



Cataract Surgery by Phacoemulsification – Surgical and Visual Outcome with Foldable and Non-Foldable Lenses

Authors

**Dr. Chitra Pande¹, Dr. Lubna Rahman², Dr. Vikas Mahatme³,
Dr. Nikhilesh Wairagade⁴, Dr. Seema Deshmukh⁵**

¹Senior Consultant; Mahatme Eye Bank Eye Hospital, Nagpur India

²Consultant Ophthalmologist, Private Practitioner, Bangalore

³Founder Medical Director – Dept of Ophthalmology, Mahatme Eye Bank Eye Hospital, Nagpur

⁴Senior Consultant – Dept of Ophthalmology, Mahatme Eye Bank Eye Hospital

⁵Ex-Consultant Dept of Ophthalmology, Mahatme Eye Bank Eye Hospital

ABSTRACT

This prospective comparative study included 300 matched patients of different grades of senile cataract. All of them willfully underwent phacoemulsification at the hands of a single experienced surgeon, performing with a single and individual technique {Woodcutter's technique¹}; half of them were implanted with a foldable intraocular lens and the other half with a non-foldable PMMA intraocular lens. All the patients undergoing phacoemulsification had an improvement in vision. There was no statistically significant difference in the surgically induced astigmatism after implanting foldable or non-foldable IOL. There was a higher rate of posterior capsule opacification following the implantation of rigid PMMA intraocular lens which was statistically significant ($p=0.0113$) as compared to the foldable poly HEMA lenses. However none of these required any active intervention.

Key Words: Phacoemulsification, Cataract surgery, Foldable IOL, Non foldable phaco IOL, BCVA (Best corrected visual acuity), surgically induced astigmatism, PCO (posterior capsular opacification), PCR (posterior capsular rent)

INTRODUCTION

Phacoemulsification devised by Charles Kelman, MD, in early 1966 has reduced the trauma to the eye and has improved the stability to the corneal shape. Introduction of the foldable intraocular lens

by Dr. Mazzocca³, allows us to take full advantage of the small incision of phacoemulsification. This prospective comparative study included 300 matched patients of different grades of senile cataract. All of them

willfully underwent phacoemulsification at the hands of a single experienced surgeon, performing with a single and individual technique {Woodcutter's technique¹}; half of them were implanted with a foldable intraocular lens and the other half with a non-foldable PMMA intraocular lens. The study aimed at study surgical outcome of phacoemulsification in senile cataract by a single surgeon and to study the postoperative best corrected visual acuity at the end of 6 weeks.

MATERIALS AND METHODS

This prospective, hospital based comparative study of 300 matched patients of senile cataract of various grades, operated by single phacoemulsification technique (Woodcutter's technique) by a single experienced surgeon was carried out at Mahatme Eye Bank And Eye Hospital, Nagpur, India between May 2004 and May 2005 after ethical committee's approval.

The patients were divided into 2 groups, first group of 150 being implanted with a foldable (poly-HEMA) and the other 150 patients being implanted with a non-foldable rigid PMMA intraocular lens.

Sample size was calculated by considering confidence interval of 90% at 5% significance.

Inclusion Criteria:

Patients with operable senile cataract of all grades

Exclusion Criteria:

Patients having any of the following were excluded from the study.

- Congenital, traumatic or complicated cataract.

- Pre-existing glaucoma {primary or secondary}.
- Subluxation or pseudoexfoliation.
- Pre-existing corneal pathology.
- Uveitis.
- High myopia with degenerative changes.
- Posterior segment pathology, mainly diabetic or hypertensive retinopathy or macular pathology.
- Blind opposite eye.

PREOPERATIVE OPHTHALMIC EVALUATION

Included

a) Visual acuity –

1. Unaided
2. Best corrected
3. With spectacles

b) Intraocular pressure with {Perkin's} applanation tonometer

c) Detailed slit lamp biomicroscopic examination of the eye

d) Detailed fundus examination with the aid of a direct and indirect ophthalmoscopes and a 90 Dioptre lens

e) Retinoscopy

f) Patency of the lacrimal system {syrringing }

g) Keratometry with the aid of auto-keratometer

h) IOL power calculation and axial length by A-scan using SRK-II formula

Postoperative Evaluation Was Done

- 1} Prior to discharge
- 2} Second postoperative day
- 3} At end of 1 week
- 4} At end of 1 month

5} At the end of 6 weeks
Parameters Evaluated At Every Follow Up Were

- 1} Visual acuity
 - a} uncorrected
 - b} best corrected
- 2} Refraction
- 3} Intraocular pressure {after 1 week of surgery}
- 4} Keratometry
- 5} Thorough slit lamp biomicroscopic examination
- 6} Thorough funduscopy for posterior segment complications

STATISTICAL METHOD USED FOR ANALYSIS OF DATA

Fisher's exact test was applied for the statistical analysis of data. The software utilized for the same was of Graphpad Prism.

spectacle correction was given at end of a week and surgically induced astigmatism calculated at the end of 6 weeks by Vector analysis as described by Jaffe and Clayman⁴

OBSERVATIONS:

Table 1 shows the variety of cataracts included in the study group. Posterior subcapsular cataracts were the most common and nuclear sclerosis of grade three were the next common in frequency in both the groups. Only two cases of hypermature cataract were included, one in either group was found.

Table 1 : Distribution Of Various Types Of Cataract In The Two Groups

Grade	Cataract	Foldable	Percent	Non Foldable	Percent	TOTAL
1	NS1	3	2.00	1	0.67	4
2	NS2	20	13.33	30	20.00	50
3	NS3	24	16.00	21	14.00	45
4	PSC	29	19.33	42	28.00	71
5	PPC	9	6.00	6	4.00	15
6	MAT	17	11.33	13	8.67	30
7	NS1+PSC	4	2.67	3	2.00	7
8	NS2+PSC	25	16.67	7	4.67	32
9	NS3+PSC	4	2.67	5	3.33	9
10	NS+PPC	5	3.33	1	0.67	6
11	ASC+NS	1	0.67	1	0.67	2
12	HMSC	1	0.67	1	0.67	2
13	NS4	3	2.00	10	6.67	13
14	NS+CC	2	1.33	1	0.67	3
15	NMSC	3	2.00	6	4.00	9
16	PSC+PPC	0	0.00	2	1.33	2

Table 2 shows preoperative uncorrected visual acuity in two groups.

Table 2: Preoperative Uncorrected Visual Acuity In The Two Groups:

Pre UCVA	Foldable	percent	Non Foldable	percent	total
PL/PR	17	11.33	15	10.00	32
CFcf-3/60	46	30.67	41	27.33	87
>3/60-6/36	52	34.67	56	37.33	108
>6/36-6/12	35	23.33	38	25.33	73

Preoperative uncorrected visual acuity of the patients varied from perception of light to as high as 6/12.

Table 3 shows postoperative BCVA (Best Corrected Visual Acuity) in two groups.

Table 3 : Postoperative Best Corrected Visual Acuity In The Two Groups

Postop BCVA	Foldable	percent	NonFoldable	percent	TOTAL
PL/PR	0	0.00	0	0.00	0
CFcf-3/60	0	0.00	0	0.00	0
>3/60-6/36	1	0.67	0	0.00	1
>6/36-6/12	8	5.33	15	10.00	23
6/9.	41	27.33	52	34.67	93
6/6.	100	66.67	83	55.33	183

The trend of best corrected visual acuity following phacoemulsification showed that 141 {94% } patients in the foldable group and 135 {90% } patients in the non-foldable group improved to 6/9 or better. 8 {5.33% } patients in the foldable group and 15 {10% } patients in the non-foldable group had visual acuity ranging between 6/12 to 6/36.

Only one patient had a visual acuity of less than 6/36.

Table 4 : Postoperative Astigmatism On Keratometry

Postop astigmatism	Foldable	Non-Foldable	TOTAL
ZERO	1	0	1
upto 0.5	22	8	30
0.51-1.00	64	40	104
1.01-1.5	44	47	91
1.51-2.00	16	34	50
>2.00	3	21	24
TOTAL	150	150	

The above table 4 of postoperative astigmatism on keratometry was analysed by Graph-pad prism.

Table 5 : Postoperative Acceptance Of Astigmatic Correction

Astigmatism on acceptance of refraction	Foldable	NonFoldable	TOTAL
Zero	63	52	115
upto 0.5	31	30	61
0.75-1	37	44	81
1.25-1.5	15	15	30
>1.5	4	9	13

There was no statistically significant difference in the acceptance of astigmatism shown by patients of either group (p = 0.256). In the foldable group 146 patients accepted an astigmatic correction of less than 1.5 and 4 patients showed an acceptance of more than 1.5. On the other side , in the non-foldable group, 141 patients accepted an astigmatic correction of less than 1.5 and 9 patients accepted a value of more than 1.5.

As far as the complications are concerned, table 6 shows the details.

Table 6: Complications Observed In The Two Groups

COMPLICATIONS	Foldable	Non-Foldable	TOTAL
None	138	128	266
INTRAOPERATIVE (n=1):			
PC Rent	1	0	1
POSTOPERATIVE (n=38):			
1)PCO	8	22	30
2)Striate keratitis	3	2	5
3)Macular haemorrhage	1	0	1
4)Wound Leak	1	0	1
5)Cystoid macular edema	1	0	1
6)endophthalmitis	0	0	0
7)Uveitis	0	0	0

Phacoemulsification in 138 patients in the foldable group and 128 patients in the non-foldable group was uneventful, intraoperatively and postoperatively. Posterior capsular opacification developed in 8 patients in the foldable group and 22 patients in the non-foldable group. This difference in the number of cases of PCO in either group was statistically significant at $p = 0.0113$.

There was one case each of posterior capsular rent, macular haemorrhage, wound leak and cystoid macular edema, all in the foldable group. There were 5 cases in all of striate keratitis, 3 in the foldable group that included the case in which posterior capsular rent had occurred and 2 in the non-foldable group.

DISCUSSION

All the 300 patients were of operable senile cataract of all grades, posterior subcapsular cataract being the commonest and 56-60 yrs being the commonest age group and having preoperative uncorrected visual acuity ranging from perception of light to 6/12.

The postoperative best corrected visual acuity of patients in our study ranged from 3/60 – 6/6 in both the groups. 66.67% in the foldable IOL group, and 55.33% in the non-foldable IOL group had a best corrected visual acuity of 6/6 postoperatively at the end of 6 weeks. A patient had a macular hemorrhage discovered postoperatively and thus failed to improve beyond 6/36. This compares well with the study carried out by Afsa J Afsar et al⁵, published in the journal EYE, 1999. They carried out phacoemulsification and IOL implantation in 86 patients, of which 67 patients completed the study. All of them had a visual acuity of 6/9 or better. Parul Desai et al⁶ in their National Cataract Survey 1997-98 has shown that at final refraction, 92% patients achieved a visual acuity of 6/12 or better.

Looking at the trend of pre-operative uncorrected visual acuity and post-operative best corrected visual acuity, 299 patients improved to 6/12 and more. 1 patient failed to improve due to macular hemorrhage. Massimo Busin et al⁷ in their article published in the Archives of Ophthalmology has shown that amongst 100 eyes who underwent phacoemulsification, the postoperative uncorrected and best corrected visual acuity had improved following surgery.

One patient in the foldable group had a posterior capsular rent and he further improve to 6/9 postoperatively at the end of 6 weeks. With an experienced hand, the incidence of posterior capsular rent was seen to be negligible. We could manage to implant a foldable intraocular lens over the rim of the anterior capsule, after cleaning the vitreous from the anterior chamber. Eng-Yiat-

Yap⁸ in the book, International Ophthalmology has shown that in patients having posterior capsular rent in which Posterior Chamber intraocular lens was implanted, 86.4% had a best corrected visual acuity of 6/12 or better.

When calculated on keratometry alone, 131 patients in the foldable group and 95 patients in the non-foldable group showed a postoperative astigmatism of less than 1.5. On the other hand, 19 patients in the foldable group and 55 patients in the non-foldable group showed a postoperative astigmatism of more than 1.5. This difference in the values for the two groups was statistically significant at $p < 0.0001$ by applying Fisher's exact test. The values for the surgically induced astigmatism for the two groups were identical when divided further into two categories of less than or more than 1.5. Thus, we could infer that there was no statistically significant difference in the surgically induced astigmatism whether a foldable poly-HEMA or a rigid PMMA intraocular lens is implanted following phacoemulsification. This effect may just be because the temporal incision is away from the visual axis and it is on the steeper meridian as compared to the superior incision. John Merriam C. et al⁹ in their study of the effect of incisions for cataract surgery on the corneal curvature have inferred that there was significant change in the corneal curvature when the incision was taken on the temporal clear cornea.

CONCLUSION

Consistent and reproducible outcome can be obtained after phacoemulsification in all grades of cataract by a single technique as all the patients undergoing phacoemulsification had an improvement in their visual status. There was no statistically significant difference in the surgically induced astigmatism after implantation of foldable and non-foldable lenses. There was a higher rate of posterior capsular opacification following implantation of rigid PMMA intraocular lens, which was statistically significant ($p = 0.0113$) as compared to the foldable poly HEMA lenses. However none of these cases required active intervention.

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