COMPARISON BETWEEN RIGID AND FOLDABLE INTRAOCULAR LENSES REGARDING POSTOPERATIVE COMPLICATION AND VISUAL REHABILITATIONS

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ABSTRACT

BACKGROUND

Cataract remains the most important cause of blindness worldwide. Investigators have continued the search for better and safer methods of surgical rehabilitations of the cataract patient. Technical advances are constantly being added, revolutionising cataract surgery. Intraocular lenses being on the most important advances made in ophthalmic surgery during the past year.

MATERIALS AND METHODS

Study was carried out in patients of cataract of different age group attending outpatient department of Dept. of Ophthalmology, Netaji Subhash Chandra Bose Medical College, Jabalpur (M.P.) to evaluate the role of various intraocular lens material in relation to post-operative behaviour and its ocular compliance. We selected 100 patients of age related cataract and divided them into two Groups A, B and C. Group A patients were those patients who were implanted with rigid PMMA lenses, Group B had patients who were implanted with foldable hydrophilic lenses and Group C patients with foldable hydrophobic lenses.

RESULTS

In Group A 44.0% cases were observed with PCO, in Group B 18.2% cases showed PCO and in Group C none of the patients turned up with PCO; 27.7% of cases presented with post-operative inflammation in Group A (PMMA) and 20% cases in Group B (Hydrophilic). But comparing Group A and B, none were in Group C (hydrophobic), which is significant, $P < 0.05$. Similarly, Group B had 20% cases and none were in Group C.

CONCLUSION

Group A (PMMA) showed significantly higher proportion of PCO compared to Group B (hydrophilic) and Group C (hydrophobic). There is no significant difference in the visual outcome in both the rigid and foldable intraocular lenses initially, but in long-term foldable intraocular lenses especially hydrophobic has significantly less chances of PCO.

KEYWORDS

PMMA, PCO, BCVA, IOL.

HOW TO CITE THIS ARTICLE: Deepankar UP, Jain B. Comparison between rigid and foldable intraocular lenses regarding postoperative complication and visual rehabilitations. J. Evolution Med. Dent. Sci. 2016;5(95):7000-7004, DOI: 10.14260/Jemds/2016/1583

BACKGROUND

Cataract remains the most important cause of blindness worldwide. Investigators have continued the search for better and safer methods of surgical rehabilitations of the cataract patient. Technical advances are constantly being added, revolutionising cataract surgery. Intraocular lenses being the most important advances made in ophthalmic surgery during the past years.

An intraocular lens (IOL) is a lens implanted in the eye used to rehabilitate the vision after cataract surgery. The most common type of IOL for cataract treatment are known as posterior chamber IOLs, which work by replacing the cataractous lens in capsular bag.

In 1949, British Ophthalmologist Sir Harold Ridley successfully implanted the first Intraocular Lens (IOL) at St. Thomas Hospital in London.¹ That first intraocular lens was manufactured by the Rayner Company of Brighton, East Sussex, England from Perspex CQ Polymethylmethacrylate (PMMA) made by ICI (Imperial Chemical Industries). In 1984, Tom Mazzocco² introduced the first foldable plate haptic silicone lens produced by STAAR Surgical. It became known as the "Mazzocco taco," because of the way it appeared when folded. Presently IOL of different material are used, viz. polymethylmethacrylate (PMMA) (hard lens), hydrophilic acrylic foldable IOL, hydrophobic acrylic foldable and silicone gel.

An ideal IOL material should have high optical quality, high index of refraction, should be light weight, durable, resistant to mechanical stress, easy to fabricate, non-antigenic, non-allergic, easy to sterilise and lack of inflammatory reaction, foreign body reaction, tissue chaffing. It should be blocking UV radiation and implantable through a small incision.

Aims and Objectives

1. To evaluate the role of various intraocular lens material in relation to post-operative behaviour and its ocular compliance.

Financial or Other, Competing Interest: None.

Submission 04-10-2016, Peer Review 29-10-2016,

Acceptance 04-11-2016, Published 28-11-2016.

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DOI: 10.14260/Jemds/2016/1583

- To assess the postoperative visual outcome of patients implanted with various types of intraocular lens.

MATERIALS AND METHODS

This study was carried out in patients of cataract of different age group attending Outpatient Department of Dept. of Ophthalmology, Netaji Subhash Chandra Bose Medical College, Jabalpur (M.P.) during academic session of 2010 - 2012.

We selected 100 patients of age related cataract and divided them into three Groups A, B and C. Group A patients were those patients who were implanted with rigid PMMA lenses, Group B had patients who were implanted with foldable hydrophilic lenses (Acryfold) and Group C patients with foldable hydrophobic (Acrysof) lenses. Out of these 100 patients, 57 were male and 43 female with the age range of 5 years to 80 years. The patients who dropped during followup were also excluded from the analysis. Full informed consent regarding nature and outcomes of the surgery (SICS), IOL types (rigid PMMA versus Foldable), nature of anaesthesia (peribulbar for all case) and expected duration of visual rehabilitation was discussed and taken.

Inclusion Criteria

- All patients of cataract of age group of 5 - 80 years of both sex of different socioeconomic status.
- Patient must have least possible vision of PL and PR.
- Patient should not have any posterior segment pathologies like retinal detachment and vitreous haemorrhage, etc.
- Patient should not have any anterior segment pathology like corneal opacity, corneal degenerations, corneal dystrophy, iridocyclitis and glaucoma.

Exclusion Criteria

- Patient below 5 years and more than 80 years.
- Patient with no PL and PR defective.
- Patient with posterior segment disorders like retinal detachment and vitreous haemorrhage.
- Patients with any anterior segment disorders like corneal opacity and iridocyclitis.

Pre-Operative Evaluation

- General information – Name, age, sex, occupation, address, socioeconomic status.
- Presenting complaints of patient,
 - Blurring of vision.
 - Frequent change of glasses.
 - Polyopia.
 - Coloured halos and floaters.
 - Improvement of vision as second sight.
- History of associated systemic illness like diabetes mellitus, hypertension, bleeding disorders and others.
- Past history of any previous disease in eye, history of any surgery in eye like corneal tear repair, filtration surgery, etc.
- History of any drug usage like steroids, beta blockers, anticoagulants, antihistaminics, etc.
- Personal history.
- Family history.
- History of any drug allergy.

Ocular Examination

Detailed examination of the operating eye should be carried out to rule out any source of any infection or any pathology.

- Visual acuity - unaided and with pin hole.
- Examine any other incidental finding of lid, lacrimal apparatus, eye position and eye movements.
- Anterior segment examination should be done under high magnification of slit lamp to rule out any pathology of conjunctiva, sclera, cornea, anterior chamber, iris, pupil and lens.
- Tonometry - intraocular pressure recording with schiotz tonometer.
- Syringing - to rule out any lacrimal apparatus pathology.
- Posterior segment examination by direct and indirect Ophthalmoscope.
- B scan to rule out any posterior segment pathology.

Post-Operative Care

- Pad and bandage with topical antibiotics and steroid combination.
- After 24 hours, removal of pad and bandage.
- Topical instillation of antibiotic and steroids.
 - 1 hourly for three days.
 - Six times thereafter and subsequently tapered in 45 days.
- Topical cycloplegic and mydriatic (Homatropine) BD for 7 days.

Follow-Up

At 24 hours.
3rd day.
1 week.
1 month.
1½ month.

At each visit Following Examinations are to be done

- Visual Acuity.
- Detailed anterior segment examination using slit lamp.
- Fundus examination.
- B-scan.
- Refraction.

RESULTS

Visual Acuity	Pre-Operative	After 24 hrs.	After 1 Month	After 2 Months
PL + HM	3 4.6%	1 1.5%	-	-
CF 1 foot- 3 feet	11 16.9%	6 9.2%	-	-
1/60 - 6/60	36 55.4%	4 6.2%	2 3.1%	-
6/36 - 6/24	15 23.1%	15 23.1%	7 10.8%	4 6.2%
6/18 - 6/12	-	15 23.1%	24 36.9%	21 32.3%
6/9 - 6/6	-	24 36.9%	32 49.2%	40 61.5%
Total	65	25	65	65

Table 1. Visual Acuity in Group A (PMMA)

Table shows that the maximum no. of patients belonging to Group A (PMMA) had best corrected visual acuity (BVCA) of

6/9 - 6/6 just 1 day post-operatively, i.e. 36.9%, but gradually increased to 49.2% at the end of 1 month and to 61.5% at the end of 2 months.

Visual Acuity	Pre-Operative	After 24 hrs.	After 1 Month	After 2 Months
PL + HM	4 16.0%	0 0.0%	-	-
CF 1 feet - 3 feet	5 20.0%	0 0.0%	-	-
1/60 - 6/60	12 48.0%	6 24.0%	0 0.0%	-
6/36 - 6/24	4 16.0%	2 8.0%	0 0.0%	0 0.0%
6/18 - 6/12	-	7 28.0%	8 32.0%	7 28.0%
6/9 - 6/6	-	10 40.0%	17 68.0%	18 72.0%
Total	25	25	25	25

Table 2. Visual Acuity in Group B (Hydrophilic)

Table 2 shows patients of Group B (hydrophilic) had 24.0% cases in the category of 1/60 - 6/60, 8.0% cases in the category of 6/36 - 6/24, 28.0% and 40.0% cases in 6/18 - 6/12 and 6/9 respectively just 1 day postoperatively. But gradually the number increased to 68.0% cases in 1 month and 72.0% cases in 2 months in the 6/9 - 6/6 category.

Visual Acuity	Pre-Operative	After 24 hrs.	After 1 Month	After 2 Months
PL + HM	0 0.0%	0 0.0%	-	-
CF 1 feet - 3 feet	1 10.0%	0 0.0%	-	-
1/60 - 6/60	8 80.0%	0 0.0%	0 0.0%	-
6/36 - 6/24	1 10.0%	1 10.0%	0 0.0%	0 0.0%
6/18 - 6/12	-	2 20.0%	3 30.0%	2 20.0%
6/9 - 6/6	-	7 70.0%	7 70.0%	8 80.0%
Total	10	10	10	10

Table 3. Visual Acuity in Group C (Hydrophobic)

Table 3 shows that patients in Group C (Hydrophobic) had maximum no. of patients with visual acuity of 6/9 - 6/6, 70%, 1 day postoperatively, which was maintained by the end of 1 month and gradually increasing to 80% in the 2 months.

	PMMA	Hydrophilic	Hydrophobic
Followup	50	22	8
Lost	15	3	2
Present	22 44.0%	4 18.2%	0 0.0%
Absent	28 56.0%	18 81.81%	10 100.0%
Total	65	25	10

Table 4. Post-Operative Posterior Capsular Opacification (1 Year)

Table describes about the PCO findings at 1 year in the three study groups.

In Group A 44.0% cases were observed with PCO, in Group B 18.2% cases showed PCO and in Group C none of the patients

turned up with PCO. Group A (PMMA) showed significantly higher proportion of PCO compared to Group B (hydrophilic) and Group C (hydrophobic) with P value < 0.05 and < 0.0001 respectively, likewise comparing Group B and C for PCO, there was significant difference in between the groups. The results reveal that Group C have significantly lower PCO rates as compared to Group A and B (p < 0.05).

Inflammation	PMMA	Hydrophilic	Hydrophobic
Absent	47 72.3%	20 80.0%	10 100.0%
Present	18 27.7%	5 20.0%	0 0.0%
Total	65	25	10

Table 5. Post-Operative Inflammation (24 hrs.)

Table 10 shows that 27.7% of cases presented with post-operative inflammation in Group A (PMMA) and 20% cases in Group B (Hydrophilic) with a P value of > 0.05, which is insignificant. But comparing Group A and C, 27.

75 cases had post-operative inflammation in Group A and none were in Group C (hydrophobic), which is significant P < 0.05. Similarly, Group B had 20% cases and none were in Group C with a significant P value of < 0.05. Suggesting that Group C had significantly less chances of post-operative inflammation as compared to Group A and Group B.

DISCUSSION

In our study, 100 cases of cataract were operated by small incision cataract surgery and intraocular lens were implanted; 65 patients in Group A were implanted with rigid PMMA lenses, Group B consisted of 25 patients were implanted with foldable hydrophilic (Acryfold), and Group C 10 patients were implanted with hydrophobic (Acrysof) intraocular lenses.

This study was conducted in N.S.C.B. Medical College Hospital in the year 2010 - 2012 with the aim to evaluate the post-operative visual rehabilitation and complications, especially post-operative inflammation and post-operative opacification.

Post-Operative Visual Rehabilitation

Mohammad Alam and Zafar Iqbal³ at the end of first month in Group A, 84% of patients had best corrected visual acuity of 6/6 and 16% of patients had 6/9. In Group B 80% of patients had best corrected visual acuity of 6/6, 16% had 6/9, while 4% had 6/12.

A. J. Afsar⁴ et al study, all pseudophakic had corrected visual acuity of 6/9 or better. There were no significant differences in visual acuity (Kruskal-Wallis, p = 0.61) or contrast (ANOVA, p = 0.33) between rigid PMMA and foldable acrylic groups.

Our study shows that the maximum no. of patients belonging to Group A (PMMA) had best corrected visual acuity (BVCA) of 6/9 - 6/6 just 1 day post-operatively, i.e. 36.9% but gradually increased to 49.2% at the end of 1 month and to 61.5% at the end of 2 months. It shows that patients of Group B (hydrophilic) had 24.0% cases in the category of 1/60 - 6/60, 8.0% cases in the category of 6/36 - 6/24, 28.0% and 40.0% cases in 6/18 - 6/12 and 6/9 - 6/6 respectively. Just 1 case in 1 month and 72.0% cases in 2 months in the 6/9 - 6/6 category shows that Group C (hydrophobic) had maximum no. of patients with visual acuity more than 6/12 and it was

maintained by the end of 1 month and gradually increasing to 80% in the 2 months.

Comparing the above data, it can be stated that almost maximum no. of patients in all the three groups had best corrected visual acuity of 6/12 or better 1 day post-operatively that gradually increased to 6/9 or better by the end of 1 month and 2 months respectively.

Posterior Capsular Opacification

Muhammad Moin, Kashif Raza, Anwar Ul-Haq Ahmad,⁵ have studied 166 eyes in Group A in which 5.5 mm PMMA IOLs (LX10 BD, Alcon) were implanted and 192 in Group B eyes in which Hydrophobic Acrylic IOLs (Acrysof, Alcon) were implanted. In Group A 39 (23.4%) eyes with PMMA IOL had decreased vision due to PCO, out of which only 10 patients (6%) underwent YAG posterior capsulotomy for significant visual loss. In Group B 12 (6.2%) eyes with Hydrophobic Acrylic IOL had decreased vision due to PCO, out of which only 3 patients (1.5%) underwent YAG posterior capsulotomy for significant visual loss.

Ursell PG⁶ et al in his study, relationship between intraocular lens biomaterials and posterior capsule opacification found out that there was a significant difference in percentage of PCO at 2 years among the three lens types. The AcrySof lenses were associated with less PCO (median 11.75%) than PMMA (43.65%) and silicone (33.50%) lenses ($P < .001$ and $P = .025$, respectively). The difference between PMMA and silicone lenses was not statistically significant. Intraocular lenses made from AcrySof were associated with a significantly reduced degree of PCO.

Hollick EJ⁷ et al, studied the effect of polymethylmethacrylate, silicone and polyacrylic intraocular lenses on posterior capsular opacification 3 years after cataract surgery found out that polyacrylic lenses were associated with less PCO (10%) than silicone (40%) and PMMA lenses (56%) after 3 years.

In our study, the PCO findings at 1 year in the three study groups were in Group A (PMMA) 44.0% cases showed PCO and in Group C (hydrophobic), none of the patients turned up with PCO.

Post-Operative Inflammation

Hollick EJ⁸ et al in his study on Biocompatibility of poly (methylmethacrylate), silicone and AcrySof intraocular lenses: randomised comparison of the cellular reaction on the anterior lens surface, resulting that all three IOL types produced a mild degree of nonspecific foreign-body response, which resolved over the study period without detrimental effect. The silicone group had significantly higher small cell counts than the PMMA and AcrySof groups ($P = .02$); the AcrySof group had significantly lower giant cell counts than the other two groups ($P = .003$).

Similarly, in our study we found out that 27.7% of cases presented with post-operative inflammation in Group A (PMMA) and 20% cases in Group B (Hydrophilic) with a P value of > 0.05 which is insignificant. But comparing Group A and C, 27.75 cases had post-operative inflammation in Group A and none were in Group C (hydrophilic), which is significant $P < 0.05$. Similarly, Group B had 20% cases and none were in Group C with a significant P value of < 0.05 . Suggesting that

Group C had significantly less chances of post-operative inflammation as compared to Group A and Group B.

SUMMARY AND CONCLUSION

This study entitled 'Comparison between Rigid and Foldable Intraocular lenses regarding post-operative complication and visual rehabilitations,' was conducted in the Upgraded Department of Ophthalmology in N.S.C.B. Medical College, Jabalpur, in the year 2010 - 2012.

A total of 100 patients of cataract were taken of different age group ranging from 5 - 80 years, and were operated upon with small incision cataract surgery within the bag implantation of various intraocular lens. According to the intraocular lens implanted, patients were divided into three groups, Group A had 65 patients who were implanted with rigid (PMMA) intraocular lens, Group B and Group C had 25 and 10 patients who had hydrophobic (Acrysof) intraocular lenses simultaneously.

A detailed pre- and post-operative, systemic and local examination was done of each patient at each followup, which included best corrected visual acuity on Snellen's chart, detailed examination on slit lamp, fundus examination biometry and B-scan as and when required.

Observations were made according to age, gender, diagnosis, pre-operative visual acuity, post-operative best corrected visual acuity, post-operative posterior capsular opacification and post-operative inflammation. T-test was applied to all the observations and accordingly results were made.

Following were the Conclusions Drawn from our Study

- Maximum no. of patients belonging to Group A (PMMA) had best corrected visual acuity (BVCA) of 6/9 - 6/6 just 1 day post-operatively, i.e. 36.9% but gradually increased to 49.2% at the end of 1 month and to 61.5% at the end of 2 months.
- Patients of Group B (hydrophilic) and 24.0% cases in the category of 1/60 - 6/60, 8.0% cases in the category of 6/36 - 6/24, 28.0% and 40.0% cases in 6/18 - 6/12 and 6/9 - 6/6 respectively just 1 day post-operatively. But gradually the number increased to 68.0% cases in 1 month and 72.0% cases in 2 months.
- Comparing the best corrected visual acuity of the three groups A, B, C, it can be stated that almost maximum no. of patients in all the three groups had best corrected visual acuity of 6/12 or better 1 day post-operatively that gradually increased to 6/9 or better by the end of 1 month and 2 months respectively, which was statistically similar and had no significant differences ($p > 0.05$).
- PCO findings at 1 year in the three study groups. In Group A 44.0% cases were observed with PCO, in Group B 18.2% cases showed PCO and in Group C none of the patients turned up with PCO. Group A (PMMA) showed significantly higher proportion of PCO compared to Group B (hydrophilic) and Group C (hydrophobic) with P value < 0.05 and < 0.0001 respectively, likewise comparing Group B and C for PCO there was significant difference in between the groups. The results reveal that Group A and B ($p < 0.05$).
- 27.7% of cases presented with post-operative inflammation in Group A (PMMA) and 20% cases in Group B (Hydrophilic) with a P value of > 0.05 which is

insignificant. But comparing Group A and C 27.75 cases had post-operative inflammation in Group A and B had 20% cases and none were in Group C with a significant P chances of post-operative inflammation as compared to Group A and Group B.

- Concluding that there is no significant difference in the visual outcome in both the rigid and foldable intraocular lenses initially, but in long-term foldable intraocular lenses specially hydrophobic has significantly less chances of PCO and hence better visual rehabilitation as compared to PMMA.
- Chances of post-operative complications and posterior capsular opacification are significantly less in hydrophobic intraocular lenses making it one of the most suitable intraocular lenses in the present-day scenario.

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