International Journal of Life Sciences, Biotechnology and Pharma Research Vol. 14, No. 3, March 2025 Online ISSN: 2250-3137
Print ISSN: 2977-0122

DOI: 10.69605/ijlbpr_14.3.2025.40

ORIGINAL RESEARCH

Comparison of short term clinical results following implantation of acrylic foldable IOL and polymethyl meth acrylate rigid IOL in diabetic patients

[1]Dr. P.Sharmila, [2]Dr. Parvatha Sundari Natarajan, [3]Dr. V.Sweetha

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

Corresponding author
Dr. P.Sharmila
Assistant Professor, Department of Ophthalmology, Government Karur Medical College Hospital, Karur, India

Received: 25 January, 2025 Accepted: 21 February, 2025 Published: 08 March, 2025

ABSTRACT

Introduction: Worldwide and in our nation, cataracts are the leading cause of blindness. The most common side effect following cataract extraction is posterior capsule opacification (PCO), which can happen in as many as 50% of cases and impairs light transmission and visual acuity. The purpose of this study is to assess the changes in visual acuity brought on by PCO formation following the implantation of polymethyl methacrylate (PMMA) rigid intraocular lenses (IOLs) and acrylic foldable IOLs. **Methodology:** One hundred patients with Type 1 and Type 2 diabetes mellitus participated in this prospective, comparative investigation. There were two groups of patients: A 13.5mm PMMA IOL was implanted in Group A. 13.0mm acrylic IOLs were implanted in Group B. During post-operative visits at one week, two weeks, two months, four months, and six months, the visual acuity of the study participants was assessed. **Results:** Post-operatively, in the first week, 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.At second week 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. At second month, 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. At 4th month, 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. AT 6th month 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. **Conclusion:** The modern cataract intra ocular lens surgery has produced good visual results but this effect could be short term with the development of PCO affecting visual acuity, which is the most frequent complication following conventional cataract surgery. Compared to PMMA IOL, the rate of moderate to severe PCO grades was lower with Acrylic IOL in our study; this difference was statistically and clinically significant. Visual result was good with Acrylic IOL when compared to PMMA, this also being statistically significant and clinically noticeable.

Keywords: Visual acuity, PCO, Intraocular Lens, PMMA, Acrylic

INTRODUCTION

Worldwide and in our nation, cataracts are the leading cause of blindness. In addition to the backlog, cataracts cause an extra 3.8 million blindnesses annually. Cataract surgery has changed over time, moving from couching in antiquity to phacoemulsification and Manual Small Incision Cataract Surgery (MSICS) in the present day to improve the visual prognosis.

Using modern phaco methods for cataract surgery has several alluring advantages for the patient and the surgeon. The main benefit is that, compared to previous procedures, a smaller incision size results in less tissue damage, less post-operative pain and inflammation, and faster refractive stabilization with less astigmatism. Thus, this technique is being used to conduct this investigation.[1-3]

Iris support lenses and then the contemporary

DOI: 10.69605/ijlbpr_14.3.2025.40

posterior chamber lenses took the place of the previously employed anterior chamber lenses. Each of these lenses has a different set of materials, loops, optics, and finishes. Modern cataract surgery has produced good visual results, but these could deteriorate over time due to the most common post-cataract extraction complication, posterior capsule opacification (PCO), which can occur in as many as 50% of cases and reduce visual acuity and light transmission. Nd: YAG (neodymium-doped yttrium aluminum garnet) laser capsulotomy can be used to cure PCO-1; however, it can result in negative side effects include retinal detachment, endophthalmitis, an increase in intraocular pressure, cystoid macular edema, and intraocular lens (IOL) damage. [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]

The development of posterior capsule opacification is mostly caused by lens epithelial cells (LECs) that are left in the capsular bag following cataract excision. The development of posterior capsule opacification is also influenced by the intraocular lens materials used to create IOLs. Additionally, it may result in late problems such posterior synechiae and lens deposits, as well as early ones like corneal edema, distorted pupil, irido corneal adhesions, iris capture, choroidal detachment, hyphema, cystoid macular edema, uveitis, and fibrin response. [8–10]

Talking about the best intraocular lenses (IOLs) and their advantages is crucial in contemporary cataract surgery. The patient's ultimate visual outcome and happiness may be more influenced by the choice of lens implant (optical size, chemical composition, foldable versus non-foldable, mono versus multifocal) than by the particular method employed for nucleus phacoemulsification..[11-14] The purpose of this study is to assess the changes in visual acuity brought on by PCO formation following the implantation of polymethyl methacrylate (PMMA) rigid intraocular lenses (IOLs) and acrylic foldable IOLs.

MATERIALS AND METHODS

100 patients with Type 1 and Type 2 diabetes mellitus who were admitted as inpatients and outpatients to the ophthalmology department of a teaching hospital with pre-, intra-, and post-operative post prandial random blood sugar (PPBS) levels less than 140 mg/dl participated in this prospective, comparative study. The duration of this trial was six months.

Individuals between the ages of 40 and 70 who have uncomplicated senile cataracts, diabetics without retinal abnormalities, and PPBS levels below 140 mg/dl. A single surgeon used the continuous curvilinear capsulorrhexis approach to execute all of the procedures. The following conditions were excluded: corneal abnormalities, glaucoma, severe posterior segment pathology on inspection, prior intraocular surgery, prior intraocular inflammation, and a history of prior ocular disorders.

Ocular examination prior to surgery, including Snellen's visual acuity chart was used to assess visual acuity both unaided and with the use of a pinhole or spectacle. The slit lamp was used to evaluate the anterior section. The existence of indications of inflammation was given special consideration. Pupil dilatation was followed by an evaluation and grading of the cataract. A comprehensive assessment of the posterior portion was conducted. The Bausch and Lomb keratometer was used for keratometry. The "A" scan unit was used to measure the axial length, and the SRK II formula was used to determine the IOL power. Using a Schiotz indentation tonometer, IOP was determined. Lacrimal sac syringing was used to examine the lacrimal channels' patency.

There were two groups of patients: Group A underwent phacoemulsification through a scleral corneal tunnel incision of approximately 6.5mm, and then received an implant of a 13.5mm PMMA IOL with a 6.0mm optic. Group B had phacoemulsification via a 3.5mm temporal clear corneal incision, and a 13.0mm acrylic IOL with a 6.0mm optic was implanted.

Patients in this study were evaluated at one week, two weeks, two months, four months, and six months following surgery. Following surgery, all patients were instructed to report any visual loss.

RESULTS

The present study was conducted in 100 patients who underwent Phacoemulsification at a tertiary care teaching hospital during the study period. The entire study population was stratified by the age criteria into three groups, viz. and patients of the age group 40 – 49 years, 50 – 59 years and 60 to 70 years in which the distribution was seen as above: 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. Mean age in Group A was 56.72 ± 9.18 years (mean SD), range 40-70 years.Mean age in Group B was 56.62 ± 9.38 years (mean SD), range 40- 70 years, a 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. 48 people

DOI: 10.69605/ijlbpr_14.3.2025.40

(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 they presented with viz. Type I DM and Type II DM as above which revealed:28 (56%) of them presented with Type I (Insulin Dependent Type) 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 (Non-Insulin Dependent Type) among whom the distribution slightly tilted to the side of males with 12 being on their side and 10 on their counterparts.

That percentage of study population that underwent surgery with Acrylic IOL (50% - 50 in number) was stratified by the type of diabetes mellitus that they presented with viz. Type I DM and Type II DM as above which revealed: 30 (60%) of them presented with Type I (Insulin Dependent Type) among whom the distribution was almost high in Male accounting to 18 and Females relatively low i.e. 12and 20 (40%) of them presented with Type II (Non-Insulin Dependent Type) among whom the distribution slightly tilted to the side of females with 12 being on their side and 8 on their counterparts.

Of the total people undertaken, they were stratified base on their pre-operative visual acuity, 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%) weresubjected to PMMA IOL implantation and (2%) were subjected to Acrylic IOL implantation.

Table No-1: BCVA of both groups at 1st week after surgery

Visual acuity	Group A	Group B
6/18-6/12	1(2.00%)	0(0.00%)
6/9-6/6	49(98.00%)	50(100%)
Total	50(100%)	50(100%)

Post-operatively, in the first week, 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

Table No-2: BCVA of both groups at 2nd week after surgery

Visual acuity	Group A	Group B
6/18-6/12	2(4.00%)	0(0.00%)
6/9-6/6	48(96.00%)	50(100%)
Total	50(100%)	50(100%)

Post-operatively, in the second week, a ll 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.

Table No-3: BCVA of both groups at 2ndmonth after surgery

Visual acuity	Group A	Group B
6/18-6/12	3(6.00%)	0(0.00%)
6/9-6/6	47(94.00%)	50(100%)
Total	50(100%)	50(100%)

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.

Table No-4: BCVA of both groups at 4th month after surgery

VA	Group A	Group B
6/24-6/18	3(6.00%)	0(0.000%)
6/18-6/9	4(8.00%)	1(2.00%)
6/9-6/6	43(86.00%)	49(98.00%)
Total	50(100%)	0(100%)

Post-operatively, in the fourth month, the patients were stratifiedbase 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

Table No-5: BCVA of both groups at the end of 6months

VA	Group A	Group B
6/36-6/24	4(8.00%)	0(0.00%)
6/24-6/12	5(10.00%)	1(2.00%)
6/9-6/6	41(82.00%)	49(98.00%)
Total	50(100%)	50(100%)

Post-operatively, in the sixth month, 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

DOI: 10.69605/ijlbpr_14.3.2025.40

in Group A.

The patients were categorized according to the degree of PCO during the first week following surgery, as shown below. In the first post-operative week, neither group showed any signs of PCO development (0%) at all. One patient (2%) in Group A had Grade 1 PCO formation in the second week, while all 50 patients in Group B had no PCO formation (0%) at that time. Three patients (6%) in Group A had Grade 1 PCO formation in the second month, while all 50 patients in Group B had no PCO formation (0%) at that time.

In Group A, 43 patients (86%) had no PCO formation at the fourth month, while 7 patients (14%) had grade 2 PCO development. In Group B, 49 out of 50 patients (98%) had no PCO formation, while 1 patient (2%) had Grade 2 PCO formation. At six months, 41 patients (82%) in Group A had no PCO formation, while 9 patients (18%) had Grade 2 to 3 PCO development. In Group B, out of 50 patients (98%) had no PCO formation, while 1 patient (2%) had grade 2 PCO formation.

DISCUSSION

We enrolled 100 participants in our study. Groups A and B were assigned to them at random. Group A participants received rigid PMMA IOL implantation along with phaco emulsification. Group B participants received the same treatment, which involved implanting a foldable acrylic IOL. There were 50 patients in each group.

The average age of the patients in Group A of our study was 56.72 ± 9.18 years. It was 56.62 ± 9.38 years in Group B. 46% of the study sample was composed of individuals who were between the ages of 60 and 70. Of the 100 patients, 48 (48%) were female and 52 (52%) were male. The ratio of men to women was 1.08:1. Since there is no sexual predilection associated with senile cataract, the number of male and female patients in this study did not differ significantly (P value = 0.838).

In our study, 41 patients (82%) had 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 after 6 months, while 49 out of 50 patients (98%) had 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.

After comparing Group A to Group B at the 6-month mark, it was determined that the latter had a higher incidence of PCO formation, as evidenced by the fact that 49 out of 50 patients (98%) in Group B had no PCO formation, while 1 patient (2%) had grade 2 PCO formation. In Group A, 41 patients (82%) had no PCO formation, while 9 patients (18%) had Grade 2 to 3 PCO formation. After a retrospective analysis, it was concluded that the PCO creation was gradual and intensified rather than abruptly onset. Therefore, this can be linked to the IOL material that was utilized in our investigation, which is PMMA.[15,16]

The primary causes of the lower incidence (2%) of PCO in acrylic IOLs as opposed to PMMA IOLs (18%) are as follows: The surface of acrylic IOLs is sticky. This will stop LECs from migrating to the posterior capsule by forming a bioadhesion between the capsule and the IOL.

The Acrylic IOL has a better barrier effect than the PMMA IOL. Contact inhibition of LEC migration towards the posterior capsule will result from the intricate folds and sharp bends that the acrylic IOL creates in the posterior capsule. Comparing Acrylic IOL to other materials, this effect is better and occurs earlier. On acrylic IOLs, the capsulorrhexis edge is more stable than on other types. [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 produced good visual results but this effect could be short term with the development of PCO affecting visual acuity, which is the most frequent complication following conventional cataract surgery. Compared to PMMA IOL, the rate of moderate to severe PCO grades was lower with Acrylic IOL in our study; this difference was statistically and clinically significant. Visual result was good with Acrylic IOL when compared to PMMA, this also being statistically significant and clinically noticeable. However, this findings must be confirmed by prospective, randomized, long term investigation in larger groups.

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