

# Outcomes of Phacoemulsification versus Manual Small Incision Cataract Surgery in Age-Related Cataract Patients

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## ABSTRACT

**Introduction:** Cataract surgery is one of the most commonly performed procedures worldwide, aimed at restoring vision in patients with age-related cataracts. The two primary techniques used in cataract surgery are phacoemulsification (phaco) and manual small incision cataract surgery (MSICS). This study is designed to evaluate and compare the clinical outcomes of phacoemulsification and MSICS in age-related cataract patients. **Methods & Materials:** This prospective, comparative, randomized controlled study aimed to evaluate the outcomes of phacoemulsification versus manual small incision cataract surgery (MSICS) in 90 patients with age-related cataracts. The study took place in the Department of Ophthalmology, at Ispahani Islamia Eye Institute & Hospital, Dhaka, Bangladesh, from July 2023 to January 2024. A total of 90 patients were randomly assigned to either the phacoemulsification group (n=45) or the MSICS group (n=45). Statistical analysis was performed using SPSS version 23.0. **Result:** Phacoemulsification had a significantly better postoperative visual acuity at multiple time points: on day 1 post-op ( $0.43 \pm 0.12$  vs.  $0.49 \pm 0.15$ ,  $p=0.03$ ), 1-week post-op ( $0.21 \pm 0.09$  vs.  $0.26 \pm 0.10$ ,  $p=0.01$ ), and 6 weeks post-op ( $0.10 \pm 0.05$  vs.  $0.13 \pm 0.06$ ,  $p=0.02$ ) compared to MSICS. Surgically induced astigmatism (SIA) was lower in the phacoemulsification group, with a mean SIA of  $0.65 \pm 0.32$  D compared to  $1.15 \pm 0.46$  D in MSICS ( $p<0.001$ ). **Conclusion:** This study shows that phacoemulsification offers superior postoperative visual outcomes and less surgically induced astigmatism compared to MSICS. Both techniques provide good visual results, making MSICS a viable alternative in resource-limited settings.

**Keywords:** Phacoemulsification, Manual Small Incision, Age-Related Cataract, Astigmatism

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## INTRODUCTION

Cataract, characterized by the opacification of the eye's natural crystalline lens, is the leading cause of visual impairment and blindness worldwide, particularly among the elderly population. According to the World Health Organization (WHO), cataracts are responsible for approximately 51% of global blindness, affecting over 20 million individuals [1]. In developing countries, where access to timely surgical intervention remains limited, the burden of untreated cataracts continues to rise. Age-related cataract is the most prevalent form, and their incidence increases progressively with age, significantly impacting the quality of life, independence, and productivity of older adults [2,3]. Cataract surgery is one of the most frequently performed surgical procedures globally and is regarded as one of the most cost-effective interventions in modern medicine. With advancements in ophthalmic surgery, two primary techniques have emerged as the standard of care: phacoemulsification and manual small incision cataract surgery (MSICS). Both procedures aim to restore vision by removing the opacified lens and implanting an artificial intraocular lens (IOL), but they differ significantly in technique, technology dependence, surgical duration, and cost [4]. Phacoemulsification, pioneered

by Charles Kelman in the 1960s, utilizes ultrasonic energy to fragment the lens nucleus, which is then aspirated through a small corneal incision. The advantages of phacoemulsification include minimal postoperative inflammation, smaller induced astigmatism, faster visual rehabilitation, and lower complication rates in skilled hands [5]. However, phacoemulsification requires sophisticated equipment, a reliable power supply, and a steep learning curve, which limits its utility in rural or resource-constrained settings [6]. In contrast, MSICS involves delivering the entire lens nucleus through a self-sealing sclerocorneal tunnel without phacoemulsification. This technique has gained popularity in high-volume settings due to its low cost, efficiency, and adaptability to dense and mature cataracts. MSICS has a shorter learning curve, does not rely on advanced technology, and can be performed effectively in settings with limited infrastructure, making it particularly suitable for developing countries [7]. Several studies have demonstrated that visual outcomes of MSICS are comparable to phacoemulsification, especially in patients with advanced nuclear sclerosis [7,8]. Globally, phacoemulsification remains the gold standard in urban, tertiary, and private healthcare centers, where resources and patient affordability are not major constraints.

Meanwhile, MSICS has emerged as a reliable alternative in public health programs, rural outreach camps, and national blindness prevention initiatives, particularly in countries like India, Nepal, and sub-Saharan Africa [9]. Given the enormous socioeconomic diversity among cataract patients, the choice of surgical technique is often influenced by cost-effectiveness, surgical complexity, cataract density, patient expectations, and surgeon experience [10]. Despite the widespread use of both techniques, there remains a need for high-quality comparative studies that assess their outcomes specifically in the elderly population with senile cataracts. Variables such as best-corrected visual acuity (BCVA), uncorrected visual acuity (UCVA), surgically induced astigmatism (SIA), intraoperative and postoperative complications, recovery time, and overall patient satisfaction are essential metrics in evaluating the relative effectiveness of each method. This study is designed to evaluate and compare the clinical outcomes of phacoemulsification and MSICS in age-related cataract patients.

## METHODS & MATERIALS

This prospective, comparative, randomized controlled study aimed to evaluate the outcomes of phacoemulsification versus manual small incision cataract surgery (MSICS) in 90 patients with age-related cataracts. The study took place in the Department of Ophthalmology, at Ispahani Islamia Eye Institute & Hospital, Dhaka, Bangladesh, from July 2023 to January 2024. A total of 90 patients were randomly assigned to either the phacoemulsification group (n=45) or the MSICS group (n=45), with all surgeries performed by the same experienced surgeon. Preoperative assessments included ocular history, clinical examination, biometry, and systemic evaluation. Both groups underwent surgery under peribulbar anesthesia, with the phacoemulsification group receiving a small temporal incision (2.2-2.8 mm) and the MSICS group undergoing a larger incision (6-7 mm). Postoperatively, patients were managed with topical antibiotics and corticosteroids, with follow-up visits on the first day, one week, and six weeks. The primary outcome was postoperative visual acuity measured using the LogMAR scale at three-time points, while secondary outcomes included intraoperative parameters (surgical time and complications), postoperative

complications, surgically induced astigmatism (SIA) at 6 weeks. Statistical analysis was performed using SPSS version 23.0, with appropriate tests to compare outcomes between the two groups, and a p-value of <0.05 was considered significant.

### Inclusion Criteria:

- Age  $\geq$  50 years
- Bilateral or unilateral age-related cataracts
- Best-corrected visual acuity (BCVA) of  $\leq$  0.8 LogMAR
- No history of previous ocular surgery
- No systemic contraindications to surgery

### Exclusion Criteria:

- Patients with coexisting ocular conditions such as glaucoma, diabetic retinopathy, macular degeneration, or ocular trauma
- Patients with systemic diseases such as uncontrolled diabetes or severe cardiovascular conditions
- Pregnant or lactating women
- Patients who declined to participate

## RESULTS

Table I presents the baseline demographic and clinical characteristics of the study participants, with 45 patients in each group—Phacoemulsification and Manual Small Incision Cataract Surgery (MSICS). The mean age of patients in the phacoemulsification group was  $64.3 \pm 5.9$  years, while in the MSICS group, it was  $65.1 \pm 6.2$  years, with no statistically significant difference ( $p=0.47$ ). The gender distribution was also comparable, with a male-to-female ratio of 26:19 in the phaco group and 24:21 in the MSICS group ( $p=0.66$ ). Eye laterality was nearly balanced in both groups, with 22 right and 23 left eyes in the phaco group, and 21 right and 24 left eyes in the MSICS group ( $p=0.84$ ). The mean preoperative visual acuity, measured in LogMAR, was similar between the two groups ( $0.88 \pm 0.20$  in phaco vs.  $0.91 \pm 0.22$  in MSICS;  $p=0.45$ ).

**Table – I: Baseline Demographic and Clinical Characteristics (n=90)**

Variable	Phacoemulsification (n=45)	MSICS (n=45)	p-value
Mean Age (years)	$64.3 \pm 5.9$	$65.1 \pm 6.2$	0.47
Gender (Male: Female)	26:19	24:21	0.66
Laterality (Right: Left eye)	22:23	21:24	0.84
Mean Preoperative Visual Acuity (LogMAR)	$0.88 \pm 0.20$	$0.91 \pm 0.22$	0.45

Table II summarizes the intraoperative parameters observed in both the phacoemulsification and MSICS groups. The mean surgical time was significantly longer in the phacoemulsification group ( $12.5 \pm 2.2$  minutes) compared to the MSICS group ( $9.8 \pm 2.5$  minutes), with a statistically significant difference ( $p<0.001$ ). Intraoperative complications were slightly more frequent in the MSICS group (6.6%, 3

cases) than in the phacoemulsification group (4.4%, 2 cases), although this difference was not statistically significant ( $p=0.64$ ). The types of complications also varied between groups, with both cases in the phacoemulsification group involving posterior capsule rent, while in the MSICS group, two cases had iris prolapse and one had a posterior capsule rent.

**Table II: Intraoperative Parameters (n=90)**

Parameter	Phacoemulsification	MSICS	p-value
Mean Surgical Time (minutes)	12.5 ± 2.2	9.8 ± 2.5	<0.001
Intraoperative Complications (%)	4.4% (2 cases)	6.6% (3 cases)	0.64
Type of Complication	Posterior capsule rent (2)	Iris prolapse (2), rent (1)	—

Table III displays the comparison of postoperative visual acuity (measured in LogMAR) between the phacoemulsification and MSICS groups at different follow-up intervals. On postoperative day 1, patients in the phacoemulsification group had better visual acuity ( $0.43 \pm 0.12$ ) compared to those in the MSICS group ( $0.49 \pm 0.15$ ), with the difference being statistically significant ( $p=0.03$ ). This

trend continued at 1 week postoperatively, where the mean visual acuity further improved to  $0.21 \pm 0.09$  in the phaco group versus  $0.26 \pm 0.10$  in the MSICS group ( $p=0.01$ ). By 6 weeks postoperatively, both groups showed substantial visual improvement; however, the phacoemulsification group still demonstrated slightly superior outcomes ( $0.10 \pm 0.05$  vs.  $0.13 \pm 0.06$ ;  $p=0.02$ ).

**Table III: Postoperative Visual Acuity (LogMAR) (n=90)**

Time Point	Phacoemulsification (Mean ± SD)	MSICS (Mean ± SD)	p-value
Day 1 Post-op	$0.43 \pm 0.12$	$0.49 \pm 0.15$	0.03
1 Week Post-op	$0.21 \pm 0.09$	$0.26 \pm 0.10$	0.01
6 Weeks Post-op	$0.10 \pm 0.05$	$0.13 \pm 0.06$	0.02

Table IV outlines the postoperative complications observed in both surgical groups. Corneal edema on the first postoperative day was slightly more common in the MSICS group (20%) compared to the phacoemulsification group (13.3%), though the difference was not statistically significant ( $p=0.38$ ). Anterior chamber reaction was seen in 6.7% of phacoemulsification patients and 11.1% of MSICS patients

( $p=0.46$ ). In terms of intraocular lens (IOL) stability, no cases of decentration occurred in the phaco group, whereas two cases (4.4%) were noted in the MSICS group ( $p=0.15$ ). Posterior capsular opacification (PCO) at 6 weeks postoperatively occurred in 4.4% of the phaco group and 6.7% of the MSICS group ( $p=0.64$ ).

**Table – IV: Postoperative Complications (n=90)**

Complication	Phacoemulsification (n=45)	MSICS (n=45)	p-value
Corneal Edema (Day 1)	6 (13.3%)	9 (20%)	0.38
Anterior chamber reaction	3 (6.7%)	5 (11.1%)	0.46
IOL decentration	0 (0%)	2 (4.4%)	0.15
Posterior Capsular Opacification (6 weeks)	2 (4.4%)	3 (6.7%)	0.64

Table V presents the comparison of surgically induced astigmatism (SIA) between the phacoemulsification and MSICS groups at 6 weeks postoperatively. A significantly higher proportion of patients in the phacoemulsification group had astigmatism less than 1.0 diopter (84.4%) compared to the MSICS group (60.0%), with the difference being statistically significant ( $p=0.01$ ). Moderate astigmatism

(1.0–2.0 D) was observed in 13.3% of phaco patients versus 28.9% in the MSICS group, while high astigmatism (>2.0 D) was more common in the MSICS group (11.1%) than in the phaco group (2.2%). The mean SIA was significantly lower in the phacoemulsification group ( $0.65 \pm 0.32$  D) compared to the MSICS group ( $1.15 \pm 0.46$  D), with a highly significant  $p$ -value of <0.001.

**Table – V: Surgically Induced Astigmatism (SIA) at 6 Weeks (n=90)**

Degree of Astigmatism (D)	Phacoemulsification (n=45)	MSICS (n=45)	p-value
<1.0 D	38 (84.4%)	27 (60.0%)	0.01
1.0–2.0 D	6 (13.3%)	13 (28.9%)	—
>2.0 D	1 (2.2%)	5 (11.1%)	—
Mean SIA (D)	$0.65 \pm 0.32$	$1.15 \pm 0.46$	<0.001

## DISCUSSION

In this study, we aimed to compare the outcomes of phacoemulsification and manual small incision cataract surgery (MSICS) in patients with age-related cataracts. The results of postoperative visual acuity were consistent with prior studies that demonstrated superior early visual outcomes in patients undergoing phacoemulsification. A study by Nischal et al. showed that phacoemulsification led to faster recovery of visual acuity compared to MSICS, particularly at

the 1-week and 6-week follow-up points [11]. This study also showed statistically significant improvements in visual acuity with phacoemulsification at all follow-up time points, aligning with findings by Jain et al., who observed superior visual outcomes in the phaco group compared to MSICS patients, especially in terms of reduced postoperative astigmatism and faster recovery [12]. The intraoperative parameters demonstrated a significantly longer surgical time for phacoemulsification ( $12.5 \pm 2.2$  minutes) compared to MSICS ( $9.8 \pm 2.5$  minutes), a finding supported by earlier studies

such as those by Singh et al., which reported longer surgical times for phacoemulsification due to its more intricate technique involving ultrasound fragmentation of the cataract [13]. Despite this, the incidence of intraoperative complications was comparable between the two groups, with posterior capsule rent occurring more frequently in the phacoemulsification group, in line with findings from Goel et al., who also noted a slightly higher rate of posterior capsule rupture in phacoemulsification due to its complex nature [14]. Postoperative complications revealed no major differences between the groups. Corneal edema, anterior chamber reaction, and posterior capsular opacification (PCO) were observed in both groups, with no statistically significant differences. These results are in agreement with a study by Devendra et al., which reported comparable complication rates between phacoemulsification and MSICS, suggesting that, while both procedures are generally safe, phacoemulsification may have a slightly higher risk of complications due to its more complex intraocular maneuvers [15]. The surgically induced astigmatism (SIA) results revealed a significant difference in astigmatism between the two groups at 6 weeks postoperatively, with phacoemulsification causing less astigmatism. The lower incidence of astigmatism in the phacoemulsification group is consistent with the study by Tripathi et al. who observed that the smaller incision size and the self-sealing nature of phacoemulsification incisions result in less postoperative astigmatism compared to the larger incisions required for MSICS [16]. The mean SIA for phacoemulsification ( $0.65 \pm 0.32$  D) was significantly lower than MSICS ( $1.15 \pm 0.46$  D), highlighting the advantages of phacoemulsification in terms of minimizing refractive error after surgery. These findings are in line with previous research by Gilbert et al., which also showed similar levels of outcomes with both surgical techniques, suggesting that the choice of procedure may ultimately depend on factors such as patient preference, surgical facility capabilities, and financial considerations [17].

### Limitations of The Study

The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community.

### CONCLUSION

This study shows that phacoemulsification offers superior postoperative visual outcomes and less surgically induced astigmatism compared to MSICS. Both techniques provide good visual results making MSICS a viable alternative in resource-limited settings.

### RECOMMENDATION

Based on the findings of this study, phacoemulsification is associated with better postoperative visual acuity and lower surgically induced astigmatism compared to manual small incision cataract surgery (MSICS). However, MSICS offers a comparable outcome, especially in settings with limited resources. It is recommended that clinicians select the appropriate surgical technique based on the patient's clinical profile, resource availability. Further studies with larger sample sizes and long-term follow-up are needed to strengthen the evidence and guide clinical decision-making.

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