



To evaluate the effects of Nd: Yag laser capsulotomy on visual acuity and spherical equivalent

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Abstract

Aim: to evaluate the effects of Nd: YAG laser capsulotomy on visual acuity and spherical equivalent in two groups based on energy used (Group I ≤ 30 mJ, Group II > 30 mJ).

Design: A prospective, unmasked and interventional study was conducted on patients with posterior capsular opacification (PCO) after cataract extraction surgery who came to outpatient department (OPD) of Regional Institute of Ophthalmology, Pt. B.D. Sharma, PGIMS, Rohtak who underwent Nd:YAG laser capsulotomy between February 2020-December 2021. The best corrected visual acuity (BCVA) and spherical equivalent (SE) were noted preoperatively, at 1hr, 2 weeks and at 1-month postoperatively. Patients were divided into two groups based on energy used (Group I ≤ 30 mJ, Group II > 30 mJ).

Results: The study was conducted on 123 patients with posterior capsular opacification (PCO) after cataract extraction surgery. The mean of energy used (mJ) in the Group-I was 21.48 (6.04) mJ and in Group: II was 51.83 (13.17) mJ. The mean best corrected visual acuity (BCVA) (logMAR) in group I, improved from a maximum of 0.57 at the pre-laser time-point to a

minimum of 0.08 at the 1 month post-laser time-point and in group: II, the mean BCVA improved from a maximum of 0.97 at the Pre-Laser time-point to a minimum of 0.11 at the 1 Month Post-Laser time-point. This change was statistically significant in both the groups ($p < 0.001$). The mean spherical equivalent (SE) in group I, decreased from a maximum of -0.30 at the pre-laser timepoint to a minimum of -0.34 at the 1 month post-laser timepoint and in Group-II, the mean spherical equivalent increased from a minimum of -0.86 at the pre-laser timepoint to a maximum of -0.77 at the 1 month post-laser timepoint. This change was not statistically significant in both groups ($p = 0.249$ and $p = 0.736$ respectively).

Conclusion: There was marked improvement in visual acuity in all patients after Nd:YAG laser capsulotomy. Nd:YAG capsulotomy have been proven to be an effective and safe alternative option to surgical desiccation. Capsulotomy size is an important parameter as it have been seen that patients subjected to lower amounts of laser energy for perhaps a smaller capsulotomy may benefit from fewer complications of RD, IOP rise and perhaps to less CME. Thus, Nd:YAG capsulotomy have become the preferred mode of

treatment for posterior capsule opacification in post cataract surgery patients.

Keywords: Best corrected visual acuity (BCVA), Spherical equivalent (SE), Intra ocular pressure (IOP), and Posterior capsular opacification (PCO), and Nd:YAG laser capsulotomy.

Introduction

Cataract extraction either with extracapsular cataract extraction or phacoemulsification, most of the surgeon extract all the lens fibres and leave behind an intact posterior capsule and peripheral anterior capsule of the capsular bag for IOL implantation. Along with the residual capsule, lens epithelial cells (LECs) that have the potential to lay down cellular products are also left behind. These cause opacification, which is referred to as posterior capsular opacification (PCO).^{1,2} The development of PCO is a very dynamic process and involves three basic phenomena: proliferation, migration and differentiation of residual lens epithelial cells (LECs).^{3,4} The PCO has two forms, fibrous and pearl form.⁵ Central PCO obscuring the visual axis can be treated with either surgical intervention such as posterior capsule scraping, PCO polishing or with a non-surgical post-operative intervention by *Neodymium*-yttrium aluminum garnet (Nd: YAG) laser capsulotomy.⁶

Neodymium: yttrium aluminum garnet (Nd:YAG) laser is used in Ophthalmology to treat posterior capsular opacification and for peripheral iridotomy in patients with acute angle-closure glaucoma, where it has superseded surgical iridectomy.⁷ Although Nd:YAG laser posterior capsulotomy is safe and effective procedure but the complications like rise in intraocular pressure can occur.^{8,9} This procedure also causes a shift in the position of the implant, which can cause a change in the anterior chamber depth.^{10,11} Movement and damage in the vitreous cavity and release of

inflammatory mediators due to the damage of blood aqueous barrier cause cystoid macular edema (CME).¹²

Material and Methods

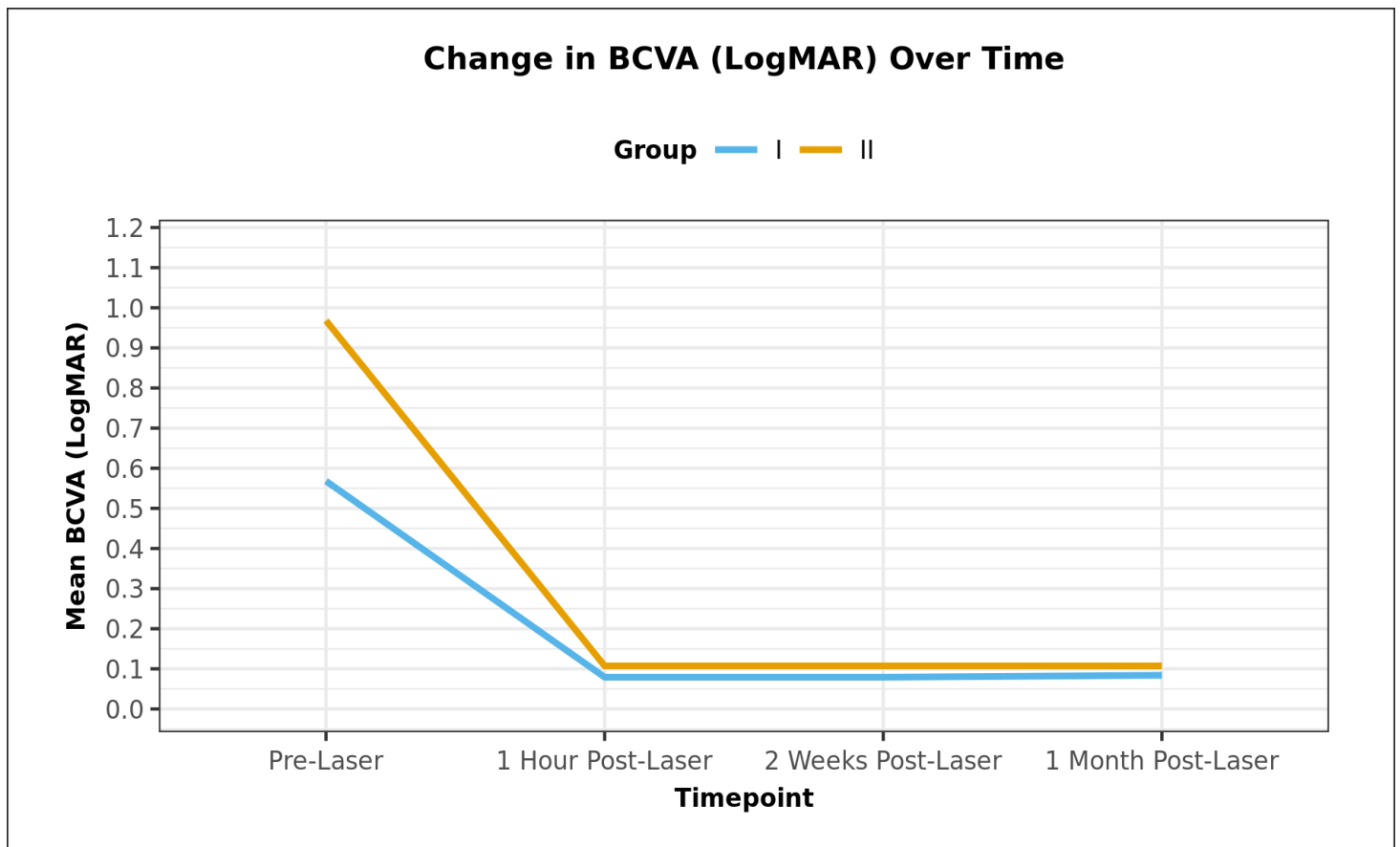
A prospective, unmasked and interventional study was conducted on patients with posterior capsular opacification (PCO) after cataract extraction surgery who came to outpatient department (OPD) of Regional Institute of Ophthalmology, Pt. B.D. Sharma, PGIMS, Rohtak who underwent Nd:YAG laser capsulotomy between February 2020-December 2021. Total 123 patients were taken for study, patients were divided in two groups on the basis of energy used for Nd: YAG capsulotomy i.e, patients with energy level ≤ 30 mJ were included in Group-I, and for energy >30 mJ included in Group-II. All Nd: YAG capsulotomy were carried out by same surgeon. Patient's affected eye was fully dilated with a combination of eye drop tropicamide (0.8%) and phenylephrine (5%). No anaesthesia was used for capsulotomy. Visual acuity was recorded on snellen's chart and logMAR chart was used for analysis. Subjective refraction was done for individual patient by the same person on every follow up visit. The spherical equivalent (SE) values were calculated as the sum of the sphere plus half the cylindrical power. The data was compiled and analysed in Microsoft Excel spread sheet programme. SPSS v23 (IBM corp.) was used for data analysis. All pre-treatment data (including measurement of BCVA, and SE) data at 1-month follow-up was collected from non-dilated eyes. However, data at 1 hr after treatment was taken from pharmacological dilated eyes. After capsulotomy, a combination of antibiotic and steroid (moxifloxacin 0.5% + dexamethasone 0.1%) was prescribed four times daily for 14 days. All the patients in group I and II who had undergone Nd: YAG posterior capsulotomy were observed and compared for the effects of Nd:YAG laser capsulotomy on intra ocular pressure,

visual acuity and anterior chamber depth after 1 hour, after 2 week and after 1 month.

Results

In this study, the mean age in the Group- I was 61.89 ± 13.04 and in Group: II was 61.85 ± 13.38 . In group I, 42.9% males and 57.1% females participated while in group II, 45% were males and 55% were females participated. There was statistically no significant difference between the groups in terms of age and gender distribution i.e, age and gender matched in both groups. The mean of energy used (mJ) in the Group I group was 21.48 ± 6.04 and in Group II group was 51.83 ± 13.17 .

There was statistically significant difference between the groups in terms of energy. ($W = 0.000$ $p < 0.001$). The mean best corrected visual acuity (BCVA) (logMAR) in group I, improved from a maximum of 0.57 at the pre-laser time-point to a minimum of 0.08 at the 1 month post-laser time-point ($\chi^2 = 183.1$, $p < 0.001$) and in group: II, the mean BCVA (logMAR) improved from a maximum of 0.97 at the Pre-Laser time-point to a minimum of 0.11 at the 1 Month Post-Laser time-point ($\chi^2 = 180.0$, $p < 0.001$). This change was statistically significant in both the groups ($p < 0.001$).



BCVA (logMAR)	Group		P value for comparison of the two groups at each of the timepoints (Wilcoxon-Mann-Whitney Test)
	I	II	
	Mean (SD)	Mean (SD)	
Pre-Laser	0.57 (0.30)	0.97 (0.51)	<0.001
1 Hour Post-Laser	0.08 (0.14)	0.11 (0.11)	0.052
2 Weeks Post-Laser	0.08 (0.14)	0.11 (0.11)	0.052
1 Month Post-Laser	0.08 (0.14)	0.11 (0.11)	0.090
P Value for change in BCVA (logMAR) over time within each group (Friedman Test)	<0.001	<0.001	
Overall P Value for comparison of change in BCVA (logMAR) over time between the two groups (Generalized estimating equations)	-		

The mean spherical equivalent (SE) in group I, the mean spherical equivalent decreased from a maximum of -0.30 at the pre-laser timepoint to a minimum of -0.34 at the 1 month post-laser timepoint. This change was not statistically significant ($\chi^2 = 4.1$, $p = 0.249$) and in Group-II, the mean spherical equivalent increased from a

minimum of -0.86 at the pre-laser timepoint to a maximum of -0.77 at the 1 month post-laser timepoint. This change was not statistically significant ($\chi^2 = 1.3$, $p = 0.736$).

Spherical Equivalent	Group		P value for comparison of the two groups at each of the timepoints (Wilcoxon-Mann-Whitney Test)
	I	II	
	Mean (SD)	Mean (SD)	
Pre-Laser	-0.30 (0.76)	-0.86 (0.83)	<0.001
1 Hour Post-Laser	-0.34 (0.65)	-0.77 (0.81)	<0.001
2 Weeks Post-Laser	-0.34 (0.65)	-0.77 (0.81)	<0.001
1 Month Post-Laser	-0.34 (0.65)	-0.77 (0.81)	<0.001
P Value for change in Spherical Equivalent over time within each group (Friedman Test)	0.249	0.736	-

Spherical Equivalent	Group		P value for comparison of the two groups at each of the timepoints (Wilcoxon-Mann-Whitney Test)
	I	II	
	Mean (SD)	Mean (SD)	
Overall P Value for comparison of change in Spherical Equivalent over time between the two groups (Generalized Estimating Equations)	-		

Discussion

This prospective study was conducted on 123 patients with posterior capsular opacification (PCO) after cataract extraction surgery to evaluate the effects of Nd:YAG laser capsulotomy on visual acuity and spherical equivalent in two study groups based on energy used for Nd:YAG capsulotomy. The mean age between two groups is almost similar with $p=0.773$, i.e., no statistically significant difference in both the study groups were observed, which is consistent with similar studies, like Karahan et al.¹³ and Khambhiphant B et al.¹⁴ Similarly, study conducted by Parajuli A et al.¹⁵ there was no significant difference between the two groups in terms of distribution of Gender ($p = 0.811$). In this study, this study there was not much significant difference between the various groups in terms of distribution of gender (mean men ($n=54$) and women ($n=69$) in both groups) which is constant with the results observed in the previous studies by Karahan et al.¹³ and Parajuli A et al.¹⁵ showed no significant difference between the two groups in terms of distribution of gender. There was a significant difference between the various groups in terms of energy distribution. The mean of energy used (mJ) in the Group-I group was 21.48 (6.04) and in Group: II group was 51.83 (13.17) which is constant with the results observed in the previous studies like Parajuli A et al.¹⁵

In this study, there was statistically significant difference in terms of visual acuity in both the groups. The mean BCVA (logMAR) improved from a pre-laser time-point to 1 month post-laser time-point. K M Gardner et al.¹⁶ in 1985 conducted a study in the first 100 cases of Nd: YAG laser posterior capsulotomy and they observed improved visual acuity in 90 patients. Parajuli A et al.¹⁵ observed the same results from their study results. Ozkurt et al.¹⁷ studied 26 eyes and improvement in visual acuity was achieved in all cases. Similarly, Ari et al.¹⁸ showed improved visual acuity in all 30 patients in their study. Karahan et al.¹³ compared repeated measurements of BCVA in their study and BCVA improved at 1 week, 4 weeks, and 12 weeks that was statistically significant.

In this study, there was no significant difference between the two groups in terms of distribution of Spherical equivalent (SE) Similarly, Thornval P et al.¹⁹, Chua et al.²⁰ and Ozkurt et al.¹⁷ showed no significant change in spherical equivalent (SE). Parajuli A et al.¹⁵ also concluded the same from their study

Conclusion

BCVA improved significantly after Nd: YAG capsulotomy after 1 hour post-laser in both groups (≤ 30 mJ were included in Group-I, and for energy >30 mJ included in Group-II). There is no effect of Nd: YAG laser capsulotomy on spherical equivalent (SE).

Nd:YAG capsulotomy have been proven to be an effective and safe alternative option to surgical desiccation. Nd:YAG capsulotomy have become the preferred mode of treatment for posterior capsule opacification in post cataract surgery patients.

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