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Visual Outcome and surgically induced astigmatism in manual small incision cataract surgery versus phacoemulsification with rigid 5.25mm PMMA IOLs

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Introduction

Cataract has been documented to be the most significant cause of bilateral blindness in India where vision <20/200 in the better eye on presentation is defined as blindness. In India, cataract has been reported to be responsible for 50-80% of the bilaterally blind in the country. The first surgical procedure for cataract was displacement of lens into the vitreous cavity introduced by Susruta (600BC). Daviel J (1753) described planned extracapsular cataract surgery. To overcome the pitfalls of conventional ECCE Kelman CD (1967) introduced the technique of phacoemulsification for removing the cataractous lens. The advantages of phacoemulsification are that it can be performed under local anaesthesia, minimal post op complications, early visual rehabilitation and postoperative astigmatism is comparatively less. But it requires more skill and sophisticated equipments which are quite expensive and in an economically weaker country like India, the method needs to be cheap and effective. in order to obtain the advantages of a self sealing sutureless incision at alower cost, ophthalmologist developed another technique called Manual small incision cataract surgery. The final visual outcome has been observed to be similar after MSICS and phacoemulsification. Phacoemulsification with standard 2.8mm incision achieves minimal post op astigmatism but a foldable IOL is a prerequisite for this procedure. One more modification in standard phacoemulsification procedure is to enlarge the incision size to 5.5mm & implant 5.25mm PMMA PCIOL so that on one hand the advantages of phacoemulsification can be retained and on the other hand cost factor is also reduced.

Material and Methods

The proposed study was conducted on 80 patients attending the OPD of upgraded department of ophthalmology Govt. Medical college jammu. it was a comparative study which included patients with age related cataract .patients with coexisting glaucoma, uveitis, subluxated lens, traumatic cataract, corneal opacity eso and exo tropias and high myopia were excluded from the study. The cases were divided into two groups of 40 each. detailed history and complete general physical and ocular examination was done. Preoperative protocol were same for both the groups.pre operative antibiotic drops and oral antibiotics were

given a day before surgery. Preoperative mydriasis was achieved with 1% tropicamide and 10% phenylephrine eyedrops. All patients were operated using peribulbar block. the eye planned for surgery was cleaned and draped.

Surgical technique

Group 1: manual SICS through superior sclera corneal tunnel approach with 5.25mm PMMA posterior chamber IOL was done.after placing the wire speculum &reflecting the fornix based conjuctival flap, tenons & episcleral attachments from the sclera was cleaned. A gentle cautery was applied. The incision comprised of 3 components:

1. **External sclera incision**: a frown shaped 5.5mm in length and 1.5 to 2mm from the superior limbus, given with a no.15 disposable blade.

2. **Sclerocorneal tunnel**: created using a crescent knife. cornea was dissected 1.5mm to 2mm of clear cornea.

3. **Internal incision**: side ports were created at 9 O'clock and 3O'clock position in right and left eye respectively with a 2.8mm angled keratome. After entry into AC with the same keratome , AC was deepened with HPMC and continuous curvilinear capsulorrhexis was done with 26 G bent needle. Hydrodissection was done and nucleus was prolapsed out of the bag. After injecting viscoelastic behind the nucleus nucleus was rotated &delivered out with the help of irrigating wire vectis. The cortical material was washed using two way cannula and a 5.25mm rigid PMMA PCIOL was implanted through sclerocorneal tunnel after injecting viscoelastic into the capsular bag & AC. All the viscoelastic was washed from the anterior chamber and AC was reformed. The conjuctival flap was apposed.

Group 2: Side port created using MVR blade & clear corneal temporal incision of 2.8mm was given and CCC performed. After hydrodissection and hydrodelineation, nucleus was emulsified using an ultrasound probe. Incision was enlarged upto 5.5mm and 5.25mm PMMA IOL was implanted within the capsular bag. Suturing of the wound was decided on the table.

In both the groups postoperative injection of dexamethasone and gentamycin was given and pad and bandage was applied for 24 hours.

Patients were followed on 1st postoperative day, 1st week,4th week and 6th week for visual acuity, slit lamp examination, keratometry and refraction. Any complication if occurred was recorded.

Results

Table 1 Pre-operative corneal astigmatism in patients

Astigmatism in dioptres	Group I		Group II	
	No	%	No	%
0-0.9	24	60	23	57.5
1-1.9	9	22.50	11	27.5
2-2.9	7	17.50	5	12.5
3-3.9	0	0	1	2.5
MEAN	0.95		0.99	
SD	0.88		0.91	

t -.223 , p=0.824 (Not significant)

As seen from the above table, both group I (82.5%) and Group II (85%) had maximum number of patients with pre-operative astigmatism of < 2.00 D The difference of pre-operative astigmatism between the two groups was statistically insignificant.

Pre-operative corneal astigmatism in patients

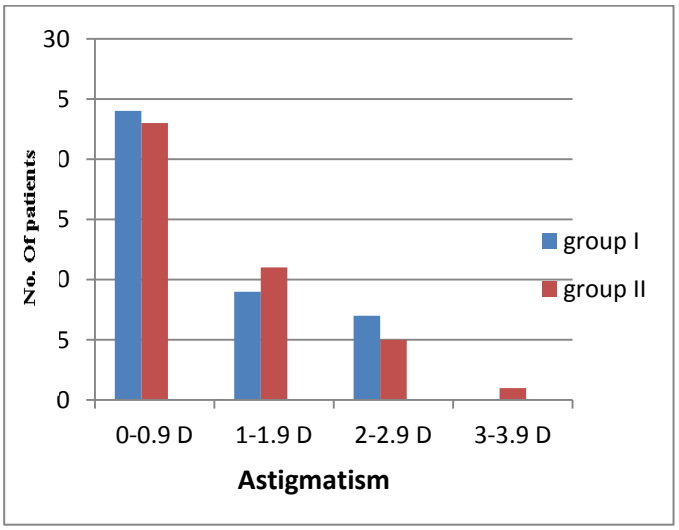


Table 4: Surgically induced astigmatism at the end of 1st week

Astigmatism in diopters	Group I		Group II	
	No	%	No	%
0-0.9	0	0	4	10
1-1.9	0	0	4	10
2-2.9	9	22.5	20	50
3-3.9	31	77.5	12	30
MEAN	3.17		2.52	
SD	0.50		0.74	

t= 4.55, p= 0.000 (Highly significant)

At the end of 1st week after surgery, 22.5% of patients in group I and 50% in group II had surgically induced astigmatism of 2-2.9 D. 77.5% of patients in group I and 30% in group II had surgically induced astigmatism of 3-3.9 D .The difference of surgically induced astigmatism between group I and group II was statistically highly significant.

Surgically induced astigmatism at 1st week

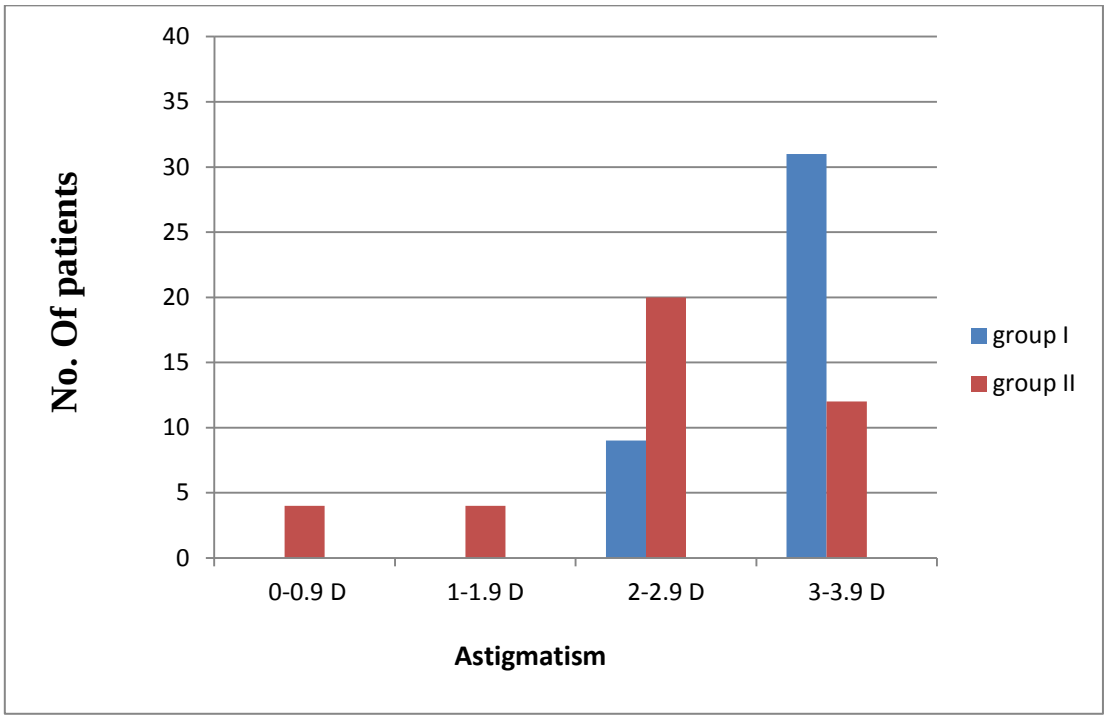


Table 5 Surgically induced astigmatism at the end of 4th week

Astigmatism in diopters	Group I		Group II	
	No	%	No	%
0-0.9	4	10	6	15
1-1.9	9	22.5	18	45
2-2.9	19	47.5	15	37.5
3-3.9	8	20	1	2.5
MEAN	2.13		0.74	
SD	1.66		0.69	

t= 2.91, p=0.005 (Highly significant)

At the end of 4th week after surgery, 47.5% of patients in group I and 37.5% in group II had surgically induced astigmatism of 2-2.9 D. 22.5% of patients in group I and 45% in group II had surgically induced astigmatism of 1-1.9 D .The difference of surgically induced astigmatism between group I and group II was statistically highly significant.

Surgically induced astigmatism at 4th week

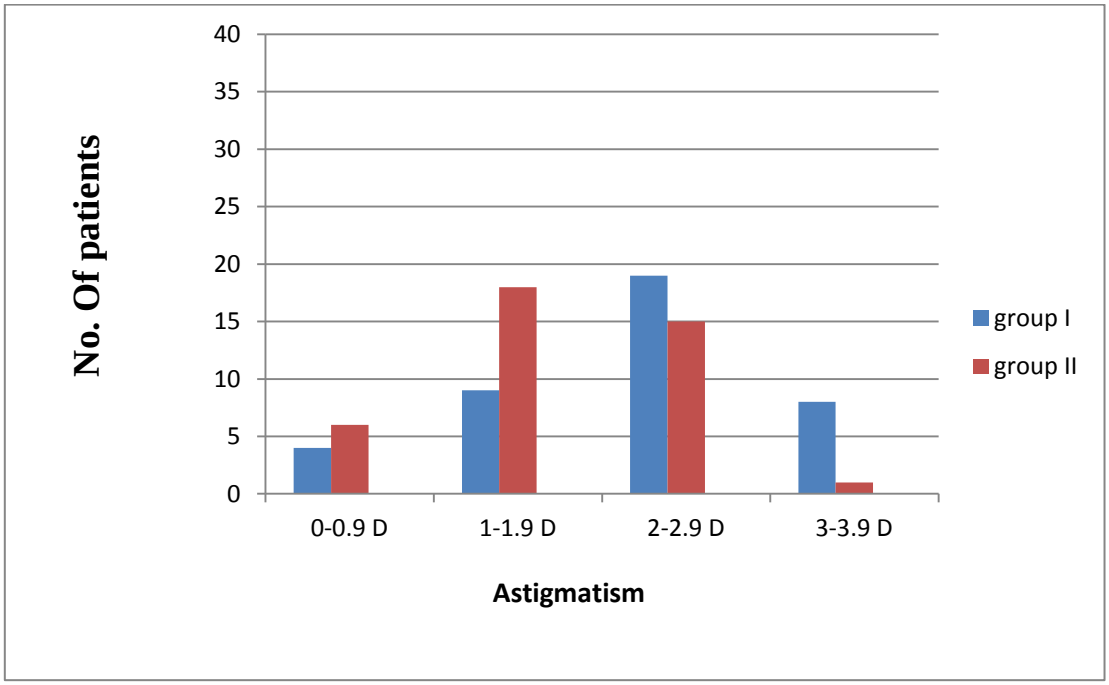


Table 6: Surgically induced astigmatism at 6th week

Astigmatism in diopters	Group I		Group II	
	No	%	No	%
0-0.9	7	17.5	9	22.5
1-1.9	23	57.5	27	67.5
2-2.9	19	22.5	4	10
3-3.9	1	2.5	0	0
MEAN	1.48		1.19	
SD	0.65		0.57	

t = 2.09, p= 0.40 (Significant)

As seen from the above table, 22.5 % of patients in group I and only 10% in group II had surgically induced astigmatism of 2-2.9 D. 57.5% of patients in group I and 67.5% in group II had surgically induced astigmatism of 1-1.9 D. The difference of surgically induced astigmatism between group I and group II was statistically significant at the end of 6th week after surgery.

Surgically induced astigmatism at 6th week

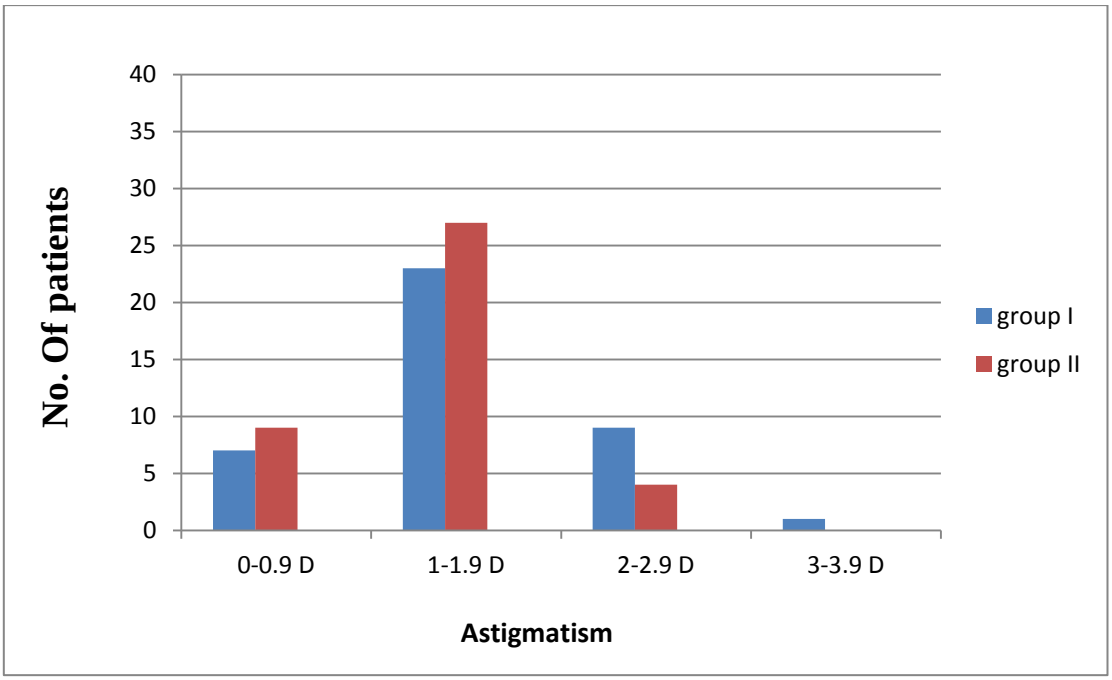


Table 7 Distribution of patients according to pre-operative visual acuity

Visual acuity	Group I		Group II	
	No	%	No	%
PL+ PR+ to FC close to face	20	50	16	40
1/60-5/60	18	45	20	50
6/60-6/36	2	5	4	10
Total	40	100	40	100

Fisher exact p = 0.67 (Not significant)

As seen from the above table in group I maximum number of patients (50%) had preoperative visual acuity between PL+ PR+ to FC Close to face and in group II maximum number of patients (50%) had preoperative visual acuity between 1/60-5/60. Applying Fisher exact P there is no significant difference between the two groups regarding preoperative visual acuity.

Distribution of patients according to pre-operative visual acuity

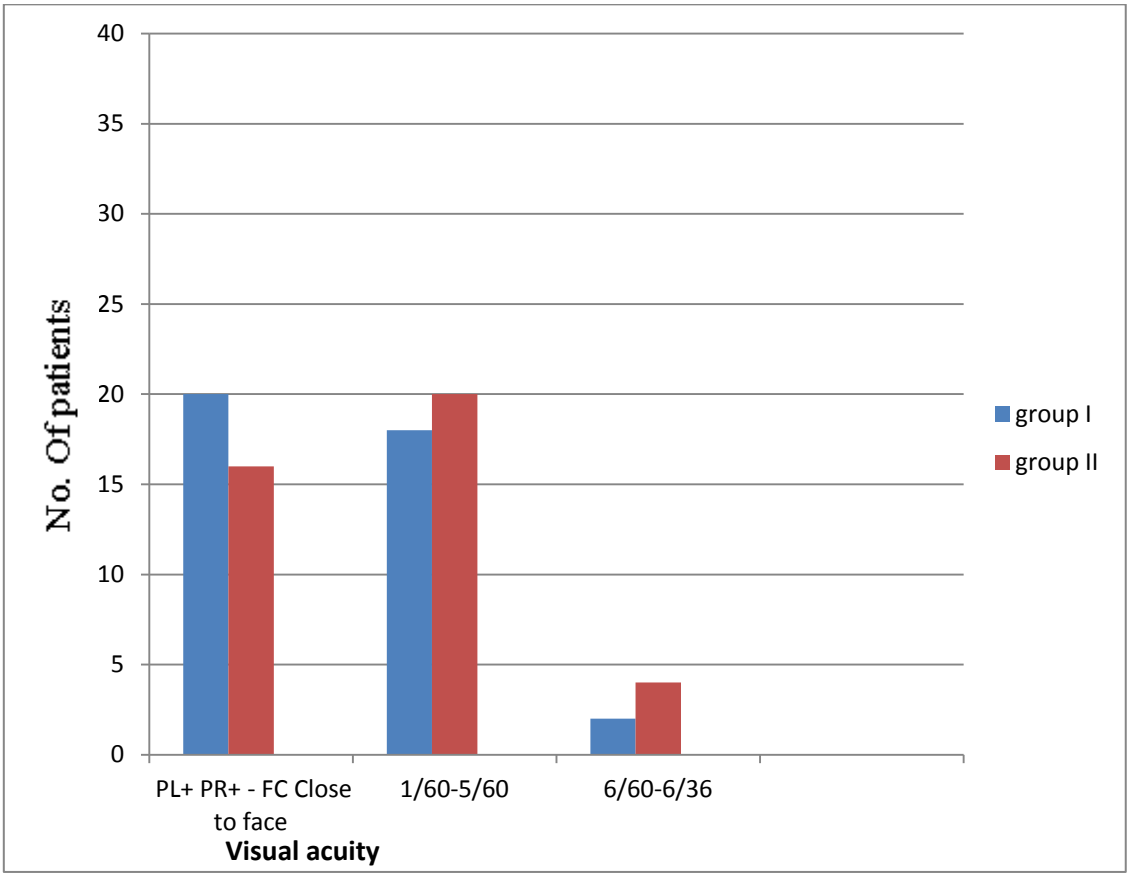


Table 8 Post-operative uncorrected visual acuity at 1st day

Uncorrected Visual acuity	Group I		Group II	
	No	%	No	%
6/60 or less	6	15	6	15
6/36-6/18	23	57.5	23	57.5
6/12-6/6	1	2.5	1	2.5

At the 1st post operative day, both the groups had 57.5% patients with uncorrected visual acuity of 6/36-6/18. Similarly both the groups had only 2.5% patients with uncorrected visual acuity of 6/12-6/6.As the number of patients were same in both the groups, no statistical comparison was made.

Post- operative uncorrected visual acuity at 1st day

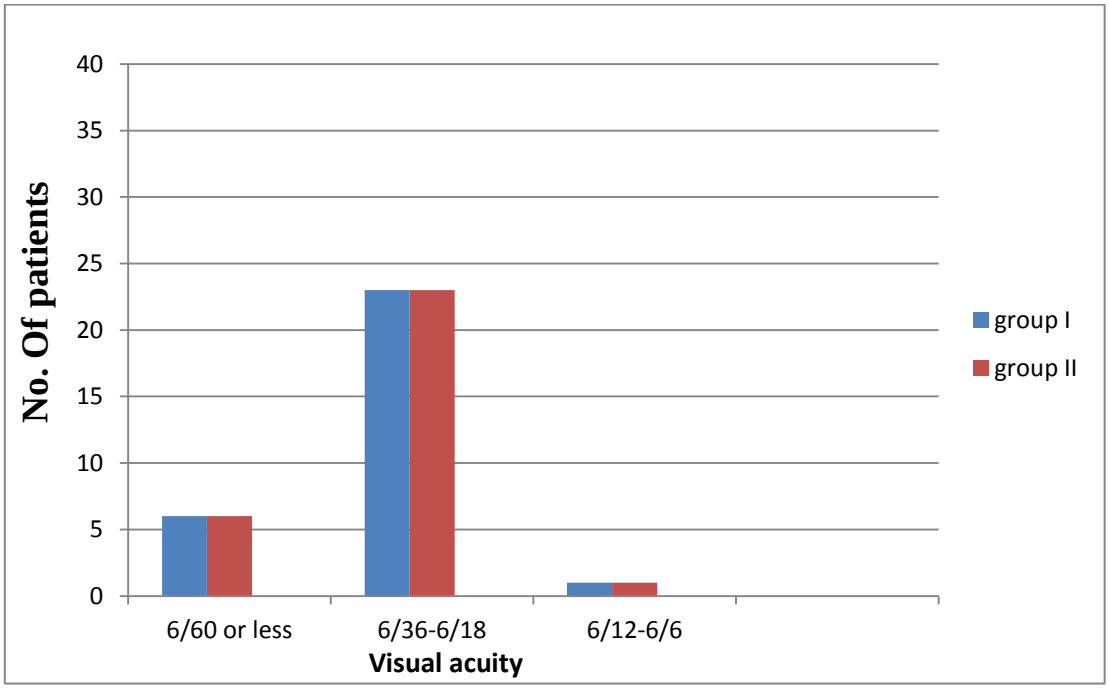


Table 9 Post-operative uncorrected visual acuity at 1st week

Uncorrected Visual acuity	Group I		Group II	
	No	%	No	%
6/60 or less	3	7.5	3	7.5
6/36-6/18	34	85	32	80
6/12-6/6	3	7.5	5	12.5

$\chi^2_{(2)} = 0.56$, p=0.75 (not significant)

At the end of 1st post-operative week 85% patients in group I where as 80% patients in group II had uncorrected visual acuity 6/36-6/18. Only 7.5% of patients in group I where as 12.5% patients in group II had uncorrected visual acuity of 6/12-6/6. The difference between both the groups was found to be statistically non significant.

Post- operative uncorrected visual acuity at 1st week

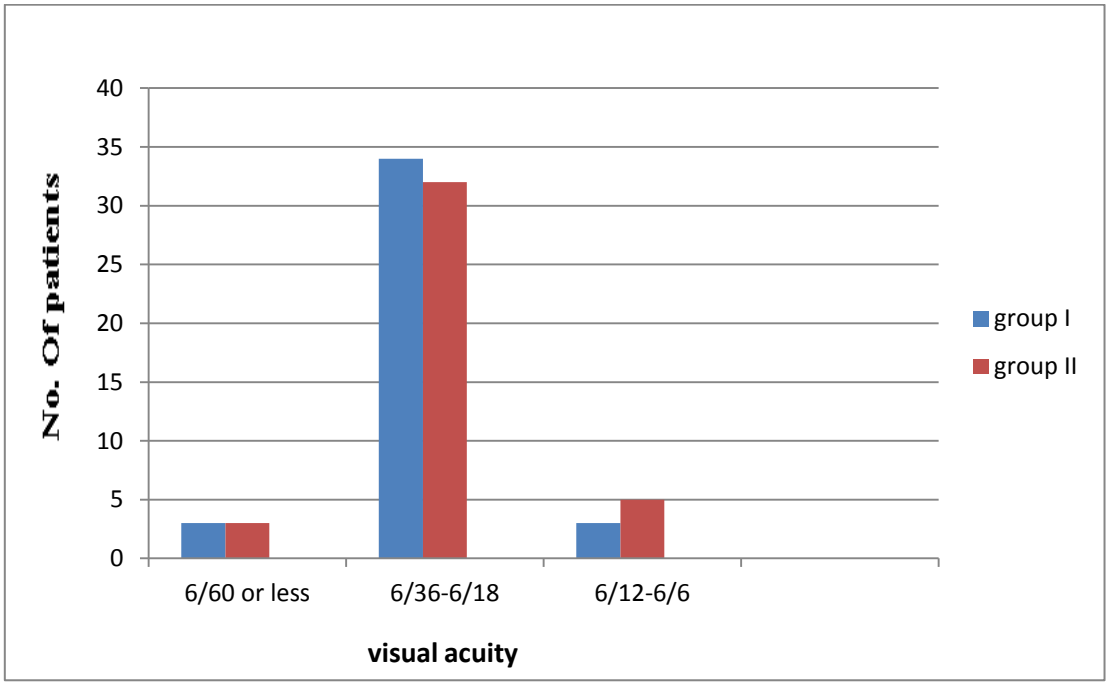


Table 10 Post-operative uncorrected visual acuity at 4th week

Uncorrected Visual acuity	Group I		Group II	
	No	%	No	%
6/60 or less	1	2.5	2	5
6/36-6/18	28	70	26	65
6/12-6/6	11	27.5	10	25

$\chi^2_{(2)} = 0.40$, p=0.81 (not significant)

At the end of 4th postoperative week 70% patients in group I where as 65% patients in group II had uncorrected visual acuity of 6/36-6/18. 27.5% of patients in group I where as 25% patients in group II had visual acuity of 6/12-6/6. The difference between both the groups was found to be statistically insignificant.

Post- operative uncorrected visual acuity at 4th week

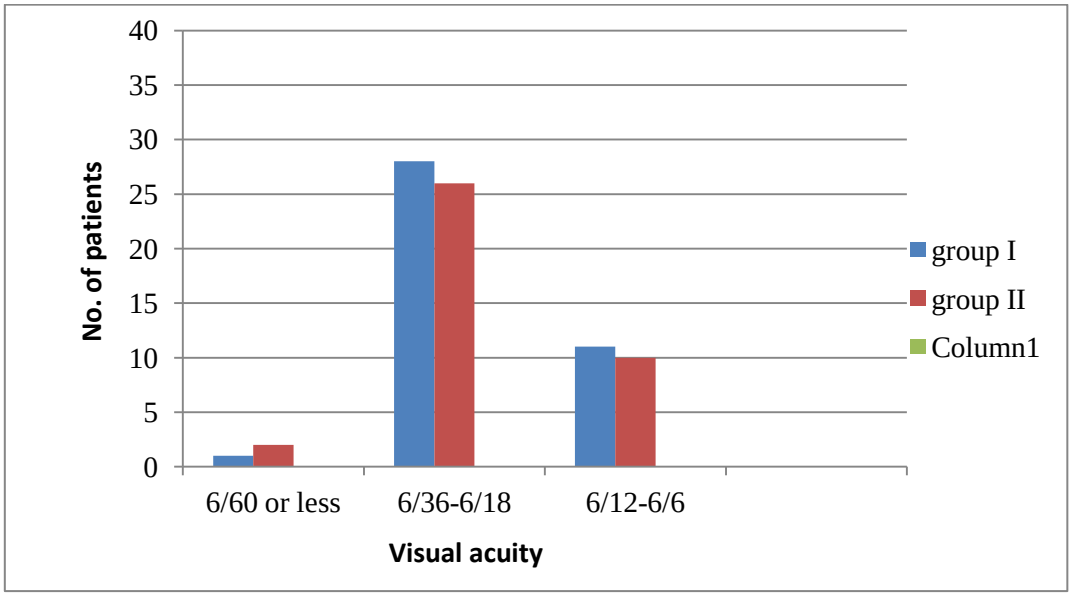


Table 11 Post-operative uncorrected visual acuity at 6th week

Uncorrected Visual acuity	Group I		Group II	
	No	%	No	%
6/60 or less	1	2.5	0	0
6/36-6/18	28	70	24	60
6/12-6/6	11	27.5	16	40

$\chi^2_{(2)} = 2.23$, p=0.32 (not significant)

At the end of 6th postoperative week 70% patients in group I where as 60% patients in group II had uncorrected visual acuity 6/36-6/18. 27.5% of patients in group I where as 40% patients in group II had uncorrected visual acuity of 6/12-6/6. The difference between both the groups was found to be statistically insignificant.

Post -operative uncorrected visual acuity at 6th week

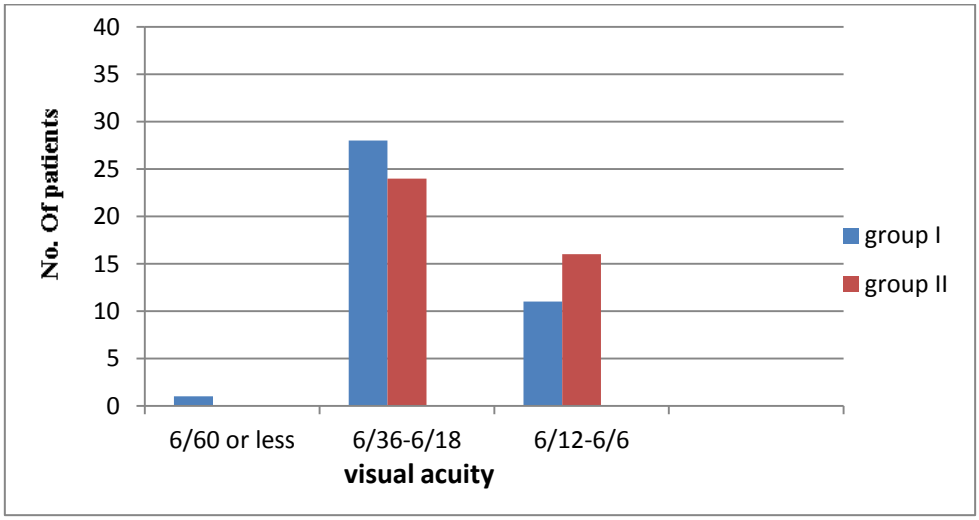


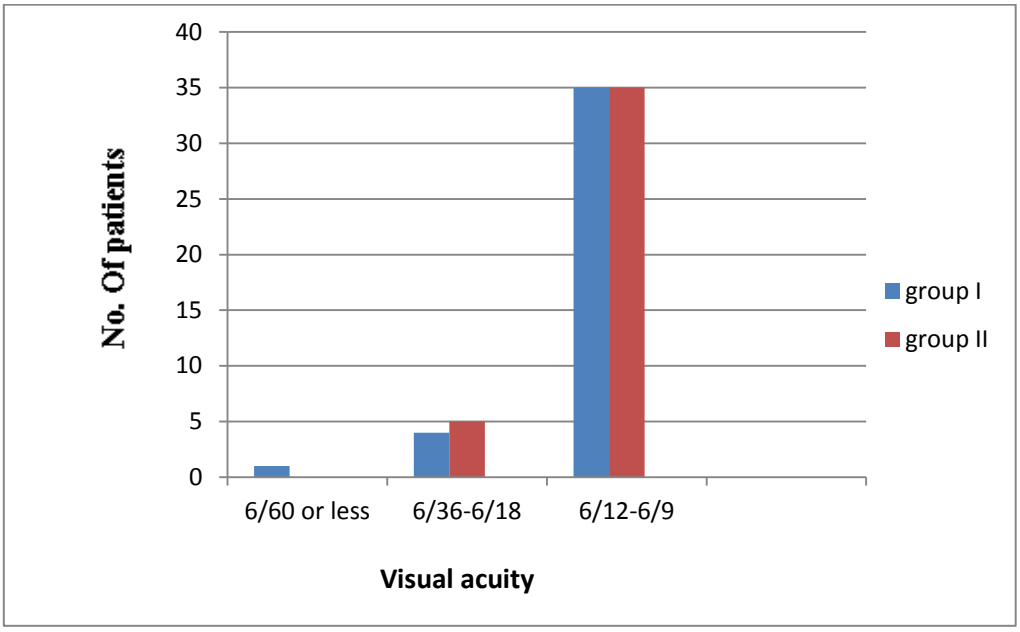
Table 12 Best corrected visual acuity at 6th week

Best corrected Visual acuity	Group I		Group II	
	No	%	No	%
6/60 or less	1	2.5	0	0
6/36-6/18	4	10	5	12.5
6/12-6/6	35	87.5	35	87.5

$\chi^2_{(2)}$ =1.11, p=0.57 (not significant)

At the end of 6th postoperative week 10% patients in group I where as 12.5% patients in group II had best corrected visual acuity of 6/36-6/18. 87.5% of patients in group I and group II had visual acuity of 6/12-6/6. The difference between both the groups was found to be statistically insignificant.

Best corrected visual acuity at 6th week



Discussion

Success of cataract surgery is determined by quicker visual and functional recovery and least surgically induced astigmatism. Factors affecting surgically induced astigmatism are the artitecture and location of incision, the surgical skills, accuracy of biometry and to a greater extent on the pre existing astigmatism. There were a total of 80 patients in our study. in group 1, 40 patients were included who underwent manual SICS with rigid 5.25mm PCIOLs. Group 2 also comprised of 40 patients who had undergone phacoemulsification with rigid 5.25mm PMMA PCIOLs implantation. the comparison was made in terms of surgically induced astigmatism and visual outcome.

In our study mean preoperative astigmatism was found to be 0.95Din group 1 and 0.99D in Group 2. There was statistically no significant difference in the preoperative astigmatism in the two groups. In our study, surgically induced astigmatism was divided into four categories: category I : 0–0.9 D, category II : 1–1.9 D, category III: 2 – 2.9 D, category IV : 3 – 3.9 D.

At the end of 1st week, 77.5% of the patients in group I and 30% in group II had surgically induced astigmatism of 3-3.9 D. 22.5 % of the patient in group I and 50% in group II had surgically induced astigmatism of 2-2.9 D. There was no patient in group I who had a surgically induced astigmatism of 1- 1.9 D and 10% patient in group II had a surgically induced astigmatism of 1- 1.9 D.. The difference of surgically induced astigmatism was statistically highly significant.

At end of 4th week 20% of patient in group I where as 2.5% in group II had surgically induced astigmatism of 3-3.9 D. 47.5% patient in group I where as 37.5% in group II had surgically induced astigmatism of 2-2.9D. 22.50% patient in group I where as 45% in group II had surgically induced astigmatism of 1-1.9D. 10 % of patient in group I where as 15% in group II had surgically induced

astigmatism of 0-0.9D. the difference of surgically induced astigmatism was statistically highly significant.

At the end of 6th week, 2.5% in group I where as no patient in group II had surgically induced astigmatism of 3-3.9 D. 22.5% of patient in group I where as 10% in group II had surgically induced astigmatism of 2-2.9 D. 57.5% patient in group I where as 67.5% in group II had surgically induced astigmatism of 1-1.9 D. 17.5 % of patient in group I where as 22.5% in group II had surgically induced astigmatism of 0-0.9 D. The difference of surgically induced astigmatism was statistically significant.

The difference in mean surgically induced astigmatism between the two groups was statistically highly significant at 1st and 4th week whereas significant at 6th week. Iftikhar S et al (2004) in their study summarized that implantation of 6mm rigid IOL after sutureless phacoemulsification is a safe procedure with acceptable levels of post operative astigmatism. In our study in group II phacoemulsification with implantation of rigid IOL through clear corneal temporal incision 67 % had surgically induced astigmatism of 1-1.9 D at the end of 6th week. Thus surgically induced astigmatism in our study in group II was near similar to the above study.

George R et al (2005) in their study on comparison of endothelial cell loss and surgically induced astigmatism following conventional extracapsular cataract surgery, manual small incision cataract surgery and phacoemulsification with non foldable with intraocular lens implantation found that mean induced astigmatism in ECCE group was 1.77 D, in SICS 1.1 D and in phacoemusification 0.77 D. While SICS did induce a statistically greater amount of astigmatism than phacoemulsification, the magnitude of difference was only 0.4 D.

In our study the visual outcome was recorded as uncorrected visual acuity on 1st post operative day, 1st week, 4th week, 6th week and best corrected visual acuity at 6th week.

On 1st post operative day, both the groups had 57.5% patients with uncorrected visual acuity 6/36-6/18. Similarly both the groups had 15% of patients with uncorrected visual acuity of 6/60 or less. This is mainly because of post-operative corneal oedema which later on resolved. Only 2.5% patients in both the groups had uncorrected visual acuity 6/12-6/6.As the number of patients were same in both the groups, no statistical comparison was made.

At the end of 1st postoperative week 85% patients in group I where as 80% patients in group II had uncorrected visual acuity 6/36-6/18. Only 7.5% of patients in group I where as 12.5% patients in group II had visual acuity of 6/12-6/6. The difference between both the groups was found to be statistically non significant.

At the end of 4th postoperative day 70% patients in group I where as 65% patients in group II had Uncorrected visual acuity 6/36-6/18. 27.5% of patients in group I where as 25% patients in group II had visual acuity of 6/12-6/6. The difference between both the groups was found to be statistically insignificant.

At the end of 6th postoperative week, 70% patients in group I where as 60% patients in group II had Uncorrected visual acuity 6/36-6/18. 27.5% of patients in group I where as 40% patients in group II had visual acuity of 6/12-6/6. The difference between both the groups was found to be statistically insignificant.

At the end of 6th postoperative week 10% patients in group I where as 12.5% patients in group II had best corrected visual acuity 6/36-6/18. 87.5% of patients in group I and group II had visual acuity of 6/12-6/6. The difference between both the groups was found to be statistically insignificant.

Mishra P (2003) reported that the postoperative best corrected visual acuity was 6/12- 6/18 or better in almost 96% of cases at 4weeks follow up in frown incision. In our study we found that 92.5% of cases achieve best corrected visual acuity of 6/18 or better at 6 weeks in group I with small incision cataract surgery with 5.5 mm

incision. Thus the results were comparable with our study.

Alam et al (2007) in their study on comparison of visual acuity and astigmatic changes in phacoemulsification with posterior chamber foldable vs non foldable intraocular lens implant reported that 72% of the patients in group A whereas 52% of the patients in group B had visual acuity of 6/18 or better on 1ST post operative day . At the end of 1st post operative week 88% of the patients had visual acuity of 6/18 or better in group A whereas 96% had visual acuity of 6/18 or better in group B. At the end of first month 96% of the patients in group A whereas 100% of the patients had visual acuity of 6/18 or better. After 1 month in group A 84% of the patients had BCVA of 6/6 while 16% had visual acuity of 6/9 whereas in group B 80% of the patients had visual acuity of 6/6, 16% 6/9 while 4% had visual acuity of 6/12.In our study 87.5% of patients achieved best corrected visual acuity of 6/12-6/6 at 6th post operative week in group II with phacoemulsif-ication with implantation of rigid 5.25mm IOL's. Our results were comparable with the above study in terms of post operative visual outcome.

Conclusion

It can be concluded that phacoemulsification with implantation of rigid 5.25 mm posterior chamber IOL's gives better result as compared to small incision cataract surgery with 5.25 mm posterior chamber IOL's with respect to surgically induced astigmatism but visual outcome was found to be comparable in both the groups as per the statistical analysis. There was no significant difference as far as post operative complications are concerned in both the groups.

- The less postoperative surgically induced astigmatism in group II with phacoemulsification with implantation of rigid 5.25 mm posterior chamber IOL's through clear corneal temporal incision because of following reasons :
- As there is no need of cauterization in clear corneal incision.
- Other possible reason for less astigmatism in case of phacoemulsification could be lack of wound stretching which occurs in MISCS while extraction of nucleus from anterior chamber in toto. In phacoemulsification nucleus is removed as piece meal after fragmenting with phacoemulsification probe and wound enlargement is done in a very controlled manner.
- The other possible reason for less post-operative astigmatism can be because of temporal location of the incision. The temporal location is farthest from the visual axis, and thus the effect of any flattening around the wound is less likely to affect the corneal curvature at the visual axis. Incisions at the temporal location are more stable with respect to against-the-rule shift. When the incision is located superiorly, both gravity and eyelid blink tend to create drag on the incision. With temporally placed incisions, these forces are better neutralized, because the incision is parallel to the vector of the forces. At temporal location, astigmatism induced is with-the-rule. This is advantageous for the large majority of cataract age patients, whose pre-operative astigmatism found to be "against-the –rule".

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