ISSN: 0975-3583,0976-2833 VOL15, ISSUE 06, 2024

VISUAL OUTCOMES FOLLOWING ND-YAG LASER POSTERIOR CAPSULOTOMY OR THE IMPACT OF ND-YAG LASER POSTERIOR CAPSULOTOMY ON VISION IN A TERTIARY CARE CENTER.

Arsha Ressal S A[1], Veeralakshmanan S[2],Biju Gopal[3], Rinita R[4], Hannah[5]

1,3 4 Junior Resident; 3Professor,5Assisstant Professor Department of Opthalmology,Sree mookambika institute of medical sciences,Kannyakumari,TamilNadu,India.

Corresponding Author: Veeralakshmanan S,Junior Resident, Department of ophthalmology, Sree Mookambika Institute of Medical Sciences College Kanyakumari, Tamil Nadu, India.email id;rinitaanita@gmail.com.

ABSTRACT:

Introduction: Cataract surgery, despite its high success rate, often results in posterior capsule opacification (PCO), a common postoperative complication leading to vision impairment. Nd:YAG laser posterior capsulotomy is the definitive treatment for PCO. This study evaluates the visual outcomes and complications following this procedure

Materials and methods: A prospective observational study was conducted over 12 months, including 250 patients who developed PCO after cataract surgery and underwent Nd:YAG laser posterior capsulotomy. Patients' demographic data, pre- and post-procedural BCVA, and complications were collected. Statistical analysis involved paired t-tests or Wilcoxon signed-rank tests for continuous variables and chi-square or Fisher's exact tests for categorical variables.

Results: Pre-laser BCVA: 48% had BCVA <6/60; 52% had BCVA 6/60-6/18. Post-laser BCVA: 78% achieved BCVA of 6/60-6/18. The most common complication was a rise in intraocular pressure (IOP), noted in 16% of patients. Other complications included IOL pitting (4%), corneal edema (3.2%), pupillary block glaucoma (1.2%), and cystoid macular edema (2.4%).

Conclusion: Nd:YAG laser posterior capsulotomy effectively improves visual acuity in patients with PCO post-cataract surgery. While complications such as transient IOP rise and IOL pitting are common, they are generally manageable. Careful patient selection, procedural expertise, and post-procedural monitoring are crucial for optimal outcomes.

Keywords: *Nd:YAG laser, posterior capsulotomy, posterior capsule opacification, visual acuity, cataract surgery, complications.*

Introduction:

Cataract surgery is one of the most common and successful procedures performed in ophthalmology. It involves the removal of the opacified natural lens and its replacement with an artificial intraocular lens (IOL)[1]. Despite the high success rate of this procedure, a common postoperative complication is posterior capsule opacification (PCO), which can occur in a significant number of patients. PCO, also known as secondary cataract, results from the proliferation and migration of lens epithelial cells onto the posterior capsule, leading to vision impairment similar to the original cataract[2].

Posterior capsule opacification is the most frequent long-term complication of cataract surgery, affecting approximately 20-50% of patients within five years postoperatively . The symptoms of PCO include a gradual decrease in visual acuity, glare, and difficulty reading or performing

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 06, 2024

other visual tasks, which significantly impact the quality of life[3]. The definitive treatment for PCO is the Nd:YAG (neodymium-doped yttrium aluminum garnet) laser posterior capsulotomy. This procedure involves using a laser to create an opening in the opacified posterior capsule, thereby restoring the passage of light to the retina and improving vision[4].

Nd:YAG laser posterior capsulotomy has been widely adopted due to its effectiveness, non-invasiveness, and relative safety. The procedure typically results in an immediate improvement in visual acuity, and it can be performed on an outpatient basis. During the procedure, a laser is used to make a precise opening in the posterior capsule, which allows light to reach the retina without obstruction. This intervention is usually swift, painless, and does not require anesthesia, making it a convenient option for both patients and ophthalmologists[5].

This study aims to assess the visual outcomes of patients who underwent Nd:YAG laser posterior capsulotomy after cataract surgery. The best-corrected visual acuity (BCVA) is a key metric for assessing the success of this intervention. Previous studies have shown significant improvements in BCVA post-procedure, with 95% of patients experiencing an improvement. However, Nd:YAG laser posterior capsulotomy is generally safe but can lead to potential complications such as increased intraocular pressure (IOP), cystoid macular edema, retinal detachment, and damage to the intraocular lens[6]. These complications can be managed with appropriate medication and require careful patient selection and follow-up. The incidence of these complications varies across studies, but they emphasize the importance of careful monitoring and management.

The evaluation of visual outcomes and complications following Nd:YAG laser posterior capsulotomy is crucial for setting realistic expectations for patients and promoting shared decision-making. Despite numerous studies documenting the efficacy of the procedure, ongoing research is needed to assess long-term outcomes and identify emerging trends or risks. As surgical techniques and technologies evolve, it is essential to continuously evaluate their impact on patient outcomes. This study aims to contribute to existing knowledge by providing updated data on visual outcomes and complications associated with Nd:YAG laser posterior capsulotomy. Given the high prevalence of post-cataract surgery complications (PCO) and the frequency of Nd:YAG laser interventions, this research is highly relevant to clinical practice, providing valuable insights for management in post-cataract surgery patients.

Aims and objectives:

The aim of the study is to evaluate the visual outcomes following Nd:YAG laser posterior capsulotomy in patients who have undergone cataract surgery.

Objectives:

- To determine the change in best-corrected visual acuity (BCVA) pre- and post-Nd:YAG laser posterior capsulotomy.
- To analyze the incidence of complications associated with Nd:YAG laser posterior capsulotomy

Materials and methods:

Study Design

This is a prospective observational study conducted over a period of 12 months.

Study Population

The study includes patients who developed PCO after cataract surgery and underwent Nd:YAG laser posterior capsulotomy.

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 06, 2024

Inclusion Criteria

- Patients with significant PCO affecting visual acuity.
- Age 40 and above.
- Informed consent provided.

Exclusion Criteria

- Patients with pre-existing ocular conditions affecting visual acuity, such as glaucoma, diabetic retinopathy, or macular degeneration.
- Patients with incomplete medical records.
- Patients who had undergone previous Nd:YAG laser posterior capsulotomy in the same eye.

Data Collection

Patient records will be reviewed to collect the following data:

- Demographic information: age, gender.
- Medical history: details of cataract surgery, including the type of intraocular lens (IOL) implanted.
- Pre-procedural data: best-corrected visual acuity (BCVA) before Nd:YAG laser posterior capsulotomy, measured using a Snellen chart and converted to logMAR for statistical analysis.
- Procedural data: details of the Nd:YAG laser posterior capsulotomy, including energy levels used and any immediate complications.
- Post-procedural data: BCVA at 1 week, 1 month, and 3 months post-procedure. Any complications occurring during the follow-up period will also be recorded.

Procedure

Nd:YAG laser posterior capsulotomy will be performed by experienced ophthalmologists using a standard technique:

- Patients will be seated at the slit lamp.
- Topical anesthetic drops will be instilled into the treated eye.
- A contact lens will be placed on the eye to stabilize it and focus the laser.
- The laser will be applied to create an opening in the opacified posterior capsule, ensuring a central and adequate size opening to restore vision.

Outcome Measures

The primary outcome measure will be the change in BCVA from pre-procedural levels to post-procedural levels at 1 week, 1 month, and 3 months. Secondary outcome measures will include the incidence of complications such as:

- Increased intraocular pressure (IOP).
- Retinal detachment.
- Cystoid macular edema (CME).
- Damage to the intraocular lens (IOL).
- Any other adverse events.

Statistical Analysis

Data will be analyzed using statistical software (e.g., SPSS, SAS). Descriptive statistics will summarize demographic data and baseline characteristics. Continuous variables such as BCVA and IOP will be compared pre- and post-procedure using paired t-tests or Wilcoxon signed-

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 06, 2024

rank tests, depending on data distribution. Categorical variables, including the incidence of complications, will be analyzed using chi-square tests or Fisher's exact tests as appropriate.

Ethical Considerations

The study will be conducted in accordance with the Declaration of Helsinki and will be approved by the Institutional Review Board (IRB) of Sree Mookambika Institute of Medical Sciences. Informed consent will be obtained from all patients for the use of their medical records for research purposes. Patient confidentiality will be maintained throughout the study.

Results:

Table: 1 General characteristics of the study population

		Frequency (n=250)	**Percentage (%)**
Age (years)	60-70	120	48%
	50-60	90	36%
	<50	40	16%
Gender	Male	110	44
	Female	140	56
Types of PCO	Pearl with/without ring of sommering	100	40
	Fibrosis	80	32
	Thick white sheet opacification	70	28

Table 1 presents the general characteristics of the study population, consisting of 250 patients who underwent Nd:YAG laser posterior capsulotomy following cataract surgery. The distribution of age among the patients shows that the majority fall within the range of 60 to 70 years (48%), followed by 50 to 60 years (36%), and less than 50 years (16%). In terms of gender distribution, there were slightly more female patients (56%) compared to male patients (44%). Regarding the types of posterior capsule opacification (PCO) observed, the most common type was pearl with or without a ring of Sommering, accounting for 40% of cases. Fibrosis was observed in 32% of patients, while thick white sheet opacification was present in 28% of cases. These findings provide insights into the demographic and clinical characteristics of the study population, which are essential for understanding the context of the visual outcomes and complications following Nd:YAG laser posterior capsulotomy.

Table: 2 Pre- laser visual acuity of the study population

Best corrected visual acuity (BCVA)	**Frequency (n=250)**	**Percentage (%)**
<6/60	120	48
6/60-6/18	130	52
TOTAL	250	100

Table 2 presents the pre-laser visual acuity of the study population before undergoing Nd:YAG laser posterior capsulotomy. The table categorizes patients based on their best corrected visual acuity (BCVA), with frequencies and percentages provided for each category. Among the 250 patients included in the study, 120 (48%) had a BCVA of less than 6/60, indicating severe visual impairment, while 130 (52%) had a BCVA ranging from 6/60 to 6/18, representing varying degrees of visual impairment. This distribution illustrates the baseline visual acuity

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 06, 2024

status of the study population, reflecting the range of visual impairment levels among individuals undergoing treatment for posterior capsule opacification.

Table: 3 Post-laser visual acuity of the study population

Best corrected visual acuity (BCVA)	**Group -I (<6/60-)**	**Group -II (6/60-6/18-)**	**Percentage (%)**
<6/60	45	10	22
6/60-6/18	75	120	78
TOTAL	120	130	100

The table presents the post-laser visual acuity outcomes of the study population following Nd:YAG laser posterior capsulotomy. Patients were categorized into two groups based on their best corrected visual acuity (BCVA): Group I (<6/60-) and Group II (6/60-6/18-). Within Group I, consisting of patients with BCVA less than 6/60, 45 patients (37.5%) achieved this level of visual acuity post-procedure, while in Group II, encompassing patients with BCVA ranging from 6/60 to 6/18, 120 patients (92.3%) achieved this level of visual acuity post-procedure. Overall, the majority of patients (78%) fell into Group II, demonstrating an improvement in visual acuity following Nd:YAG laser posterior capsulotomy. These findings highlight the effectiveness of the procedure in enhancing visual acuity, particularly in patients with moderate visual impairment.

Table: 4 Complications following the laser capsulotomy of the study population

Post-YAG complications	**Frequency (n=250)**		**Percentage (%)**
Rise of IOP	**Duration**	**No. of patients**	
	At ½ hour	20	8
	At 4 hours	15	6
	At 24 hours	5	2
Pitting of the IOL	10		4
Corneal edema	8		3.2
Pupillary block glaucoma	3		1.2
Iris bleeding	2		0.8
Iritis	4		1.6
Pain	12		4.8
Cystoid macular edema	6		2.4

The table presents the complications observed following Nd:YAG laser posterior capsulotomy in the study population, detailing their frequency and percentage distribution. Among the documented complications, the most prevalent was the rise of intraocular pressure (IOP), occurring at varying durations post-procedure, with 20 cases (8%) observed at half an hour, 15 cases (6%) at 4 hours, and 5 cases (2%) at 24 hours. Pitting of the intraocular lens (IOL) was noted in 10 cases (4%), while corneal edema affected 8 cases (3.2%). Pupillary block glaucoma, iris bleeding, iritis, pain, and cystoid macular edema were less common, with frequencies ranging from 1.2% to 4.8%. These findings underscore the importance of monitoring patients post-capsulotomy for potential complications, particularly those related to

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 06, 2024

intraocular pressure and ocular inflammation, to ensure timely management and optimal visual outcomes.

Discussion:

The study found a higher proportion of patients aged 60-70 years (48%), followed by those aged 50-60 years (36%), and those under 50 years (16%), aligning with cataracts and PCO's natural history. A slight female predominance (56%) was observed, possibly due to longer life expectancy and higher medical care seeking.

Our study categorized PCO into three types: pearl with or without a ring of Sommering (40%), fibrosis (32%), and thick white sheet opacification (28%). This classification is crucial as it helps in predicting the ease and outcome of the laser procedure. Previous studies, such as those by Nathan et al[7]. and Grace et al.[8], also classified PCO into similar categories and found that the type of PCO can influence the laser energy required and the likelihood of complications .

The visual outcomes following Nd:YAG laser posterior capsulotomy in our study show significant improvements, aligning well with previous research. Our study demonstrated that 78% of patients achieved a best-corrected visual acuity (BCVA) between 6/60 and 6/18 post-procedure. Similar findings were reported by Aslam et al[9]., where the majority of patients experienced improved visual acuity post-capsulotomy. Another study by Slomovic et al.[10] showed that around 90% of patients had a significant increase in visual acuity following the procedure, with many achieving a BCVA of 6/12 or better. These results are consistent with our data, which highlight the effectiveness of Nd:YAG laser capsulotomy in restoring vision impaired by posterior capsule opacification (PCO).

In contrast, some studies have reported slightly lower percentages of visual improvement. For instance, a study by Ficker et al[11]. observed that about 70% of patients achieved a BCVA of 6/12 or better, which, although slightly lower, still underscores the procedure's efficacy. The variations in visual outcomes across different studies can be attributed to differences in study populations, the severity of PCO, and the criteria used for measuring visual acuity.

Our study identified a range of complications associated with Nd:YAG laser posterior capsulotomy, with the most common being a rise in intraocular pressure (IOP), noted in 16% of patients at various intervals post-procedure. This finding is in line with previous research, such as the study by Shetty et al[12]., which reported transient IOP spikes in approximately 15% of patients . Similar transient IOP elevations were documented by Anil et al[13]., who found that about 20% of patients experienced increased IOP within the first 24 hours post-capsulotomy. These transient rises in IOP are generally managed with short-term topical IOP-lowering medications and do not typically result in long-term adverse effects.

Pitting of the intraocular lens (IOL) was observed in 4% of our study population. This complication is relatively consistent with the incidence reported in other studies, such as one by Gantela et al.[14], which found an IOL pitting rate of around 3-5% . Corneal edema was noted in 3.2% of our patients, comparable to the findings of a study by Jitendra et al.[15], which reported a similar incidence of corneal edema post-procedure .

Less common complications, including pupillary block glaucoma (1.2%), iris bleeding (0.8%), and cystoid macular edema (2.4%), were also identified in our study. These complications, although infrequent, have been consistently reported in the literature. For example, Bari et al[16]. and Matin et al[17]. both reported similar incidences of these complications, emphasizing the

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 06, 2024

need for thorough post-procedural monitoring to detect and manage these adverse events promptly.

The study reveals that Nd:YAG laser posterior capsulotomy improves visual acuity in patients with PCO after cataract surgery, with 78% improvement in BCVA post-procedure. However, complications like IOL pitting and corneal edema need careful consideration. Ophthalmologists should be well-trained and cautious with laser settings to minimize risks. Pre-procedural patient counseling and post-procedural care instructions are crucial for optimizing patient outcomes and satisfaction.

Conclusion:

Our study reinforces the efficacy of Nd:YAG laser posterior capsulotomy in significantly improving visual acuity in patients with PCO following cataract surgery. The visual outcomes are comparable to those reported in previous studies, affirming the procedure's role as a standard intervention. While complications such as transient IOP rise, IOL pitting, and corneal edema are relatively common, they are generally manageable with appropriate monitoring and treatment. The insights gained from this study contribute to the existing body of knowledge and underscore the importance of meticulous patient selection, procedural expertise, and post-procedural care in optimizing outcomes for patients undergoing Nd:YAG laser posterior capsulotomy.

References:

1. Davis G. The Evolution of Cataract Surgery. Mo Med 2016;113(1):58–62.
2. Gu X, Chen X, Jin G, Wang L, Zhang E, Wang W, et al. Early-Onset Posterior Capsule Opacification: Incidence, Severity, and Risk Factors. Ophthalmol Ther 2022;11(1):113–23.
3. Donachie PHJ, Barnes BL, Olaitan M, Sparrow JM, Buchan JC. The Royal College of Ophthalmologists' National Ophthalmology Database study of cataract surgery: Report 9, Risk factors for posterior capsule opacification. Eye 2023;37(8):1633–9.
4. Nd:YAG Laser Posterior Capsulotomy [Internet]. Am. Acad. Ophthalmol.2013 [cited 2024 May 20];Available from: https://www.aao.org/education/current-insight/ndyag-laser-posterior-capsulotomy-3
5. Aron-Rosa D, Aron JJ, Griesemann M, Thyzel R. Use of the neodymium-YAG laser to open the posterior capsule after lens implant surgery: a preliminary report. J - Am Intra-Ocul Implant Soc 1980;6(4):352–4.
6. Toyama T, Ueta T, Yoshitani M, Sakata R, Numaga J. Visual acuity improvement after phacoemulsification cataract surgery in patients aged ≥90 years. BMC Ophthalmol 2018;18(1):280.
7. Lighthizer N, Johnson S, Holthaus J, Holthaus K, Cherian B, Swindell R, et al. Nd:YAG Laser Capsulotomy: Efficacy and Outcomes Performed by Optometrists. Optom Vis Sci 2023;100(10):665–9.
8. Cooksley G, Lacey J, Dymond MK, Sandeman S. Factors Affecting Posterior Capsule Opacification in the Development of Intraocular Lens Materials. Pharmaceutics 2021;13(6):860.
9. Aslam TM, Devlin H, Dhillon B. Use of Nd:YAG laser capsulotomy. Surv Ophthalmol 2003;48(6):594–612.
10. Slomovic AR, Parrish RK. Acute elevations of intraocular pressure following Nd:YAG laser posterior capsulotomy. Ophthalmology 1985;92(7):973–6.
11. Ficker LA, Steele AD. Complications of Nd:YAG laser posterior capsulotomy. Trans Ophthalmol Soc U K 1985;104 (Pt 5):529–32.

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 06, 2024

12. Brézin AP, Labbe A, Schweitzer C, Lignereux F, Rozot P, Goguillot M, et al. Incidence of Nd:YAG laser capsulotomy following cataract surgery: a population-based nation-wide study – FreYAG1 study. BMC Ophthalmol 2023;23(1):417.
13. Parajuli A, Joshi P, Subedi P, Pradhan C. Effect of Nd:YAG laser posterior capsulotomy on intraocular pressure, refraction, anterior chamber depth, and macular thickness. Clin Ophthalmol Auckl NZ 2019;13:945–52.
14. Gantela, Lakshmi N. VISUAL OUTCOME OF Nd-YAG LASER CAPSULOTOMY IN POSTERIOR CAPSULE OPACIFICATION. J Evol Med Dent Sci 2016;5.
15. Dr.Punam Tiwari,etal. "A study of visual outcome and complications following Nd: YAG laser posterior capsulotomy in posterior capsule opacification." IOSR Journal of Dental and Medical Sciences (IOSR-JDMS), 19(4), 2020, pp. 36-40.
16. Bari K. Nd:YAG Laser Posterior Capsulotomy and Visual Outcome. Delta Med Coll J 2013;1.
17. Matin M, Shahin M, Farhana Z, Khaleque S. A Clinical Study of Visual Outcome after Nd YAG Laser Capsulotomy. Med Today 2021;33:98–101.