Detailed history was noted and ocular examination was carried out. Best corrected visual acuity was noted using Snellen's chart. All eyes underwent detailed slit lamp examination and fundoscopy with. PCO was graded from grade 0, I, II, III as per protocol followed in Madurai intraocular lens study IV.⁴

Pre-operative baseline intra ocular pressure was measured by applanation tonometer. All patients with grade II and III PCO were subjected to ND-YAG laser capsulotomy. The procedure to be done and associated complications were explained to all the patients and informed consent was taken. All eyes were dilated with tropicamide plus 1% eye drops one hour prior to laser therapy and proparacaine was instilled to each eye undergoing laser.

The Nd: YAG laser capsulotomy procedure was performed under topical anaesthesia using a Q-switched Quantel Nd:YAG laser. A contact lens such as an Abraham lens, was used to stabilize the eye and provide precise targeting. The laser energy settings will begin at 1.0 mJ and be adjusted as needed depending on the thickness of the PCO. A circular opening of approximately 3.5-4.0 mm in the posterior capsule was created, ensuring optimal visual improvement while minimizing the risk of complications. The procedure was minimally invasive and was performed on outpatient basis.

Postoperative evaluation involved immediate assessment of intraocular pressure (IOP) and visual acuity within the first hour following the laser procedure, as IOP spike is expected during the first few hours after Nd:YAG laser capsulotomy. Patients were prescribed 0.5% timolol maleate eye drops to control any IOP spikes and

ofloxacin (0.3%), dexamethasone (0.05%) eye drops to reduce inflammation twice daily for 1week. In cases where IOP exceeded beyond 30 mmHg, oral acetazolamide (250 mg twice daily) was administered for a short period. Patients were closely monitored at 1 hour, 4 hour, 1 day, 1 week, and 1 month after the procedure. During each follow-up visit, a detailed slit-lamp examination was conducted to evaluate the position of the intraocular lens (IOL), and check for any complications such as cystoid macular edema (CME), retinal detachment, or IOL pitting. Visual acuity was reassessed at each follow-up, and the IOP was measured again, especially during the initial 24-hour period, to detect any significant rises that may require treatment.

Observations and Results

During the period of study spanning from March 2025 to April 2026, 64 eyes of posterior capsular opacification were identified and recorded. These 64 eyes underwent YAG laser posterior capsulotomy and the observation made are as follows.

Table 1: Age distribution of the patients

Age (years)	No of Patients	Percentage
41-50	10	15.6%
51-60	10	15.6%
61-70	36	56.2%
71-80	08	12.5%
Total	64	100%

Maximum eyes (56.2%) were in the age group of 61-70 years. The youngest patient was 45 years old female patient and oldest was 72 years old male patient.

Table 2: Gender Distribution

Gender	No of Patients	Percentage
Male	30	46.8%
Female	34	53.1%
Total	64	100%

Table 3: Distribution of patients as per Types and grades of PCO

Type	No of eyes		Percentage
	Fibrous		
		22	34%
	Elschnig Pearl	42	66%
Grade	I	00	00%
	II	48	75%
	III	16	25%

It was observed that Elsching pearl type of PCO was more common than fibrous type. Grade II was more common than Grade III.

Table 4: Laser energy/ Shots required

Type of PCO	Total Energy(mJ)	No. of shots
Fibrous type	4- 9.5mJ	7-40
Elsching Pearl	1-3.5mJ	5-10

Elsching pearl require minimum energy and minimum shots whereas fibrous type of PCO required maximum energy and maximum shots.

Table 5: Distribution of best corrected visual acuity- Pre laser

Best corrected visual acuity	No.of patients	Percentage
<6/60	12	18.7%
6/60-6/18	52	81.2%
Total	64	100

Maximum number of cases have pre laser BCVA between 6/60-6/18 (81.2%).

Table 6: Distribution of best corrected visual acuity- Post Laser

Best corrected visual acuity	Group –I <6/60 (12 eyes)	Group- II 6/60-6/18 (52 eyes)	Total (%)
6/12-6/6	10	52	62 (96.8%)
6/36-6/18	02	0	02 (3.1%)
Total	12	52	64 (100%)

Post YAG laser capsulotomy visual improvement is seen in 96.8% cases (6/12- 6/6).

Table 7: Distribution of pre and post laser spike of intraocular pressure

Intraocular pressure	Pre laser number	percentage	After 1 hour number	percentage	After 4 hour number	percentage	After 1day number	percentage
<12	02	3.1	02	3.1	01	1.5	04	6.25
12-16	44	68.7	48	75	51	79.6	48	75
16-20	18	28.1	13	20.3	11	17.1	11	17.01
20-22	00	00	01	1.5	00	00	01	1.5
>22	00	00	00	00	01	1.5	00	00
Total	64	100	64	100	64	100	64	100

DISCUSSION

Posterior capsular opacification (PCO) is one of the most common long term complications following various types of ECCE and IOL implantation. ND-YAG laser therapy presents the advantage of a non-invasive, effective, relatively safe technique to manage intact posterior capsule that opacify postoperatively.

In the present study of 64 eyes comprising of 30 males 34 females underwent ND-YAG capsulotomy. The youngest patient was 45 years old female patient and oldest was 72 years old male patient.

In our study PCO was categorized according to density and as per the protocol followed in Madurai Intraocular Lens Study IV. The most common is Elsching's pearl (66%) and grade II (75%).

In present study, the pulse energy used for capsulotomy was ranging from 1 mJ to 9.5 mJ. Most of the laser procedures were done using energy between 2.0 to 2.4mJ. The total amount of energy (i.e. power x no. of pulses) used for most of the cases was ranging from 30 mJ to 50 mJ as compared to Wajeehja Rasool et al⁵ in whose study, the average pulse energy used for capsulotomy was 2 mJ+0.77 ranging from 1.1 to 4.8mJ, the mean total energy used was 54.5+26 ranging from 6.6 to 163.2 mJ, and the results were almost similar.

The number of shots ranged from 5-40. Elsching's Pearl required minimum number of shots, while fibroust type of opacification requires the maximum number of shots (Table 4).This similar findings is seen in study conducted by Pankaj Soni et al⁶.

The results of Nd-YAG laser capsulotomy were quite satisfying. . 96.8% eyes showed improvement in best corrected visual acuity by at least 2 lines on snellen's chart (Table 5 and Table 6).

Similar findings were also reported by other studies. Tariq M et al⁷ reported that 95% of patients had improvement in the vision. Though they studied only 26 patients, they used the Bailey Lovie distance 10logMAR visual acuity for measurement instead of Snellen's chart and they considered both glare and contrast sensitivity in their study. Hossain MI et al⁸ in their study observed that 96% of the patients had improvement in the vision after intervention.

Wajeeha R et al⁵ found that after their intervention, 96% of patients had better vision. Skolnick et al⁹ observed improvement of vision among their study subjects to a lower side of about 89.7%. Mirza S et al¹⁰ who studied 500 eyes, reported the vision improvement among 92% of patients.

There was no significant difference in intra ocular pressure before and after ND-YAG laser capsulotomy in the present study. This was due to the use of timolol 0.5% eye drops and ofloxacin(0.3%)-dexamethasone(0.05%) prophylactically to blunt the transient intra ocular pressure rise as well as to reduce the ocular inflammation respectively usually observed after ND-YAG laser capsulotomy. Only one patient had significant rise of intra ocular pressure but he was a known case of glaucoma and was managed appropriately. With topical use of 0.5% timolol eye drops, and ofloxacin (0.3%)and dexamethasone (0.05%) eye drops the frequency and magnitude of intra ocular pressure rise as well as ocular inflammation can be reduced significantly. The incidence of transient rise of intra ocular pressure was almost similar to that reported by Wajeeha Rasool et al⁵ and seethalaxmi, M N et al¹¹ but Hossain MI et al⁷ reported slightly higher incidence of transient rise of intra ocular pressure.

CONCLUSION

Posterior capsular opacification is a very common complication following SICS with IOL implantation. Improvement in the visual acuity was excellent after ND-YAG laser capsulotomy. It is safe,

relatively non invasive and readily acceptable to patients and can be performed as an outpatient department based procedure. Although it is safe, it is associated with complications like transient intraocular pressure rise which is not vision threatening. Therefore this treatment modality is very cost effective and safe.

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