



A COMPARATIVE STUDY ON VISUAL ACUITY AND INTRAOCULAR PRESSURE CHANGES IN PATIENTS OF POSTERIOR CAPSULAR OPACIFICATION BEFORE AND AFTER NEODYMIUM –YTTRIUM ALUMINUM– GARNET[Nd YAG LASER] CAPSULOTOMY

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ABSTRACT

INTRODUCTION : Cataract is the leading cause of curable blindness, primarily affecting middle-aged and elderly individuals, impacting their daily life, mental well-being, and economic productivity. Surgical options such as phacoemulsification, extracapsular cataract extraction (ECCE), and small incision cataract surgery (SICS) with posterior chamber intraocular lens (PCIOL) implantation significantly restore vision. However, many patients develop posterior capsular opacity (PCO), or after-cataract, within three months to four years post-surgery, leading to recurrent visual impairment. Nd: YAG laser capsulotomy effectively treats PCO non-invasively, improving visual acuity. Evaluating post-procedure outcomes, managing complications, and ensuring long-term vision stability are essential for patient care. **AIM :** To study and compare on visual acuity and intraocular pressure changes in patients of posterior capsular opacification before and after Neodymium –yttrium aluminum–garnet[Nd yag laser] capsulotomy. **MATERIAL AND METHODS:** This study included 100 post-cataract surgery patients with symptomatic posterior capsular opacification (PCO) and a posterior chamber intraocular lens (PCIOL) with visual acuity <6/18, evaluated between July 2022 and June 2024. After assessment and counseling, eligible patients underwent Nd:YAG laser capsulotomy. Those with corneal pathology, glass IOL implants, cystoid macular edema, intraocular inflammation, or difficulty maintaining fixation were excluded. The procedure was performed in an outpatient setting, with follow-ups scheduled at 3 and 15 days to assess visual outcomes and potential complications. **RESULTS:** Routine preoperative prophylaxis with **Iotim (0.5%) or Brimonidine (0.1–0.2%)** effectively maintained **intraocular pressure (IOP) stability**. Post-procedure complications were minimal, with **iritis in 27 patients and cystoid macular edema in one**, all successfully managed without significant vision loss. Nd:YAG laser capsulotomy significantly improves vision and daily function, especially in rural, economically disadvantaged patients. Its non-invasive, painless, and cost-effective nature makes it widely accepted, with no hospitalization needed. Proper pre-procedure counseling is essential.

KEYWORDS

INTRODUCTION:

Cataracts remain the leading cause of treatable blindness worldwide, particularly in rural India, where limited awareness, poverty, and restricted access to surgical facilities contribute to its high prevalence. Government initiatives, such as the National Blindness Control Programme (NBCP), have significantly reduced blindness rates, as evidenced by the National Blindness and Visual Impairment Survey (2015–2019), which reported a decline in blindness prevalence from 5.3% in 2001 to 1.99% among individuals aged 50 and above. Increased access to advanced cataract surgery techniques like phacoemulsification, small incision cataract surgery (SICS), and extracapsular cataract extraction (ECCE) with PCIOL implantation has played a crucial role in this progress.⁽¹⁾

However, a significant postoperative challenge persists posterior capsular opacification, occurring in up to 50% of patients within 2 months to 5 years after cataract surgery.⁽²⁾ PCO can impair vision, necessitating further intervention. Nd:YAG laser capsulotomy is a non-invasive, outpatient procedure that effectively restores visual acuity without requiring hospitalization⁽³⁾. While generally safe, potential complications such as iritis, intraocular pressure (IOP) elevation, corneal burns, IOL pitting, and retinal damage must be managed appropriately.

Our study evaluates the efficacy, safety, and patient outcomes of Nd:YAG laser capsulotomy in addressing PCO-related visual impairment, particularly in resource-limited settings, to further enhance postoperative cataract care and prevent avoidable vision loss.

AIMS AND OBJECTIVES:

This study aims to evaluate and compare visual acuity and intraocular pressure (IOP) changes in patients with posterior capsular opacification (PCO) before and after Nd:YAG laser capsulotomy.

The study also assesses visual acuity and IOP both pre- and post-procedure, compares the changes in these parameters following Nd:YAG laser capsulotomy, and examines any associated complications to evaluate the safety and efficacy of the treatment.

MATERIALS AND METHODS:

This study included 100 patients diagnosed with posterior capsular

opacification (PCO) following cataract surgery, assessed between July 2022 and June 2024. Patients were selected based on specific inclusion and exclusion criteria. Those with visual acuity <6/18 (Snellen's chart) and a posterior chamber intraocular lens (PCIOL) were included, while individuals with corneal scars, glass IOL implants, cystoid macular edema, active intraocular inflammation, or inability to maintain head fixation were excluded. A detailed pre-procedural assessment was conducted, recording patient demographics, history of cataract surgery, and systemic conditions such as diabetes. Best corrected visual acuity (BCVA) was evaluated, and slit-lamp biomicroscopy was performed to determine the severity of PCO.

The Nd:YAG laser capsulotomy procedure was carried out using a 1064 nm laser with a 633 nm aiming beam. Prior to the procedure, pupil dilation was achieved with 1% tropicamide, and topical anesthesia with 4% xylocaine or 0.5% procaine hydrochloride was administered. Intraocular pressure (IOP)–lowering agents, such as brimonidine or timolol, were given prophylactically to prevent post-procedure IOP spikes. Following the laser capsulotomy, prednisolone acetate 1% eye drops were prescribed, and patients were closely monitored for IOP fluctuations and potential complications. Post-procedure follow-ups were scheduled at 3 and 15 days, during which BCVA was reassessed to evaluate visual improvement and any adverse effects. This methodology ensured a thorough evaluation of Nd:YAG laser capsulotomy in the management of PCO, assessing both visual and intraocular pressure changes, as well as the safety and efficacy of the procedure.

OBSERVATIONS AND RESULTS:

A total of 100 patients (70 males, 30 females) aged 40–70 years were enrolled in the study, with each contributing one eye for evaluation. Comprehensive preoperative assessments included detailed patient history, best corrected visual acuity (BCVA) measurement, slit-lamp biomicroscopy, non-contact tonometry for intraocular pressure (IOP) monitoring, and fundus examination under mydriasis. Informed consent was obtained after explaining the benefits, risks, and expected outcomes of Nd:YAG laser capsulotomy.

The procedure was performed using the APPA YAG Laser Model: 307, employing a central cruciate capsulotomy technique. Postoperative follow-ups were conducted at 3 and 15 days, with extended monitoring

up to 6 months if required. A significant improvement in visual acuity was observed post-capsulotomy, with 89% of patients achieving vision between 6/6 and 6/18, while 10% showed borderline improvement (6/18–6/60), and only 1% exhibited a poor prognosis. Preoperatively, most patients had severely impaired vision (<6/60), with 46% in the borderline category.(Table:1)

The laser energy used during capsulotomy varied among patients: <20 mJ in 42% of cases, 21–50 mJ in 34%, and 51–80 mJ in 23%, with minimal instances requiring energy beyond 80 mJ. Postoperatively, 70% of patients achieved excellent vision (6/6–6/9) within 24 hours to 3 days, while 29% improved to good vision (6/18–6/12) within 7 days. Only one patient exhibited delayed visual improvement beyond 15 days.(Table:2)

To manage potential IOP spikes, brimonidine 0.4% and timolol maleate 0.5% eye drops were administered pre- and postoperatively. Despite these precautions, mild IOP elevation (>20 mmHg) was noted in one patient, while three patients exhibited transient spikes >25 mmHg, all of which were successfully managed.(Table:3). Post-YAG iritis developed in 27% of cases, necessitating treatment with prednisolone acetate 1% and cycloplegic agents (cyclopentolate 1%). Cystoid macular edema (CME) was observed in one patient, but it resolved with medical management without permanent visual impairment.

Intraocular lens (IOL)-related complications, including pitting and mild decentration, were seen in 12% of cases; however, these did not significantly affect visual acuity. Overall, our study demonstrated a high success rate, with significant visual improvement (VA >6/18) in 89% of patients post Nd:YAG laser capsulotomy. Moderate improvement (VA 6/18–6/60) was noted in 10% of cases, while only 1% exhibited minimal or inadequate visual recovery. These findings highlight the effectiveness and safety of Nd:YAG laser capsulotomy as a non-invasive outpatient procedure for managing PCO-related visual impairment.

TABLE 1 : Visual Outcomes Before and After Nd:YAG Laser Capsulotomy

Grading of Visual Acuity (Snellen's)	Before Capsulotomy		After Capsulotomy	
	No of Patients	Percentage	No of Patients	Percentage
Good (>6/18)	06	06	89	89
Borderline (6/18- 6/60)	48	48	10	10
Poor (<6/60)	46	46	01	01
Total	100	100	100	100

TABLE 2 : Overall energy usage and distribution:

Total Energy Used In mJs	No of Eyes	Percentage
< 20	42	42
21-50	34	34
51 -80	23	38
>80	01	01
Total	100	100

TABLE 3 : Variation in IOP before and after YAG treatment

IOP mmhg	Pre YAG		Post YAG Capsulotomy			
	No of Eyes	%	After 3 Days		After 15 Days	
	No of Eyes	%	No Of Eyes	%	No Of Eyes	%
<10	09	09	10	10	10	10
10-14	61	61	64	64	65	65
15-19	27	27	20	20	21	21
20-24	03	03	03	03	01	01
>25	00	00	03	03	03	03
Total	100	100	100	100	100	100

DISCUSSION:

Cataract remains a major cause of reversible blindness, with posterior capsular opacification (PCO) affecting nearly 50% of patients within 2 months to 5 years postoperatively. Our study evaluated the effectiveness of Nd:YAG laser capsulotomy in improving visual acuity, intraocular pressure (IOP) changes, and post-procedural complications.

Among 100 eyes (70 males, 30 females) aged 40-70 years, PCO was more common in males engaged in outdoor labor, similar to findings

by Pankaj Soni et al. and Hassan A. et al., who reported delayed PCO presentation in rural populations. Most cases developed PCO within 1-3 years, aligning with Ursell et al., who reported Nd:YAG capsulotomy rates of 2.4–12.6% at 3 years and 5.8–19.3% at 5 years post-cataract surgery.⁽⁴⁾

Pearl-type PCO (61%) was predominant, followed by fibrous-type, with Grade 2 PCO (50%) being the most common. This aligns with Gamal El-Deen AM et al., who found pearl-type PCO had the highest mean capsule bending angle, indicating active equatorial lens epithelial cell migration.⁽⁵⁾ Energy usage for capsulotomy varied, with 1.0-1.5 mJ being most common (59%) and total energy <50 mJ used in 76% of cases, comparable to Bhargava R et al., who noted that fibrotic PCO required higher energy than membranous PCO.⁽⁶⁾

Following Nd:YAG capsulotomy, 89% of patients achieved visual acuity ≥6/18, with 70% attaining 6/9–6/6 within 3 days, similar to Lighthizer et al., who also reported significant post-procedural improvement.⁽⁷⁾ 10% exhibited borderline improvement (6/18–6/60), and only 1% had minimal improvement (<6/60). Mild IOP elevations (>25 mmHg) occurred in 3% of cases, successfully managed with brimonidine and timolol, consistent with findings from Wasserman et al., who noted transient IOP spikes post-YAG capsulotomy.⁽⁸⁾ Post-YAG iritis occurred in 27% of cases, requiring treatment with prednisolone acetate 1% and cycloplegics, while only one patient developed cystoid macular edema (CME), managed successfully with medical therapy.

Additionally, IOL pitting and decentration were observed in 12% of cases, but these did not significantly impact visual acuity, aligning with findings by Bhargava R et al. Importantly, no retinal complications, including retinal detachment or retinal holes, were noted, reinforcing the safety of the procedure.

CONCLUSION:

Nd:YAG laser capsulotomy is a safe, effective, and well-tolerated procedure for treating PCO, offering rapid visual recovery with minimal complications. Our findings align with existing literature, reaffirming Nd:YAG capsulotomy as the gold standard for PCO management. Future studies with larger cohorts and extended follow-up may help optimize post-procedural care and further reduce recurrence rates.

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