FP 283053- A CLINICAL STUDY OF OUTCOME OF ND: YAG LASER CAPSULOTOMY

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FINANCIAL DISCLOSURE

- No financial interests

INTRODUCTION

- Neodymium-doped yttrium aluminum garnet (Nd:YAG) laser capsulotomy is one of the treatment modality for posterior capsular opacification(PCO).

- PCO is a common long term complication of cataract surgery that decrease vision, glare and other symptoms (*). It is caused by a proliferation of lens epithelial cells.

- Since the use of Nd:YAG laser for posterior capsulotomy, it has been gradually replacing the surgical capsulotomy as it is less invasive, and can be performed as an outpatient procedure.

Ref(*) : Aslam TM, Patton N. Methods of assessment of patients for nd: YAG laser capsulotomy that correlate with final visual improvement. BMC Ophthalmol 2004;4:13

MATERIALS AND METHODS

- **Study design** : Cross sectional prospective interventional study.
- **Study setting :** Department of Ophthalmology, Rangaraya medical college, Kakinada
- **Study subjects :** 50 patients with clinically identified posterior capsule opacification following cataract surgery above 16years.
- **Study duration :** December 2019 to August 2021
- **Study tools :** Snellen's visual acuity chart,
  - Slit lamp biomicroscope,
  - Direct ophthalmoscope,
  - Indirect ophthalmoscope- +90D biomicroscope,
  - Applanation tonometer.

Inclusion criteria:

- Evident posterior capsular thickening / opacification on examination with slit lamp.
- Decreased visual acuity by >=2 lines on Snellen’s chart.
- Time interval between cataract surgery and development of posterior capsular opacification was 6months.

Exclusion criteria :

1. Patients with <16 years of age.
2. Cases with other ocular co-morbidities.

Preparation of the Patient

Pre Op:

- After a thorough history taking, all the patients were evaluated clinically.
- Verbal consent was taken from the patients.
- Best corrected visual acuity was tested with Snellen's chart.
- Intraocular pressure was recorded.
- Silt lamp examination and fundus examination with direct ophthalmoscope was done.
- Pupil dilated with 1% Tropicamide eye drops prior to the laser capsulotomy.
- Cornea was anesthetized with 4% xylocaine prior to laser shots.
- Q switched Nd-YAG laser with Helium Neon Beam for focusing was used.

Posterior Capsulotomy Technique(#).

- Single pulse shots of minimum energy (1-2mJ) were used.
- The energy and pulses were gradually increased according to the thickness of the PCO.
- Tension lines were cut across after identification.
- A cruciate opening was performed; first puncture was aimed at the visual axis.
- Residual tags were cleaned up.
- Free floating fragments were avoided.
- Energy and shots were recorded

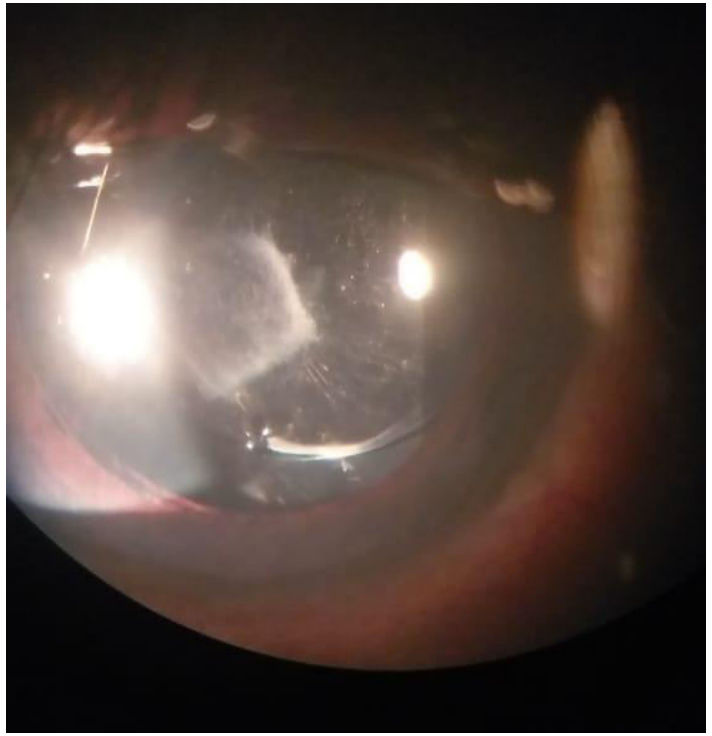
Ref(#) :Ken Hayashi, Hideyuki Hayashi, Fuminori Nakao, et al. Correlation between posterior capsule opacification and visual function before and after neodymium: YAG laser posterior capsulotomy. American Journal of Ophthalmology 2003;136(4):720-726.

Post laser treatment:

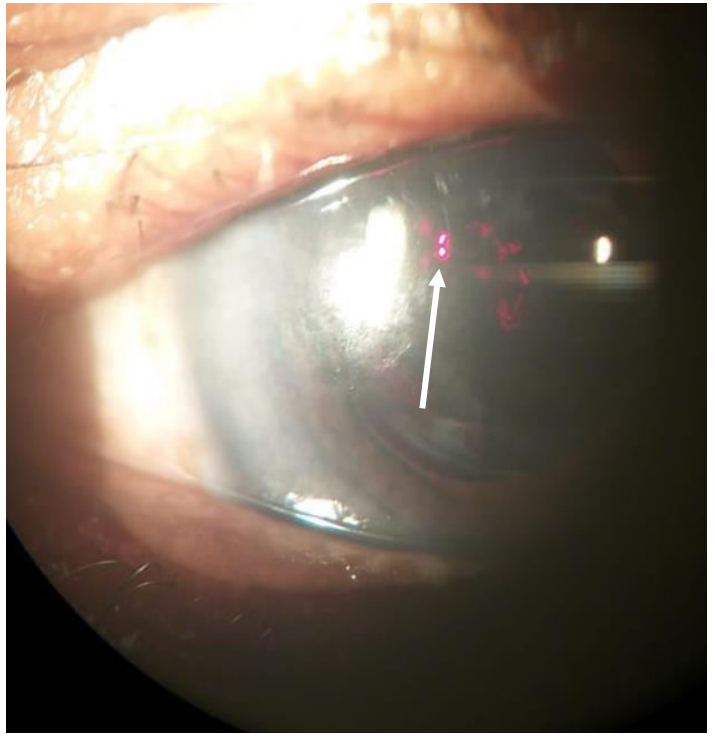
- Following procedure, Topical timolol maleate 0.5% B.D for 1 week,
  - topical antibiotic and steroid eye drops QID for 1 week,
  - oral acetazolamide tablets 250 mg QID for 5 days only when IOP was not controlled with above medication.

- Then the patients were reviewed for assessment of BCVA, IOP and for possible complications at 24 hours after the procedure and at the end of 1 week, 1 month and 3 months.

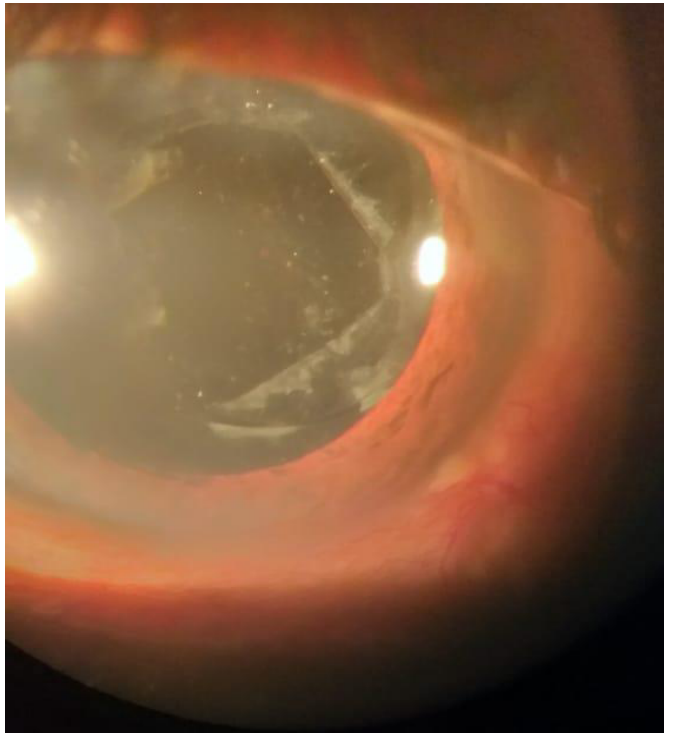
Pre laser - PCO



Laser spots during procedure



Post laser



RESULTS

- Total number of patients – 50
- RE – 27 eyes
- LE – 23 eyes

Table 1. Age Distribution

Age	Cases (n=50)	Percentage
1 to 20	0	0
21 to 40	3	6%
41 to 60	24	48%
>60	23	46%

- Maximum eyes (48%) were in the age group 41-60 years.

Table 2. Sex distribution

Sex	Cases(n=50)	Percentage
Males	22	44%
Females	28	56%
Total	**50**	**100%**

- Female (56%) outnumbered Male(44%) in ratio of 1.2:1.

Table 3: Time Interval between cataract surgery and development of posterior capsular opacification.

Duration	Cases (n=50)	Percentage
6months – 1year	16	32%
>1year – 1 ½ year	20	40%
>1 ½ year – 2years	10	20%
>2years – 2 ½ years	2	4%
>2 ½ years – 3years	2	4%
>3years	0	0
Total	**50**	**100%**

- 32%(n=16) cases of posterior capsular opacification were noted between 6 months to 1 year after cataract surgery.
- 40%(n=20) of cases were noted between 1 to 1-1/2 years after cataract surgery.
- 4%(n=2) cases of posterior capsular opacification were noted between 2 ½ to 3 years.

- Maximum number of cases need YAG laser capsulotomy between the period of >12 months -18 months was 40%.

- Cases, which had developed posterior capsular opacification within 3 – 6 months following cataract surgery, were advised to come after 6 months and posterior studies report a less incidence of complications when laser capsulotomy was done after a longer interval following cataract surgery.

Table 4: Laser power distribution

Total Energy (mj)	Cases(n=50)
10 to 20	12(24%)
21 to 40	20(40%)
41 to 60	15(30%)
61 to 80	2(4%)
81 to 100	1(2%)
>100	0

- The posterior capsulotomies were performed with Nd: YAG laser starting with 1 – 2 mj/pulse and gradually increased until the desired response were obtained.

- In most cases, desired response was obtained within the total energy of 50 mj.
- However, in one case(2%), more than 80 mj was used because of thick PCO.

Table 5: Pre laser visual acuity

Visual Acuity	<3/60	6/60 – 3/60	6/18 -6/36
Cases	4(8%)	38(76%)	8(16%)

Table 6: Post laser visual Acuity improvement

Follow up	<3/60	6/60 – 3/60	6/18 -6/36	6/6 – 6/12
24 Hrs.	2	5	25	18
1 week	2	1	20	27
1 month	1	2	18	29
3 months	1(2%)	2(4%)	13(26%)	34(68%)

Pre laser VA	Post laser visual Acuity improvement							
	6/6	6/9	6/12	6/18	6/24	6/36	6/60	<6/60
<3/60	-	-	-	-	-	-	-	1
6/60 – 3/60	4	12	10	8	2	3	1	1
6/18 -6/36	3	4	1	-	-	-	-	-

- Visual acuity profile reveals that 76% of patients had visual acuity in the range between 6/60 to 3/60 and 8% of patients had visual acuity less than 3/60 before doing YAG laser posterior capsulotomy.

- 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, 94% of subjects showed significant visual acuity improvement.

- 68%(n=34) of patients had visual acuity of 6/6 to 6/12 and 26%(n=13) of patients had visual acuity of 6/18 to 6/36.

- 76% of patients initially with visual acuity of 6/60 to 3/60 (prelaser) had dropped to 4% after capsulotomy.

- The vision of 6% (n=3) of subjects did not have significant improvement of visual acuity, because of pre-existing fundus pathology which was not detected due to thick PCO

- In this, one (2% cases) patient had Ischemic optic atrophy and another two(4%) subjects with age related macular degeneration changes were present.

Table 7: Nd: YAG laser posterior capsulotomy - IOP measurement

IOP(mmHg)	Prelaser	1 Hr	24 Hrs	1 week	1 Months	3 Months
5 to 10	2	1	2	2	2	2
11 to 15	22	18	18	20	20	20
16 to 20	26	28	28	28	28	28
>21	-	3(6%)	2(4%)	-	-	-

- In present study, Only 6% (n=3) cases showed intraocular pressure of more than 21 mm Hg. It was detected at 1 hour and 24 hours after YAG laser capsulotomy and they were returned to normal level within 1 week.

- 2 (4%) patients had IOP between 20–30 mmHg; 1 (2%) patient had pressure IOP more than 30 mmHg.

- IOP was controlled with timolol 0.5% eye drops and acetazolamide tablet 250 mg twice daily for 1 week and at the end of 1 week, IOP became normal.

- However, transient elevation of IOP of 3-5 mm Hg from their basal level was noted in 30% of subjects within 24 hours but not exceeding 20 mm Hg.

- The most likely mechanism for acute pressure elevation is trabecular blockage by capsular and cortical debris.

Table 8: Complications following Nd : YAG laser capsulotomy

COMPLICATIONS	Cases
Intraocular Pressure elevation	3(6%)
Intraocular lens pitting	5(10%)
Aqueous flare	1(2%)
Iritis	1(2%)
Vitritis	0
Cystoid macular oedema	0
Retinal Detachment	0
Endophthalmitis	0

- **Intraocular pressure elevation** more than 21 mm Hg were noted in 6% of cases.
  - It was detected at 1 hour and 24 hours after YAG laser capsulotomy and they were returned to normal level within 1 week after treating with Timolol 0.5% eye drops and tablet acetazolamide twice daily.
  - Steroid eye drops were prescribed for 1 week. Because of these reasons, IOP was not much raised in this study after Nd : YAG laser capsulotomy

- **IOL pitting** was noted in 5 out of 50 (10%) subjects.
  - Lens pitting is most likely to occur when lens and capsule are closely approximately.
  - Proper focusing of the aiming beam and low energy levels will prevent damage to the IOL. Few laser marks on the IOL do not alter visual function or impair ocular tolerance of the IOL.

- **Postoperative uveitis** was reported in 2% of subjects at one-week follow up.
  - Inflammation is produced by liberation of large amounts of lens cortex into anterior chamber.

- **Iritis** was reported in 2% of subjects after Nd:YAG laser capsulotomy manifested as cells and flare in the anterior chamber on slit lamp examination.

- They were given topical steroid, and reaction had subsided leaving no delayed complication

- In our study, no cases of cystoid macular edema, retinal detachment and endophthalmitis were recorded.
  - This could be because of the absence of risk factors in cases selected for Nd:YAG laser capsulotomy.

DISCUSSION

Comparison of our study with other studies	Cases (n)	VA improved	Raised IOP	IOL Pitting	Uveitis /aqueo -us flare	Iritis / iris bleeding	Vitritis/ rupture of ant. vitreous face	cystoid macular oedema/ retinal detachment/ endophthalmitis
[4]M.Gardner, R.Straatsma(1985)	100	95%	23%	39%	13 %	- 3%	-	-
[3]Pankaj Soni et al study (2016)	256	94.9%	21%	12.5%		- 7.6%	-	2% -
[2]Pratima Sahu, Amit Kumar Mishra study (2019)	184	97.8%	46.3%	6.5%	28.8%	- 3.8%	13%	-
Our study	50	94%	6%	10%	2%	2%	-	-

- [8]F. Steinert, Puliafito (1991) reported 11 patients (1.23%) developed cystoid macular oedema.
- [5]R. Shah (1985) reported that cystoid macular oedema occurred in 0.68% of subjects.

- Incidence of retinal detachment after Nd:YAG laser capsulotomy in various studies are:
  [6]Aron Rosa, Aron (1984) – 0.1%
  Stark & associates (1985) – 0.5%
  Steinert & associates (1991) – 1.23%

- [7]Several cases of Propionibacterium acnes endophthalmitis have been reported following Nd:YAG laser posterior capsulotomy.

CONCLUSION

- From the above study, it is clear that Nd:YAG laser posterior capsulotomy is a safe and effective procedure for the improvement of vision.
- It is non-invasive and least time consuming, can be done as outdoor procedure with better patient acceptability.
- It has very few complications when accurate focusing and low energy levels are used.
- Careful follow-up is important.

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