

Comparison between Acrylic Hydrophilic and Acrylic Hydrophobic Intraocular Lens after Phacoemulsification

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Purpose: To compare the results of acrylic hydrophilic and acrylic hydrophobic Intraocular lenses in terms of visual acuity (VA), behavior of eye (Uveitis) and posterior capsular opacification (PCO).

Material and Method: The study was carried out from September 2004 to October 2005 in the department of ophthalmology Liaquat National Hospital Karachi. One hundred patients were included in the study and were equally divided in two groups.

All patients underwent Phacoemulsification with IOL implantation (50 patients hydrophilic IOL and 50 hydrophobic IOL).

Results: 96% had VA of 6/12 or better unaided or with refraction, 2% developed posterior capsule thickening, whereas, none of the patients developed Uveitis after one year.

Conclusion: There was no significant difference between two IOLs regarding VA, Uveitis and PCO after one year follow up. There was no effect of biomaterial on PCO.

Cataract is opacity of the lens that impairs vision, which is the leading cause of blindness worldwide¹. In Pakistan it contributes to 66.8% blindness². The commonest ophthalmic surgical procedure being performed in the world is cataract surgery with insertion of intra-ocular lens³.

An ideal prosthetic lens would reproduce the original function of the crystalline lens at near and distant vision and should be biocompatible. It should also prevent posterior capsular opacification (PCO). Posterior capsular opacification can be prevented by using biocompatible IOL materials, square optic geometry and maximal optic capsule contact⁴⁻⁶.

We wished to compare the biocompatibility of two different materials, hydrophobic acrylic and acrylic hydrophilic, as well as their ability to prevent PCO. Both IOL material are good but we wanted to compare these two materials in our population to see whether they produce comparable outcome.

MATERIAL AND METHOD

A quasi-experimental study of 100 patients was carried out from September 2004 to October 2005 at department of ophthalmology Liaquat National Hospital, Karachi.

In group A fifty patients had acrylic hydrophilic IOL(C-flex) and in group B fifty patients had acrylic hydrophobic IOL (Acrysof) implanted in their eyes. To ensure the complete follow up, informed written consent was taken from all subjects.

We included patients with senile cataract, consisting of nuclear sclerosis grades 2 & 3, cortical and posterior sub capsular cataract. Eyes with clear posterior capsule immediately after surgery were included in the study. All operations were performed by a single surgeon. We excluded patients with nuclear sclerosis grade 4, post traumatic cataract, eye with pre operative Uveitis, axial length more than

25mm and less than 19mm, diabetic retinopathy and corneal dystrophy.

Patients enrolled in the study had visual acuity assessment with the help of Snellen's chart, slit lamp biomicroscopy examination of anterior segment, detailed fundus examination posterior segment and intraocular pressure measurement before and after the surgery. The position of IOL, state of posterior capsular opacification (PCO) and any other complication were also noted.

Topical medication was prescribed postoperatively to all patients, which included Dexamethasone plus Neomycin, Diclofenac sodium four times daily and Betamethasone plus Neomycin ointment at bedtime. The follow-up schedule includes first post operative visit on 1st day after surgery, second on 1st week, 3rd on 1st month, 4th visit on 4th month, 5th on seventh month and 6th on 12th month of post operatively. At each visit best-corrected visual acuity was checked, uveitis and posterior capsular opacification were assessed according to the criteria on slit lamp biomicroscopy. Uveitis was graded as shown in table 3. PCO was graded according to the Selman and Lindstrom system^{11,12} as shown in table 4. Clinically significant PCO was defined as that having grades 3 or 4 and patients were advised for Nd: YAG laser capsulotomy.

Statistical packages for social science (Spss.10) were used to analyze data. Relevant descriptive frequency and percentage was computed for qualitative variables like sex, visual acuity, PCO, uveitis for both groups. Mean and standard deviation was computed for quantitative variables age for both groups. Chi square test was used to see association for visual acuity, PCO, Uveitis for group A and group B with level of significance 0.05.

RESULTS

This study of one hundred patients was conducted at department of Ophthalmology Liaquat National Hospital Karachi. The patients were divided into two groups of fifty patients each. Group A had acrylic hydrophilic IOL implanted and Group B had acrylic hydrophobic IOL implanted.

The age range of patients in both groups was 51-73 year. In-group A the mean of age was 61 years, with standard deviation of 6.62 and in group B the mean of age 60.78 years with standard deviation was 5.89. In Group A there were twenty-nine were male and

twenty-one were female. In-group B there were twenty were male and thirty were female.

Table no 1 show the pre operative visual acuity most of the patients ranging between 6/60 to 6/18. Table 1 shows range of pre operative visual acuity from 6/60 to 6/18. Table 2 shows post operative best-corrected visual acuity (BCVA) after one year indicating no statistically significant difference between the two groups. The chi-square 2.56 and P value is 0.464. Table no 3 shows 1st postoperative week Uveitis. The results indicate that there is no statistically significant difference between the two groups in postoperative 1st week Uveitis. Table 3 shows incidence of Uveitis on 1st postoperative week. The results indicate that there is no statistically significant difference between the two groups in respect of Uveitis on 1st postoperative week. The chi square 1.342 and P value is 0.511. Table 4 shows posterior capsule opacification. The results indicate that there is no statistically significant difference between the two groups in terms of development of PCO. The chi-square 1.695 and P value is 0.792.

DISCUSSION

Posterior capsular opacification has been reported since the beginning of extra capsular cataract extraction. Sir Harold Ridley documented this complication in his first cases¹¹. It was particularly common and severe in the early days of PC-IOL surgery (late 1970s and early 1980s) when the importance of cell and cortex removal was much less well understood than it is today. The rate of PCO and subsequent Nd: YAG laser capsulotomy is on decreasing order owing to modern surgical techniques and improved IOL materials.

Reduction of this complication is important as Nd: YAG laser capsulotomy is sometimes dangerous procedure with potential damage to IOL, vitreous, retina and other structures¹² and treatment of PCO imposes significant cost burden on poor patients in a country like Pakistan.

In our study we used hydrophobic acrylic (Acrysof) UV foldable multipiece posterior chamber IOL in 50 eyes and acrylic hydrophilic (C-Flex IOL) in 50 eyes. The physical properties of the hydrophobic IOL include overall length of 13mm with an optic of 6mm diameter. It has modified C-flexible blue core PMMA haptic, whereas, the optical portion consist of high refractive index of 1.55 soft hydrophobic acrylic material, which is capable of being folded prior to

insertion, allowing through an incision of approximately 3.5mm. Acrylic hydrophilic (C-Flex), has biconvex optic with supporting haptics made of acrylic. The optic is made from Rayacryl, which is a copolymer of hydrophilic and hydrophobic methacrylates namely Hydroxy Ethyl Methacrylate (HEMA) and Methyl MethAcrylate (MMA) and has water content of 26%. Acrylic Hydrophilic was chosen because of the specially patented haptic which prevents decentration, antero-posterior movement and buckling in response to capsular contraction⁷. It has relatively low index of refraction (1.46) and reflection coupled with equi-convex design reduces the chance of optical aberration after surgery⁸.

We used widely accepted surgical technique for preventing PCO in this study. Continuous curvilinear capsulorhexis¹² with diameter slightly smaller than IOL optics¹³, routine capsule polishing and implantation of foldable IOL¹⁴ all of which has been shown to reduce the PCO rates, best post operative visual acuity and biocompatibility.

In this study we compare the two IOLS (Acrylic hydrophobic) and (Acrylic hydrophilic) regarding VA, PCO and biocompatibility. As far as the visual acuity is concerned, 96% of the patients see 6/12 or better in both groups A and B, whereas, 2% develop PCO in eyes having both types of IOL. It was concluded that no statistical significant difference between two groups in terms of post-op visual acuity and PCO.

The biocompatibility of IOL materials and AC reaction in the post-op period ranging from end of first week till one year in both groups shows no statistical significant difference.

Antony et al¹⁵, reported incidence of PCO after three year in 3.5% of cases, whereas, Spratt¹⁶ et al described it 1.8% at 30 months using hydrophilic IOLs. So the incidence of 2% of PCO in both groups in our study is equally comparable with other international studies.

Our study is also comparable with Ashok vyas¹⁷, which shows visual acuity 6/12 or better in 97% of the eyes and no PCO and Uveitis at two years with both hydrophilic (C-Flex) and hydrophobic (Acrysof) IOLs.

This low rate of PCO is because of design of IOLs. Both IOLs have square edge shape optic which provide a secondary barrier to lens epithelial cell migration. This may provide a mechanical barrier to cell migration "No space no cells" phenomenon¹¹. It has been also proposed that the mechanism by which

the hydrophobic IOL's lowers the PCO rate is a combination of two things: first is the sharp, rectangular optic edge and the second is its sticky surface¹⁸, which adheres to lens capsule. This second third factor is the basis for the "sandwich theory"¹⁹. This theory suggests that the anterior capsule over the IOL's bioactive surface bonds to the IOL directly or as a result of the remaining lens epithelial cells (LEC) preventing LEC proliferation. Thus the anterior capsule over the IOL remains clear. Inside the bag, the remaining LECs proliferate and migrate behind the IOL. The 90-degree edge of the IOL optic against the posterior capsule directs the proliferating LECs to form a monolayer between the IOL and posterior capsule. Another bioactive bond is formed when a single LEC has the posterior capsule on one side and the bioactive IOL surface on the other. The sandwich is formed and the cell-posterior capsule and cell-bioactive IOL surface junction prevents more cells from migrating behind the IOL.

Although this study consisted of patients who were all Pakistanis, but they belonged to different localities and had different postoperative behaviors. The criteria were also the same for the two groups. Some studies shows surgeon's factor on PCO. It was ensured that all the patients had phacoemulsification performed by same surgeons of fully acquainted with the advances in surgical skills needed to tackle the factors involved in PCO. Moreover the behavior of the Pakistani population regarding development of PCO is also similar to that observed in different parts of the world. The use of modern flexible acrylic lenses and surgical techniques has tremendously reduced the incidence of PCO thereby, benefiting the patients a lot.

We have worked on null hypothesis that these two types of intraocular lenses though different in their material, both of them provide equal benefit to patients as regard VA and reduction in PCO and our study of short duration to some extent confirm our impression that acrylic hydrophilic IOL and acrylic hydrophobic IOLs available in market can provide equal amount of benefit to patients, a cheaper option can be available with no hesitation.

The difference between two IOL with respect to outcome regarding VA, behavior of eye and PCO at one year was not clinically significant. So we suggest that further studies be conducted using contrast sensitivity and with duration of two years or more to asses the significant difference between two IOLs in our population.

Table 1: Pre operative visual acuity

VA	6/12 n (%)	6/18 n (%)	6/24 n (%)	6/36 n (%)	6/60 n (%)	CF n (%)	Total
Group A	5 (10)	12 (24)	11 (22)	9 (18)	10 (20)	3 (6)	50
Group B	3 (6)	13 (26)	13 (26)	11 (22)	8 (16)	2 (4)	50
Total	8	25	24	20	18	5	100

Group A: Acrylic Hydrophilic IOL implanted patients. **Group B:** Acrylic Hydrophobic IOL implanted patients
VA: Visual acuity, **CF:** Counting finger, **IOL:** Intraocular lens

Table 2: Post operative visual acuity (12th Month)

VA	6/6	6/9	6/12	6/18	Total
Group A	38	8	2	2	50
Group B	33	11	4	2	50
Total	71	19	6	4	100

Chi square 25b, df 3, P value 0.464

Group A: Acrylic Hydrophilic IOL implanted patients. **Group B:** Acrylic Hydrophobic IOL implanted patients
VA: Visual acuity, **IOL:** Intraocular lens

Table 3: First week post operative uveitis

Uveitis	Grade 0	Grade 1	Grade 2	Grade 3	Grade 4
Group A	39	10	1	0	0
Group B	34	15	1	0	0
Total	73	25	2	0	0

Chi square 1,342, dF 2, P 0.511

Group A: Acrylic Hydrophilic IOL implanted patients. **Group B:** Acrylic Hydrophobic IOL implanted patients
 Cell in anterior chamber:

Grade 0: No or less than 5 cells, **Grade 1:** 5 - 10 cells +, **Grade 2:** 11-20 cells ++,

Grade 3: 21-50 cells +++, **Grade 4:** > 50 cells +++, **IOL:** Intraocular lens

Table 4: Posterior capsule opacification (12th Month)

PCO	Grade 1	Grade 2	Grade 3	Grade 4	Total
Group A	43	4	2	1	50
Group B	41	6	2	1	50
Total	84	10	4	2	100

Chi square 1,695, dF 4, P 0.792

Group A: Acrylic Hydrophilic IOL implanted patients. **Group B:** Acrylic Hydrophobic IOL implanted patients
PCO: Posterior capsule opacification, **IOL:** Intraocular lens, **Grade 1:** No or slight PCO without reduced red reflex, also no pearls at all or pearl not on the IOL edge. **Grade 2:** Mild PCO reducing the red reflex, Eschnig pearls to the IOL edge. **Grade 3:** Moderate fibrosis or Eschnig pearls inside IOL edge but with a clearer visual axis. **Grade 4:** Severe fibrosis or Eschnig pearls cover the visual axis and severely reducing the red reflex.

CONCLUSION

There was no significant difference in visual acuity, uveitis and PCO in hydrophilic and hydrophobic IOL after one year. These two IOLs show same characteristics. The optic of both lenses have square truncated edges that functionally blocks ingrowths of lens epithelium cell migration towards visual axis, leaving clear posterior capsules.

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