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Comparision Of Visual Outcome And IOP Changes Before And After Nd-Yag Laser Capsulotomy In Patients With Posterior Capsular Opacification

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ABSTRACT

Background: Posterior capsular opacity (PCO) is the commonest longterm complication of cataract surgery. PCO present with gradual decrease in visual acuity after successful cataract surgery. Various methods employed for the prevention of PCO like capsular polishing, implanting IOL's with convex posterior surface and surface-modified lens have not been shown to be very successful in long term follow up. All my patients underwent Nd:YAG laser capsulotomy for Posterior capsular opacity, which is a noninvasive, effective and relatively a safe technique for PCO management.

Hence, in this present study every effort is made to study the visual outcome and IOP changes before and after Nd: YAG LASER capsulotomy.

Objective: To compare the visual outcome and IOP before and after ND-YAG laser capsulotomy in patients with Posterior Capsular Opacity

Methodology: A total of 100 patients with posterior capsular opacification attending the Department of Ophthalmology, Vinayaka Missions Medical College and Hospital, Karaikal who gave consent for the research purpose were taken up for the study. Patient's details including age, sex, and surgical history was recorded. Complete Ocular examination was done before ND-YAG capsulotomy including Best corrected visual acuity (BCVA), Anterior segment examination using Slitlampbiomicroscopy, Retinoscopy, Intraocular pressure measurement using Applanation Tonometer and Posterior segment examination includes dilated fundus examination with Slitlamp biomicroscopy using +90D was recorded. Statistical analysis was performed using SPSS software.

Results: This prospective study was conducted in the Department of Ophthalmology at Vinayaka Missions Medical College, Karaikal. On approval by ethical committee, 100 patients with Posterior Capsular Opacification recruited after obtaining informed consent.The result of the study showed that, maximum number of patients had developed Elschnig pearl type of PCO i.e. 64 patients (64%). After 1 week ND YAG laser capsulotomy 84% (84 patients) of patients showed improvement in best corrected visual acuity. The results of the study showed that, all the 100 patients showed a temporary rise in the intraocular pressure values after ND YAG laser capsulotomy which return to near normal of the base line values at the 1 week of follow up.

Conclusion: The results of the study showed that Complications with Nd:YAG laser capsulotomy are very minimal and only transient elevation of IOP, which can be managed with topical Timolol maleate 0.5% drops on outpatient basis with regular follow up. Improvement in visual acuity with Nd:YAG laser capsulotomy is excellent and complications with Nd:YAG laser capsulotomy are minimal and transient in this study. Hence concluded that Nd-YAG laser capsulotomy is a noninvasive, effective, relatively safe technique to manage posterior capsular opacity and it does not require patient hospitalization.

Keywords: Nd:YAG laser capsulotomy, Posterior capsular opacity, Intra ocular pressure

Introduction

Posterior capsular opacification / After cataract /Secondary cataract is the most frequent late complications of cataract surgery. It is caused by the incomplete removal of epithelial cells of lens capsule during cataract surgery. The lens epithelial cells, still possess the capacity to proliferate, differentiate and undergo fibrous metaplasia. Migration of these cells, towards the center of the previously acellular posterior capsule cause Posterior capsular opacification. The incidence of PCO in adults is 18 – 50% in 5 years after cataract surgery. Almost all children (100%) develop within 3 months of cataract surgery. Based on the growth patterns, the pathogenesis is of PCO Fibrous type - associated with

the anterior epithelium and Pearl type - associated with equatorial epithelium.
Duke elder classified the lens remnants Capsular remains as Capsulolenticular remains and Pigmentary, hemorrhagic or inflammatory fibrous elements. Clinically PCO is classified as Dense memberanous, Soemmering's ring and Elschnig pearls.

Table 1 – Six factors to reduce PCO

Surgery – related factors (capsular / surgery)	**IOL – related factors (Ideal IOL)**
Hydrodissection enhanced cortical clean-up	Biocompatible IOL to reduce stimulation of cellular proliferation
In the bag fixation	Maximal IOL optic posterior capsule contact, angulated haptic, adhesive, biomaterial to create a shrink wrap.
Small CCC with edge on IOL surface	IOL optic geometry square, truncated edge.

Evaluation techniques of PCO are red reflex evaluation by - Slit lamp and Direct Ophthalmoscopic examination, Photographic image analysis system of PCO, High resolution digital retroillumination imaging and Scheimpflug photography system. There are two different ways to manage the Posterior capsular opacification Surgical Capsulotomy and Nd: YAG laser Capsulotomy.
The principle of Nd:YAG Laser is PHOTODISRUPTION. The Nd:YAG Laser produces a beam of infrared light at 1064 nm which concentrates a chosen amount of energy at a focal point of approximately 11 microns of sufficient energy density to create a small 'plasma effect' which in turn causes an acoustic wave which disrupts the adjacent tissues. This is known as photodisruptive effect. Suggested settings for Nd-YAG capsulotomy is 0.8-2.0 mJ with either Q switched or mode locked system. One should start with a pulse energy of 0.5mJ not exceed 2 mJ. Dilatation of the pupil is optional, specific level marks in the posterior capsule near the visual axis should be noted before dilatation, focus the laser beam slightly behind the posterior surface of the capsule for initial application, moving subsequent application anteriorly until the desired puncture is achieved. The centre of the visual axis is the desired site of the opening which is usually adequate at 3-4 mm in diameter.
Transient elevation of intraocular pressure is the commonest complication observed after Nd: YAG posterior capsulotomy. Intra ocular pressure starts rising soon the procedure, reaches peak after three hours. In most treated eyes intraocular pressure 21 returns to normal level within one week. The rise in IOP occurs due to blockage of trabecular meshwork out flow facility by cellular debris. Patients at high risk to develop high IOP are Primary open angle glaucoma (POAG), Associated secondary glaucoma, and Sulcus fixated IOLs. Other complications are Cystoid macular edema, Iritis, Hyphema, Disruption of anterior hyaloid face during the procedure and IOL pitting. Very rare complications are Rhegmatogenous retinal detachment and Endophthalmitis. hence Nd: YAG laser capsulotomy is a relatively quite safer alternative to surgical capsulotomy.
Absolute contraindication of Nd: YAG laser Capsulotomy are Corneal leucomatous or macular opacity, Corneal surface disorders, Corneal edema and Uncooperative or unwilling patients. Relative contraindications are Cystoid macular edema, eyes with active inflammation, Patients with previous history of rhegmatogenous retinal detachment, High myopic patient and patients having peripheral retinal degenerations, silent holes etc.

Aim of the study
Comparison of visual outcome and IOP changes before and after ND-YAG laser capsulotomy in patients with Posterior Capsular Opacity

Methodology
Ethics approval: With prior approval from our institutional ethical committee, this study was conducted in the department of ophthalmology at Vinayaka Missions Medical College, Karaikal. Informed consent was taken from all participating patients. Patients were explained in their vernacular language and were informed that they could drop out of the study at any point. An informed written consent was obtained from the patients.
Study population: Study population included 100 patients diagnosed with Posterior Capsular Opacification who attended the Ophthalmology out-patient department at Vinayaka Missions Medical College, Karaikal.
Study design: This study is a prospective case study conducted in Vinayaka Mission Medical College, Karaikal.
Inclusion criteria: All patient with postoperative PCO with vision <6/18
Exclusion criteria: Patients with PCO associated with corneal opacities or edema, active intraocular inflammation, cystoid macular edema, uncooperative patient who is unable to hold fixation

during the procedure and patients with increased IOP.

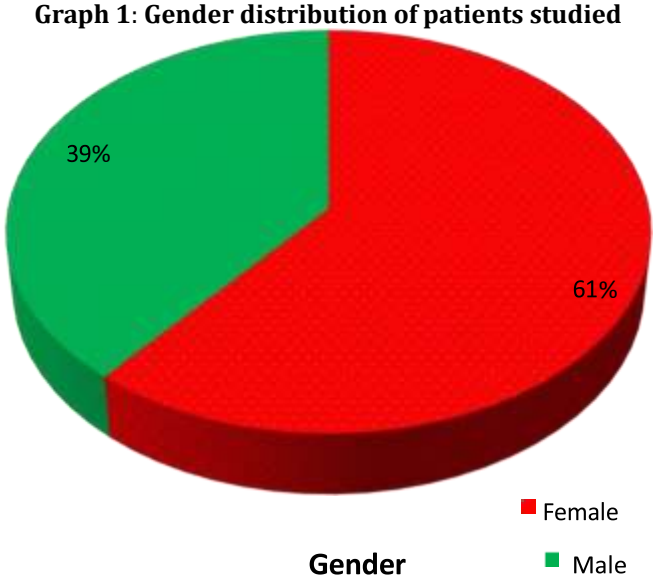
Data collection: Patient's details including age, sex, and surgical history was recorded. Complete Ocular examination was done before ND-YAG capsulotomy including Best corrected visual acuity (BCVA), Anterior segment examination using Slitlamp biomicroscopy**,** Retinoscopy, Intraocular pressure measurement using Applanation Tonometer and Posterior segment examination includes dilated fundus examination with Slitlamp biomicroscopy using +90D.

Procedure: After pupillary dilatation, Topical anaesthesia achieved using 1 – 2 drops of proparacaine 0.5. Patient was seated comfortably at Nd:YAG laser machine and an illuminated target was provided to the patient for maintaining steady fixation. Abraham lens (contact lens) was placed to stabilize the eye and to improve the laser optics and facilitate accurate focusing. Using Appasamy ND-YAG Laser machine posterior capsulotomy was done by same surgeon. Capsulotomy was started with minimal energy 1 to 2 MJ/ pulse to predict the behavior of the posterior capsule to the photodisruptive forces and to avoid pitting of the IOL in the central position and increased upto 3 to 5 MJ. Once the procedure is completed, IOP and visual acuity was recorded. Postoperatively topical NSAIDS and β blocker was given for a week. Follow up will be done 1 week after the procedure to assess the visual outcome and IOP.

Data management and statistical analysis: Collected data was entered into the Microsoft Excel sheet and the statistical software SPSS version 25 was used to analyze the data. The data were presented in percentages and proportions using tables and charts. Using suitable statistical tests, associations were calculated, and a p-value of <0.05 was considered statistically significant.

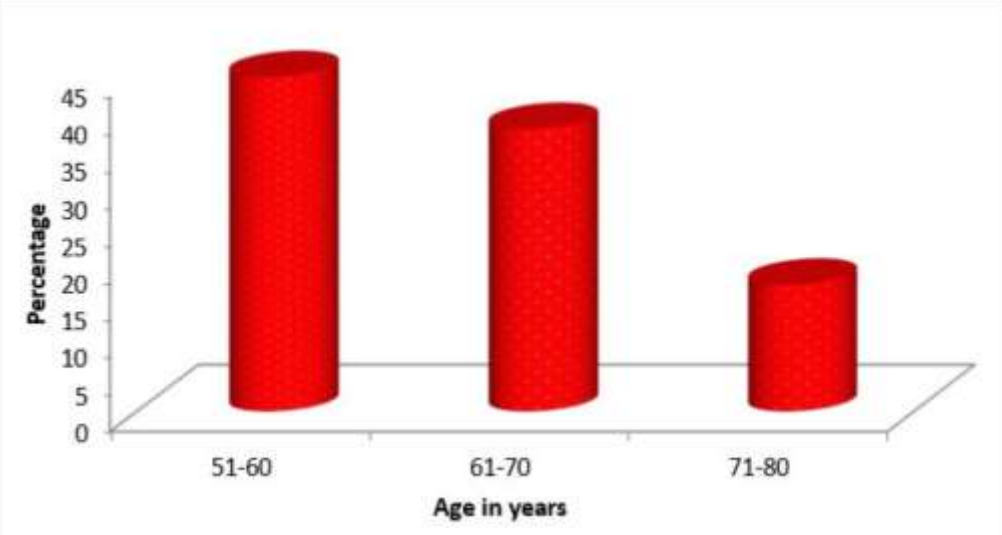
Results

Graph 1: **Gender distribution of patients studied**



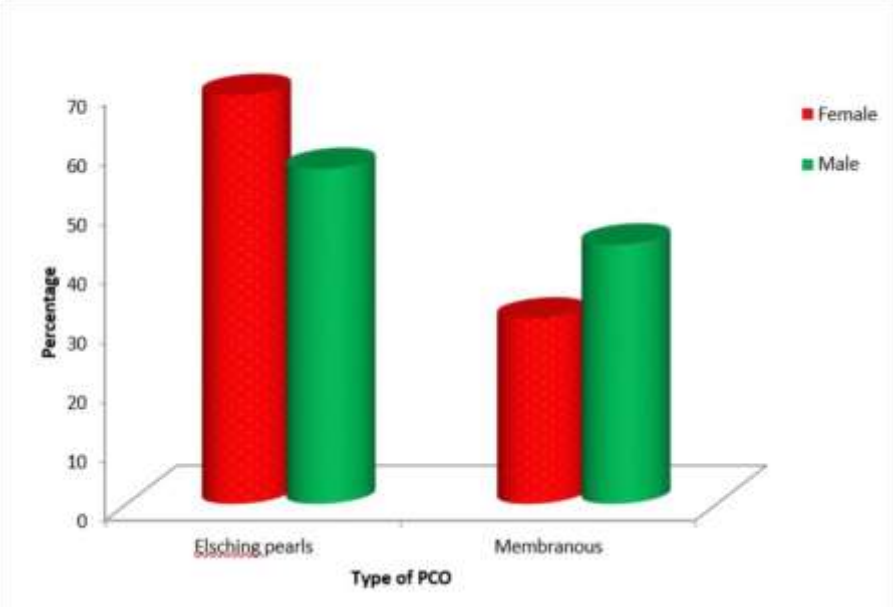
Out of 100 patients studied, majority i.e. 61 patients (61%) were females and only 39 patients (39%) were males.

Graph 2: Age distribution of patients studied



Out of 100 patients studied, maximum number of patients belong to age group of 51-60 years i.e. 45 patients (45%), followed by the age group of 61-70 years, i.e. 38 patients (38%) and 71-80 years of age i.e. 17 patients (17%). The Mean ± SD was found to be 63.21 ± 7.45.

Graph 3: Type of PCO distribution of patients studied



Out of 61 female patients studied, maximum number of patients found to have Elschnig pearl type of PCO i.e. 42 patients (68%) and 19 patients (31%) found to have memberanous type. Out of 39 male patients studied, maximum number of patients found to have Elschnig pearl type of PCO i.e. 22 patients (56%) and 17 patients (43%) found to have memberanous type.

Table 2: Best corrected visual acuity before ND YAG laser capsulotomy of patients studied

Visual Acuity	No. of eyes	%
< 6/60	36	36.0
6/60 - 6/24	53	53.0
6/18	11	11.0
Total	100	100.0

Out of 100 patients studied, majority of patients ie. 53 patients (53%) had visual acuity ranging between 6/60 - 6/24 followed by 36 patients (36%) with visual acuity <6/60 and 11 patients (11%) were having visual acuity of 6/18 before ND YAG laser capsulotomy.

Table 3: Table showing periodic improvement in visual acuity after ND YAG laser capsulotomy of patients studied

Visual Acuity	After Procedure	%	1week after Procedure	%
<6/60	3	3.0	0	0.0
6/60 - 6/24	62	62.0	39	39.0
6/18 - 6/6	35	35.0	61	61.0
Total	100	100.0	100	100.0

The above table depicts that, immediately following ND YAG laser capsulotomy 62 patients (62%) gained best corrected visual acuity of 6/60 – 6/24. 35 patients (35%) gained best corrected visual acuity of 6/18 – 6/6 and only 3 patients had low visual acuity of <6/60. It also depicts that, after 1 week of ND YAG laser capsulotomy majority of 61 patients (61%) gained best corrected visual acuity of 6/18 – 6/6. 39 patients (39%) gained best corrected visual acuity of 6/60 – 6/24 and none of the patient having visual acuity <6/60.

Table 4: Table showing comparison of visual acuity before and 1 week after ND YAG laser capsulotomy of patients studied

Visual Acuity	Before Procedure	1week After Procedure
<6/60	36(36%)	0(0%)
6/60-6/24	53(53%)	39(39%)
6/18-6/12	11(11%)	45(45%)
6/9-6/6	0(0%)	16(16%)
Total	100(100%)	100(100%)

P<0.001**, Significant, Chi-Square Test

Out of 100 patients studied, majority of patients ie. 53 patients (53%) had visual acuity of 6/60 - 6/24, 36 patients (36%) had visual acuity of <6/60 and only 11 patients (11%) had visual acuity of 6/18 before ND YAG laser capsulotomy. The above table depicts that, after 1 week of ND YAG laser capsulotomy 45 patients (45%) gained best corrected visual acuity of 6/18 – 6/12. 39 patients (39%) gained best corrected visual acuity of 6/60 – 6/24 and 16 patients (16%) improved to 6/9 – 6/6 visual acuity. The P value was found to be less than 0.001, which was statistically significant.

Table 5: Table showing Intra Ocular Pressure comparison before and after ND YAG laser capsulotomy of patients studied

IOP (mmhg)	Before Procedure	After Procedure	1week after Procedure
14-18	84(84%)	24(24%)	76(76%)
19-23	16(16%)	71(71%)	23(23%)
24	0(0%)	5(5%)	1(1%)
Total	100(100%)	100(100%)	100(100%)

P<0.001**, Significant, Chi-Square Test

The above table depicts that, before ND YAG laser capsulotomy (baseline values) 84 patients (84%) had IOP which ranges between 14-18 mmhg and 16 patients (16%) had IOP between 19-23 mmhg and none of the patients had IOP of 24mmhg. Out of 100 patients studied, immediately after ND YAG laser capsulotomy all 100 patients had a temporary rise in IOP 71% had range of 19-23 mmHg, 24% had IOP range of 14-18 mmHg and 5% had increased IOP of 24mmHg. One week after ND YAG laser capsulotomy

76 patients (76%) had IOP ranging between 19-23 mmHg and 23 patients (23%) had IOP between 14-18 mmHg and only 1 patient (1%) had increase in IOP of 24mmHg.

Table 6: Statistical comparison of IOP variation at baseline, immediately after YAG laser treatment and 1 week after YAG treatment of patients studied

IOP	Min-Max	Mean ± SD	difference	t value	P value
Baseline	14.00-22.00	17.94±1.32	-	-	-
After YAG Laser	16.00-24.00	19.93±1.59	-1.990	-15.322	<0.001**
1week After YAG Laser	14.00-24.00	18.02±1.47	-0.080	-1.474	0.15

The above table depicts that, in comparison to the mean baseline pre Nd:YAG values of 17.94 (± 1.32), all the 100 patients who underwent showed a rise in the intraocular pressure values after ND YAG laser capsulotomy showing a mean of 19.93 (± 1.59), which showed high statistical significance ie. <0.001. All the 100 patients IOP return back to near normal of the base line values at the1 week of follow up after ND YAG laser capsulotomy, the mean value being 18.02 (±1.47) which was found to be not statistically significant ie. 0.15.

Discussion

In my study out of 100 patients, majority i.e. 61 patients (61%) were females and only 39 patients (39%) were males. Maximum number of patients belong to age group of 51-60 years i.e. 45 patients (45%) and the Mean ± SD was found to be 63.21 ± 7.45. And maximum number of patients found to have Elschnig pearl type of PCO i.e. 64 patients (64%) and 36 patients (36%) found to have memberanous type. Out of 100 patients studied, majority of patients ie. 53 patients (53%) had visual acuity of 6/60 - 6/24, 36 patients (36%) had visual acuity of <6/60 and only 11 patients (11%) had visual acuity of 6/18 before ND YAG laser capsulotomy. Similarly after 1 week of ND YAG laser capsulotomy 45 patients (45%) gained best corrected visual acuity of 6/18 – 6/12. 39 patients (39%) gained best corrected visual acuity of 6/60 – 6/24 and 16 patients (16%) improved to 6/9 – 6/6 visual acuity. All the 100 patients who underwent showed a rise in the intraocular pressure values after ND YAG laser capsulotomy with a mean of 19.93 (± 1.59), which is of high statistical significance ie. <0.001. All the patients showed values returning to near normal of the base line values at the 1 week of follow up after ND YAG laser capsulotomy, the mean value being 18.02 (±1.47) which was found to be not statistically significant ie. 0.15.

Conclusion

The most common postoperative complication of cataract extraction is posterior capsular opacification, which in turn causes deterioration of visual acuity and is the second most common cause of visual loss following cataract surgery worldwide. The results of the study showed that after 1 week of ND YAG laser capsulotomy totally 84% (84 patients) of patients showed improvement in best corrected visual acuity. The results of the study further showed that, in comparison to the mean baseline pre Nd:YAG values of 17.94 (± 1.32), all the 100 patients who underwent showed a transient rise in the intraocular pressure values after ND YAG laser capsulotomy, which return to near normal of the base line values at the 1 week of follow up after ND YAG laser capsulotomy. The results of the study also showed that Complications with Nd:YAG laser capsulotomy are very minimal and only transient elevation of IOP, which can be managed with topical Timolol maleate 0.5% drops on outpatient basis with regular follow up. Improvement in visual acuity with Nd:YAG laser capsulotomy is excellent and Complications with Nd:YAG laser capsulotomy are minimal and transient in this study. Hence concluded that Nd-YAG laser capsulotomy is a noninvasive, effective, relatively safe technique to manage posterior capsular opacity and it does not require patient hospitalization.

Conflict of interest: None
Source of funding: None

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