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EFFECT OF ND:YAG LASER PARAMETERS ON INTRAOCULAR PRESSURE AND INFLAMMATORY OUTCOMES FOLLOWING POSTERIOR CAPSULOTOMY

Ophthalomology

Dr Riddhi Gajjar Senior Resident Department of Ophthalmology, Ananya College of Medicine and Research, Kalol, Gandhinagar, Gujarat, India- 382721

ABSTRACT

Background Nd:YAG laser posterior capsulotomy remains the treatment of choice for visually significant posterior capsular opacification (PCO). Although the procedure is generally safe, postoperative intraocular pressure (IOP) elevation and inflammatory reactions may occur, and these complications may be influenced by the laser settings employed during treatment. This study evaluated the relationship between Nd:YAG laser parameters and early postoperative IOP changes and inflammatory outcomes following posterior capsulotomy. **Methods** A prospective observational study was conducted on 102 eyes undergoing Nd:YAG laser posterior capsulotomy for visually significant PCO. Laser parameters, including total laser energy and number of laser shots, were recorded for each procedure. Patients underwent ophthalmic examination before treatment and at three postoperative follow-up visits (3–4 days, 7–10 days, and 21–30 days). Outcome measures included changes in IOP and the occurrence of inflammatory complications. Statistical analysis was performed using appropriate parametric and non-parametric tests, with statistical significance defined as $p<0.05$. **Results** Eyes requiring a greater number of laser shots and higher total laser energy demonstrated significantly higher rates of postoperative inflammatory complications. Increased laser parameters were also associated with significantly greater IOP during later follow-up visits. The number of laser shots showed a weak positive correlation with postoperative IOP ($r=0.322$), while total laser energy demonstrated a similar positive correlation ($r=0.387$). **Conclusion** Laser parameters are important determinants of early clinical outcomes following Nd:YAG posterior capsulotomy. Greater laser energy and increased pulse count were associated with higher postoperative IOP and a greater risk of inflammatory complications. Optimizing laser settings while achieving an adequate capsulotomy may help reduce procedure-related adverse events and improve postoperative safety.

KEYWORDS

Nd:yag Laser Posterior Capsulotomy; Laser Energy; Laser Shots; Intraocular Pressure; Posterior Capsular Opacification

INTRODUCTION

Posterior capsular opacification (PCO) is the most common delayed complication of cataract surgery. It results from the proliferation, migration, and transformation of residual lens epithelial cells on the posterior capsule, leading to reduced visual acuity, glare, and diminished contrast sensitivity. [1][2][3] Nd:YAG laser posterior capsulotomy is the standard treatment for visually significant PCO and is considered a safe and effective procedure for restoring visual function. [4] Nevertheless, transient elevation of intraocular pressure (IOP) and postoperative inflammatory reactions may occur following the procedure, and these outcomes may be influenced by the laser energy delivered and the number of laser shots used. The present study was conducted to evaluate the effect of Nd:YAG laser parameters on postoperative IOP and inflammatory outcomes following posterior capsulotomy.

Materials and Methods

This prospective longitudinal study was conducted to evaluate the association between Nd:YAG laser parameters and early postoperative intraocular pressure (IOP) and inflammatory outcomes following posterior capsulotomy. The study was performed in accordance with the principles of the Declaration of Helsinki. A total of 102 eyes with visually significant posterior capsular opacification (PCO) following phacoemulsification with posterior chamber intraocular lens implantation were included.

Eyes with pre-existing glaucoma, complicated pseudophakia, recent ocular laser procedures, significant retinal or macular pathology, a single functional eye, or patients younger than 7 years or older than 70 years were excluded. Written informed consent was obtained from all participants before enrolment.

All patients underwent a detailed preoperative ophthalmic evaluation including visual acuity, best-corrected visual acuity, intraocular pressure measurement, slit-lamp biomicroscopy, and fundus examination.

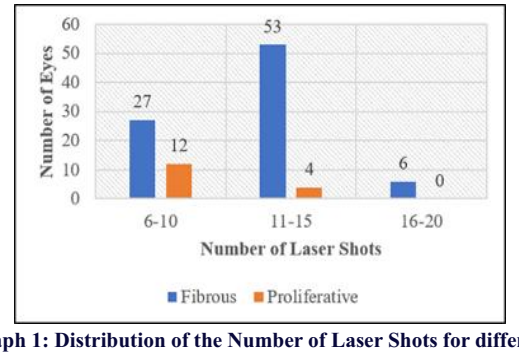
Nd:YAG laser posterior capsulotomy was performed as an outpatient procedure following adequate pupillary dilatation using tropicamide 0.8% and phenylephrine 5%. A Q-switched Nd laser was used for all procedures. The total laser energy delivered and the number of laser shots required for capsulotomy were documented for each eye. Patients were subsequently followed at three postoperative visits (3–4 days, 7–10 days, and 21–30 days). At each follow-up, BCVA, IOP, slit-lamp findings, fundus examination, and postoperative inflammatory complications were recorded.

Statistical analysis was performed using IBM SPSS Statistics version 20. Student's t-test and Pearson's Chi-square test were used. A p-value <0.05 was considered statistically significant.

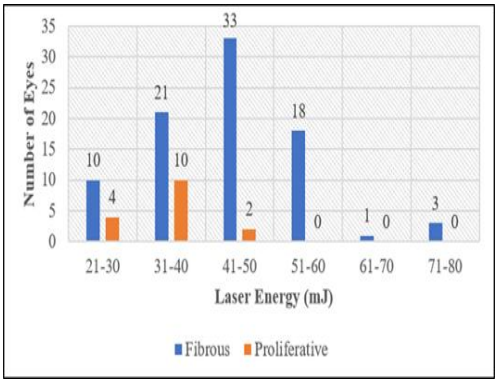
RESULTS

A total of 102 eyes with visually significant posterior capsular opacification (PCO) were included in the study. Fibrous PCO was the predominant morphological subtype, accounting for 85 (83.33%) eyes.

The distribution of laser shots and total laser energy used during Nd:YAG posterior capsulotomy is illustrated in Graph 1 and 2, respectively.



Graph 1: Distribution of the Number of Laser Shots for different PCO types



Graph 2: Distribution of Laser Energy for different PCO types

Eyes that developed postoperative inflammatory complications required significantly higher laser energy and a greater number of laser shots than eyes without inflammation. The mean number of laser shots was 12.50 versus 11.26 (p=0.038), and the mean total laser energy was 48.57 mJ versus 42.26 mJ (p=0.024), respectively.

The relationship between the number of laser shots and postoperative IOP is presented in Table 1. No significant difference in IOP was observed at baseline or during the first postoperative visit; however, eyes receiving 16–20 laser shots demonstrated significantly higher IOP at the second and third follow-up visits.

Table 1: Association between Number of Nd:YAG Laser Shots and Postoperative Intraocular Pressure Following Posterior Capsulotomy

Number of Laser Shots	Baseline IOP (mmHg) (mean ± SD)	Visit 1 IOP (mmHg) (mean ± SD)	Visit 2 IOP (mmHg) (mean ± SD)	Visit 3 IOP (mmHg) (mean ± SD)	P-value
6-10	14.07 ± 2.58	15.92 ± 3.14	13.89 ± 2.63	13.56 ± 2.69	0.1173 (Not significant)
11-15	13.91 ± 2.68	16.66 ± 3.11	14.66 ± 3.26	14.43 ± 2.75	0.1136 (Not significant)
16-20	15.66 ± 1.03	15.83 ± 2.48	18.16 ± 2.99	19.5 ± 2.42	0.0014 (Significant)
P-value	0.2925 (Not significant)	0.4743 (Not significant)	0.0068 (Significant)	0.000015 (Significant)	

Similarly, increasing total laser energy was associated with higher postoperative IOP (Table 2).

Table 2: Association between Total Nd:YAG Laser Energy and Postoperative Intraocular Pressure Following Posterior Capsulotomy

Laser Energy (mJ)	Baseline IOP (mmHg) (mean ± SD)	Visit 1 IOP (mmHg) (mean ± SD)	Visit 2 IOP (mmHg) (mean ± SD)	Visit 3 IOP (mmHg) (mean ± SD)	P-value
21-40	13.91 ± 2.47	15.97 ± 3.12	13.57 ± 2.14	13.66 ± 2.24	0.41179 (Not significant)
41-60	14.22 ± 2.72	16.67 ± 3.08	15.32 ± 3.49	14.83 ± 3.33	0.10939 (Not significant)
61-80	14 ± 2.82	15.75 ± 2.98	16 ± 5.16	17 ± 4.24	0.01324 (Significant)
P-value	0.8351 (Not significant)	0.4948 (Not significant)	0.0123 (Significant)	0.0214 (Significant)	

DISCUSSION

Posterior capsular opacification (PCO) continues to be the most common delayed complication following cataract surgery, and Nd:YAG laser posterior capsulotomy remains the standard treatment for restoring visual function in affected pseudophakic patients. Although the procedure is considered safe and highly effective, postoperative elevation of intraocular pressure (IOP) and inflammatory complications remain recognized adverse events. [4] The present study evaluated the influence of Nd:YAG laser parameters, specifically total laser energy and number of laser shots, on early postoperative IOP changes and inflammatory outcomes.

In the present study, 102 eyes of 86 patients underwent Nd:YAG laser posterior capsulotomy. Fibrous PCO constituted the majority of cases and generally required greater laser energy and a higher number of laser shots than proliferative PCO. Eyes requiring higher laser energy and increased pulse counts demonstrated a significantly greater incidence of postoperative inflammatory complications. Furthermore, postoperative IOP was significantly higher during the second and third follow-up visits in eyes treated with higher laser energy and a greater number of laser shots. Both laser energy (r=0.387) and number of laser shots (r=0.322) showed weak positive correlations with postoperative IOP, indicating that increasing laser exposure was associated with greater IOP elevation.

These observations are consistent with previous reports demonstrating that post-Nd:YAG IOP elevation is influenced not only by patient-related factors but also by procedural variables. Monica Deshwal et al. reported that IOP elevation following Nd:YAG capsulotomy is generally transient and gradually returns towards baseline during follow-up. [5] Other investigators have similarly shown that higher total laser energy and increased pulse counts are associated with a greater likelihood of postoperative ocular hypertension and inflammatory reactions. [6][7][8][9]

The mechanism underlying these findings is likely multifactorial. Greater laser energy produces increased disruption of the posterior capsule, resulting in liberation of lens capsule fragments, pigment particles, and inflammatory mediators into the anterior chamber. These materials may transiently obstruct the trabecular meshwork and reduce aqueous humour outflow, leading to temporary IOP elevation. Simultaneously, greater tissue disruption may intensify the inflammatory response, predisposing susceptible eyes to postoperative iridocyclitis, vitritis, and other inflammatory sequelae. [10]

The findings of the present study emphasize the importance of optimizing laser settings during Nd:YAG posterior capsulotomy. Although complete capsulotomy remains the primary objective, unnecessary increases in laser energy or pulse count should be avoided whenever possible. Careful titration of laser parameters may reduce postoperative IOP elevation and inflammatory complications while maintaining the excellent visual outcomes associated with the procedure.

CONCLUSION

Nd:YAG laser posterior capsulotomy is an established, safe, and effective treatment for visually significant posterior capsular opacification. However, postoperative intraocular pressure elevation and inflammatory complications remain important early adverse events that may be influenced by procedural factors.

The present study demonstrated that greater total laser energy and an increased number of laser shots were significantly associated with higher postoperative intraocular pressure and a greater incidence of inflammatory complications. Although the observed rise in IOP was generally transient, eyes requiring higher laser exposure were more likely to develop clinically significant postoperative changes. These findings highlight the importance of judicious selection of laser parameters during capsulotomy. Employing the minimum effective laser energy and pulse count required to achieve an adequate capsulotomy may help reduce procedure-related complications while preserving the excellent clinical outcomes of Nd laser treatment.

REFERENCES

1. McDonald, M. (2021). Posterior Capsule Opacification. In: Liu, C., Shalaby Bardan, A. (eds) Cataract Surgery. Springer, Cham. https://doi.org/10.1007/978-3-030-38234-6_12
2. Donachie, P.H.J., Barnes, B.L., Olaitan, M. et al. The Royal College of Ophthalmologists' National Ophthalmology Database study of cataract surgery: Report 9, Risk factors for posterior capsule opacification. Eye 37, 1633–1639 (2023). https://doi.org/10.1038/s41433-022-02204-1
3. Pradeep, Thanuja Gopal. An unusual case of hemorrhage along the capsulotomy margin following Nd YAG capsulotomy. Journal of Clinical Ophthalmology and Research 12(1):p 52-54, Jan–Apr 2024. | DOI: 10.4103/jcor.jcor_110_23
4. Borkenstein, A.F., Borkenstein, EM. Neodymium-doped yttrium aluminum garnet (Nd:YAG) laser treatment in ophthalmology: a review of the most common procedures Capsulotomy and Iridotomy. Lasers Med Sci 39, 167 (2024). https://doi.org/10.1007/s10103-024-04118-8
5. Deshwal, Monica1; Sethi, Harinder S.2; Naik, Mayuresh P.1,; Gupta, Vishnu S.1. Topical steroid alone vs a combination with a posterior segment NSAID after Nd-YAG capsulotomy: Is the posterior segment NSAID really necessary?. Journal of Family Medicine and Primary Care 9(2):p 664-668, February 2020. | DOI: 10.4103/jfmpc.jfmpc_461_19
6. Shetty NK, Sridhar S. Study of Variation in Intraocular Pressure Spike (IOP) Following Nd- YAG Laser Capsulotomy. J Clin Diagn Res. 2016 Dec;10(12):NC09-NC12. doi: 10.7860/JCDR/2016/21981.9037. Epub 2016 Dec 1. PMID: 28208899; PMCID: PMC5296472.
7. Asghar H, Zubair AH, Malik M, Sami AM, Ashraf A, Ashraf B. Evaluation of intraocular pressure changes following Nd: YAG laser posterior capsulotomy. Professional Medical Journal. 2026 Mar 1;33(3):461.
8. Bhargava R, Kumar P, Phogat H, Chaudhary KP. Neodymium-Yttrium Aluminium Garnet Laser Capsulotomy Energy Levels for Posterior Capsule Opacification. J Ophthalmic Vis Res. 2015;10(1):37–42.
9. Ahmed I, Alvi R, Shaikh AA, Khan I. Change in intraocular pressure at different energy levels of yag laser capsulotomy. Pakistan Journal of Surgery. 2023 Apr 1;39(2).
10. VS H. Comparision Of Visual Outcome And IOP Changes Before And After Nd-Yag Laser Capsulotomy In Patients With Posterior Capsular Opacification. American Journal of Psychiatric Rehabilitation. 2025;28(5):276.