

To evaluate the effects of Nd: YAG laser posterior capsulotomy on best corrected visual acuity (bcva) and intraocular pressure



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ABSTRACT

Background: Nd: YAG laser is non-invasive and effective means to deal with the posterior capsule opacification. However safe it may have some inherent complications. Rise of intraocular pressure is frequently encountered and incompletely understood complication of YAG laser capsulotomy and documented with conflicting results. **Aims and Objective:** To assess the efficacy of Nd: YAG laser capsulotomy in term of visual outcome (Best Corrected Visual Acuity) and also study the changes in IOP after the procedure. **Materials and Methods:** Study evaluated the changes in IOP and visual acuity after Nd-YAG laser capsulotomy in 100 eyes with significant PCO after uncomplicated cataract surgery with IOL implantation. Complete ocular examination including visual acuity, anterior segment examination with slit lamp, fundus and applanation tonometry were performed pre and post-laser in all cases. Posterior capsulotomy was done with VISULAS YAG III Q-switched Nd: YAG laser machine by ZEISS. IOP was recorded before and then at 1 hour, 1 Day, 1 week and 1 month post-laser in order to determine the IOP changes. **Results:** Pre-laser visual acuity ranged from 1/60 to 6/12. Results showed statistically significant improvement in BCVA with 70% patients had BCVA 6/6, 21% had BCVA 6/9 and 8% having BCVA 6/12 post-laser at 1 month. It was observed that 36% of the patients showed no change in IOP while 64% patients showed elevated IOP. Among these 59% patients show rise in IOP that was ≤ 5 mm Hg while only 5% of the patients had a rise of more than IOP > 5 mm Hg. Most of these patients achieved their baseline IOP within 1 day and only 7% patient had rise in IOP compared to baseline IOP on day 1. None of the patients show elevated IOP after 1 week. **Conclusion:** Our study showed that Nd: YAG laser posterior capsulotomy provided excellent results in terms of visual improvement and most of the patients had a rise of < 5 mm Hg which was transient in nature and routine antiglaucoma medication may not be needed in all the patient undergoing Nd:YAG capsulotomy, however caution should be exercised in glaucomatous, aphakic, high myopic and other high risk patients.

Key words: Nd: YAG laser, Posterior capsular opacification, Visual acuity, Intraocular pressure.

INTRODUCTION

Secondary cataract, also known as posterior capsule opacification (PCO), is the most common complication after cataract surgery, resulting from migration and proliferation of residual lens epithelial cells (LECs) onto the central posterior capsule, leading to decrease in visual function and ultimately in visual acuity.¹

Posterior capsular opacification of initially clear posterior capsule occurs frequently in patients after extra capsular cataract extraction of senile cataracts. In adults, the time from surgery to visually significant opacification varies from months to years and the rate of opacification declines with increasing age. The incidence of PCO is in the range of 18 – 50% in adults followed for 5 years. In infants and juveniles, an opacification rate of 44% was found within

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3 months of surgery after in the bag intraocular lens (IOL) implantation with an intact posterior capsule.²

There are two modalities for posterior capsulotomy – surgical and Nd: YAG laser. Latter is non-invasive, convenient and effective means to deal with the posterior capsule opacification and has largely obviated the need for surgical intervention.³ Although procedure is safe but rise of intraocular pressure (IOP) is a frequently encountered and incompletely understood complication of YAG laser capsulotomy.

This study was designed to evaluate the changes in best corrected visual acuity (BCVA) and intra-ocular pressure (IOP) after Nd: YAG laser capsulotomy in patients with posterior capsular opacification.

MATERIALS AND METHODS

The study was hospital based prospective, observational study and was conducted on 100 eyes at Venu Eye Institute and Research Centre (V.E.I.R.C.), New Delhi between November 2014 to May 2016. Inclusion criteria included patients more than 18 years of age, time period of more than 90 days of previous cataract surgery, IOP < 21 mm Hg and Visual acuity ≤ 6/12 with snellen chart while patients < 18 years of age, patients with corneal opacities or retinal pathology amounting to loss of vision, patients with history of complicated cataract surgery and patients unable to fixate for the procedure were excluded from the study. An informed consent was taken from all the patients and ethical committee clearance was taken.

Detailed ocular, systemic, family history was noted with special reference to the date of the cataract surgery, type of the surgery and details of post-operative recovery period. Pre-laser visual acuity by Snellen's chart, refractive status by auto-refractometer and subjective testing, intraocular pressure by Goldman's Applanation Tonometry was recorded. Pre-laser slit lamp examination and fundus examination with direct and indirect ophthalmoscopy was carried out. Nd: YAG laser posterior capsulotomy was done using ZIESS VISULAS YAG III Q switched Nd: YAG laser instrument in all the patient starting with using minimum energy i.e. 0.8 mJ initially and increased as per the need. Shots were placed across the tension lines with starting from 12'o clock position and moving towards 6'o clock. Patient was reviewed after 1 hour and post-procedural IOP was noted with Goldmann's applanation tonometry. Post-laser topical antibiotics and steroid eye drops (Ofloxacin 0.3% and Dexamethasone sodium phosphate 0.1%) was started four times a day for seven days to counteract post laser infection and inflammation.

Anti-glaucoma medication (Eye drop Timolol maleate 0.5%) was started two times a day in case of IOP > 25 mm Hg. Patient was followed up with the same evaluation procedure on 1st day post-laser, at 1 week and at 1 month.

Ethics

Clearance of institutional ethics committee was taken in accordance to the laid parameters.

Statistical analysis

The quantitative variables are expressed as *mean ± standard deviation (SD)* and compared between the various follow-ups using paired t-test. The qualitative variables are expressed in terms of frequencies and percentages and compared using Chi-square/Fisher's exact test. Pearson's correlation coefficient is calculated to assess correlation between quantitative variables. A p-value < 0.05 is considered statistically significant. Statistical Package for Social Sciences (SPSS) version 16.0 is used for the statistical analysis.

RESULTS

In our study maximum number of patients were in the age group of 61 to 70 years with mean age 63.31 years including 43(43%) males and 57(57%) females.

Pre laser BCVA ranged from 1/60 to 6/12. 70% patients achieved 6/6 BCVA, 21% achieved 6/9 BCVA and 8% achieved 6/12 BCVA post Nd: YAG laser posterior capsulotomy (Table 1). Mean BCVA (logMAR) was 0.59 pre-laser which improved to 0.11 1st day post laser, 0.08 at 1 week and 0.07 at 1 month which is statistically significant (p value < 0.001) (Table 2).

It is observed that 36% of the patients showed no change in IOP while 64% patients showed elevated IOP. Among these 59% patients show rise in IOP that was ≤ 5mm Hg while only 5% of the patients had a rise of more than IOP > 5 mm Hg. Most of these patients achieved their baseline

Table 1: Distribution of cases according to pre-laser and post-laser visual acuity

BCVA (Snellens)	Pre-laser	Day 1	1 week	1 month
6/6	0	55	65	70
6/9	0	30	24	21
6/12	27	13	10	8
6/18	23	0	0	0
6/24	25	1	0	0
6/36	10	0	0	0
6/60	10	1	1	1
3/60	3	0	0	0
1/60	2	0	0	0
Total	100	100	100	100

IOP within 1 day and only 7 % patient had shown rise in IOP compared to baseline IOP on day 1. None of the patients show elevated IOP after 1 week (Table 3).

Base line mean IOP was 14.91 ± 2.37 mm Hg and post laser mean IOP was 16.7 ± 3.95 mm Hg at 1 hour, 15.18 ± 2.9 mm Hg at 1 day which returned to baseline 14.91 ± 2.37 mm Hg at 1 week. P values at 1 hour post laser and 1 day post laser shows statistically significant increase in IOP (Table 4).

Majority of the eyes were treated with 31-40 mJ.

DISCUSSION

The study aimed to evaluate the results of Nd: YAG laser capsulotomy in 100 eyes with special reference to changes in Best Corrected Visual Acuity (BCVA) and Intraocular Pressure (IOP).

In our study maximum number of patients were in the age group between 61 to 70 years with mean age 63.31 years. Similar findings have been noted by Prajna NV et al,⁴ Shashi Jain et al⁵ with median age of 60 years and 58.6 years respectively.

Researchers have tried to predict the approximate time duration between cataract surgery and development of PCO. Our study shows the mean duration of development of PCO after cataract surgery was 2.4 years which

correlates well with other studies done by Durham Davis G. et al⁶, Mohan Lal Gupta.⁷

In eyes with PCO, the Nd: YAG laser was effective in achieving a clear pupillary opening in every case. As shown in Table 2, there was statistically significant increase in BCVA post Nd: YAG capsulotomy. Similar findings have been noted by Gardener KM,⁸ Wasserman et al,⁹ Mohan Lal Gupta⁷ which reports significant improvement in visual acuity after capsulotomy in >90% patients out of 100 patients studied.

Increase in intraocular pressure has been well documented complication after virtually all anterior segment laser surgeries. In our study as shown in Table 3 and Table 4, a transient rise in IOP was the most common complication. Maqsood A. Burq et al¹⁰, Gore VS¹¹ reported transient and immediate rise in 56.2% and 59.4% of cases respectively which is comparable to our study finding of transient rise in 64% cases.

Among these 59% patients show rise in IOP that was ≤ 5 mm Hg while only 5% of the patients had a rise of more than IOP >5 mm Hg. In 5% patients the IOP was above 25 mm Hg, in these patients topical administration of 0.5% timolol maleate eye drops twice a day was started for one week. However the rise in IOP was transient and no patient showed increased IOP at 1 week post-laser. Our results were in concordance with study conducted by Hassan KS et al¹² and Kraff CM et al¹³ who reported average rise in IOP by 6 mm Hg and 3.5 mm Hg after laser capsulotomy respectively. Channel MM et al,¹⁴ Morique JJ Leys et al¹⁵ and Shubert HD et al¹⁶ reported >10 mm Hg of IOP rise in 59%, 29% and 15% cases respectively.

The incidence given by these authors and those found in our study are variable which may be due to use of higher energy and larger capsulotomy as explained in their studies. Various other factors documented in different studies explain for rise of IOP after laser capsulotomy were presence or absence of IOL, sulcus or bag fixation of IOL, pre laser IOP, glaucomatous patients, different time period of IOP recording, type of PCO, size of capsulotomy, initial pulse energy and treatment given.

In our study total energy used was between 10 – 60 mJ. Majority of the patients were treated with total energy of 31-40 mJ. Our study shows no significant linear correlation between energy levels used and rise in IOP. Review of literature showing relation between IOP rise and total

Table 2: Improvement in visual acuity following Nd: YAG laser posterior capsulotomy (logMAR)

BCVA (logMAR)	Pre-laser	Day 1	1 week	1 month
Mean±SD	0.59±0.3	0.11±0.15	0.08±0.14	0.07±0.14
p-value (vs pre-laser)	-	<0.001	<0.001	<0.001

Table 3: Effect of Nd: YAG posterior capsulotomy on IOP

Rise in IOP (mm Hg)	1 hour	Day 1	1 week	1 month
No change	36	93	100	100
1-5	59	6	0	0
6-10	3	1	0	0
11-15	1	0	0	0
>15	1	0	0	0
Total	100	100	100	100

Table 4: Mean IOP elevation in respect to time interval after YAG-laser capsulotomy

AT (mmHg)	Pre-laser	1 hour	Day 1	1 week	1 month
Mean±SD	14.91±2.37	16.7±3.95	15.18±2.9	14.91±2.37	14.91±2.37
p-value (vs pre-laser)	-	<0.001	0.008	-	-

Table 5: Correlation between total energy used and rise in IOP after Nd: YAG posterior capsulotomy (n=100)

Rise in IOP →	N (%)					Total
	No change	1-5 mmHg	6-10 mmHg	11-15 mmHg	>15 mmHg	
Total energy used (mJ) ↓						
10–20	6 (26.09)	17 (73.91)	0 (0.00)	0 (0.00)	0 (0.00)	23
21–30	13 (46.43)	13 (46.43)	1 (3.57)	1 (3.57)	0 (0.00)	28
31–40	12 (37.50)	19 (59.38)	1 (3.13)	0 (0.00)	0 (0.00)	32
41–50	3 (27.27)	8 (72.73)	0 (0.00)	0 (0.00)	1 (9.09)	11
51–60	2 (40.00)	2 (40.00)	1 (20.00)	0 (0.00)	0 (0.00)	5
Total	36 (36.00)	59 (59.00)	3 (3.00)	1 (1.00)	1 (1.00)	100

Table 6: Other post Nd: YAG laser capsulotomy complications (n=100)

Complications	N
IOL pitting	6
Corneal damage	0
Iritis	10
CME	0
Retinal detachment	0
Endophthalmitis	0

energy used is not conclusive. Our study is favoured by studies conducted by Slomovic et al,¹⁷ Kraff et al,¹⁸ Dawood Z et al,¹⁹ Holwegar RR,²⁰ Mahtab AK et al²¹ who noted that there is no statistically significant linear correlation between the rise of IOP and total energy used. In contrast to our study significant correlation was found between IOP elevation and energy used by Stark et al,²² Mohammad W et al,²³ Channell MM et al¹⁴ who postulated that higher energy levels tend to cause higher rise in IOP (Table 5).

Other complications of Nd: YAG laser posterior capsulotomy are corneal damage, iritis, lens pitting, cystoid macular edema (CME), retinal detachment (RD) and endophthalmitis.^{22,24-26} In our study there was iritis in 10% patients and lens pitting in 6%. corneal damage, hyphaema, cystoid macular edema, retinal detachment and endophthalmitis were not seen in our study (Table 6).

Other complications cannot be directly blamed on YAG laser but they occur due to other factors including the experience of operating surgeon, patients compliance of instructions regarding stability of head and no movements of the eyes during the procedure and physical state of trabecular meshwork, which is related to clearance of inflammatory and other debris produced by radiation injury and cutting of posterior capsule.²⁷

CONCLUSION

Nd: Yag laser capsulotomy is effective, relatively safe, non-invasive, fast, outpatient procedure in treatment of posterior capsular opacification. Nd: Yag laser posterior capsulotomy

provides excellent outcome in terms of improvement in Best Corrected Visual Acuity (BCVA) with most of the patients having visual acuity upto or more than 6/9 post-laser. Nd: Yag laser capsulotomy is associated with rise in intraocular pressure (IOP). The rise in IOP is transient in nature and routine antiglaucoma medication may not be needed in all the patient undergoing Nd:YAG capsulotomy, however caution should be exercised in glaucomatous, aphakic, high myopic and other high risk patients.

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Author's contribution:

OP- Concept and design of the study, manuscript preparation, statistically analyzed and interpreted, critical revision of the manuscript; **NC-** Concept and design of the study, critical revision of manuscript and review of the study; **PB-** reviewed the literature, helped in preparing first draft of manuscript, collected data; **SM-** collected data, statistically analyzed and interpreted, helped in preparing first draft of manuscript.

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