

# A Study of Visual Improvement and Variation in IOP Following Nd-YAG Laser Capsulotomy

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DOI: <https://doi.org/10.52403/ijrr.20230616>

## ABSTRACT

**AIM:** To study the visual improvement and to correlate the effect of energy used and number of shots with post procedural IOP spike following Nd-YAG laser capsulotomy cases.

**MATERIALS AND METHODS:** A total of 36 patients presented with pseudophakia with PCO attending ophthalmology outpatient department at Rajah Muthiah medical college hospital during the period of October 2020 - December 2022 were included in the study. Patients with glaucoma, Uveitis, high myopia, posterior segment disorders will be excluded from the study. The patient will be subjected to visual acuity testing, detailed slit lamp examination, IOP measurement using Non-contact tonometer pre and post laser procedure and detailed fundus examination done and results were interpreted.

**OBSERVATION:** Among the total 36 participants, 31.4% belong to age group 56 to 65 years followed by 28.6% in the age group 66 to 75 years. 51.4% were males and 48.6% were females. Of the total participants 28.6% had visual acuity of 6/24 in the affected eye and 22.9% had visual acuity of 6/36 in the affected eye. one subject presented with visual acuity of hand movements (HM) only in the involved eye. The mean pre-operative intraocular pressure among the participants was  $1.85 \pm 0.73$ . 45.7% had preoperative IOP of 13 to 16 mmHg and 34.3% had preoperative IOP of 8 to 12. The mean number of YAG shots among the participants was  $1.96 \pm 0.81$ . 36.3% were provided with 5 to 8 YAG shots and 33.3% with 2 to 4. The mean IOP among the participants in

the preop was  $14.03 \pm 2.92$ . The mean IOP immediately after the intervention was  $15.29 \pm 2.83$ . The mean IOP 20 mins after the intervention was  $17.43 \pm 2.96$ . Our study shows that the change in mean IOP after ND YAG LASER administration was significant with P value of less than 0.05 and also our study shows improvement in post laser BCVA with significant P values

**CONCLUSION:** The study concluded that all patients had good visual recovery. The post laser IOP raise is minimal and transient. It varies with amount of laser energy used. Hence recommended to use minimum possible laser energy and must be followed up for raised intraocular pressure changes.

**Key words:** Intraocular pressure, Neodymium: Yttrium Aluminium GARNET Capsulotomy.

## INTRODUCTION

Cataract is defined as any opacity in the lens or its capsule, whether developmental or acquired stationary or progressive causing visual impairment and is the leading causes of curable blindness in India. Common causes of blindness in India are cataract, refractive errors, glaucoma, corneal pathologies, posterior segment pathologies. Of these cataracts account for roughly 62.6% of cases of blindness in India. Surgery remains the only available treatment for the same.

Cataract surgery has come a long way since its introduction and placements of

Intraocular lens in posterior capsular bag ensure better visual prognosis however these in-the-bag Intraocular lens placement procedures are not exempted from the complication and formation of posterior capsular opacification (also termed as secondary cataract)

Extra capsular cataract extraction with the posterior chamber IOL implantation is the frequent ocular surgery done at all of the eye care facilities.

One of the commonest side effect of cataract surgery with posterior chamber IOL implantation is posterior capsular opacification(PCO).

After a cataract surgery, symptoms like blurring of vision, hazy vision, glare from lights may be caused by a PCO. Vision loss and blurriness caused by PCO typically occur gradually. During a cataract procedure, the surgeon will carefully remove the cataractous lens from the affected eye and an artificial Intraocular lens (IOL) will be placed. The lens is located within a very thin membrane "bag" called the capsule.

The anterior of the capsule must be opened to remove and place the IOL . The posterior of the capsule is still intact, supporting the new implanted artificial Intraocular lens.

In small proportion of patients, the outer cells of the old lens remain and grow on the posterior capsule, which makes the capsule hazy or clouded and causes blurred vision . Treatment for PCO is extremely straightforward. To clear the haze and restore clear vision, a treatment known as Nd-YAG laser capsulotomy is performed.

The PCO treatment known as Nd-Yag laser capsulotomy is risk-free, non-invasive, and time-tested. IOP rise, hyphaema, cystoid macular oedema, corneal haze, uveitis, IOL pits, and retinal detachments are the most common post-Nd-Yag Capsulotomy problems identified. The most prevalent of these are IOP spikes.

Depending on the size of the capsulotomy and other humoral factors, it has been hypothesised that the increase in IOP following Nd-Yag capsulotomy is caused by

a decreased outflow facility caused by the blockage of the trabecular meshwork by capsular debris, vitreous particles floating in the anterior chamber, and other humoral factors.

The surgical capsulotomy has been replaced with the ND-YAG laser because it is less intrusive and performed as an outpatient procedure.

Kraff and co-authors have found that the IOP spike post capsulotomy is lower in pseudophakes compared to aphakes, as IOL would block the capsular and vitreal debris reaching the anterior chamber which blocks the trabecular meshwork. The maximum rise is seen 2-4 hours post procedure.

In the first week of surgery, most ophthalmologists give anti-glaucoma drugs. Among the ocular hypotensives, Alpha 2-adrenergic receptor agonists are the most commonly used medication. Patients who have been previously diagnosed with glaucoma require pre-procedure antiglaucoma medications as well as more frequent monitoring.

Our research looks for a relationship between the amount of laser energy used, the number of shots, and the post-procedure IOP spike.

This correlation will allow us to identify the patients who need more frequent follow-up visits and prophylactic antiglaucoma medication. This study justifies the use of antiglaucoma drugs by evaluating the pattern of intraocular pressure changes following Nd-YAG CAPSULOTOMY.

## **MATERIALS AND METHODOLOGY**

All patients of pseudophakia with PCO attending the Ophthalmology Out Patient Department at Rajah Muthiah medical college hospital during the period of October 2020 - December 2022 to be randomly selected and included in the study. The patients having PCO following cataract surgery, with no other complications will be included in the study. Patients with Glaucoma, Uveitis, High-Myopia and posterior segment disorders will be excluded from the study. The patients will

be subjected to visual acuity testing, autorefractometer, detailed slit lamp examination for presence of PCO, type of PCO, type of IOL, position of IOL, IOP measurement using Non-contact tonometer and detailed fundus examination.

Post-procedure IOP will be evaluated immediate post-procedure, 20 minutes post-procedure. Immediate Post-Procedure the patients will also be evaluated for visual acuity, slit lamp biomicroscopy and post-procedure Refractive shift. Based on the readings of IOP values, patients will be evaluated administered with anti-glaucoma medication.

### STATISTICAL ANALYSIS

The data collected were entered into Microsoft excel 2016 and the master chart was then loaded into SPSS version 26 for statistical analysis. Qualitative variables were expressed using frequency and percentages and quantitative variables using mean and standard deviation. Bar charts and pie diagrams were used for representing the data.

To find out the change in mean IOP from the baseline after the intervention, repeated measured ANOVA (Analysis of Variance) was used. A P value of less than 0.05 was considered to be statistically significant. A line diagram was used to represent the trend of intra ocular pressure over the follow up period. To find out the improvement in vision post intervention, Chi square test was applied and to find out the difference in mean across three different categories, ANOVA test was applied.

### RESULTS

Among the participants, 31.4% belonged to age group 56 to 65 years followed by 28.6% in the age group 66 to 75 years. 51.4% were males and 48.6% were females. Among the males, 38.9% belonged to age group 56 to 65 years and 22.2% belonged to age group 66 to 75 years. Among the females, 35.3% belonged to age group 66 to 75 years followed by 23.5% in the age group 56 to 65

years and 66 to 75 years, respectively. (Table 1 and figure 1)

Table 2 and figure 2 shows that the mean pre operative intraocular pressure among the participants was  $1.85 \pm 0.73$ .

45.7% had preoperative IOP of 13 to 16 mmHg and 34.3% had preoperative IOP of 8 to 12 mmHg

Table 3 and figure 3 shows that the mean number of YAG shots among the participants was  $1.96 \pm 0.81$ .

34.2% were provided with 2 to 4 YAG shots and 5 to 8 YAG shots, respectively.

Table 4 and figure 4 shows that the mean level of energy used among the participants was  $3.26 \pm 0.49$ .

28.57% had received energy levels of 3.2 to 3.4 and 3.8 to 4.1, respectively.

Table 5 and figure 5 shows that the mean total energy used was  $21.15 \pm 9.81$ .

In 37.1% the total energy used was more than 25 and 34.3% between 1.51 and 1.25.

Table 6 and figure 6 shows that the mean IOP among the participants in the preop was  $14.03 \pm 2.92$ .

The mean IOP immediately after the intervention was  $15.29 \pm 2.83$ .

The mean IOP 20 mins after the intervention was  $17.43 \pm 2.96$ .

The change in IOP following the intervention was significant with P value of less than 0.05.

Table 7 and figure 7 shows that the mean IOP during the preop period for 6.1 to 15 MJ, 15.1 to 25 MJ and more than 25 MJ was  $14.10 \pm 1.72$  mmHg,  $14.50 \pm 3.55$  mmHg and  $13.54 \pm 3.15$  mmHg, respectively. The mean IOP immediately following the intervention for 6.1 to 15 MJ, 15.1 to 25 MJ and more than 25 MJ were  $14.70 \pm 2.11$  mmHg,  $15.08 \pm 1.92$  mmHg and  $15.92 \pm 3.91$  mmHg, respectively. The mean IOP after 20 mins following intervention among the 6.1 to 15 MJ, 15.1 to 25 MJ and more than 25 MJ groups were  $15.70 \pm 2.35$ ,  $17.67 \pm 2.67$  and  $18.54 \pm 3.21$ , respectively. The change in mean IOP was more in the group that had received higher total energy than those received lesser. But the P value was not significant.

**DISCUSSION**

In our study 35 patients who underwent Nd:YAG laser capsulotomy for PCO, majority was males(18) 51.4%, than females (17) 48.6%. In contrast to our study, Younas Khan et al stated that of the 58 patients in his study, 19(32.8%) were male and 39 (67.2%) were female in patients with PCO.<sup>[1]</sup>

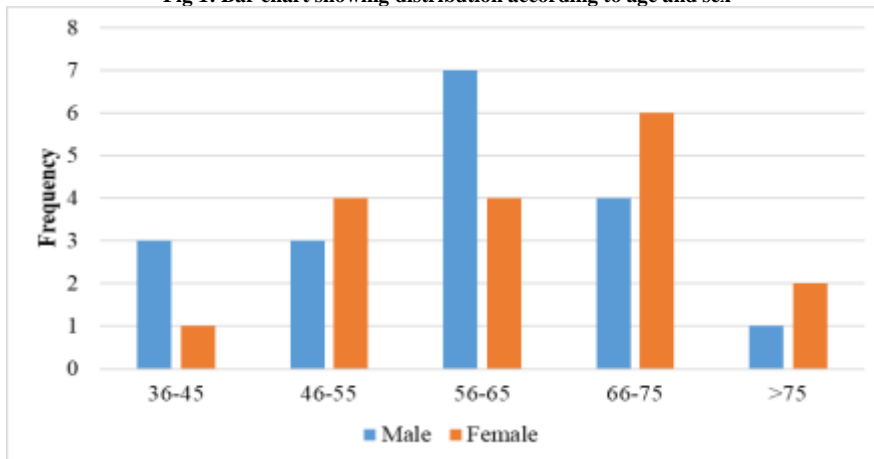
In our study out of 35 patients, 31.4% were between the age group of 56-65 years and

28.6% were between the age group of 66-75 years. The age group ranged between 56-75 years.

**Table 1: Distribution according to age and sex**

Age group (In years)	Male		Female		Total	
	N	%	N	%	N	%
36-45	3	16.7	1	5.9	4	11.4
46-55	3	16.7	4	23.5	7	20
56-65	7	38.9	4	23.5	11	31.4
66-75	4	22.2	6	35.3	10	28.6
>75	1	5.6	2	11.8	3	8.6
Total	18	51.4	17	48.6	35	100

**Fig 1: Bar chart showing distribution according to age and sex**



In the study by Varghese et al, out of 50 patients, 30 (60%) were above 60 years of age, 15 were in the age group of 41-60 years (30%) and 5 patients (10%) were less than or equal to 40 years. The age group ranged from 40 -83 years with a mean of 62.3 (±12.4). This correlates with our study.<sup>[2]</sup>

In our study we included only the subjects with PCO with visual acuity of 6/12 or <6/12 in the affected eye. Of the total participants 28.6% had visual acuity of 6/24 in the affected eye and 22.9% had visual acuity of 6/36 in the affected eye. one subject presented with visual acuity of hand movements (HM) only in the involved eye. In a similar study by Niharika K Shetty et al, Pre-procedure visual acuity estimation showed that 62.85% patients had a Vision range of 6/36 to 6/18 on Snellens visual acuity chart and 25.71% patients had a vision recording of < 6/60.

In our study majority of patients that is 28.57% received energy levels in the range of 3.8 to 4.1mJ for capsulotomy and 28.57%

received energy levels of 3.2 to 3.4mJ. The mean level of energy used among the participants was 3.26±0.49

In our study, the mean IOP rise according to time from pre-laser to immediately after laser to 20 minutes later after laser procedure was highly significant with P value <0.05. Wasserman et al stated that there is a transient IOP rise that occurred within 1 hour of the capsulotomy.<sup>[3]</sup> These findings are comparable to this study.

In our study it was also found that the mean IOP according to energy used was raised with increasing amount of energy, but the P value was not significant. Borgohain et al in 2017 reported that complications can be minimized by minimizing energy and number of precisely focused shots.<sup>4</sup>

In contrast to our findings, Rathod et al. in 2016 reported that the number of pulses applied for the Nd:YAG laser posterior capsulotomy had no significance on the IOP Changes.<sup>[5]</sup>

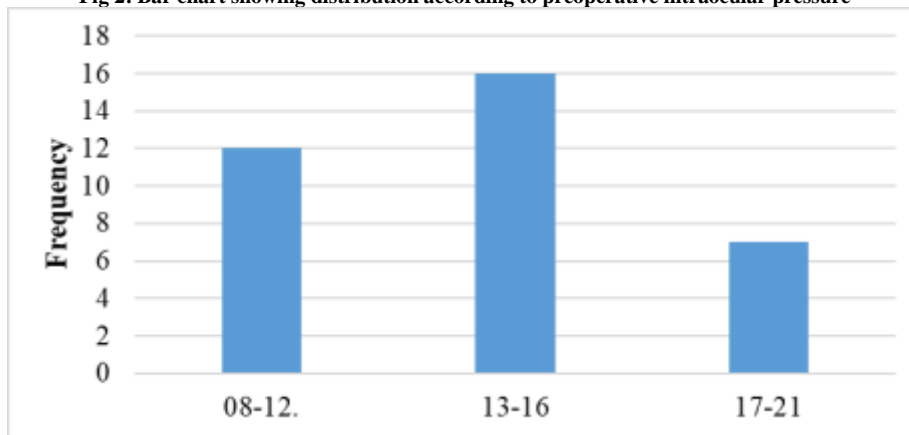
In this study visual acuity pre-laser was in the range of 6/12 to 6/24 in 66.7% and 6/36 to 6/60 in 22.7%, which shows improvement in post laser BCVA is 6/9p to 6/6 respectively with significant p values. Shani et al. stated that in their study, 97% cases had shown improvement in visual acuity. Visual acuity improved to 6/6 in 16 cases, 6/9 in 36 cases, 6/12 in 16 cases, 6/18 in 10 cases, 6/24 in 8 cases, 6/36 in 7 cases,

and 6/60 in 4 Cases.<sup>[6]</sup> Congdon et al. reported improvement in best corrected visual acuity after Nd: YAG laser capsulotomy.<sup>[7]</sup>

**Table 2: Distribution according to preoperative intraocular pressure**

Preoperative IOP (in mmHg)	Frequency	Percentage
8-12	12	34.3
13-16	16	45.7
17-21	7	20

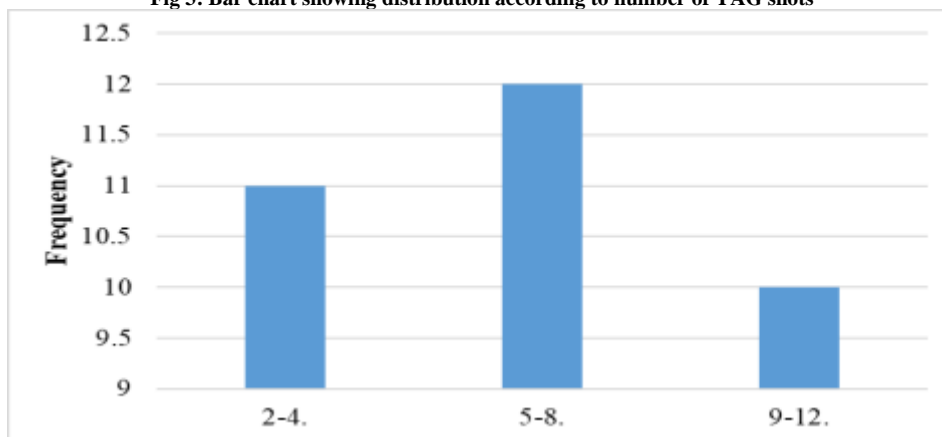
**Fig 2: Bar chart showing distribution according to preoperative intraocular pressure**



**Table 3: Distribution according to number of YAG shots**

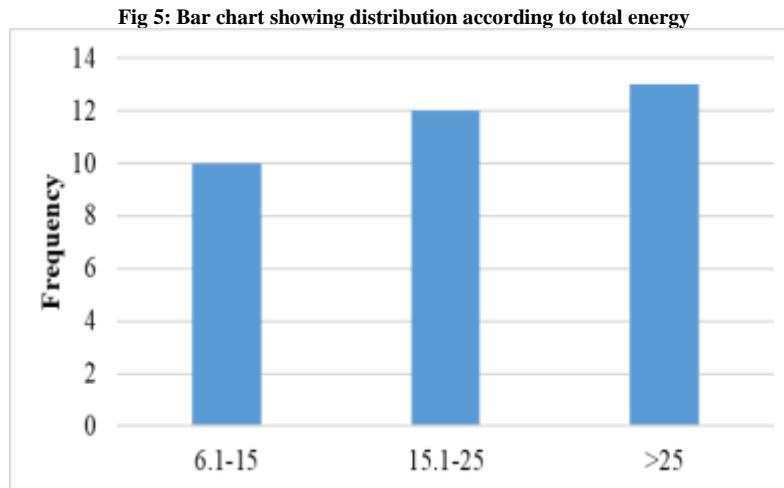
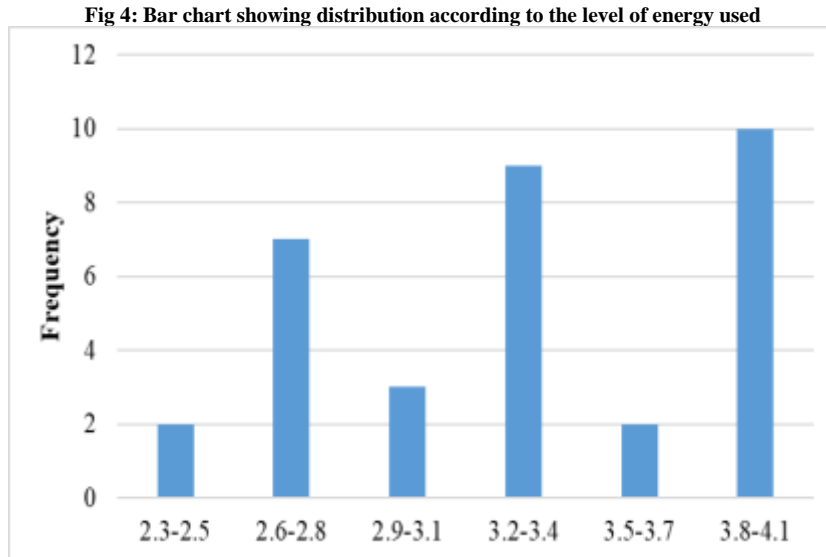
Number of YAG shots	Frequency	Percentage
2-4.	12	34.2
5-8.	12	34.2
9-12.	11	31.4
Total	35	100

**Fig 3: Bar chart showing distribution according to number of YAG shots**



**Table 4: Distribution according to level of energy used**

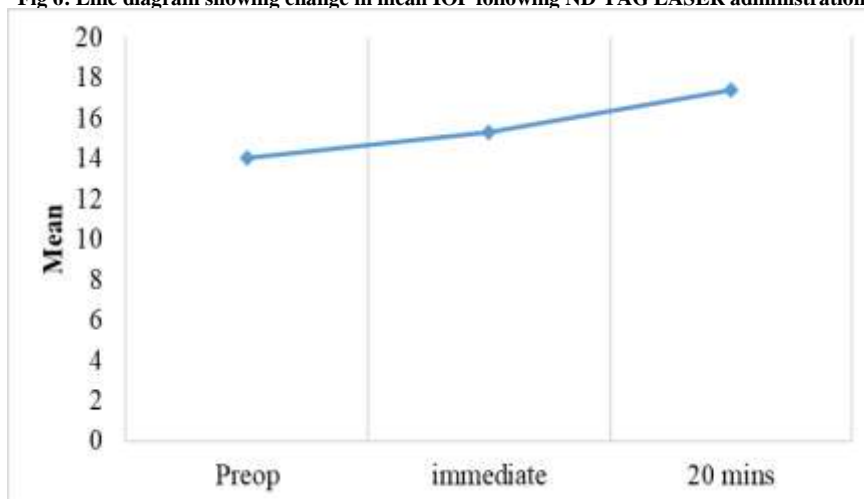
Level of energy used	Frequency	Percentage
2.3-2.5	3	8.57
2.6-2.8	7	20
2.9-3.1	3	8.57
3.2-3.4	10	28.57
3.5-3.7	2	5.71
3.8-4.1	10	28.57
Total	35	100



**Table 6: Change in mean IOP following ND YAG LASER administration**

Timeline	Mean	SD	Within group P value
Preop	14.03	2.92	0.001
immediate	15.29	2.83	
20 mins	17.43	2.96	

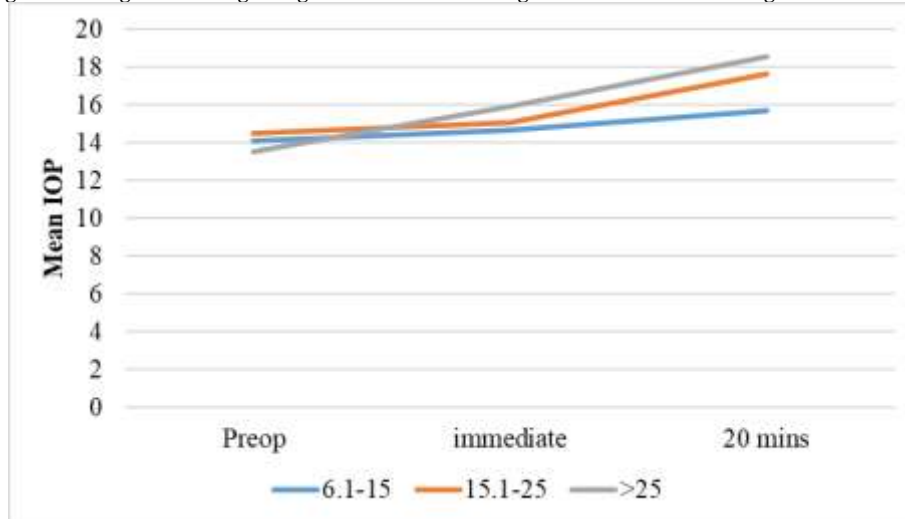
**Fig 6: Line diagram showing change in mean IOP following ND YAG LASER administration**



**Table 7: Change in mean IOP with regard to total energy used**

Timeline	Total energy			P value	
	6.1-15	15.1-25	>25	Within	Between
Preop	14.10±1.72	14.50±3.55	13.54±3.15	0.311	0.302
immediate	14.70±2.11	15.08±1.92	15.92±3.91		
20 mins	15.70±2.35	17.67±2.67	18.54±3.21		

**Fig 7: Line diagram showing change in mean IOP following ND YAG LASER with regard to total energy**



## CONCLUSION

PCO is the most common complication after cataract surgery. Nd-YAG laser capsulotomy is the one best treatment done for PCO. It is a simple non-invasive OPD based procedure. This procedure shows remarkable improvement in visual outcome post laser treatment. IOP rise is the most common complication. Hence all patient undergoing Nd-YAG capsulotomy needs IOP monitoring pre and post laser procedure. There is a correlation between total laser energy used and IOP raise. Those patients receiving higher amount of laser energy develop significant IOP elevations than lower energy patients. Minimal required total energy can be used while performing capsulotomy, and those patients who require higher energy are subjected to regular follow up of IOP.

### Declaration by Authors

**Ethical Approval:** This study was approved by the institutional ethics committee of Rajah Muthiah Medical College and Hospital. This study was conducted after obtaining permission from the concern authorities and consent from the individuals.

**Acknowledgement:** The authors would like to acknowledge the contributions made by the professors and staff members of the Department of Ophthalmology, Rajah Muthiah Medical College and Hospital towards the conduct of the study. We like to thank all the study participants.

**Source of Funding:** None

**Conflict of Interest:** The authors declare no conflict of interest.

## REFERENCES

1. Khan MY, Jan S, Khan MN, Khan S, Kundi N. Visual outcome after Nd-YAG capsulotomy in posterior capsule opacification. Pak J Ophthalmol. 2006;22(2). doi:10.36351/pjo.v22i02.842.
2. Varghese MM, Biradar SG. A clinical study on the intraocular pressure changes following Nd:YAG laser capsulotomy. Indian J Clin Exp Ophthalmol 2021;7(3):496-502.
3. Magno BV, Datiles MB, Lasa MS, Fajardo MR, Caruso RC, Kaiser- Kupfer MI. Evaluation of visual function following neodymium: YAG laser posterior capsulotomy. Ophthalmology. 1997;104(8): 1287–93.
4. Borgohain M, Paul G. Clinical study of visual outcome and complications following Neodymium Yttrium Aluminium Garnet

- (Nd: YAG) Laser posterior capsulotomy for posterior capsular opacification. *J Evol Med Dent Sci.* 2017;30(9):733–7.
5. Rathod D, Gharat A, Agrawal A, Murade S. Intraocular Pressure Variation After Nd: yag Laser Posterior Capsulotomy. *Int J Sci Res.* 2018;5(12):43–50.
  6. Shani L, David R, Tessler Z, Rosen S, Schneck M, Yassur Y. Intraocular pressure after neodymium: YAG laser treatments in the anterior segment. *Journal of Cataract & Refractive Surgery.* 1994;20(4):455–463.
  7. Congdon N, Fan H, Choi K, Huang W, Zhang L, Zhang S, et al. Impact of posterior subcapsular opacification on vision and visual function among subjects undergoing cataract surgery in rural China: Study of Cataract Outcomes and Up-Take of Services (SCOUTS) in the Caring is Hip Project, report 5. *Br J Ophthalmol.* 2008;92(5):598–603.
- How to cite this article: Sangavi V, Manavalan S, Sridevi V et.al. A study of visual improvement and variation in IOP following Nd-YAG laser capsulotomy. *International Journal of Research and Review.* 2023; 10(6): 142-149.  
DOI: <https://doi.org/10.52403/ijrr.20230616>

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