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Original Research Article

A COMPARATIVE STUDY ON INCIDENCE OF POSTERIOR CAPSULAR OPACIFICATION FOLLOWING IMPLANTATION OF ACRYLIC FOLDABLE INTRAOCULAR LENS AND POLYMETHYL METH ACRYLATE RIGID INTRAOCULAR LENS IN PATIENTS WITH DIABETES MELLITUS

P.Sharmila[1], Parvatha Sundari Natarajan[2]

[1]Assistant Professor, Department of Ophthalmology, Government Karur Medical College Hospital, Karur, India.
[2]Professor, Department of Ophthalmology, Madurai Medical College, Madurai, India., India.

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Corresponding Author:
Dr. P.Sharmila,
Assistant Professor, Department of Ophthalmology, Government Karur Medical College Hospital, Karur, India.
Email: sharmip1980@gmail.com

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ABSTRACT

Background: Cataract is the most common cause of blindness worldwide and in our country also. Posterior Capsule Opacification (PCO), which is the most frequent complication after cataract extraction, which can occur in up to 50% of cases, resulting in poor light transmission and reduced visual acuity. Aim of this study is to compare the incidence of posterior capsular opacification after implantation of Acrylic Foldable Intraocular lenses and poly methyl methacrylate (PMMA) Rigid intraocular lenses (IOLs).

Material and Methods: This is a prospective, comparative study, conducted among 100 patients with Type 1 and Type 2 diabetes mellitus. Patients were divided into two groups: Group A were implanted with 13.5mm PMMA IOL. Group B were implanted with 13.0mm acrylic IOL. In patients under this study were examined for Posterior Capsule Opacification during post-operative visits at 1 week, 2 weeks, 2 months, 4 months and 6 months.

Results: Post-operatively, in the first week there was no apparent PCO formation (0%) in the first post-operative week in the both the groups. At the second week, all 50 patients had no PCO formation (0%) in Group B whereas 1 patient (2%) had Grade 1 PCO formation in Group A. At the second month, all 50 patients had no PCO formation (0%) in Group B whereas 3 patients (6%) had Grade 1 PCO formation in Group A. At the fourth month, 49 out of 50 patients (98%) had no PCO formation in Group B whereas 1 patient (2%) had Grade 2 PCO formation and in Group A, 43 (86%) had no PCO formation, whereas 7 patients (14%) had grade 2 PCO formation at 6th month out of 50 patients (98%) had no PCO formation in Group B whereas 1 patient (2%) had grade 2 PCO formation and in Group A, 41(82%) had no PCO formation, whereas 9 patients (18%) had Grade 2 to 3 PCO formation.

Conclusion: In our study the rate of moderate to severe grades of PCO was found to be less with Acrylic IOL when compared to PMMA IOL, the difference was both clinically and statistically significant. Visual outcome was excellent with Acrylic IOL when compared to PMMA, this also being statistically significant and clinically evident. However, this study must be confirmed by prospective, randomized, long-term study in larger populations.

Keywords: Posterior Capsular Opacification, Intraocular Lens, PMMA, Acrylic.

INTRODUCTION

Cataract is the most common cause of blindness worldwide and in our country also. In addition to the backlog, an additional 3.8 million people become blind each year because of cataract. To improve the visual outcome, cataract surgery has evolved from couching in ancient times to modern day phacoemulsification and Manual Small Incision Cataract Surgery (MSICS).

Cataract surgery using current phaco techniques offers a number of attractive benefits to both the surgeon and the patient. The principle advantage is a smaller incision size, which decrease the amount of tissue injury, reduces the amount of post-operative pain and inflammation and provides more rapid refractive stabilization with less astigmatism than other procedures performed before. Hence, this study is being done by using this technique.

The Anterior chamber lenses which were once used were replaced with iris support lenses and later to today's modern posterior chamber lenses. There are a variety of modifications in materials, loops, optics and finish in all these lenses. The modern cataract surgery has given good visual results, but this could deteriorate over times because of Posterior Capsule Opacification (PCO), which is the most frequent complication after cataract extraction, which can occur in up to 50% of cases, resulting in poor light transmission and reduced visual acuity.[1-3]

PCO can be treated by Nd: YAG (neodymium-doped yttrium aluminum garnet) laser capsulotomy, which, however, can cause adverse complications such as retinal detachment, endophthalmitis, intraocular pressure rise, cystoid macular edema, and damage to intraocular lens (IOL).[4,5]

In developing countries, laser treatment is often not available. Moreover, it is a financial burden to the patient. Posterior capsule opacification often disturbs fundus examination and optimal treatment by photocoagulation or vitrectomy in eyes with vitreo-retinal disorders. Socio-economic consequences are also enormous. Thus resolution of posterior capsule opacification is an urgent task in cataract surgery.[6,7]

Lens epithelial cells (LECs) left behind in the capsular bag after cataract extraction is mainly responsible for the development of posterior capsule opacification. The Intra Ocular lens materials that is used to make IOLs, also influences the development of Posterior Capsule Opacification. It can also cause some early post-operative complications like corneal edema, distorted pupil, irido corneal adhesions, iris capture, choroidal detachment, hyphema, cystoid macular edema, uveitis, fibrin reaction and late complications like lens deposits and posterior synechiae.[8-10]

In modern cataract surgery it is essential to discuss the intraocular lens (IOL)'s of choice and their merits. Selecting the correct lens implant (size of optic, chemical material, foldable vs. non- foldable, mono vs. multifocal) may play a more important role in the patient's final visual outcome and satisfaction than the specific technique used for phacoemulsification of the nucleus.[11-14] Aim of this study is to compare the incidence of posterior capsular opacification after implantation of Acrylic Foldable Intraocular lenses and poly methyl methacrylate (PMMA) Rigid intraocular lenses (IOLs).

MATERIALS AND METHODS

This is a prospective, comparative study, conducted among 100 patients with Type 1 and Type 2 diabetes mellitus attended as outpatient and inpatient in the ward with pre-operative, intra and post-operative postprandial random blood sugar (PPBS) < 140mg/dl at Ophthalmology Department of tertiary care teaching hospital. This study was done for a period of 6 months.

Patient with age group 40-70 years with uncomplicated senile cataract with diabetics without retinal change & with PPBS less than 140mg/dl. All surgeries were performed by a single surgeon by using continuous curvilinear capsulorrhexis technique. Patients with history of previous ocular diseases, previous intra ocular surgery, previous intraocular inflammation, corneal pathologies, glaucoma and significant posterior segment pathology on examination were excluded.

Pre-operative ocular examination including Visual acuity, both unaided as well as aided using spectacle or pin hole was checked with snellen‟s visual acuity chart. The anterior segment evaluation was done using the slit lamp. Particular attention was paid for the presence of signs of inflammation. After pupillary dilatation, the cataract was assessed and graded. A thorough posterior segment evaluation was done. Keratometry was done using Bausch and Lomb keratometer. Axial length was measured with „A‟ scan unit and the IOL power was calculated using SRK II formula. IOP was measured using a schiotz indentation tonometer. Patency of lacrimal passages was checked using lacrimal sac syringing.

Patients were divided into two groups: Group A were implanted with 13.5mm PMMA IOL with 6.0mm optic after performing phacoemulsification through a scleral corneal tunnel incision of size about 6.5mm. Group B were implanted with 13.0mm acrylic IOL with 6.0mm optic after performing phacoemulsification through a 3.5mm temporal clear corneal incision.

In patients under this study were examined during post-operative visits at 1 week, 2 weeks, 2 months, 4 months and 6 months. All patients were told to report if there was any visual loss post operatively.

POSTERIOR CAPSULAR OPACIFICATION WAS GRADED AS

Grade-0: Nil

Grade-1: PCO not reaching IOL edge

Grade-2: PCO just within the IOL edge

Grade-3: PCO well inside the IOL edge but not involving the visual axis

Grade-4: PCO obscuring the visual axis

RESULTS

The present study was conducted in 100 patients who underwent Phacoemulsification at Department of Ophthalmology, Madurai medical College, and Madurai during the study period. Patients were divided into two groups: Group A were implanted with 13.5mm PMMA IOL with 6.0mm optic after performing phacoemulsification through a scleral corneal tunnel incision of size about 6.5mm. Group B were implanted with 13.0mm acrylic IOL with 6.0mm optic after performing phacoemulsification through a 3.5mm temporal clear corneal incision.

The entire study population was stratified by the age criteria into three groups, in which 27 people (27%) were in the age group of 40 – 49 years among whom 13 of them underwent surgery with PMMA IOL and 14 underwent surgery with Acrylic IOL. 27 people (27%) were in the age group of 50 - 59 years among whom 14 of them underwent surgery with PMMA IOL and 13 underwent surgery with Acrylic IOL. 46 (46%) people were in the age group of 60 – 70 years among whom 23 of them underwent surgery with PMMA IOL and with Acrylic IOL. P' value=0.957 was obtained and therefore there is no significant difference between the people underwent surgery with two IOLs when age is considered as a factor.

Gender distribution involves stratifying the population on the basis of sex. 52 People (52%) were in the male group among whom 26 of them underwent surgery with PMMA IOL and with Acrylic IOL, people (48%) were in the female group among whom 24 of them underwent surgery with PMMA IOL and 24 with Acrylic IOL.

That percentage of study population that underwent surgery with PMMA IOL (50% - 50 in number) was stratified by the type of diabetes mellitus that with 28 (56%) of them presented with Type I DM among whom the distribution was almost 50 – 50% in Male and Females i.e. 14 in each group and 22 (44%) of them presented with Type II DM among whom the distribution slightly tilted to the side of males with 12 being on their side and 10 on their counterparts.

Table 1: Visual acuity

V/A	Group A	Group B	Total
6/18	5(10.00%)	3(6.00%)	8
6/24	12(24.00%)	13(26.00%)	25
6/36	11(22.00%)	13(26.00%)	24
6/60	9(18.00%)	11(22.00%)	20
4/60	10(20.00%)	8(16.00%)	18
CFCF	36.00%)	2(4.00%)	5
Total	50(100%)	50(100%)	100

Among those who had a visual acuity of 6/18, 5 (10%) were subjected to PMMA IOL implantation and 3 (6%) were subjected to Acrylic IOL implantation. Among those who had a visual acuity of 6/24, 12 (12%) were subjected to PMMA IOL implantation and 13 (26%) were subjected to Acrylic IOL implantation. Among those who had a visual acuity of 6/36, 11 (22%) were subjected to PMMA IOL implantation and 13 (26%) were subjected to Acrylic IOL implantation. Among those who had a visual acuity of 6/60, 9 (18%) were subjected to PMMA IOL implantation and 11 (22%) were subjected to Acrylic IOL implantation. Among those who had a visual acuity of 4/60, 10 (20%) were subjected to PMMA IOL implantation and 8 (16%) were subjected to Acrylic IOL implantation. Among those who had a visual acuity of CFCF, 3 (6%) were subjected to PMMA IOL implantation and (2%) were subjected to Acrylic IOL implantation. [Table 1]

Post-operatively, in the first week, the patients were stratified base on their visual acuity. All 50 (100%) patients had their visual acuity in the range of 6/9 – 6/6 in both groups with none in the range of 6/18 – 6/12.

All 50 (100%) patients had their visual acuity in the range of 6/9 – 6/6 in Group B whereas 49 (98%) patients had their visual acuity in the range of 6/9 – 6/6 in Group A and 1 (2%) in the range of 6/18 – 6/12.

Post-operatively, in the second month, the patients were stratified base on their visual acuity as below. All 50 (100%) patients had their visual acuity in the range of 6/9 – 6/6 in Group B whereas 47 (94%) patients had their visual acuity in the range of 6/9 – 6/6 in Group A and 3 (6%) in the range of 6/18 – 6/12.

Post-operatively, in the fourth month, the patients were stratified base on their visual acuity as below. 49 out of 50 patients (98%) had their visual acuity in the range of 6/9 – 6/6 and the remaining 1(2%) in the range of 6/18 – 6/9 in Group B whereas 43 (86%) patients had their visual acuity in the range of 6/9 – 6/6, 5 (10%) in the range of 6/18 – 6/9 and 2 (4%) in the range of 6/24 – 6/18 in Group A

Post-operatively, in the sixth month, the patients were stratified base on their visual acuity as below. 49 out of 50 patients (98%) had their visual acuity in the range of 6/9 – 6/6 and the remaining 1 (2%) in the range of 6/18 – 6/9 in Group B whereas 41 patients (82%) had their visual acuity in the range of 6/9 – 6/6, 6 in the range of 6/18 – 6/9 and 3 in the range of 6/36 – 6/24 in Group A.

Table 2: Formation of PCO in both groups

Timeline	PCO	Group A	Group B
Week 1	Grade 1 and 2	1(2.00%)	0(0.00%)
Week 2	Grade 1 and 2	1(2.00%)	0(0.00%)
2nd month	Grade 1 and 2	3(6.00%)	0(0.00%)
4th month	Grade 1 and 2	7(14.00%)	1(2.00%)
6th month	Grade 3	3(6.00%)	0(0.00%)
	Grade 1&2	6(12.00%)	1(2.00%)

Post-operatively, in the first week, the patients were stratified base on the extent of PCO as below. There was no apparent PCO formation (0%) in the first post-operative week in the both the groups. At the second week, all 50 patients had no PCO formation (0%) in Group B whereas 1 patient (2%) had Grade 1 PCO formation in Group A. At the second month, all 50 patients had no PCO formation (0%) in Group B whereas 3 patients (6%) had Grade 1 PCO formation in Group A. [Table 2]

DISCUSSION

In our study 100 patients were included. They were randomly assigned to either Group A or Group B. Those in Group A underwent phaco emulsification with implantation of rigid PMMA IOL. Those in Group B underwent the same procedure with implantation of foldable Acrylic IOL. Both groups had 50 patients each.

In our study mean age of patients in Group A was 56.72 ± 9.18 years. In Group B it was 56.62 ± 9.38 years. More patients belonged to the age group of 60-70 years accounting to 46% of the study population. Out of 100 patients 52 patients (52%) were males and 48 (48%) were females. Male to female ratio was 1.08:1. As senile cataract doesn't exhibit sexual predilection, there was no P value = 0.838 which is not significant difference between number of male and female patients in this study.

In our study 49 out of 50 patients (98%) had their visual acuity in the range of 6/9 – 6/6 and the remaining 1 (2%) in the range of 6/18 – 6/9 in Group B whereas 41 patients (82%) had their visual acuity in the range of 6/9 – 6/6, 6 in the range of 6/18 – 6/9 and 3 in the range of 6/36 – 6/24 in Group A after 6 months.

The decrease in the post-operative VA in Group A was analyzed and was found to be associated with the increased incidence of PCO formation when compared to Group B at the end of 6 months as 49 out of 50 patients (98%) had no PCO formation in Group B whereas 1 patient (2%) had grade 2 PCO formation and in Group A, 41(82%) had no PCO formation, whereas 9 patients (18%) had Grade 2 to 3 PCO formation. This was retrospectively analyzed and was inferred as a gradual, increasing intensity PCO formation, than being of abrupt onset. Hence this can be attributed to the material of IOL used. As this was predominantly a phenomenon in Group A patients, the likely reason for increased incidence is the material used – PMMA.[15,16]

At the fourth month, 49 out of 50 patients (98%) had no PCO formation in Group B whereas 1 patient (2%) had Grade 2 PCO formation and in Group A, 43 (86%) had no PCO formation, whereas 7 patients (14%) had grade 2 PCO formation At 6th month out of 50 patients (98%) had no PCO formation in Group B whereas 1 patient (2%) had grade 2 PCO formation and in Group A, 41(82%) had no PCO formation, whereas 9 patients (18%) had Grade 2 to 3 PCO formation.

Decreased incidence (2%) of PCO in Acrylic IOL, when compared to PMMA (18%) IOL is mainly due to following factors: Acrylic IOLs have a tacky surface. This will create the bio adhesion between the capsule and the IOL, which will prevent the migration of LECs towards the posterior capsule.

The barrier effect of the Acrylic IOL is superior to the PMMA IOL. Sharp bend and complex folds created in the posterior capsule by Acrylic IOL will induce contact inhibition of migration of LECs towards the posterior capsule. This effect is superior and earlier in Acrylic IOL when compared to others. Capsulorrhexis edge is more stable on Acrylic IOLs than others.[17-20]

Schauersberger et al found that IOL material was important determinant in PCO rather than the edge design. The refractive index of Acrylic IOL was higher than the PMMA IOL. This allows it to have a thinner optic, which can be inserted through the smaller incision. So less BAB damage post operatively, which could not be possible with PMMA IOL. Because it requires larger size incision for its insertion, can induce post-operative astigmatism.[21]

CONCLUSION

The modern cataract intra ocular lens surgery has given good visual results but this effect could be short term with the development of PCO, which being the most frequent complication following conventional cataract surgery. In our study the rate of moderate to severe grades of PCO was found to be less with Acrylic IOL when compared to PMMA IOL, the difference was both clinically and statistically significant. Visual outcome was excellent with Acrylic IOL when compared to PMMA, this also being statistically significant and clinically evident. However this study must be confirmed by prospective, randomized, long term study in larger populations.

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