

A STUDY TO COMPARE THE AMOUNT OF ASTIGMATISM FOLLOWING MANUAL SMALL INCISION CATARACT SURGERY AND PHACOEMULSIFICATION

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Abstract

Background: Cataract is the most common cause of reversible blindness worldwide. Surgical removal of cataractous lens remains the only effective treatment for management of cataract blindness. The success of cataract surgery is determined by best and earliest visual recovery. But the occurrence of post-operative astigmatism has become a major hurdle in achieving this goal. The study was designed to compare the amount of astigmatism following manual small incision cataract surgery with phacoemulsification. **Materials and Methods:** This prospective interventional study conducted in a tertiary health care institution over a period of 2 years. A total of 140 eyes were randomised into 2 groups. Group 1 was operated by manual small incision cataract surgery (SICS) and Group 2 by phacoemulsification. The patients were followed up post-operatively at 1st week and 4th week. At each follow up Visual Acuity (VA), Refraction and acceptance, and Keratometry were recorded and the findings were analysed for astigmatism. Descriptive statistics and analytical statistics like chi-square test and Independent sample t-test were generated. A p-value of <0.05 was taken as level of significance. **Result:** The Mean (SD) age of the participants was 64.3± 8.2 years with females constituting 58.6%. At the end of 4 weeks post-operatively the mean (SD) astigmatism of the phacoemulsification group (0.471±0.28 D) was found to be significantly lower as compared to the SICS group (0.885±0.28 D) (p<0.001). At the end of 1st and 4th week of follow up the VA was found to be significantly better in the Phacoemulsification group as compared to the SICS group (p<0.001). **Conclusion:** The result of the study shows that phacoemulsification is the better technique to control post-operative astigmatism as compared to manual small incision cataract surgery.

INTRODUCTION

Cataract is the principal cause of avoidable blindness in India and throughout the world and account for 66.2% blindness in India.^[1] Surgical removal of cataractous lens remains the only effective treatment for management of cataract blindness. The fundamental aim of cataract surgery is removal of the opacified natural lens and replacing it with an artificial intraocular lens to improve vision. There are different techniques of cataract surgery like conventional extracapsular cataract extraction (ECCE), manual small incision cataract surgery (SICS) and phacoemulsification.^[2] The success of cataract surgery is determined by best and earliest visual recovery. The visual outcome depends mainly on the amount of post-operative astigmatism. Surgically induced astigmatism (SIA) is the

astigmatic changes produced due to surgical measures on the cornea. Various factors influence SIA like the type of incision, length and location of incision.^[3] Nowadays, all techniques of cataract surgery are being modified to give best uncorrected visual acuity and early rehabilitation. The study was conducted to find out the best technique of cataract surgery causing least amount of post-operative astigmatism to address the backlog of cataract blindness in our part of the developing world. The study was designed to compare the amount of astigmatism following manual small incision cataract surgery and phacoemulsification.

MATERIALS AND METHODS

This prospective interventional study was conducted in the Department of Ophthalmology in a Tertiary

Institution in Imphal, Manipur, Northeast India Approval of the Institutional Ethics Committee was obtained and Informed Consent was taken from each patient before surgery. The study was conducted over a period of 2 years (2018-20). All patients 50 years and above with uncomplicated senile cataract who consented to participate in the study during the study period were included. Patients with pre-existing astigmatism, complicated cataract, traumatic cataract, cataract with pterygium, corneal opacity, and patients with any intraoperative complication rendering them aphakic, eyes that have undergone previous refractive or ocular surgeries were excluded from the study.

Sample size calculation and sampling: Taking the mean (SD) post-operative astigmatism at 4 weeks for phacoemulsification group as 0.42 ± 0.27 D (Rathi A et al) ⁴ and a treatment effect size of 0.20 ± 17 at 5% significance level both sided with a power of 90% the calculated sample size was found to be 70 in each arm. All patients fulfilling the inclusion criteria were consecutively recruited into the study after obtaining written informed consent. Study participants were randomly assigned into two groups namely: Group I (70 eyes) as SICS group and Group II (70 eyes) as Phacoemulsification group using restricted block randomisation technique using a block size of 4.

Preoperative assessment of the patients was performed meticulously. Visual acuity, slit lamp examination of the anterior segment, funduscopy, intraocular pressure measurement, keratometry using Bausch and Lomb keratometer and IOL power calculation was done using A-scan ultrasonography and SRK-II formula.

Surgical techniques: The same surgeon perform both the types of cataract surgery in all the patients to avoid intra surgeon variations. Group I were operated by manual SICS and Group 2 by Phacoemulsification. An adequate mydriasis was obtained with Tropicamide 0.8% and Phenylephrine 5%. All cases were operated under local anaesthesia by peribulbar injection of a mixture of 2% Lignocaine and Hyaluronidase in the concentration of 1.2 units/ml. In SICS, partial thickness frown incision 6.5mm in length was given 2mm posterior to limbus superiorly. A self-sealing scleral tunnel was constructed. Side port was made at 9 o' clock position and continuous curvilinear capsulorrhexis performed after staining with Trypan blue. A 2.8mm keratome was used to assess the anterior chamber superiorly. Hydrodissection was done and lens was brought to anterior chamber and delivered using an irrigating Vectis. Cortical wash was done with Simcoe canula and PCIOL implanted in the capsular bag. Viscoelastic substance was washed and anterior chamber maintained with balance salt solution. Side port hydrated and intracameral Moxifloxacin injected.

In group II, phacoemulsification was done using Alcon Infiniti machine. After peribulbar anaesthesia, side ports were made at 9 o' clock and 1 o' clock positions and continuous curvilinear capsulotomy

was done. Hydro dissection were performed and the nucleus was emulsified using stop and chop technique. A foldable PCIOL (Posterior chamber intra ocular lens) was implanted in the capsular bag, viscoelastic substance replaced with balance salt solution and intracameral Moxifloxacin injected after hydrating the side ports. Post-operative antibiotic-steroid applied for 4 weeks in tapering doses.

Patients were followed-up at 1st week and 4th weeks post-operatively. At each follow-up, the following were recorded: - 1) Visual acuity 2) Refraction and acceptance and 3) Keratometry.

Visual acuity was recorded by Snellen's test type for literate patients and Landolt's ring or E-chart for illiterate patients. Refraction was measured by Retinoscopy, Pinhole test, Acceptance after Trial and error and Automated refractometer. Keratometry was performed with Bausch and Lomb Keratometer to measure the curvature of anterior surface of cornea. During the study for detection of post-operative astigmatism, the same investigator uses the same keratometer for the same patient at each follow-up to avoid intra-observer bias.

Statistical analysis: Data analysis was conducted using SPSS software version 20 (IBM Corp., Armonk, NY). Descriptive statistics were analyzed using mean, percentage and proportion. Analytical statistics like chi-square test and t-test were used to test for association. A p-value of <0.05 was taken as level of significance.

RESULTS

A total of 140 eyes with uncomplicated senile cataract were recruited in the study and were randomly assigned into two groups namely Group I (SICS group) of 70 eyes and Group II (phacoemulsification group) of 70 eyes. The Mean (SD) age of the participants was 64.3 (8.2) years with a Median age of 65 years, ranging from 50-87 years. Males constituted 58(41.4%) and females 82(58.6%). There were no lost to follow up. Taking median age group of 65 the participants were divided into two age groups of <65 years and 65 years & above.

At the baseline the two groups were comparable in terms of age, gender and vision at admission [Table 1].

At the first follow up the Phacoemulsification group showed a significantly better vision improvement (47, 82.5%) as compared to the SICS group (10, 17.5%) with a p-value <0.001. Similarly at the last follow up the Phacoemulsification group showed better improvement of vision 6/6 to 6/9 as compared to the SICS group and the difference was found to be statistically significant. [Table 2]

The Mean \pm SD (1.238 ± 0.27 D) amount of astigmatism of the phacoemulsification group at the first follow up was found to be significantly lower than the mean \pm SD (1.778 ± 0.47 D) astigmatism of the SICS group (p<0.001). Similarly at the last follow-up the Phacoemulsification group showed a

significantly lesser amount of astigmatism as compared to the SICS group ($p < 0.001$) [Table 3].

Table 1: Showing baseline characteristics of the participants by groups (N=140)

Characteristics	Category	SICS group N(%)	Phacoemulsification group N(%)	p- value
Age (Yr)	<65	30 (44.1)	38 (55.9)	0.176
	≥65	40(55.6)	32(44.4)	
Gender	Male	28(48.3)	30(51.7)	0.731
	Female	42(51.2)	40(48.8)	
Vision at admission	3/60 and worse	31(45.6)	37(54.4)	0.310
	6/60 and better	39(54.2)	33(45.8)	

Table 2: Showing Vision at first and last follow-up of the participants by groups (N=140)

Characteristics	Category	SICS group N(%)	Phacoemulsification group N(%)	p- value
Vision at first follow up	6/6 to 6/9	10(17.5)	47(82.5)	0.001
	6/12 and worse	60(72.5)	23(27.7)	
Vision at last follow up	6/6 to 6/9	57(44.9)	70(50.1)	0.001*
	6/12 and worse	13(100)	0(0)	

*Fisher's Exact Test

Table 3: Comparison of amount of astigmatism at first and last follow in the two groups using t-test (N=140)

Variable	Groups	Mean ±SD	Mean difference	t-value	p-value
Astigmatism at first follow-up	SICS	1.778 ±0.47	0.550(0.420-0.679)	8.384	0.001
	Phacoemulsification	1.238±0.27			
Astigmatism at last follow-up	SICS	0.885 ±0.28	0.414(0.329-0.498)	9.718	0.001
	Phacoemulsification	0.471±0.22			

DISCUSSION

Astigmatism prevention and control is one of the biggest challenges for a surgeon after cataract surgery. The mean post-operative astigmatism in the last follow-up at 1 month in this study is 0.885 ± 0.28 in the SICS group and 0.471 ± 0.22 in the Phacoemulsification group. This finding is similar to that of Rathi et al,^[4] of Post-Operative Refraction (Cylindrical) 1 month of 0.79 ± 0.44 in manual SICS and 0.42 ± 0.27 in Phacoemulsification group. Ruit et al,^[5] reported mean astigmatism of 0.7D for Phaco group and 0.88D for MSICS group at 6 months follow-up. A study by Ramalakshmi V et al,^[6] found on 40th postoperative day, mean SIA in the phacoemulsification group of 1.100476 and 1.124333 in the MSICS group, showing higher SIA in the MSICS group. Similarly, Gogate et al,^[7] reported a mean astigmatism of 1.1D for phaco and 1.2D for MSICS. Venkatesh R et al,^[8] and George R et al,^[9] reported that phaco caused significantly lesser surgically induced astigmatism compared with MSICS at 6 weeks postoperatively. Gogate P et al,^[10] showed that phacoemulsification group had statistically significantly less astigmatism ($p=0.005$) and more eyes with UCVA (Uncorrected Visual Acuity) of 6/9 (0.040). Harakuni U et al,^[11] did a study on astigmatism in phacoemulsification by placing incision on the steepest meridian and showed that the average SIA recorded was $0.54D \pm 0.34D$. Priyanka et al,^[12] found in their study at 3 months postoperative, the mean astigmatism was $0.808 \pm 0.34D$ in the phaco group and $1.565 \pm 0.51D$ in the MSICS group.

Our study found that Phacoemulsification group showed significantly better visual outcome than SICS group in all the first and last follow-up. Priyanka et

al,^[12] found at postoperative 80% of patients in the MSICS group had uncorrected visual acuity better than or equal to 6/18 versus 88% of patients in the phacoemulsification group. Pathak M et al,^[13] found that phacoemulsification delivered better postoperative visual outcome than MSICS in PPC (Posterior Polar Cataract) patients. Another study by Khanna RC et al,^[14] found that the number of patients having postoperative BCVA (Best Corrected Visual Acuity) $\geq 6/12$ was similar in both the groups (84.3% for MSICS and 88% for phacoemulsification). Waragade N et al,^[15] found in their studies that 99.6% of patients from Phaco group achieved BCVA of 6/18 or better as compared to 97.6% in SICS group. Ahmed MS,^[16] found no statistically significant differences between the phacoemulsification and SICS group in visual outcome or proportion of patients with normal vision at follow-up. Ramalakshmi V et al,^[17] found in their study that VA outcome of both the groups was comparatively the same, but mean induced astigmatism after cataract surgery and intra and post-operative complications were slightly higher in MSICS than in phacoemulsification group. Naik AU,^[18] found no statistically significant differences in terms of intra and post-operative complications following cataract surgery by SICS and phacoemulsification in Pseudo-exfoliation Syndrome. Thus, Phacoemulsification is the preferred technique of cataract surgery among eye surgeons all over the world irrespective of the types of cataracts.^[19,20] The limitations of our study is that longer duration of follow up was not done to ascertain the amount of post-operative astigmatism.

CONCLUSION

From our study, we have concluded that Phacoemulsification produces better visual outcome

and lesser surgically induced astigmatism than small incision cataract surgery. Though SICS is an affordable alternative of cataract surgery, people who requires earliest and best visual outcome and who can afford should be given the phacoemulsification alternative.

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