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Visual Outcome and Complications after Nd:YAG Laser Capsulotomy in Patients with Posterior Capsular Opacification - An Observational Study

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A B S T R A C T

Purpose:To compare the visual outcome and different complications after Nd:YAG Laser Capsulotomy in patients with Posterior Capsular Opacity and analyse the changes in intraocular pressure following Nd:YAG laser capsulotomy.***Patients and methods:***All the patients reporting at the OPD were evaluated clinically and by proper history which included type of cataract surgery performed along with the date of surgery, and its functional impairment and symptoms of patients. A complete pre laser and post laser work up was done. Posterior Capsulotomy was performed with Nd:YAG Laser starting from a minimum pulse energy and then gradually increasing the energy.***Results:***To Significant visual improvement was seen 1 hr after laser capsulotomy. 12.7% of patients had improved visual acuity of 3/60-6/60 and 55.9% patients had VA of 6/60- 6/18 and 27.9% had improved visual acuity of 6/12-6/6; 4 patients showed no visual improvement in VA. The percentage of patients with better visual acuity had increased gradually during follow up period – at 24 Hours, 1 week, 1 month and 3 months. At the end of 3 months, 3.3% of patients had VA of less than 3/60. 0.84%% of patients had VA of 3/60- 6/60, 26.27% of patients had VA of 6/36-6/18, and 69.49% of patients had VA of 6/12-6/6.***Conclusion:***The Nd:YAG laser is a noninvasive surgical tool that provides excellent posterior capsulotomies. It safe, least time consuming and readily acceptable to patients can be done as a day care procedure, thus preferred over surgical intervention that is, manual surgicalcapsulotomy.

Keywords: Posterior capsular opacification, Capsulotomy, Nd:YAG laser, Intraocular pressure, Visual acuity, Intraocular lens, Capsulartensionring.

INTRODUCTION

Cataract is the most common reversible cause of blindness in India. It generally causes diminution or loss of vision, so extraction of cataract is the only treatment of choice [1]. Extraction can be intracapsular (obsolete) or extracapsular. Extracapsular cataract extraction (ECCE) is being used nowadays in which the content of lens are removed leaving the posterior capsule intact that forms a barrier between the anterior and the posterior segment of the eye. Different methods of ECCE are Conventional ECCE, Small Incision Cataract Surgery (SICS), Phacoemulsification and Femtolaser assisted cataract surgery [1].

Posterior Capsular Opacity (PCO) also known as “After Cataract” or Secondary Cataract is the most common late complication of cataract surgery [1]. This is due to proliferation and differentiation of residual lens epithelial cells resulting in fibrous metaplasia [2]. PCO can be minimized by keeping the capsulorrhexis opening in touch with the front surface of the intra ocular lens (IOL) [3]. Symptoms include persistent worsening or blurring of vision, glare and sometimes monocular diplopia. Mostly seen with polymethmethacrylate IOL, round edged hydrophilic lenses and can opener anterior capsulotomy. Can be minimized using acrylic IOL, square edged IOL, hydrophobic lenses and continuous curvilinear capsulorrhexis [4].

The three morphological forms of PCO are (1) Fibrous type: arises when epithelial cells undergo fibrous metaplasia and develop contractile characteristics [1]; (2) Pearl/Vacuolated type: these are globular or grape like groupings of swollen cells [3]; (3) Soemmering’s Ring: white annular cell growth and matrix production in between the anterior and posterior capsules [1].

Earlier PCO was treated using Zeigler's knife and surgical membranectomy [5]. Nowadays, Nd:YAG laser capsulotomy is the modality of treatment for PCO. In this procedure, we create an opening in the posterior capsule using a Nd:YAG Laser (Neodymium yttrium aluminium garnet laser) [2]. Indications for the same are increase in intra ocular pressure, pitting of IOL, Retinal holes and detachment, cystoid macular edema, iritis and corneal edema. Contraindications include corneal scars, sublimated lens, if patient is unable or unwilling to fixate adequately [2, 4].

This study will assess the visual outcome after Nd:YAG laser capsulotomy along with the relevant risks of different complications that may be caused due to the use of it in different grades of PCO.

Materials and Methods

This study was conducted in the department of ophthalmology of Rohilkhand Medical College and Hospital, Bareilly from November 2022 to October 2023. Total of 118 patients who had undergone cataract surgery and presented with visually significant PCO and giving consent for the procedure were included in the study. The patients with thick PCO requiring surgical intervention and those with ocular co-morbidities like corneal opacities, retinal or optic nerve pathologies and high myopia were excluded from the study.

Examination of each patient was done and visual acuity was recorded using Snellen's chart. Slit lamp examination done for diagnosing type and grade of PCO. Intraocular pressure was measured by Goldman Applanation Tonometer. After this workup, posterior capsulotomy was performed with Nd:YAG laser starting from minimum pulse energy and then gradually increasing it. After the procedure, timolol 0.5% and a low dose steroid were given to control the rise in IOP and reduce inflammation respectively. Post laser follow up was done at 1 hour, 24 hours, 1 week, 1 month and 3 months. During each visit, visual acuity, slit lamp examination, IOP pressure and fundus examination were done.

RESULTS

The study included equal number of males and females (59 each).

Table 1: Age Distribution

Age	Cases	%
<40yrs	3	3%
40-60yrs	44	37%
60-80yrs	71	60%

In our study maximum PCO occurred in age group of 60-80yrs that is 60% followed by 37% in patients of age group 40-60yrs. Only 3% patients were from age group of <40yrs.

Table 2: Time interval between cataract surgery and development of capsular opacification

Duration	Cases	%
6month-1yr	44	37%
1yrs-2yrs	54	46%
2yrs-3yrs	13	11%
3yrs-4yrs	5	4%
>4yrs	2	2%

Maximum cases of 46% of were noted between 1 to 2 years following cataract surgery. Cases, which had developed PCO within 6 months following cataract surgery, were advised to come after 6 months.

Table 3: Type of PCO

Type of PCO	Cases	%
Fibrous/Membranous type	66	56%
Elsching's pearls	50	42%
Sommering rings	2	2%

Most common type of PCO isFibrous/membranous type thatisaround 56% followed by Elsching's pearlswhichisaround 42% and thenSommering rings in around 2% patients.

Table 4: Pre laser VA and post laser VA at 1 hr follow up

Pre laser Visual acuity	Cases	%	Post laser visual acuity 1 hr follow up	Cases	%	P value
<3/60	13	11.01%	**<3/60**	4	3.3%	<0.00001
3/60-6/60	83	70.33%	**3/60-6/60**	15	12.7%	

6/60-6/18	17	14.4%	**3/60-6/60**	66	55.9%	
6/12-6/6	5	4.2%	**6/12-6/6**	33	27.9%	

Immediately after doing YAG laser capsulotomy within one hour, 12.7% of patients had improved visual acuity of 3/60-6/60 and 55.9% patients had VA of 6/60-6/18 and 27.9% had improved visual acuity of 6/12-6/6. Only 3.3% patients showed no improvement following Nd:YAG laser capsulotomy.

Table 5: Pre laser VA and post laser VA at 24 hr follow up

Pre laser Visual acuity	Cases	%	Post laser visual acuity 24 hr follow up	Cases	%	P value
<3/60	13	11.01%	**<3/60**	4	3.3%	<0.00001
3/60-6/60	83	70.33%	**3/60-6/60**	13	11.01%	
6/36-6/18	17	14.4%	**3/60-6/60**	57	48.3%	
6/12-6/6	5	4.2%	**6/12-6/6**	44	37.28%	

At the end of 24hrs, 3.3% of patients had VA of less than 3/60. 11.01% of patients had VA of 3/60-6/60, 48.3% of patients had VA of 6/36-6/18, and 37.28% of patients had VA of 6/12-6/6.

Table 6: Pre laser VA and post laser VA at 1 week follow up

Pre laser Visual acuity	Cases	%	Post laser visual acuity 1week follow up	Cases	%	P-value
<3/60	13	11.01%	**<3/60**	4	3.3%	<0.00001
3/60-6/60	83	70.33%	**3/60-6/60**	1	0.84%	
6/36-6/18	17	14.4%	**3/60-6/60**	46	38.98%	
6/12-6/6	5	4.2%	**6/12-6/6**	67	56.77%	

At the end of 1 week, 3.3% of patients had VA of less than 3/60. 0.84% of patients had VA of 3/60-6/60, 38.98% of patients had VA of 6/36-6/18, and 56.77% of patients had VA of 6/12-6/6.

Table 7: Pre laser VA and post laser VA at 1 month follow up

Pre laser Visual acuity	Cases	%	Post laser visual acuity 1 month follow up	Cases	%	P-value
<3/60	13	11.01%	**<3/60**	4	3.3%	<0.00001
3/60-6/60	83	70.33%	**3/60-6/60**	1	0.84%	
6/36-6/18	17	14.4%	**3/60-6/60**	36	30.50%	
6/12-6/6	5	4.2%	**6/12-6/6**	77	65.25%	

At the end of 1 month, 3.3% of patients had VA of less than 3/60. 0.84% of patients had VA of 3/60-6/60, 30.50% of patients had VA of 6/36-6/18, and 65.25% of patients had VA of 6/12-6/6.

Table 8: Pre laser VA and post laser VA at 3 month follow up

Pre laser Visual acuity	Cases	%	Post laser visual acuity 3 month follow up	Cases	%	P-value
<3/60	13	11.01%	**<3/60**	4	3.3%	<0.00001
3/60-6/60	83	70.33%	**3/60-6/60**	1	0.84%	
6/36-6/18	17	14.4%	**3/60-6/60**	31	26.27%	
6/12-6/6	5	4.2%	**6/12-6/6**	82	69.49%	

At the end of 3 months, 3.3% of patients had VA of less than 3/60. 0.84%% of patients had VA of 3/60-6/60, 26.27% of patients had VA of 6/36-6/18, and 69.49% of patients had VA of 6/12-6/6.

Table 9: Pre laser IOP and post laser IOP at 1 hr follow up

Pre laser IOP (mmHg)	Cases	%	Post laser IOP (mmHg) 1 hr follow up	Cases	%	P-value
10-13	44	37.28%	**10-13**	24	20.33%	<0.05
13-16	30	25.4%	**13-16**	36	30.50%	
16-19	41	34.74%	**16-19**	39	33.05%	
19-21	2	1.6%	**19-21**	9	7.62%	
>21	1	0.84%	**>21**	10	8.47%	

After 1 hr 20.33% had IOP in range of 10-13mmHg, 30.50% patients had IOP in range of 13-16mmHg, 33.05% patients had IOP in range of 16-19mmHg, 7.62% patients had IOP in range of 19-21mmHg, only 8.47% patients had IOP more than >21mmHg. These patients was treated with timolol 0.5% eye drops twice daily for 1 week.

Table 10: Pre laser IOP and post laser IOP at 24 hr follow up

Pre laser IOP (mmHg)	Cases	%	Post laser IOP (mmHg) 24 hr follow up	Cases	%	P-value
10-13	44	37.28%	**10-13**	34	28.81%	<0.3
13-16	30	25.4%	**13-16**	39	33.05%	
16-19	41	34.74%	**16-19**	40	33.89%	
19-21	2	1.6%	**19-21**	1	0.84	
>21	1	0.84%	**>21**	5	4.23%	

Intraocular pressure after 24 hour was measured. 28.81% had IOP in range of 10- 13mmHg, 33.05% patients had IOP in range of 13-16mmHg, 33.89% patients had IOP in range of 16-19mmHg, 0.84% patients had IOP in range of 19-21mmHg, only 4.23% patients had IOP more than >21mmHg.

Table 11: Pre laser IOP and post laser IOP at 1 week follow up

Pre laser IOP (mmHg)	Cases	%	Post laser IOP (mmHg) 1 week follow up	Cases	%	P-value
10-13	44	37.28%	**10-13**	49	41.52%	<0.4
13-16	30	25.4%	**13-16**	38	32.20%	
16-19	41	34.74%	**16-19**	29	24.57%	
19-21	2	1.6%	**19-21**	1	0.84%	
>21	1	0.84%	**>21**	1	0.84%	

Intraocular pressure after 1 week was measured. 41.52% had IOP in range of 10-13mmHg, 32.2% patients had IOP in range of 13-16mmHg, 24.57% patients had IOP in range of 16-19mmHg, 0.84% patients had IOP in range of 19-21mmHg, only 0.84% patients had IOP more than >21mmHg.

Table 12: Pre laser IOP and post laser IOP at 1 month follow up

Pre laser IOP (mmHg)	Cases	%	Post laser IOP (mmHg) 1 month follow up	Cases	%	P-value
10-13	44	37.28%	**10-13**	47	39.83%	<0.7
13-16	30	25.4%	**13-16**	40	33.89%	
16-19	41	34.74%	**16-19**	29	24.57%	
19-21	2	1.6%	**19-21**	1	0.84%	
>21	1	0.84%	**>21**	1	0.84%	

Intraocular pressure after 1 month was measured. 39.83% had IOP in range of 10-13mmHg, 33.89% patients had IOP in range of 13-16mmHg, 24.57% patients had IOP in range of 16-19mmHg, 0.84% patients had IOP in range of 19-21mmHg, only 0.84% patients had IOP more than >21mmHg.

Table 13: Pre laser IOP and post laser IOP at 3 month follow up

Pre laser IOP (mmHg)	Cases	%	Post laser IOP (mmHg) 3 month follow up	Cases	%	P-value
10-13	44	37.28%	**10-13**	47	39.83%	<0.4
13-16	30	25.4%	**13-16**	40	33.89%	
16-19	41	34.74%	**16-19**	29	24.57%	
19-21	2	1.6%	**19-21**	1	0.84%	
>21	1	0.84%	**>21**	1	0.84%	

Intraocular pressure after 3 month was measured. There was no significant change after 3 months of Nd:YAG laser capsulotomy.

Table 14: Complication after Nd:YAG laser capsulotomy

Complications	Cases	%
Increased IOP	10	32.25%
Pitting of IOL	8	25.8%
Uveitis	2	6.4%
CME	1	3.2%

Vitreous in AC	2	6.4%
Retinal detachment	0	0%
Total Number of Complications	23	19.49%
Total Number of Patients	118	

Out of 118 patients only 23 patients showed complications after Nd:YAG laser capsulotomy. 10 patients showed increased IOP from there base IOP, 8 patients showed pitting of IOL, 2 patients had uveitis, 1 patients developed CME after Nd:YAG laser capsulotomy, and only 2 patients had vitreous in AC post laser.

DISCUSSION

Our study was conducted with the objective to evaluate whether Nd:YAG laser is an effective procedure in improving visual acuity in patients with PCO.

The individuals in this study showed proven improvement in their vision, which supports the effectiveness of the Nd:YAG laser in producing posterior capsulotomy. With its higher risk of intraocular lens and vitreous displacement, cystoid macular oedema, and retinal detachment, this noninvasive surgical laser allows for the avoidance of the initial intraoperative capsulotomy.

There was a significant improvement in VA after Nd:YAGlaser capsulotomy which was analysed after 1hr, 24hr, 1week, 1month and 3months. Immediately after doing YAG laser capsulotomy within one hour, 27.9% had improved visual acuity of 6/12-6/6. Only 3.3% patients showed no improvement after Nd:YAG laser capsulotomy. At the end of 24hrs, 3.3% of patients had visual acuity of less than 3/60. 11.01% of patients had visual acuity of 3/60-6/60, 48.3% of patients had visual acuity of 6/36-6/18, and 37.28% of patients had visual acuity of 6/12-6/6. At the end of 1 week, 56.77% of patients had visual acuity of 6/12-6/6. At the end of 1 month, 65.25%of patients had visual acuity of 6/12-6/6. At the end of 3 months, 69.49% of patients had visual acuity of 6/12-6/6.similarly in a study conducted by KedarNemivant*et al*., [5] on 35 individuals and found that, following laser capsulotomy, 43 patients (86%) had functional visual acuity up to 6/9.

Nishant V Shah *et al*., [6] conducted a study on 97 patients. The study concluded that at one month after the laser, four patients' visual acuity had improved by five Snellen's lines, visual acuity increased by four Snellen’s lines in five patients, 26 patients' visual acuity had improved by three Snellen's lines, and 43 patients' visual acuity had improved by two lines.

In this study Out of 118 patients only 23 patients showed complications after Nd:YAG laser capsulotomy. 10 patients showed increased IOP from there base IOP, 8 patients showed pitting of IOL, 2 patients had uveitis, 1 patients developed CME after Nd:YAG laser capsulotomy, and only 2 patients had vitreous in AC post laser. Whilethe study carried out by Bilal Khan *et al*., [7] with 406 patients in all, 56 eyes, intraocular lens pitting was the most frequent problem observed, 38 eyes there was a brief increase in IOP, and in 17 eyes, there was cystoid macular edema.

NaseemAbid*et al*., [8] conducted a study on 50 eyes of 45 patients with PCO who underwent Nd:YAG Laser capsulotomy concluded that raised intraocular pressure in 7 eyes which was the commonest complication followed by damage to intraocular lens in 2 eyes and corneal burn in 1 eye corneal oedema in 2 eyes and anterior uveitis in 2 eyes.

CONCLUSION

The Nd:YAG laser is a noninvasive surgical tool that provides excellent posterior capsulotomies. It safe, least time consuming and readily acceptable to patients can be done as a day care procedure, thus preferred over surgical intervention that is, manual surgicalcapsulotomy.

Improvement in best corrected visual acuity after Nd:YAG laser posterior capsulotomy is good with minimal complications. The most common of these complications are intraocular lens pitting, transient intraocular pressure elevation and CME.

Therefore, it can be concluded that Nd: YAG laser capsulotomy is a effective and safe method of restoring vision in patients with PCO.

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