ORIGINAL ARTICLE

Comparison of Visual Outcomes between Phacoemulsification and Small Incision Cataract Surgery

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Abstract

Background: Globally, it is approximated that there are around 100 million cases of cataracts resulting in visual acuity of less than 6/60, and this number is expected to increase to approximately three to four times more for cases causing acuity of less than 6/18. Small incision cataract surgery is distinguished by its ability to provide early wound stability, reduce post-operative inflammation, eliminate suture-related complications, necessitate fewer post-operative visits, and have a milder impact on the corneal endothelium. This approach can be applied to all types of cataracts, unlike phacoemulsification, where careful case selection is particularly crucial, especially for less experienced surgeons.

Objective: The objective of this study is to compare the visual outcome between Phacoemulsification and Small Incision Cataract surgery.

Methods: An experimental interventional study was conducted concurrently at Kulsoom Bai Valika Social Security Hospital and Sindh Govt. Qatar Hospital from January 2022 to January 2023. During this study, Phacoemulsification and Small Incision Cataract Surgery (SICS) procedures were performed. The research received approval from the relevant authorities at both hospitals. The study included a total of 200 participants, with one group undergoing SICS and the other group undergoing phacoemulsification, each consisting of 100 patients. To assess the relationship between the two procedures, a statistical analysis employing either the Chi-square or Fisher's test was conducted, and for LogMAR Mann-Whitney test with a p-value of 0.05 was deemed statistically significant.

Results: The age difference between the two groups was found to be statistically insignificant, with a p-value of 0.158. The mean age for the SICS group was 54.96 ± 11 years, while the mean age for the Phacoemulsification group was 57.3 ± 12 years. In terms of gender distribution, the SICS group consisted of 47 females and 53 males out of 100 participants, while the Phacoemulsification group had 45 females and 55 males out of 100 participants. The results indicate that there was no significant difference in the mean best-corrected visual acuity (BCVA) between both groups, with a p-value of 0.36. In the Phacoemulsification and SICS groups, 86 and 83 patients out of 100, respectively, achieved a BCVA of 6/6-6/12 [LogMAR (0-0.3)].

Conclusion: The postoperative mean visual acuity in both the SICS and Phacoemulsification groups was found to be similar. Nevertheless, it's noteworthy that the SICS procedure offers significant cost-effectiveness and can be a viable option for cataract treatment, enabling economically disadvantaged patients to achieve excellent vision.

Keywords: *Small Incision cataract surgery, phaco emulsification, cataract, visual outcomes, Karachi.*

INTRODUCTION

Cataract stands as a primary factor in avoidable blindness, accounting for approximately 66.2% of the estimated 50 million cases of preventable blindness [1]. The term "operable cataract" is employed to describe a cataract for which both the patient and the surgeon have mutually agreed to pursue cataract surgery [2]. Globally, it is estimated that there are around 100 million individuals with cataracts causing a visual acuity of less than 6/60, and this number is projected to increase to approximately three to four times more for those with cataracts causing an acuity of less than 6/18. This number is expected to double if there is no improvement in eye care services [2]. Restoring nearly normal vision can be achieved by removing the opacified lens and implanting an intraocular lens (IOL) or by using spectacles. Phacoemulsification is the most widely preferred technique for this purpose [3]. Phacoemulsification is preferred over other techniques due to its safety, effectiveness, and ability to provide early visual recovery. However, its higher cost, the need for machine upgrades, and ongoing maintenance make it less suitable for implementation in developing countries [4].

Small incision cataract surgery (SICS) is distinguished by its prompt wound stabilization, reduced post-operative inflammation, absence of suture-related complications, fewer follow-up visits, and less adverse impact on the corneal endothelium. Notably, this surgical approach can be applied across a broad spectrum of cataract types, in contrast to phacoemulsification, where the careful selection of cases is particularly crucial, especially for less experienced surgeons [5]. The primary goal of cataract surgery is to attain improved unaided visual acuity while ensuring a swift post-surgical recovery and minimizing intraoperative complications. This study aims to assess the differences in visual rehabilitation between Phacoemulsification and Small Incision Cataract surgery.

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METHODS

This study was conducted as a quasi-experimental interventional study, simultaneously at Kulsoom Bai Valika Social Security Hospital and Sindh Govt and Qatar Hospital from January 2022 to January 2023. During this period, both Phacoemulsification and Small Incision Cataract surgeries (SICS) were performed. The research received approval from the respective authorities of both hospitals.

The sample size for the study was determined using the online version of OPEN-EPI, employing the RCT calculation option. The proportions of best-corrected visual acuity were 52.5% for the SICS group and 22.5% for the Phaco group [6]. Calculations based on these proportions, with 80% statistical power and a 95% confidence interval, suggested a sample size of 40 per group. However, for more robust results, a larger sample of 100 patients per group was studied.

A total of 200 patients with senile cataracts were recruited for the procedures and divided into two groups using a non-random selection method. Written informed consent was obtained from all the patients. One group (Group 1) underwent SICS, while the other (Group 2) underwent phacoemulsification, with each group consisting of 100 patients. Patients with congenital and secondary cataracts (those resulting from uveitis, steroid use, or trauma) were not included in the study.

The study evaluated complications experienced by the surgeon before and after the procedures, including issues such as corneal complications (striate keratopathy, corneal edema), anterior chamber reactions, iatrogenic trauma to the iris, anterior chamber hyphema, posterior capsular rupture, vitreous prolapse, nucleus drop, and lens implantation into the anterior chamber (A/c I.O.L). Patients were followed up for four weeks after the procedure. The best-corrected visual acuity (BCVA) at the end of the fourth week was chosen as the visual outcome measure. BCVA was assessed using the Snellen chart both before and after the surgery, and the Snellen chart values were categorized into subgroups: 1. Worse than 6/60; 2. < 6/12 to 6/60. These preoperative and postoperative measures were then compared. Snellen chart values were also converted to logMAR chart visual acuity for quantitative analysis of group differences.

Inclusion Criteria

Patients of a minimum age of 18 years were considered for inclusion in the study.

Patients with cataracts categorized as grade 1, 2, or 3 of nuclear sclerosis were eligible for inclusion.

Exclusion Criteria

Patients with cataracts categorized as grade 4 or higher of nuclear sclerosis were excluded from the study. Patients under the age of 18 with cataracts were not included. Patients with comorbidities such as glaucoma, uveitis, lens subluxation, retinal or macular pathologies, and those with aphakic lenses were excluded from the study.

Categorical data were presented as percentages and frequencies, while quantitative data were reported using means and standard deviations. Statistical analysis included the use of a two-sample t-test and Mann-Whitney test after assessing the normality of the data with the Shapiro-Wilk test. To assess the association

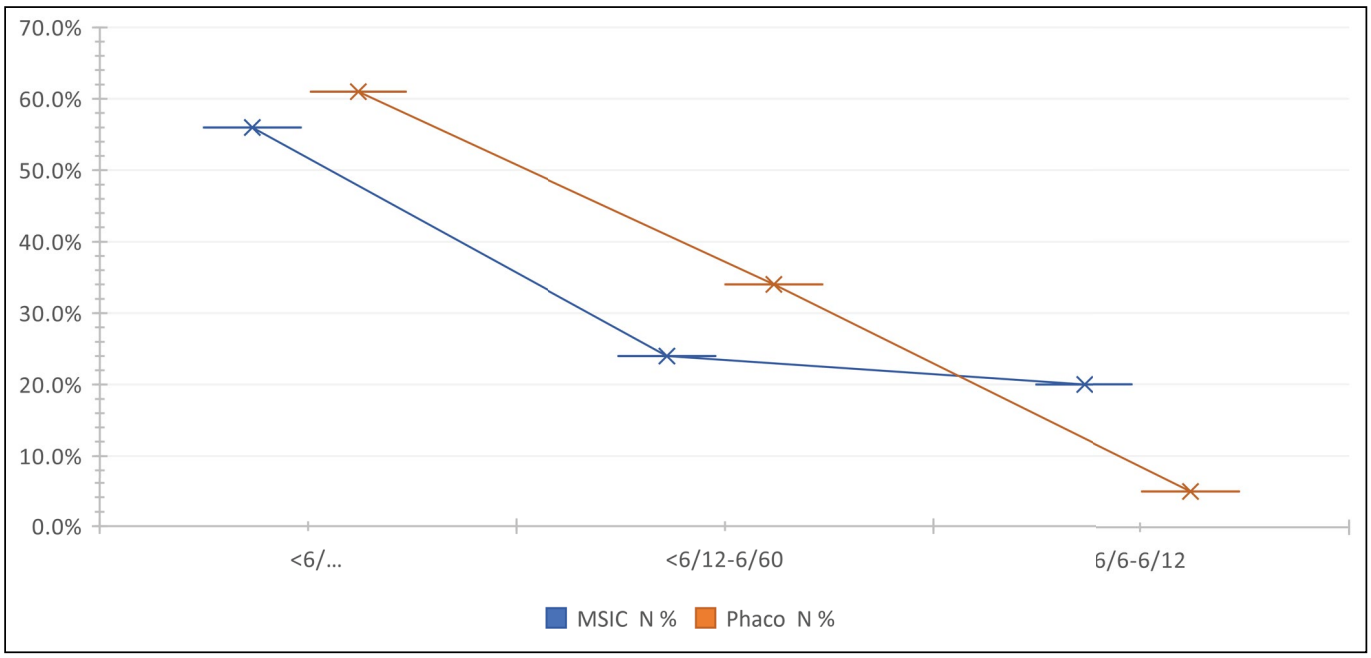

Fig. (1): Best corrected vision of patients before the procedure: in SICS and Phaco Group.

Table 1: Demographics and Risk Factors associated with type of surgery.

Demographics & Risk Factors		Overall n(%)	Procedures Groups		
			SICS n(%)	Phacoemulsificationn n(%)	p-value
Age (Mean± SD)		56 ± 12	54.96 ± 11	57.3 ± 12	0.158ɬ
LogMAR Chart	Preoperatively	1 (0.75-1)	1 (0.75-1)	1 (0.75-1)	0.36
	Postoperatively	0 (0-0.3)	0 (0-0.3)	0 (0-0.3)	
Gender	Female	92 (46)	47 (47)	45 (45)	0.777
	Male	108 (54)	53 (53)	55 (55)	
BCVA Preoperative	>6/60	117 (58.5)	56 (56)	61 (61)	0.042
	>6/12-6/60	58 (29)	24 (24)	34 (34)	
	6/6-6/12	25 (12)	20 (20)	5 (5)	
BCVA Post-operative	<6/60	12 (6)	5 (5)	7 (7)	0.803
	<6/12-6/60	19 (9.5)	9 (9)	10 (10)	
	6/6-6/12	169 (84.5)	83 (83)	86 (86)	
Postoperative Complications	NO COMPLICATION	58 (29)	23 (23)	35 (35)	-
	Posterior Capsule Rupture	4 (2)	1 (1)	3(3)	0.234
	Nucleus Drop	0 (0)	0 (0)	0(0)	-
	Vitreous prolapse	0 (0)	0 (0)	3(3)	0.185
	Striate Keratopathy	8 (4)	3 (3)	5 (5)	0.721*
	A/C Reaction	126 (63)	71 (71)	55(55)	0.02
	Traumatic Hyphema	3 (1.5)	1 (1)	2 (2)	1.000*
	Anterior Chamber IOL	0 (0)	0 (0)	0 (0)	-
	Wound Leak	1 (0.5)	1 (1)	0 (0)	1.000*

*ɬ Independent sample t-test was applied,*Fisher exact test was applied, If no sign Chi-square test was applied.*

between the procedures about Snellen's chart, Chi-square or Fisher's exact test was performed, while the Mann-Whitney U test was used for LogMAR visual acuity. A p-value of 0.05 was considered the threshold for statistical significance.

RESULTS

A total of 200 cataract removal procedures were conducted by a team of ophthalmologists at Qatar Hospital. Group 1 consisted of 100 small incision cataract surgeries (SICS), while Group 2 underwent 100 Phacoemulsification surgeries. In terms of age, there was no statistically significant difference between the two procedure groups (p-value 0.158), with a mean age of 54.96 ± 11 years for SICS and 57.3 ± 12 years for Phacoemulsification (**Fig. 1**).

Regarding gender distribution, out of 100 patients in the SICS group, there were 47 females and 53 males, while the Phacoemulsification group had 45 females and

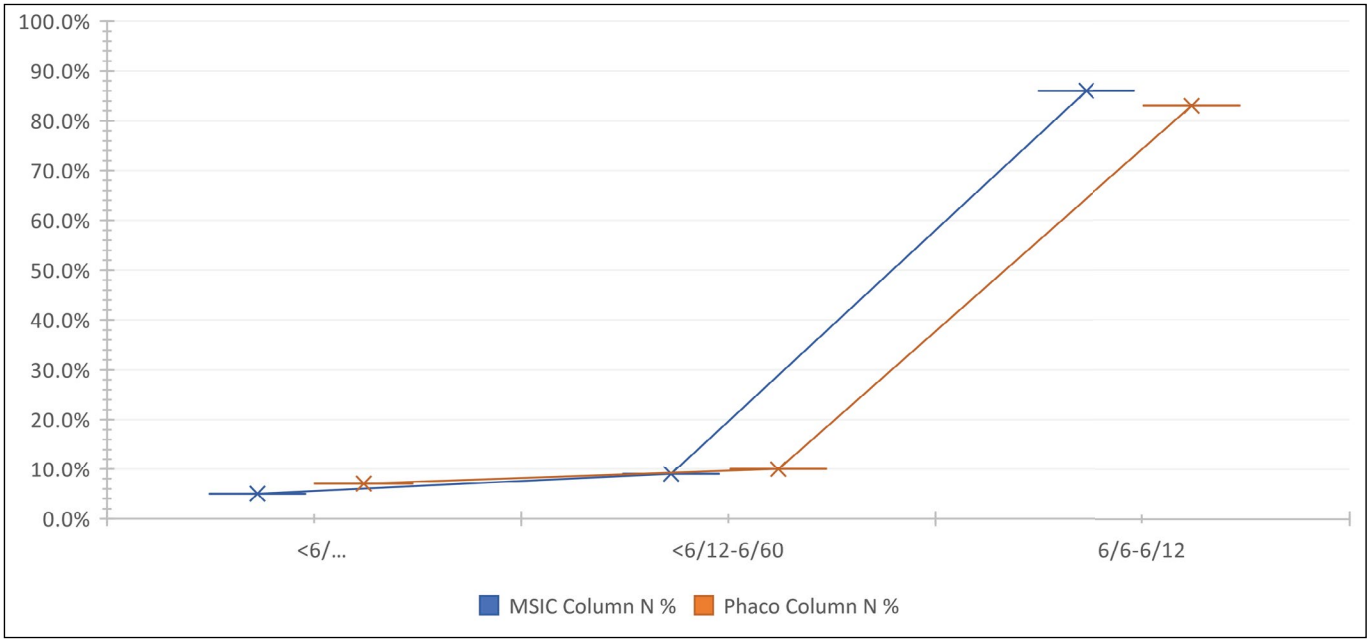

Fig. (2): This figure demonstrates the distribution of BCVA after the procedures in SICS and Phaco Group.

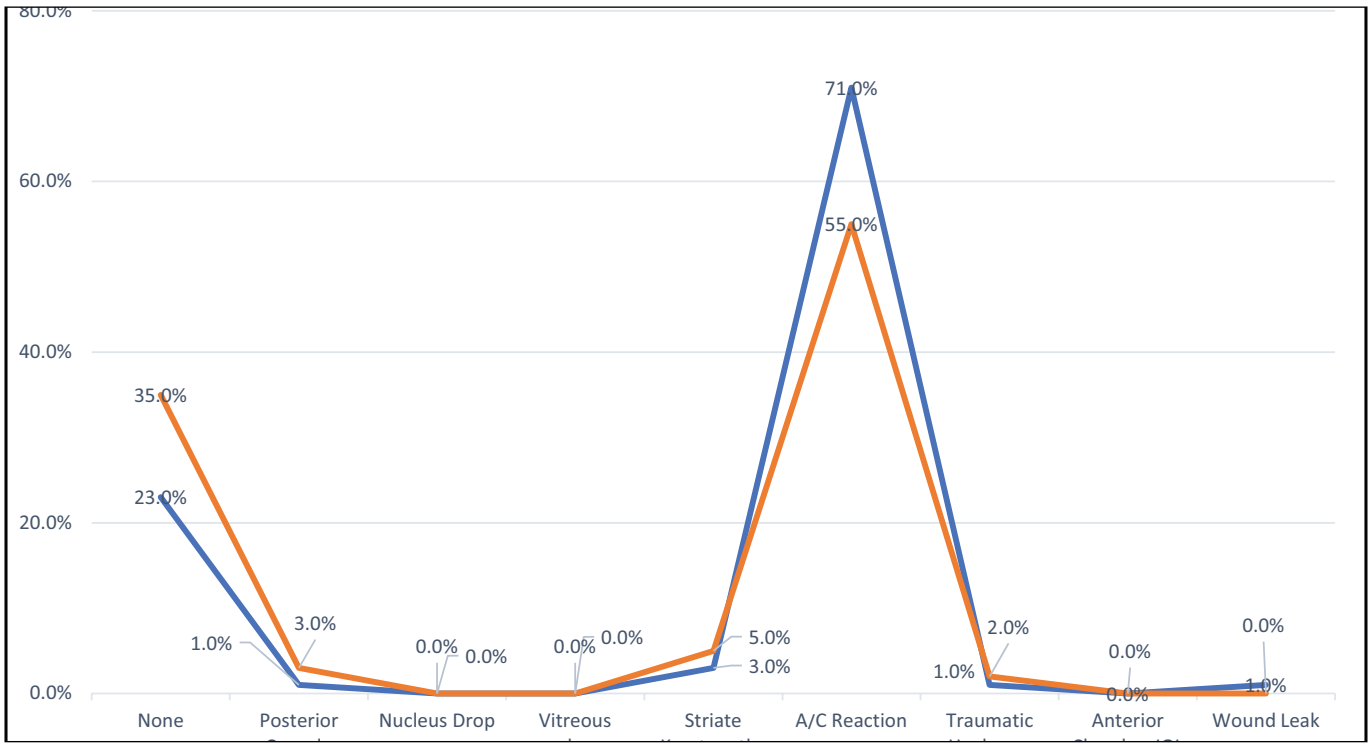

Fig. (3): Post-operative complications.

55 males. Gender did not show statistical significance in both groups (p-value 0.777). Demographics and risk factors are shown in **Table 1**.

The median (IQR) for the logMAR chart was 1 (0.75-1) preoperatively, which improved to 0 (0-0.3) postoperatively. There was no statistically significant difference between the two groups preoperatively (p-value 0.15).

The best corrected visual acuity (BCVA) observed before the procedures indicated that 56% of patients in both the SICS and Phacoemulsification groups had a visual acuity of less than 6/60 measured with the Snellen chart. Similarly, 24 patients in the SICS group and 34 in the Phacoemulsification group had a visual acuity of 6/12-6/60. Furthermore, 20 patients in the SICS group and 5 in the Phacoemulsification group had a vision of 6/6-6/12. The p-value of 0.04 demonstrated a significant difference in BCVA between both groups before the procedures.

Specifically, 86 patients in the Phaco group and 83 in the SICS group achieved a vision of 6/6-6/12, as shown in **Fig. (2)**.

LogMAR chart visual acuity showed no statistically significant difference in postoperative visual acuity between the two procedure groups (p-value 0.363).

Regarding anterior chamber reaction, there were 71 patients in the SICS group and 55 in the Phaco group, indicating a statistically significant difference between the two groups with a p-value of 0.02. No such difference was observed in the other groups. **Fig. (3)** shows the graphic presentation of post-operative complications.

DISCUSSION

This research aims to investigate the complications associated with two common cataract procedures, Small Incision Cataract Surgery (SICS) and Phacoemulsification. These procedures are frequently performed to treat cataracts. The overall outcomes of this study align with many previous reports in the field [7-12].

The results of this research demonstrate that, preoperatively, both groups had relatively poor visual acuity. However, after the procedures, the majority of patients achieved a visual acuity of up to 6/12 (LogMAR 0.3) in both procedures, which represents a significant improvement in visual acuity [13].

Post-operative complications were observed in both groups, with anterior chamber reaction being the most common issue. Other complications included posterior capsule rupture (PCR) and striate keratopathy. The occurrence of PCR was consistent with findings from previous studies, with only one reported case in the SICS group (out of 100 patients), similar to a previous study [13].

Research has previously indicated that SICS and Phacoemulsification yield comparable visual outcomes [14]. In this study, the complication rate was slightly

lower in the SICS group than in the Phaco group, whereas some studies have reported higher complication rates in Micro Coaxial Cataract Surgery (MCICS) [15]. The number of complications in this study was also consistent with findings from other studies [16].

Another study mentioned a lower number of complications and excellent visual outcomes, with three patients experiencing PCR in the phacoemulsification procedure and only two in the SICS group [16]. These findings correlate with our study's results, suggesting that both procedures are safe for patients, with few complications and improved visual acuity [17].

Another study reported similar outcomes regarding visual rehabilitation and complication rates in both groups, with no statistically significant difference [19]. Additionally, SICS is considered a rapid and convenient procedure, making it suitable for use in small hospitals or eye camps.

In terms of cost-effectiveness, when comparing both procedures, the SICS procedure is more cost-effective than Phacoemulsification due to its lower equipment requirements and fewer complications, while still providing excellent vision [20].

LIMITATIONS

The study's sample size was relatively small, and the limited number of patient follow-up visits after the procedures prevented the assessment of long-term complications such as retinal detachment and posterior capsular opacity. However, despite these limitations, the research findings can be applied to various settings in Pakistan.

CONCLUSION

In conclusion, both SICS and Phacoemulsification procedures resulted in similar post-operative visual acuity. However, the SICS procedure stands out for its cost-effectiveness and its potential to provide excellent vision while treating cataracts in economically disadvantaged patients.

ETHICAL APPROVAL

Ethical approval was obtained from the Institutional Review Committee of the Kulsoom Bai Valika Social Security Hospital, Karachi. All procedures performed in studies involving human participants were by the ethical standards of the institutional and/ or national research committee and with the Helsinki Declaration.

CONSENT FOR PUBLICATION

Informed consent was obtained from the patients verbally, and they were informed about the anonymous publication of the data, to which they agreed.

AVAILABILITY OF DATA

The data set may be acquired from the corresponding author upon a reasonable request.

FUNDING

Declared none.

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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AUTHOR'S CONTRIBUTION

Dr. Iftekhar Ahmed (IA): Principal Investigator, manuscript writer, and procedure performer.

Dr. Rashid Hassan Alvi (RH): Reviewer and procedure performer.

Dr. Maazallah (MA): Manuscript writer.

Muhammad Nizamuudin (MN): Data analyst and manuscript writer. He is responsible for the integrity of the data.

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