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COMPARATIVE STUDY OF PCO WITH FOLDABLE AND RIGID IOL IMPLANTATION FOLLOWING CATARACT SURGERY

Ophthalmology

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ABSTRACT

Aim: To compare the occurrence of PCO in foldable versus rigid IOL implantation following cataract surgery.
Material and methods: A total of 60 patients, above 45 years of age, undergoing cataract extraction surgery with IOL implantation were assorted in two groups of 30 each i.e. Group A: Patients undergoing cataract surgery with single piece rigid PMMA IOL implantation and Group B : Patients undergoing cataract surgery with single piece foldable ACRYLIC IOL implantation. All patients underwent complete ophthalmic examination prior to cataract surgery. The density of PCO was assessed 1 week, 1 month, 3 months, 6 months and 12 months postoperatively and best corrected visual acuity was also recorded. The grading of PCO was done on Slit lamp examination.
Results: Incidence of PCO increased from 13.3% to 23.4% in group A (PMMA IOL implantation) and 6.6% to 10% in group B (Acrylic IOL implantation) from 1 week to 12 months post-operatively. Statistically significant difference was found between group A and B, when different PCO grades were compared at 6 and 12 months (p value at 6 months = 0.04; p value at 12 months = 0.008).
Conclusion: The intraocular implantation of the ACRYLIC IOL helps to reduce the incidence of PCO to a greater degree as compared to the PMMA IOL.

KEYWORDS

PCO, PMMA IOL, ACRYLIC IOL

INTRODUCTION:

In the modern day, cataract surgery Posterior Capsular Opacification is the commonest long-term complication and probably the commonest cause of non-refractive decreased postoperative vision.[1] Secondary cataract (PCO) has been recognized since the origin of extracapsular cataract surgery (ECCE) and was noted by Sir Harold Ridley in his first intraocular lens implantations.[2-3] PCO is caused by lens epithelial cells that remain in the capsular bag after cataract surgery. They migrate, proliferate and transform to produce Elschnig's pearls and capsular fibrosis.[4]

A number of variables including patient characteristics such as age and type of cataract, surgical variables such as capsulotomy type and size, intraocular lens designs, placement and surgical technique have received attention in literature as possible factors involved in modulating PCO development.[5] The reported incidence of PCO varies widely. Analysis of multiple reports has found the visually significant PCO rate overall to be approximately 11.8% at 1 year, 20.7% at 3 years, and 28.4% at 5 years after cataract surgery.[6]

PCO can be minimized by In-The-Bag placement of IOL which occurs about 60% of time in non phaco ECCE. With modern foldable lens implantation, in-the-bag fixation has increased to over 90%. **Nishi et al**[7] support a physiological barrier to cellular migration through the phenomenon of contact inhibition and this factor certainly plays a role in prevention of PCO.

In order to prevent PCO, changes in IOL material have proven to reduce the incidence of PCO. Nowadays, more attention is being focused on the type of IOL. Foldable lenses have been reported as having very low rates of PCO as compared to rigid lenses.[8] This reduced incidence of PCO is due to lower migration of lens epithelial cells on the posterior capsule and their subsequent regression.[9]

MATERIALS AND METHODS:

The study included patients attending the Outpatient Department of Ophthalmology at Netaji Subhash Chandra Bose Subharti Medical College, Meerut. Patients above 45 years of age were assorted in two groups of 30 each based on the type of intraocular lens implanted, rigid or foldable, following cataract surgery. Group A included patients undergoing cataract surgery with single piece rigid PMMA IOL implantation and Group B included patients undergoing cataract surgery with single piece foldable ACRYLIC IOL implantation.

The patients with age-related cataract, normal pupillary reactions and adequate pupillary dilatation and in-the-bag IOL implantation were included in the study. The patients with anterior segment disease like uveitis, history of LASIK, posterior segment pathology, diabetic retinopathy, pseudo-exfoliation, traumatic/complicated cataract and primary PCO were excluded from the study.

An informed consent was taken from all the patients included in the study. Ethical clearance was obtained from the ethics committee of Subharti Medical College and hospital. A detailed history was obtained from the patient including: Time since patient noted diminution of vision, progression and variability, history of symptoms like pain, photophobia, glare and coloured halos, patient's age, sex, occupation, address and type of cataract, date of cataract surgery and type of cataract surgery performed, type of intraocular lens implanted following cataract surgery, history of trauma and any associated systemic illness.

On examination visual acuity and best corrected visual acuity in each case was determined using Snellen chart, examination of anterior chamber was done on slit lamp to rule out any pathology, grading of cataract was done using (LOCS III criteria), intraocular pressure was recorded with Applanation tonometer and examination of the posterior segment was done by +90D Volk lens and indirect ophthalmoscopy.

All patients underwent complete ophthalmic examination prior to cataract surgery. Baseline visual acuity of patients was recorded 1 week postoperatively. On subsequent visits at 1 month, 3 months, 6 months and 12 months, best corrected visual acuity was recorded. On every follow up, posterior capsular opacification was evaluated after full mydriasis, achieved under Tropicamide-Plus (1%). The grading of PCO was done on Slit lamp examination. The grading was done according to the criteria proposed by Sellman and Lindstrom.[10]

Grade	Posterior Capsular Opacification
NO PCO	(-)
1	Slight PCO with normal red reflex and no Elschnig pearls
2	Mild PCO reducing red reflex with Elschnig pears to IOL edge
3	Moderate Fibrosis or Elschnig pearls inside IOL edge with clear visual axis
4	Severe fibrosis with Elschnig pearls covering the visual axis with severely reduced red reflex

Difference between two groups was determined using student t-test as well as chi square test and the level of significance was set at $p < 0.05$.

RESULTS:

In Group A; the males were 17 (56.7 %) and the females were 13 (43.3%) and in Group B; the males were 11 (36.6%) and the females were 19 (66.7%). The mean age of patients in Group A was 58.2±6 years (ranging between 45-65 years) and in Group B was 58.7±6.1 years (ranging between 46-65 years), respectively.

Pre-operatively both the cases had grade 2 cataract according to LOCS 3 criteria. The mean cataract grade in group A was 3.76±0.72 and in group B was 3.9±0.80, respectively with statistically significant difference. In Group A, 4 cases (13.4%) had grade 1 PCO and 1 (3.3%) had grade 2 PCO, at 1 month post-operatively while in Group B; 3 cases (10%) had grade 1 PCO, at 1 month post operatively. No subject in Group A and B was found to have grade 2, 3 and grade 4 PCO. There is no statistically significant difference in PCO value at 1 month postoperatively between both the groups (Paired t-test, P=0.11). In Group A; 3 subjects (10%) had grade 1 PCO, 2 (6.7%) had grade 2 PCO and 1 (3.3 %) had grade 3 PCO, at 3 months post- operatively whereas in group B, 2 (6.7%) had grade 1 PCO and 1 (3.3%) had grade 2 PCO. No subject in Group B was found to have grade 3 and 4 PCO. When different grades of PCO was compared statistically between group A and B using chi square test at 12 months postoperatively, it was found to be statistically significant ($p<0.05$). There was statistically significant difference in mean PCO value at 6 months postoperatively between both the groups (Paired t-test, P=0.049) as shown in Table 1.

Mean LogMAR BCVA was 0.13±0.07, 0.13±0.7, 0.18±0.19, 1±0.2 and 1±0.2 in group A at 1 week, 1 month, 3 month, 6 month and 12 month respectively. Mean LogMAR BCVA was 0.12±0.07, 0.11±0.7, 0.14±0.19, 0.17±0.26 and 0.18±0.3 in group B at 1 week, 1 month, 3 month, 6 month and 12 month respectively. Significant difference was found between group A and B at 6 and 12 month with respect to mean LogMAR BCVA as $p<0.05$ (table 2).

Table 1: Comparison of cataract grade (LOCS III) preoperatively and PCO grade postoperatively between both the groups

Cataract Grading (LOCS 3)	GROUP A		GROUP B		Chi Square	p value
	N	%	N	%		
Grade 1	7	23.3	8	26.6	0.79	0.62
Grade 2	12	40	13	43.3		
Grade 3	9	30	8	26.6		
Grade 4	2	6.6	1	3.3		
Grade 5	0	0	0	0		
					t test	p value
MEAN	3.76		3.9		0.41	0.75
SD	0.72		0.80			
PCO GRADE (1M)						
NO PCO	25	83.33	27	90	0.61	0.69
GRADE 1	4	13.4	3	10		
GRADE 2	1	3.3	0	0		
GRADE 3	0	0	0	0		
GRADE 4	0	0	0	0		
					t test	p value
MEAN	0.2		0.1		1.48	0.11
SD	0.1		0.06			
PCO GRADE (3M)						
NO PCO	24	80	27	90	2.71	0.17
GRADE 1	3	10	2	6.7		
GRADE 2	2	6.7	1	3.3		
GRADE 3	1	3.3	0	0		
GRADE 4	0	0	0	0		
					t test	p value
MEAN	0.33		0.13		1.79	0.08
SD	0.14		0.08			
PCO GRADE (6M)						
NO PCO	23	76.7	27	90	3.81	0.044*
GRADE 1	3	10	1	3.3		
GRADE 2	2	6.7	1	3.3		
GRADE 3	1	3.3	1	3.3		
GRADE 4	1	3.3	0	0		
					t test	p value
MEAN	0.47		0.20		2.92	0.03*
SD	0.12		0.11			
PCO GRADE (12M)						
NO PCO	23	76.6	27	90	3.84	0.041*
GRADE 1	2	6.7	1	3.3		
GRADE 2	2	6.7	1	3.3		
GRADE 3	2	6.7	1	3.3		
GRADE 4	1	3.3	0	0		
TOTAL	30	100	30	100		
					t test	p value
MEAN	0.50		0.20		4.11	0.008*
SD	0.14		0.11			

*: statistically significant

Table 2: Comparison Of Visual Acuity Between Both Groups

Log MAR VISION	GROUP A (Mean±SD)	GROUP B (Mean±SD)	t test	p value
1 WEEK	0.13±0.07	0.12±0.07	0.17	0.78
1 MONTH	0.13±0.7	0.11±0.07	0.28	0.62
3 MONTHS	0.18±0.19	0.14±0.16	0.83	0.39
6 MONTHS	1±0.2	0.17±0.26	3.91	0.008*
12 MONTHS	1±0.2	0.18±0.3	3.91	0.008*

*: statistically significant

DISCUSSION:

Most researchers are of the opinion that overall incidence of PCO and subsequently the incidence of Nd: YAG laser posterior capsulotomy has decreased from about 50% in the 1980s, to about 25% in the 1990s and to less than 10% today. Although better surgical tools, surgical procedures, skills and improved IOL designs have helped to significantly reduce this incidence of PCO, it still remains to be eradicated as it has not been possible to completely get rid of lens epithelial cells in the equatorial lens bow by any aspiration methods currently known[11].

The results of our study suggest that the incidence of PCO in PMMA group was 23.4% and in Acrylic group was 10% at 12 months postoperatively. The PCO grade was significantly lower and best corrected vision was significantly better in Acrylic group at 12 months postoperatively. Similarly, Neha Ghawate et al[12] in their study showed that incidence of PCO was found to be more in PMMA group i.e. 16.8% and comparatively less i.e. 3.6% in acrylic group. However, studies conducted by Muhammad Moin et al[13] (PMMA-23.9%, Acrylic-6.2%) and Oner FH (PMMA-24.7%, Acrylic-8.7%) showed a higher incidence of PCO in PMMA group compared to acrylic group and the incidence is more in both the groups as compared to our study. This might be because of longer duration of follow up i.e. 2 years and 18 months respectively.

Hollick et al[9] in their study found that there was a significant difference ($P<0.001$) in percentage of PCO at 3 years among the lens biomaterials. Polyacrylic lenses were associated with less PCO (10%) than silicone (40%) and PMMA lenses (56%). The incidence of PCO was significantly lower in our study as all patients had cataract surgery with in-the-bag implantation of IOL.

The results of our study were similar to Auffarth et al[14] who found that after 3 years of follow-up, hydrophobic acrylic IOLs showed a statistically lower incidence of PCO and Nd: YAG capsulotomy rate than the other three materials. Also, Khanzada et al[15] reported that at 3rd month postoperatively the incidence of significant PCO was found to be less in the acrylic group (14.5%) as compared to the PMMA group (34.5%).

Our results also matched the studies done by Ursell et al[8] who revealed that the 3-year incidence in PCO was: AcrySof: 4.7%; non-AcrySof hydrophobic: 6.3%; non-AcrySof hydrophilic: 14.8%. The sub-group analysis (single-piece IOLs) revealed that the pattern remained (2.4% vs 5.1% vs. 10.9%, respectively). This real-world study provided evidence that within 3 years following PCIOL implantation, AcrySof IOLs are significantly superior in reducing PCO incidence and Nd: YAG capsulotomy compared to other hydrophilic and hydrophobic acrylic IOLs.

Li et al[16] in their meta-analysis revealed that AcrySof had a significantly lower PCO score ($P<0.001$) and a lower Nd: YAG capsulotomy rate ($P<0.001$) than round-edged PMMA IOLs. However, there was no significant difference in BCVA between

AcrySof and PMMA IOLs (OR, 3.20; 95% CI, 0.78-13.16; P = 0.11). The results of this meta-analysis support the theory that a major factor in preventing PCO development is a sharp-edged IOL design.

In our study, there was statistically significant difference between group A and B at 6 and 12 months postoperatively with respect to mean LogMAR BCVA, as $p<0.05$, while no such difference was revealed at 1 week, 1 month and 3 months postoperatively. The results of our study were consistent with the study done by Hayashi et al[17]. who found that the mean Log MAR visual acuity in the PMMA group increased postoperatively and was worse than in the silicone or acrylic group. However, in the study conducted by Li et al[16], in their meta-analysis revealed that there was no significant difference in BCVA between AcrySof and PMMA IOLs (OR, 3.20; 95% CI, 0.78-13.16; P = 0.11).

The shortcomings of our study were a short follow up duration (12months) and small sample size (n=30 in each group). Studies with a larger sample size and longer follow up duration could provide more definite results.

CONCLUSION:

The present study highlighted the fact that post cataract surgery PCO incidence can be reduced though not totally avoided. Intraocular lens material is an important variable in the development of posterior capsule opacification. As there is more incidence of PCO with PMMA IOLs than Acrylic IOLs, therefore judicious selection of IOL material (Acrylic over PMMA) goes a long way in minimising the incidence of postoperative PCO.

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