e-ISSN: 0975-1556, p-ISSN:2820-2643

Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2023; 15(8); 1461-1466

Original Research Article

Comparative Analysis of the Incidence of Posterior Capsule Opacification between Square Edged PMMA and Round Edged PMMA Intraocular Lens in Patients Underwent for Small Incision Cataract Surgery

Ruchi Priya[1], Pallavi Mishra[2]

[1]Assistant Professor, Department of Ophthalmology, Naraina Medical College & Research Centre, Kanpur

[2]Assistant Professor, Department of Ophthalmology, Dr. Susheela Tiwari Government Hospital & Government Medical College, Haldwani

Received: 30-5-2023 / Revised: 30-06-2023 / Accepted: 30-07-2023

Corresponding author: Dr. Pallavi Mishra

Conflict of interest: Nil

Abstract:

Introduction: "Posterior capsule opacification (PCO)" is a common long-term impact of cataract surgery induced by "residual lens epithelial cells." PCO requires surgery to prevent vision loss. Despite advances, PCO affects millions in worldwide. "Laser posterior capsulotomy", the principal treatment, is risky and expensive. Prevention and better "intraocular lens (IOL)" designs are needed to solve this issue.

Aims and Objectives: The study has compared PCO incidence, severity, and PMMA IOLs requiring laser capsulotomy.

Methods: One hundred patients at Naraina Medical College and Hospital who had posterior chamber intraocular lens implantation following manual small incision cataract surgery were included in the study. Patients were chosen for the trial based on several factors, including their interest in participating, their availability for follow-up, the absence of conditions known to affect study outcomes, and their willingness to provide informed permission after being fully briefed on the study's methods, risks, and benefits.

Results: Table 1 demonstrates ocular laterality and Group A/Group B allocation. Both groups had good BCVA results, as shown in Table 2. After one year, Group A had a higher rate of "posterior capsule opacification (PCO)" than Group B (Table 3). 12% had laser capsulotomy. Most patients did not need. These data imply PCO rates varied between the two groups and emphasise the significance of diligent follow-up and PCO management after cataract surgery.

Conclusion: The incidence of PCO was found to be lower in patients who had square-edged IOLs, while Nd: YAG capsulotomy was found to be more effective with square-edged IOLs.

Keywords: Cataracts, "posterior capsule opacification (PCO)", "Laser posterior capsulotomy".

Introduction

The incidence of cataracts is highest in older individuals. 3.8 million people worldwide go blind each year as a result of cataracts, which is one of the main causes of blindness. Corrective lenses can or cannot assist people with cataracts focus on items that are distant or relatively close up for a longer duration of time [2]. The primary and initial symptom that a patient experiences is blurred visibility because their lenses no longer have the ability to discriminate between near and far objects. After noticing vision disturbance, the patient eventually notices failure of vision.

The degree of visual impairment is determined by how big and where of the opacity. And sensitivity to light, necessitating greater light for tasks likes reading. They notice a halo surrounding the light as well as a diminishing or yellowing of the colors. In just one eye, individuals have double vision [3]. Congenital cataracts, traumatic cataracts, secondary cataracts, radiation cataracts, lamellar or zonular cataracts, posterior polar cataracts, anterior polar cataracts, post-vitrectomy cataracts, Christmas tree cataracts, nuclear cataracts, brunescent cataracts, and diabetic snowflake cataract are a few examples of cataract types [4].

Visual acuity test- A doctor will ask you to observe letters from a distance with one eye first, then with the other, and then carry out a glare test as part of a visual acuity test, also referred to as an eye chart exam [3,4]. Slit-lamp examination: In this test, the cornea, outer layer, iris, and lens of the eye are examined under a magnifying lens with bright light. Retinal exam - During this procedure, eye drops are used to broaden your pupils to enable

access to the retina and the tissue underlying the back of your eyes [5,6].

The most popular and renowned ophthalmic implementation. In the world nowadays, cataract surgery includes the extracapsular ablation of the inherently translucent lens fibers and the inserting of a lens inside the eye to restore vision [7]. Contrary to all therapies, it is the condition that is most successfully treated. In the United States, about 2 million extractions are carried out yearly. Without the aid of an implant, restoring vision is still achievable with contact lenses or thick glasses, frequently referred to as aphakic optics. Make sure the cataract is solely responsible for the degree of visual loss before considering cataract surgery. Modern posterior chamber standard PMMA Round Edged or Square Edged intraocular lenses are utilized in SICS [8].

However, a typical long-term side effect of contemporary cataract surgery is posterior capsular opacification (PCO), frequently referred to as secondary cataract. The creation of an obscure film on the posterior capsule is known as posterior capsular opacification, which is caused through the posterior translocation of energized epithelial cells.These epithelial cells proceed to the visual axis, where they multiply, generate Eischnig's pearls, and impede visibility. These epithelial cells fail to produce symptoms in the peripheral capsular bag, but instead go to the visual axis, where they scatter light and impair vision [9,10]. There are numerous causes of posterior capsular opacification, which frequently results in a decline in visual acuity, glare impairment, and loss of contrast sensitivity by disrupting the axis of vision or by optical distortion.

Visually significant visual acuity is regarded as a decrease of greater than two lines on the Snellen chart. Proliferation, Migration, and Characterization of remaining Lens Epithelial cells are three fundamental events that are involved in the development of PCO, which is a highly unpredictable process[11]. Furthermore, it prevents a posterior section examination. The time within ablation and posterior capsular opacification, which can take ranging between three months and four years, varies substantially.

Method

Research Design “

One hundred patients at Naraina Medical College and Hospital were included in the study, all of whom had manual small incision cataract surgery with posterior chamber intraocular lens implantation. Patients were selected based on their willingness to participate in the study, their ability to attend follow-up appointments, and their lack of any ocular or systemic conditions that could affect the study outcomes, as well as their ability to provide informed consent before surgery. Before giving their agreement to participate in the trial, the patients were given detailed information regarding the study's procedures, risks, and benefits.

Inclusion and Exclusion Criteria

Inclusion

- 40–70 years of age range.
- Immature or Mature Senile Cataract.
- Nuclear Sclerosis grading of 1, 2, and 3.

Exclusion

- Cataracts that are not connected to normal ageing.
- Any condition characterised by dysfunctional or abnormal corneal endothelial cells.
- Inflammatory eye conditions that are currently active include severe chronic uveitis and iritis.
- "Posterior segment pathology" (such as "proliferative diabetic retinopathy", "retinal detachment", "cystoid macular oedema", or "optic atrophy") or history or signs of such.
- Cataracts at the posterior pole and subcapsular level are dense.
- Glaucoma patients.

Statistical Analysis

The study's data was analysed using statistical methods. The demographics and health status of the patients were summarised using descriptive statistics. To determine if there was a correlation between intraocular lens type and the development of posterior capsule opacification, we used inferential statistics such as the chi-square test and Fisher's exact test. Furthermore, regression analysis can be used to assess how PCO severity correlates with visual acuity. The cut-off point for statistical significance was $p<0.05$.

Ethical approval

The study was approved by the IRB at Naraina Medical College and Hospital to ensure participant safety.

Result

The laterality distribution of eyes among the people who participated in the study is provided in Table 1. There were a total of 100 patients participating in the study, with 50 patients assigned to each of the two groups (Group A and Group B). 53 of the 100 eyes were on the right side, with 25 from Group A and 28 from Group B constituting the right eyes.

In a similar fashion, there were 47 left eyes, with 25 belonging to Group A and 22 to Group B. The table shows a clear overview of the distribution of eyes in terms of laterality and their allocation to each study group. It also highlights the balanced distribution of patients between the two groups,

which is necessary for appropriate comparison and analysis.

Table 1: Laterality distribution of the eyes

Eye	Number of Patients		Total	%
	Group A	Group B		
Right	25	28	53	53
Left	25	22	47	47
Total	50	50	100	100

The results of the "best-corrected visual acuity (BCVA)" test are presented in Table 2 for both Group A and Group B. In Group A's 50 eyes, 80% of them were able to obtain a BCVA of R6/6-6/9 (20/20-20/30), whereas the other 20% had a BCVA of 6/12-6/18 (20/40-20/60). In Group A, none of the eyes had a BCVA that was lower than 6/24 (20/80). In Group B, 84 per cent of participants attained a BCVA score of R6/6-6/9 (20/20-20/30), 14 per cent had a BCVA score of 6/12-6/18 (20/40-20/60), and 2 per cent had a BCVA score of 6/24-6/60 (20/80-20/200). In neither of the two groups was there a single eye with a BCVA that was lower than 6/60 (20/200). The table shows a comparison of the BCVA outcomes of the two groups, suggesting a favourable visual outcome overall in both groups, with the majority achieving the good vision. This is indicated by the table.

Table 2: Outcome of Visual Acuity in the study

Best Corrected visual activity at 1st month				
BVCA	**Group A**		**Group B**	
	No. of patients	**%**	**No. of patients**	**%**
6/6-6/9	40	80	42	84
6/12-6/18	10	20	7	14
6/24-6/60	0	0	1	2
<6/60	0	0	0	0
Total	50		50	
Visual Acuity Loss				
S. No	**V/A Loss**		**Total No. (%) of eyes**	
			Group A	**Group B**
1	No loss		34 (68%)	41 (82%)
2	1 line		8 (16%)	5 (10%)
3	2 lines		3 (6%)	3 (6%)
4	3 lines		2 (4%)	1 (2%)
5	4 lines		2 (4%)	0
6	5 lines		1 (2%)	0

Postoperative "Posterior Capsule Opacification (PCO)" rates for Group A and Group B are shown in Table 3. After 1 year, 20% (10 eyes) of those in Group A (N=50) had developed PCO, whereas at 1 month there were none. Group B (N=50) had no cases of PCO at 1 month, and 8% (4 eyes) developed PCO after 1 year, which was lower than Group A's incidence. The overall prevalence of PCO was 14% (14 eyes) among the sample population of 100. There were 2% of cases of Grade I PCO, 8% of Grade II PCO, 6% of Grade III PCO, and 4% of Grade IV PCO. After a year, 16 eyes in Group A and 8 eyes in Group B both underwent Nd: YAG laser capsulotomy, for a total of 12 eyes (12%). Treatment with a laser was unnecessary for 89% of patients.

Table 3: Study outcomes on post-operative opacification and Nd: YAG requirement

Incidence of Posterior Capsule Opacification at Various Post-operative Visits				
S.No.	**The time interval from surgery**	**Group A (N=50)**	**Group B (N=50)**	**Total (N= 100)**
1	1 month	0	0	0
2	3 month	1	0	1
3	6 month	7	3	10
4	1 year	10	4	14
5	Total	10	4	14
6	PCO Rate	20%	8%	14%
Grading of Posterior Capsule Opacification after surgery at 1st year				
S. No.	**Grade of PCO**	**Group A (N=50%)**	**Group B (N=50%)**	**Total (N= 100%)**
1	Grade I	1 (2%)	0 (0%)	1 (1%)

2	Grade II	5 (10%)	3 (6%)	8 (8%)
3	Grade III	2 (4%)	1 (2%)	3 (6%)
4	Grade IV	2 (4%)	0 (0%)	2 (4%)
5	Total	10 (20%)	4 (8%)	14 (14%)
Nd: YAG posterior capsulotomy after surgery at 1st year				
S. No.	**Parameter**	**Group A (N=50%)**	**Group B (N=50%)**	**Total (N= 100%)**
1	No. of cases requiring Nd YAG laser after 1 year	8	4	12
2	Nd YAG capsulotomy Rate %	16%	8%	12%
3	No. of cases not requiring Nd YAG laser	42	47	89
4	Rate of patients not requiring Nd YAG	84%	94%	89%

Discussion

Statistical evaluation and contrast IOLs (intraocular lenses) with a rounded posterior capsules opacification (PCO) or sharp optic edge design. For the investigation of the whole the centre 3-mm zone and the optic region, the PCO values for both Alcon Acrysof and Pharmacia 911A silicon IOLs were statistically substantially less common than sharp-edge IOL types. Between both of the sharp-edge optic IOLs, there were no fluctuation in PCO levels that is statistically significant. When the anterior IOL optical area and capsulorrhexis rim overlapped more more than 20%, PCO values were lower when the Acrysof IOL was used [12].

To compare the visual performance and intra-individual variations of Specifically, in between the sphere AcrySof SN60AT and its aspheric AcrySof SN60WF intraocular lenses (IOLs), both of which are made of the same hydrophobic acrylic substance, there is posterior capsule opacification (PCO). In this randomised, fellow-eye comparison, posterior capsule opacification wasn't substantially different between the aspheric and spheric IOLs. Performance of the PCO is unaffected by additional asphericity of the present IOL model [13].

To compare a polymethylmethacrylate (PMMA) with square edges (SE) change of the intraocular lens to a SE-Acrylic or a round-edge (RE) PMMA (poly IOL IOL in order to objectively evaluate titanium aluminium garnet with neodymium doping (Nd: YAG) capsulotomy frequency posterior capsule opacification (PCO), which is long-lasting. Using conventional, high-resolution retroillumination photos taken each year [14]. Using Assessment for Posterior Capsules Opacification (EPCO) processing software, PCO density was objectively assessed during the initial five postoperative years as well as year nine.

According to Using this future, 9-year neighbour as a baseline research, a low-cost The squared optic edge in the PMMA IOL design might considerably lessen secondary membrane load, which reduces vision in impoverished nations [15].

to ascertain if performing extracapsular cataract surgery in a poor country nation uses intraocular lenses (IOLs) made of polymethyl methacrylate (PMMA) with square edges to minimise PCO. In poor nations, PCO may be measured using complex image analysis techniques [16]. Square-edged PMMA IOLs used in extracapsular surgery decreased the extent and severity of PCO in comparison to an equivalent phacoemulsification; however the advantages were not as obvious as those seen with the latter. Round-edged IOL. This could be because it would be challenging to execute a capsulorhexis in this circumstance because it would be on the IOL surface. However, extracapsular surgery with square-edged IOLs may be advantageous in underdeveloped countries [17].

Visual acuity (VA) is often reduced, glare sensitivity is impaired, and contrast sensitivity is lost as a result of PCO. Hard edge intraocular lens optical are listed to be superior to rounded edge IOL optics in previous reports. The purpose the study intended to ascertain how frequently IOLs with cataract surgery cause posterior capsule opacification square edges. The design of IOLs, in particular those with square edges, is crucial in reducing opacification of the posterior capsule, particularly in elderly people with excellent visual results [18].

A clouding of the posterior portion of the lens's pill, a transparent structure that shields the clear lens in the human eye, is known as posterior capsule opacification (PCO). Nowadays, posterior chamber intraocular lenses (IOL) are implanted during cataract surgery, and the most frequent surgical complication is PCO [19]. The main symptoms and PCO indications include decreased visual acuity, "cloudy," vision that is blurred & diminished contrast sensitivity. To cure PCO, a small hole is made in utilising a neodymium: YAG (Nd:YAG) laser, the opaque capsule treatment, which then restores a clear central visual axis. This might lead to other eye problems such increased intraocular pressure with macular oedema, a swelling in the centre of the retina capsulotomy. The cost of this operation is very high to health care systems all around the world. To aid in preventing PCO

development following cataract surgery, improvements have been made to the choice of IOL materials & IOL design optimisation in recent decades. These include alterations to the IOL optic edge geometry and IOL haptics, which are the side structures which hold the lens inside the lens capsule bag to evaluate how various IOL optic edge geometries affect PCO following cataract surgery. This review offers proof the relationship between IOLs having sharp edges and lower PCO development and less Nd: YAG capsulotomy than IOLs with round edges. Less was known about how they might affect visual acuity. Only comparably low-certainty data are available for adverse events, and the effect of such lenses overall quality of life hasn't been evaluated [20].

Conclusion

This study has concluded that the effects of round versus square-edged "intraocular lens (IOL)" designs on "posterior capsule opacification (PCO)" after cataract surgery, this study examined in the "Naraina Medical College and Hospital". Compared to the round-edged PMMA IOL, the square-edged reduced PCO and Nd: YAG laser capsulotomy. Except for a slightly greater rate of severe vision loss in the square-edged IOL group at one year, the two groups had similar postoperative visual acuity. The study's weaknesses include its small sample size, short follow-up period, and single-institution emphasis. To corroborate these findings, larger sample numbers and longer follow-up periods are needed. Future research should include examining surgical methods, lens material, and patient characteristics as PCO risk factors. The study shows that a square-edged PMMA IOL may reduce PCO and the need for Nd: YAG laser capsulotomy. This basic IOL design change could improve visual outcomes and reduce patient costs. To confirm these findings and examine the long-term impact of different IOL designs on PCO incidence and visual outcomes, more research and clinical observations are needed.

References

1. Shweta, D. B. (2019). A Comparative Evaluation of Posterior capsular Opacification with Square Edged and Round Edged PMMA Intraocular Lens in Small Incision Cataract Surgery in rural areas of North Maharashtra. Journal of Medical Science and Clinical Research, 7(2). https:// doi.org/10.18535/ jmscr/v7i2.41
2. Naga, S. V., & Radhika, R. (2016). A study of incidence of posterior capsular opacification after cataract surgery with square edge PMMA intra ocular lens. Indian Journal of Clinical and Experimental Ophthalmology, 2(3), 178.
3. Tassignon MJ, Gobin L, Mathysen D, Van Looveren J, De Groot V. Clinical outcomes of cataract surgery after bag-in-the-lens intraocular lens implantation following ISO standard 11979-7:2006. J Cataract Refract Surg. 2011; 37(12):2120-9.
4. Peng Q, Apple Dj , Visessook N, Werner L, Pandey SK, Escobar Gomez M, et al. Eradication of posterior capsule opacification. Documentation of marked decrease in Nd: YAG laser posterior capsulotomy rates noted in an analysis of 5416 pseudophakic human eyes obtained postmortem. Ophthalmology 2001; 108:505-518.
5. Schaumberg DA, Dana MR, Christen WG, Glynn RJ. A systematic overview of the incidence of posterior capsule opacification. Ophthalmology. 1998 Jul; 105(7):1213-21.
6. Oshika T, Suzuki Y, Kizaki H, Yaguchi S. Two year clinical study of soft acrylic IOL. J Cataract Refract surg 1996; 22:104-109.
7. Nishi O, Nishi K, Wickstrom K. Preventing lens epithelial cell migration using intraocular lenses with sharp rectangular edges. J Cataract Refract Surg 2000; 26:1543-1549.
8. Buehl W, Findl O, Menapace R, Georgopoulos M, et al. Reproducibility of standardized retroillumination photography for quantification of posterior capsule opacification. J. Cataract Refract Surg. 2002 Feb; 28(2):265–270.
9. Aslam TM, Patton N, Graham J. A freely accessible, evidence based, objective system of analysis of posterior capsular opacification; evidence for its validity and reliability. BMC Ophthalmol. 2005; 7:9.
10. Tetz M, Wildeck A. Evaluating and defining the sharpness of intraocular lenses: part 1: Influence of optic design on the growth of the lens epithelial cells in vitro. J. Cataract Refract Surg. 2005 Nov; 31(11):2172–2179.
11. Findl O, Buehl W, Menapace R, Georgopoulos M, et al. Comparison of 4 methods for quantifying posterior capsule opacification. J. Cataract Refract Surg. 2003 Jan;29(1):106–111.
12. Alió JL, Piñero DP, Ortiz D & Montalbán R (2009): Clinical outcomes and postoperative intraocular optical quality with a microincision aberration-free aspheric intraocular lens. J Cataract Refract Surg 35: 1548– 1554.
13. Apple DJ, Peng Q, Visessook N et al. (2000): Surgical prevention of posterior capsule opacification. Part 1: progress in eliminating this complication of cataract surgery. J Cataract Refract Surg 26: 180– 187.
14. Barman SA, Hollick EJ, Boyce JF, Spalton DJ, Uyyanonvara B, Sanguinetti G & Meacock W (2000): Quantification of posterior capsular opacification in digital images after cataract surgery. Invest Ophthalmol Vis Sci 41: 3882–3892.

15. Biber JM, Sandoval HP, Trivedi RH, de Castro LE, French JW & Solomon KD (2009): Comparison of the incidence and visual significance of posterior capsule opacification between multifocal spherical, monofocal spherical, and monofocal aspheric intraocular lenses. J Cataract Refract Surg 35: 1234–1238.
16. Boyce JF, Bhermi GS, Spalton DJ & El-Osta AR (2002): Mathematical modeling of the forces between an intraocular lens and the capsule. J Cataract Refract Surg 28: 1853–1859.
17. Davidson MG, Morgan DK & McGahan MC (2000): Effect of surgical technique on in vitro posterior capsule opacification. J Cataract Refract Surg 26: 1550– 1554.
18. Denoyer A, Le Lez ML, Majzoub S & Pisella PJ (2007): Quality of vision after cataract surgery after Tecnis Z9000 intraocular lens implantation: effect of contrast sensitivity and wavefront aberration improvements on the quality of daily vision. J Cataract Refract Surg 33: 210– 216.
19. Haripriya A, Chang DF, Vijayakumar B, Niraj A, Shekhar M, Tanpreet S, Aravind S. Long-term Posterior Capsule Opacification Reduction with Square-Edge Polymethylmethacrylate Intraocular Lens: Randomized Controlled Study. Ophthalmology. 2017 Mar;124(3):295-302. doi: 10.1016/j.ophtha.2016.11.010. Epub 2017 Jan 5. PMID: 28065436.
20. Shah A, Spalton DJ, Gilbert C, Vasavada A, Boyce JF, Minassian D, Jayaram H, Mabey D. Effect of intraocular lens edge profile on posterior capsule opacification after extracapsular cataract surgery in a developing country. J Cataract Refract Surg. 2007 Jul; 33(7): 1259-66. doi: 10.1016/ j. jcrs.2007.03.044. PMID: 17586384.