



EFFECT OF ND: YAG LASER CAPSULOTOMY ON VISUAL ACUITY IN PATIENTS WITH POSTERIOR CAPSULAR OPACIFICATION

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ABSTRACT

Introduction: Posterior Capsular Opacification (PCO) is the most common long-term complication following cataract surgery, significantly impacting visual acuity. Neodymium-doped Yttrium Aluminium Garnet (Nd:YAG) laser capsulotomy is widely used for its effective and non-invasive treatment of PCO. This study evaluates the improvement in visual acuity following Nd: YAG laser capsulotomy and assesses its short-term complications. **Objectives:** To evaluate the visual results to ascertain whether Nd:YAG laser capsulotomy is beneficial in treating posterior capsule opacification and to investigate how Neodymium-YAG laser capsulotomy impacts intraocular pressure changes and other side effects. **Methods:** A prospective observational study was conducted at the Department of Ophthalmology, Rajshree Medical Research Institute, Bareilly, including 64 patients diagnosed with visually significant PCO. Pre- and post-procedural Best Corrected Visual Acuity (BCVA) was assessed using the Snellen chart, along with intraocular pressure (IOP) measurements. Patients were followed up at 1 hour, 24 hours, and 1 week post-procedure to monitor visual improvement and complications. **Results:** Post-procedure, a significant improvement in BCVA was observed, with 76.6% of patients achieving 6/12 or better vision compared to only 10.9% pre-treatment. The majority (68.8%) showed a 2 to 4-line improvement in BCVA, while 25% exhibited an improvement of more than 4 lines. A transient rise in IOP was noted in 21.8% of patients, resolving within one week. Other minor complications included mild iritis (6.2%) and intraocular lens (IOL) pitting (9.3%), with no cases of severe adverse outcomes. **Conclusion:** Nd:YAG laser capsulotomy is a safe and highly effective procedure for restoring visual acuity in patients with PCO. While transient IOP spikes and minor complications occur, they are manageable with appropriate follow-up. The findings reinforce Nd:YAG laser capsulotomy as the gold standard for PCO management, ensuring rapid and sustained visual recovery in affected patients.

KEYWORDS : PCO, ND-Yag, Capsulotomy, VA, Cataract surgery**INTRODUCTION**

Cataract remains one of the primary global causes of vision impairment and blindness. Worldwide, over 2.2 billion individuals experience near or distance vision impairment, and in at least 1 billion cases, this could have been either prevented or remains unaddressed. Of these 1 billion cases, cataract is the leading causes of distance vision impairment or blindness affecting (94 million) of population. [1]

Cataract surgery is now extensively accessible in India. India performs approximately 6.5 million cataract surgeries annually under the National Programme for Control of Blindness and Visual Impairment (NPCBVI) with a record-breaking 8.34 million successful cataract surgeries were performed during 2022-2023. [2]. Cataract surgery has seen significant advancements in recent years, yet postoperative complications remain a challenge with posterior capsular opacification (PCO) being the most prevalent.

After an uncomplicated cataract operation, posterior capsular opacification (PCO), also known as "secondary cataract" or "after cataract," appears on the previously clear posterior capsule several months to years later. Posterior capsular opacification (PCO) leads to a progressive decline in visual acuity. However, no definitive methods currently exist to completely prevent its occurrence. It results from aberrant migration and proliferation of lens epithelial cells (LECs) that were left on the capsule after surgery. Reduced vision and visual-axis obscuration result from these cells migrating towards the posterior capsule and the central visual axis. PCO manifests in two forms: fibrous and pearl, with some cases displaying a combination of both. Wrinkling of the posterior capsule, especially where the anterior and posterior capsules fuse, is a characteristic of PCO. [3]

Posterior capsular opacification (PCO) presents with symptoms that closely resemble those of an original cataract. Patients commonly experience cloudy, blurred, or hazy vision, which may feel akin to looking through frosted glass. Additionally, a glare or halo effect

around lights is frequently reported, leading to increased difficulty with night vision and light sensitivity. PCO also reduces the ability to focus, causing challenges with reading or performing detailed tasks. In some cases, double vision may occur. These symptoms are primarily attributed to the formation of a hazy membrane on the lens capsule, obstructing the passage of light to the retina and impairing visual acuity. [4]

Currently Nd:YAG laser capsulotomy is a widely indicated procedure for the treatment of posterior capsular opacification (PCO). The procedure is highly effective, with studies showing that 83% to 96% of patients experience significant visual improvement. A 2022 study further demonstrated that 99% of patients reported enhanced vision following Nd:YAG capsulotomy.[5]

MATERIALS AND METHODS

This prospective observational study was conducted in the Ophthalmology Department of Rajshree Medical Research Institute, Bareilly, from July 2023 to December 2024.

A total of 64 adult following cataract surgery, patients who had been monitored for more than three months; those whose "best corrected visual acuity" had declined by two or more additional lines with PCO following the implantation of a posterior chamber intraocular lens (PCIOL) during cataract surgery and age greater than 18 years were included. Patients who were not cooperative, under the age of 18 with Intraocular lens (IOL) dislocation or Individuals who had undergone combination procedures, such as PCIOL and trabeculectomy or PCO associated with eye disorders such as complicated cataracts, glaucoma, retinal degeneration and notable opacities in the media were excluded.

All patients underwent detailed ophthalmic evaluation including visual acuity testing, slit-lamp biomicroscopy, intraocular pressure (IOP) measurement with applanation tonometry, and fundus

examination. Nd:YAG laser capsulotomy was performed using a standard posterior capsulotomy technique under topical anesthesia. IOP was measured pre-procedure, and at 1 hour, 1 day, and 1 week post-procedure. Complications such as IOP spike, IOL pitting, iritis, CME, and retinal detachment were recorded.

RESULTS

The post-laser visual acuity improvement in patients, as assessed using the Snellen chart. Out of the total cases, the majority (68.8%) showed a 2 to 4 line improvement in best-corrected visual acuity (BCVA) following laser treatment. A significant improvement of more than 4 lines was observed in 25.0% of the cases, while only 6.3% demonstrated less than 2 lines of improvement. This indicates that laser treatment resulted in notable visual gains for most patients.

Table 1: Post-laser Visual Acuity Improvement Based On Snellen Chart

POSTLASER BCVA ACC TO SNELLEN CHART	Counts	% of Total
<2 LINE IMPROVEMENT	4	6.3 %
2 to 4 LINE IMPROVEMENT	44	68.8 %
>4 LINE IMPROVEMENT	16	25.0 %

The below table represents a comparison of Best Corrected Visual Acuity (BCVA) before and after laser treatment. Prior to the laser intervention, the majority of patients (45.3%) had BCVA in the range of 6/36 to 6/18, followed by 32.8% in the 3/60 to 6/60 category, 10.9% with vision better than 6/12 to 6/6, and another 10.9% with severe visual impairment (<3/60). However, following laser treatment, there was a significant improvement in visual outcomes, with 76.6% of patients achieving BCVA between 6/12 to 6/6, while the proportion of patients in all other poorer vision categories markedly decreased. Notably, none of the patients remained in the <3/60 category post-treatment, indicating the efficacy of laser treatment in improving visual acuity.

Table 2: Comparison Of Best Corrected Visual Acuity (BCVA) Before And After Laser Treatment

BCVA Category	Pre-Laser Count	Pre-Laser %	Post-Laser Count	Post-Laser %	P Value
<3/60	7	10.9%	0	0%	0.0017
3/60 to 6/60	21	32.8%	8	12.5%	
6/36 to 6/18	29	45.3%	7	10.9%	
6/12 to 6/6	7	10.9%	49	76.6%	

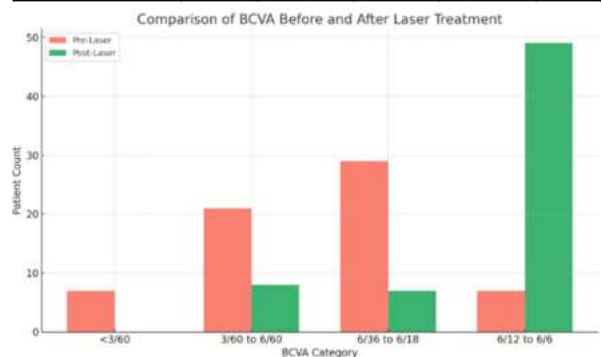


Table 3: Changes In Intraocular Pressure (IOP) Following Laser Procedure Over Time

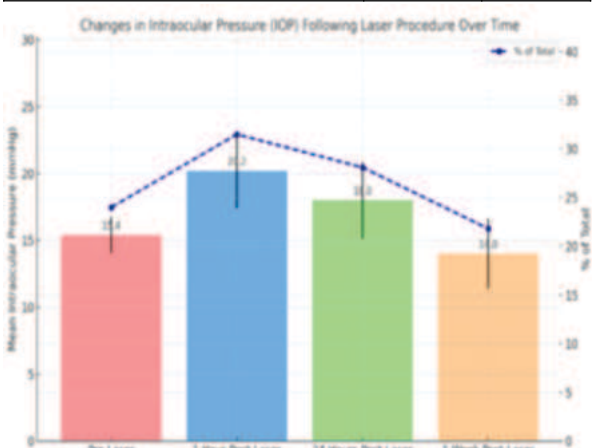
	Mean	SD	Mini mum	Maxi mum	% of Total	P Value
IOP (Pre-Laser) (mmHg)	15.4	1.37	12	18	24 %	0.0035
IOP (1 Hour Post-Laser) (mmHg)	20.2	2.79	15	26	31.5 %	0.00016
IOP (24 Hours Post-Laser) (mmHg)	18	2.86	13	23	28.1 %	0.03
IOP (1 Week Post-Laser) (mmHg)	14	2.62	10	20	21.8 %	0.032

The above table represents the changes in intraocular pressure (IOP) observed over time following a laser procedure. Initially, the mean pre-laser IOP was 15.4 mmHg with a standard deviation (SD) of 1.37, ranging from 12 to 18 mmHg and accounting for 24% of the total values. One hour post-laser, the IOP peaked with a mean of 20.2 mmHg (SD 2.79), ranging from 15 to 26 mmHg and comprising 31.5%

of the total. At 24 hours post-laser, the IOP decreased slightly to a mean of 18 mmHg (SD 2.86), ranging between 13 and 23 mmHg, representing 28.1%. By one week post-laser, the IOP had further reduced to a mean of 14 mmHg (SD 2.62), with values between 10 and 20 mmHg, making up 21.8% of the total. These findings suggest an initial rise in IOP post-laser, followed by a gradual decline over time.

Table 4: Distribution Of Immediate Postoperative Complications Following Intraocular Procedures

Complications Observed (Immediate)	Counts	% of Total
None	39	60.9 %
Transient IOP Spike	14	21.8 %
Iritis	4	6.2 %
Pitting of IOL	6	9.3 %
Iris bleed	1	1.5 %



The above table represents the distribution of immediate postoperative complications following intraocular procedures. Out of the total cases observed, the majority (60.9%) did not experience any complications. Transient intraocular pressure (IOP) spike was the most common immediate postoperative complication, occurring in 21.8% of cases. This was followed by pitting of the intraocular lens (IOL) in 9.3% of patients and iritis in 6.2% of cases. Iris bleed was the least common complication, observed in only 1.5% of cases.

DISCUSSION

This study demonstrated that Nd:YAG capsulotomy is highly effective in improving visual acuity in patients with PCO. A significant proportion of patients achieved functional visual acuity (6/12 or better), which aligns with other Indian and global studies. The incidence of complications was low and manageable with topical therapies. IOP rise post-procedure is well-documented and underscores the importance of post-laser monitoring. No serious posterior segment complications were observed, affirming the safety of the procedure in a well-selected patient population. Our study found that 76.6% of patients achieved a BCVA between 6/12 and 6/6 post-laser, 10.9% had BCVA between 6/36 and 6/18, and 12.5% had BCVA between 3/60 and 6/60. Bhadka, S. *et al.* (2022) reported that 86% achieved a BCVA of 6/9 or better, with 14% remaining between 6/24 and 6/60. Abdul Matin *et al.* (2021) found that 89.42% attained 6/8 or better, while 10.58% had BCVA between 6/24 and 6/60.

In our study, 60.9% of cases had no complications, while 21.8% experienced a transient IOP spike, 9.3% had IOL pitting, 6.2% developed iritis, and 1.5% had an iris bleed. Abdul Matin *et al.* (2021) found transient IOP spikes in 22%, IOL pitting in 10%, iritis in 5%, and iris bleeds in 1.8%.

In our study, 60.9% of cases had no complications, while 21.8% experienced a transient IOP spike, 9.3% had IOL pitting, 6.2% developed iritis, and 1.5% had an iris bleed. Bhadka *et al.* (2022) reported transient IOP spikes in 23%, IOL pitting in 8%, iritis in 7%, and iris bleeds in 2%. Abdul Matin *et al.* (2021) found transient IOP spikes in 22%, IOL pitting in 10%, iritis in 5%, and iris bleeds in 1.8%. Alam *et al.* (2018) observed transient IOP increases in 24%, IOL pitting in 11%, iritis in 6%, and iris bleeds in 2.1%.

CONCLUSION

Nd:YAG laser capsulotomy remains a cornerstone in the management

of posterior capsular opacification. This study affirms its role as a safe, effective outpatient procedure that provides significant improvement in visual acuity with minimal complications. Appropriate patient selection, accurate laser focusing, and post-procedural monitoring are key to optimizing outcomes.

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