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A Comparative study to evaluate visual outcome in Post-operative patients of small incision cataract surgery and phacoemulsification

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Abstract
Aim*:* A comparative study to evaluate visual outcome in post-operative patients of Small Incision Cataract Surgery and Phacoemulsification. **Design:** A prospective, comparative hospital based interventional study was conducted on 1450 eyes having visually significant senile cataract undergoing cataract extraction surgery by either of two methods visSmall Incision Cataract Surgery or Phacoemulsification at **Department of ophthalmology, Era University, Lucknow**. A detailed post-operative examination was carried out on first post-operative day, then follow-up of patients of both the study groups (SICS and Phacoemulsification) regarding BCVA was carried out in Eye O.P.D. on 7th, 15th, 30th and 45th day. **Results:** There was no significant difference between the SICS & Phacoemulsification in terms of BCVA at Post-Operative 15 days month, Post-Operative Spherical Refraction at 15 days (p = 0.693) and 45 days (p = 0.640). But there was significant difference between two groups in terms of Cylindrical Refraction at Post-Operative 1 Week) (p=<0.001) and at 1 Month (p = <0.001) with the median Post-Operative Cylindrical Refraction higher in M-SICS group at 1 week & 1 Month. The median Post-Operative Cylindrical Refraction difference is all due to the fact that SICS had larger surgical incision causing higher surgically induced astigmatism. **Conclusions:** Phacoemulsification gives better uncorrected visual acuity (UCVA) at post-operative day 45 days and better BCVA at 1week and Post-Operative Cylindrical Refraction at 15days and at 45 days. Whereas, BCVA at 45daysare similar in both the study groups SICS andPhacoemulsification.

Keywords: Manual Small Incision Cataract Surgery, Phacoemulsification, Hydrophobic PCIOL Lenses, Visual outcome.

I. INTRODUCTION

The word Cataract has been derived from the Greek word 'katarrakatas' which means 'Waterfall'. Cataract can occur due to either formation of opaque lens fibres (Congenital or Developmental Cataract) or due to degenerative process causing opacification of the transparent lens fibres (Acquired Cataract or Secondary Cataract). [1] Senile cataract is an age related, vision impairing disease characterized by gradual, progressive thickening of the lens. It is one of the world's leading causes of avoidable blindness.[2]All techniques of cataract extraction are being modified to achieve best uncorrected visual acuity and early rehabilitation.[3] Phacoemulsification and small- incision cataract surgery (SICS) is the most done procedures. [4] In our country, there is a large volume of cataract backlog, mainly among the rural and suburban population. Phacoemulsification is considered the gold-standard procedure for cataract. However, SICS has emerged as a popular procedure of choice in the surgical treatment of cataracts as it is less expensive and is as effective as phacoemulsification. [5] It may be considered a better procedure for doing mass surgeries. [6] However, SICS comes with its own set of limitations. Surgically induced astigmatism (SIA) remains a common cause of poor postoperative visual recovery. [7] Siteandsizeofscleralincisionarethefactors which influence the SIA. [8] Larger the incision size more is the astigmatism. However, when the size is kept constant, the main determinant for SIA is the site of the scleral incision. The purpose of this comparative hospital-based study was to assess the visual outcome in the post-operative M-SICS and Phacoemulsification.

II. MATERIAL & METHODS

In our prospective, comparative, hospital-based study conducted on patients undergoing cataract

extraction surgery bySICS & Phacoemulsification method at **Department of ophthalmology, Era University, Lucknow**. In this study 1450 consecutive patients scheduled for intraocular cataract surgery were randomly divided into two groups of 787 in SICS and 663 in phacoemulsification group. All the patients in both the groups were above the age of 40 years with visually significant age-related uncomplicated cataract. Only hydrophobic type of posterior chamber intraocular lenses was implanted in each patient. All patients were given peribulbar regional anesthesia of 6ml of injection 2% lignocaine & 4ml of injection 0.05% bupivacaine mixed with 1500 IU hyaluronidase. A detailed post-operative examination was carried out on first post-operative day, then follow-up of patients of both the study groups (SICS and Phacoemulsification) regarding BCVA was carried out in Eye O.P.D. on 7th, 15, 30 and 45th day.

III. RESULTS

In this study, mean age in phacoemulsification group was 60.34±8.5 in comparison to 59.63±8.36 in SICS group and there was no significant statistical difference was found between two groups in terms of age. With respect to gender distribution, phacoemulsification group had 333 (50.2%) males, and330 (49.8%) females as compared toSICS group, where there were 393 (49.9%) males, and 394 (50.1%) females with (p=1) suggesting no significant statisticaldifference.

Table 1: Gender distribution in both groups (n=1450)

SICS (n=787)			**Phacoemulsification** (n=663)	
	Frequency	Percent	Frequency	Percent
Female	394	50.1	330	49.8
Male	393	49.9	333	50.2
Total	787	100.0	663	100.0

There was a no significant statically difference between two groups with regards to Nuclear Sclerosis Grade (X^2 = 12, p < 0.213). Phacoemulsification had the larger proportion of Nuclear Sclerosis Grade NS4 as in comparison to SICS group which had the larger proportion of mature nuclei.

Table 2: Grade of cataract in both groups (n=1450)

SICS (n=787)			**Phacoemulsification** (n=663)	
	Frequency	Percent	Frequency	Percent
NS-I	44	5.6	83	12.5
NS-II	350	44.5	256	38.6
NS-III	340	43.2	261	39.4
NS-IV	53	6.7	63	9.5
Total	787	100.0	663	100.0

There was no significant difference noticed between two groups when distribution of Vision Category at Post-Operative Day-1 was compared, (X^2 =2.00, p = 0.157). Due to surgical incision size, surgical induced astigmatism, corneal edemadue to more manipulation during surgery.

Table-3: Visual acuity after 5 hours (Post-Operative 1 day) (n =1450)

Visual acuity after 5 hours (Post-Operative 1 day)	**SICS**		**Phacoemulsification**		***X*²** **Value**	**p Value**
	Frequency	Percent	Frequency	Percent		
6/60	2	.3	4	.6	2	.157
FC at 6 m	785	99.7	659	99.4		
Total	787	100.0	663	100.0		

At Post-Operative Day-7, visual acuity was measured and compared, wherein, no statistically significant difference was found between two groups in terms of distribution of Vision Category.

Table-4: Visual acuity after Post-Operative 7 day (n= 1450)

Visual acuity after Post-Operative 7 days	SICS		Phacoemulsification		X^2 Value	p Value
	Frequency	Percent	Frequency	Percent		
6/24	3	.4	6	.9	2	.157
6/60	784	99.6	657	99.1		
Total	787	100.0	663	100.0		

At Post-Operative Day-15, visual acuity was measured and compared, wherein, no statistically significant difference was found between two groups in terms of distribution of Vision Category.

Table-5: Visual acuity after Post-Operative 15 days (n= 1450)

Visual acuity after Post-Operative 15 days	SICS		Phacoemulsification		X^2 Value	p Value
	Frequency	Percent	Frequency	Percent		
6/12	98	12.5	122	18.4	20	.220
6/18	135	17.2	14	2.1		
6/24	30	3.8	183	27.6		
6/36	473	60.1	290	43.7		
6/9	51	6.5	54	8.1		
Total	787	100.0	663	100.0		

_____At Post-Operative Day-30, visual acuity was measured and compared, wherein, no statistically significant difference was found between two groups in terms of distribution of Vision Category.

Table-6: Visual acuity after Post-Operative 30 days (n= 1450)

Visual acuity after Post-Operative 30 days	SICS		Phacoemulsification		X^2 Value	p Value
	Frequency	Percent	Frequency	Percent		
6/12	109	13.9	47	7.1	35	.243
6/18	33	4.2	22	3.3		
6/24	76	9.7	218	32.9		
6/36	398	50.6	203	30.6		
6/6	14	1.8	13	2.0		
6/60	37	4.7	22	3.3		
6/9	120	15.2	138	20.8		
Total	787	100.0	663	100.0		

At Post-Operative Day-45, visual acuity was measured and compared, wherein, no statistically significant difference was found between two groups in terms of distribution of Vision Category.

Table-7: Best Corrected Visual acuity after Post-Operative 45 day (n= 1450)

Best Corrected Visual acuity after Post-Operative 45 day	SICS		Phacoemulsification		X^2 Value	p Value
	Frequency	Percent	Frequency	Percent		
6/12	8	1.0	7	1.1	48	.243
6/18	23	2.9	16	2.4		
6/24	305	38.8	315	47.5		
6/36	89	11.3	7	1.1		
6/6	204	25.9	227	34.2		
6/60	3	.4	2	.3		
6/9	143	18.2	72	10.9		
FC 3M	12	1.5	17	2.6		
Total	787	100.0	663	100.0		

However, the initial difference between the two groups equalized after 1 month as no significant difference was noticed between these groupswhenBCVA was compared (X^2 = -, p = -). Almost all the participants in both the groups had visual outcome of 6/18 or Better afterone-month time.Post-Operative Refraction in terms of Spherical Correction at 7 days and 1 month was not normally distributed in the 2 subgroups. Thus, non- parametric tests (Wilcoxon Test) were used to make group comparisons. No significant difference between the groups was there at 15 days and 45 days with p = 0.693 and p=0.640 respectively. As spherical correction is dependent on pre-operative Biometry and IOL power calculation.

Table-8: Comparison of the 2 Subgroups in Terms of Post-Operative Refraction (Spherical) after 15 days (n=1450)

	SICS		Phacoemulsification		Wilcoxon Test	
Post-Operative Refraction - Spherical (1 week)	Frequency	Percent	Frequency	Percent	*W*	p Value
Mean	-0.64		-0.71		7782	0.693
Median	-0.75		-0.75			
Range	-1.75-2.5		-2.5-2.5			

Table-9: Comparison of the 2 Subgroups in Terms of Post-Operative Refraction (Spherical) after 45 days (n=1450)

	SICS		Phacoemulsification		Wilcoxon Test	
Post-Operative Refraction - Spherical (1 week)	Frequency	Percent	Frequency	Percent	*W*	p Value
Mean	-0.64		-0.71		7782	0.640
Median	-0.75		-0.75			
Range	-1.75-2.5		-2.5-2.5			

The variable Post-Operative Refraction in terms of Cylindrical correction was compared at 7 days and a significant difference between2 groups withp <0.001, with the mean Post-Operative Refraction (Cylindrical) at 1 Week being highest in the Group SICS group (-0.80D) as compared to Phacoemulsification (-0.41D) due to surgically induced astigmatism inSICS.

Table-10: Comparison of the 2 Subgroups in Terms of Post-Operative Refraction (Cylindrical) after 15 days (n=1450)

	SICS		**Phacoemulsification**		**Wilcoxon Test**	
Post-Operative Refraction - Spherical (1 week)	Frequency	Percent	Frequency	Percent	*W*	p Value
Mean	-0.64		-0.71		11514.00	<0.001
Median	-0.75		-0.75			
Range	-1.75-2.5		-2.5-2.5			

Significant difference persisted between 2 groups in terms of Post-Operative cylindrical correction at 45 days with p <0.001 and median Post-Operative Cylindrical correction was still higher in SICS group but there was a decrease in mean cylindrical correction in individual group at 45 days as compared with that of 15 days.

Table-11: Comparison of the 2 Subgroups in Terms of Post-Operative Refraction (Cylindrical) after 45 days (n=1450)

	SICS		**Phacoemulsification**		**Wilcoxon Test**	
Post-Operative Refraction - Spherical (1 week)	Frequency	Percent	Frequency	Percent	*W*	p Value
Mean	-0.64		-0.71		11534.00	<0.001
Median	-0.75		-0.75			
Range	-1.75-2.5		-2.5-2.5			

IV. DISCUSSION

This prospective study was conducted to evaluate the impact of cataract surgery on the visual outcome of individuals who underwent two differentSICS and Phacoemulsification techniques.

There was no significant difference between the groups in terms of Age (Years) Mean age was 63 in the two study groups[9,10,11], which is consistent with reports of other studies like that of Sharma D et.al and Kanski JJ *et al*. where the mean age of patients was slightly higherthanyears.**[12],[13]**In this study there was not much significant difference between the various groups in terms of distribution of gender (mean women (n= 61) and men (n=62) in both groups) which is constant with the results observed in the previous studies like Javed U *et al*.[11]There was a significant difference between the various groups in terms of distribution of Nuclear Sclerosis Grade (X^2 = 43.552, p = <0.001). Phacoemulsification group had the larger proportion of participants had Nuclear Sclerosis Grade: NS4 in comparison to SICS group where larger proportion of participants (35 patients i.e., 28.5%) had mature nuclei. The SICS group had higher proportion of patients with mature nuclei grade as illustrated by Hesham A *et al*.[14]Gogate *et al*.[15] published a meta-analysis in 2015 where phacoemulsification and SICS were compared in terms of safety, efficacy, and expenses. This review analyzed, 11 comparative studies documenting 76,838 eyes that had undergone cataract surgery. UCVA of 6/18 and 6/18 BCVA were comparable between techniques (P = 0.373 and P = 0.567, respectively). BCVA of 6/9 was comparable between techniques (P = 0.685). UCVA of 6/60 and 6/60 BCVA aided and unaided vision were comparable (P = 0.126 and P = 0.317, respectively). There was no statistical difference in: Endothelial cell loss during surgery (P = 0.298), intraoperative (P = 0.964) complications and postoperative complications (P = 0.362).The phacoemulsification group had statistically significantly less astigmatism (P = 0.005) and more eyes with UCVA of 6/9 (P = 0.040). The average time for SICS was lower than phacoemulsification andcost<½ of phacoemulsification.Gamal Mostafa Abo El Maaty *et al*.[16] in 2014, & Ruit S *et al*.[17] compared the surgically induced astigmatism, financial cost, intraoperative difficulties and complications andpostoperative complications and visual outcome of manual sutureless small incision cataract surgery (SICS), planned extracapsularcataractextractionand phacoemulsification. Indra T. Mahayana *et al*.[18] also suggested in their study independently that there was no statistical difference in visual outcome between

both groups (p=0.10) after 1 month and 6 months respectively. V Ramalakshmi1 *et al*.[19] in their study showed that visual outcome was comparable in phacoemulsification and SICS groups. Both are equally safe and effective in skilled hands to acquire better visual outcome. As per our study there was no significant difference between both the groups in terms of distribution of Vision Category at Post-Operative 1 month with p = 0.000, Post-Operative Spherical correction at 1 Week with p=0.693 and 1 month with p = 0.640. Almost all the participants in both the groups had visual outcome of 6/18 or Better after one-month time. However, there was a significant difference between the 2 groups in terms of Post-Operative Cylindrical correction at 1 Week (p=<0.001) & 1 Month (p=<0.001) with the median Post-Operative Cylindrical correction at 15 days being highest in the SICS Group because of the larger size of the surgical incision and thereafter surgically induced astigmatism esp. more after 15 day than 45 days.

V. CONCLUSION

Participants in the Phacoemulsification group had the better proportion of Vision Category correction compared to SICS group which is justified by the difference in the size of incision, surgically induced astigmatism as well as more manipulation of anterior chamber during surgery causing corneal edema following surgery.There was no significant difference between theSICS & Phacoemulsification in terms of BCVA at Post- Operative 1-month, Post-Operative Spherical correction at 1 Week (p = 0.693) & 1 month (p = 0.640).Due to the fact that SICS had larger surgical incision which resulted in higher surgically induced astigmatism at post-operative 15thDay and 45 days, there was significant difference between the M-SICS & Phacoemulsification in terms of Post-Operative Cylindrical Refraction at 1 Week (p = <0.001) & 1 Month (p = <0.001) with the median Post-Operative Cylindrical Refraction higher in SICS group at 15 days&45 days.

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