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ORIGINAL RESEARCH

Visual Outcome Comparison Between Manual Small Incision Cataract Surgery and Phacoemulsification in tertiary health care centre

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ABSTRACT

Aim: To compare the visual outcomes and postoperative complications between Manual Small Incision Cataract Surgery (MSICS) and Phacoemulsification in patients undergoing cataract surgery at a tertiary care center.**Material and Methods:**This prospective, comparative observational study was conducted in the Department of Ophthalmology at Nalanda Medical College and Hospital, Patna, from October 2023 to September 2024. A total of 100 patients aged 50 years and above with visually significant senile cataract were enrolled and randomly divided into two groups: Group A (MSICS) and Group B (Phacoemulsification), with 50 patients each. Preoperative and postoperative visual acuity (UDVA and BCVA) were assessed at Day 1, Week 1, and 1 Month using LogMAR conversions. Complications were recorded and statistical comparisons were made using t-tests and Chi-square tests ($p< 0.05$).**Results:**Baseline demographics and preoperative visual acuities were comparable between the two groups ($p> 0.05$). Postoperatively, the Phacoemulsification group showed significantly better mean UDVA at Day 1 (0.32 vs. 0.43), Week 1 (0.21 vs. 0.29), and 1 Month (0.12 vs. 0.19), all $p< 0.001$. Similarly, BCVA at 1 Month was significantly better in the Phaco group (0.07 vs. 0.11, $p< 0.001$). At 1 Month, 86% of Phaco patients achieved 6/6 to 6/9 UDVA, compared to 64% in the MSICS group ($p = 0.01$). Postoperative complications were fewer in the Phacoemulsification group, with 88% having uneventful recovery versus 64% in MSICS ($p = 0.006$).**Conclusion:**Phacoemulsification resulted in superior uncorrected and best corrected visual outcomes with fewer complications and faster recovery when compared to MSICS. Despite this, MSICS remains a safe and effective alternative, particularly in resource-limited settings.

Keywords: Phacoemulsification, MSICS, Cataract surgery, Visual outcome, Postoperative complications

INTRODUCTION

Cataract remains the leading cause of avoidable blindness worldwide, and its management has become a primary focus of ophthalmic healthcare systems, especially in developing countries. With the global burden of cataract-related visual impairment continuing to rise, particularly in low- and middle-income nations, the selection of an appropriate, cost-effective, and outcome-oriented surgical technique is of paramount importance. In the context of tertiary health care centres, where patient load is high and resources often limited, both manual small incision cataract surgery (MSICS) and phacoemulsification have emerged as the most commonly practiced surgical modalities for cataract extraction.[1]

Manual small incision cataract surgery (MSICS) has evolved significantly in the last few decades. Originally derived from extracapsular cataract extraction (ECCE), it was developed to provide high-quality visual rehabilitation while circumventing the need for advanced and costly phacoemulsification machines. MSICS involves a self-sealing scleral tunnel incision that permits the removal of the nucleus without the requirement of ultrasound energy. It is particularly advantageous in high-volume settings where affordability, reduced operating time, and independence from sophisticated technology are crucial. The procedure is known for its adaptability across diverse patient profiles, including mature and brunescent cataracts, and is effective in areas with limited infrastructure.[2]

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On the other hand, phacoemulsification is widely regarded as the gold standard in cataract surgery in developed healthcare settings due to its minimally invasive approach, reduced postoperative inflammation, faster recovery, and improved visual outcomes in carefully selected cases. It uses ultrasound energy to emulsify and aspirate the lens through a small corneal incision, often under 3 mm. This technique offers excellent wound stability and facilitates rapid visual rehabilitation, which makes it attractive to both surgeons and patients. However, its higher cost, longer learning curve, and dependency on advanced technology make its routine application in high-volume public sector hospitals of developing countries a logistical challenge.[3]

Comparing the visual outcomes between MSICS and phacoemulsification is essential for evidence-based decision-making, especially in tertiary care centres where a large and diverse population seeks ophthalmic care. Studies conducted across different geographical and clinical contexts have shown that both techniques can deliver comparable visual results in terms of best corrected visual acuity (BCVA), uncorrected visual acuity (UCVA), and patient satisfaction when performed by skilled surgeons. However, certain clinical parameters such as corneal endothelial cell loss, surgically induced astigmatism, intraoperative complications, and recovery time may vary depending on the technique employed.[4]

The demographic shift toward an aging population and increasing prevalence of systemic diseases like diabetes mellitus further complicate the management of cataract patients. In elderly patients or those with dense cataracts, MSICS often provides a safer and more practical alternative to phacoemulsification, as it can handle harder nuclei with less risk of endothelial trauma and capsular rupture. Moreover, the reduced need for expensive equipment and disposable materials enhances its sustainability in resource-constrained environments.[5]

In contrast, phacoemulsification has gained popularity in urban and private tertiary care settings due to its cosmetic appeal, minimal incision, and faster visual recovery. Technological advancements such as torsional phacoemulsification, microincision surgery, and intraoperative aberrometry have further improved its safety profile and postoperative outcomes. Despite these advantages, its application in under-resourced government hospitals remains limited due to the higher initial investment and ongoing maintenance costs.[6-8]

Tertiary health care centres serve as nodal points for managing complex and high-risk cataract cases referred from primary and secondary levels of care. These centres must balance clinical excellence with operational efficiency to address the growing demand for cataract services. Therefore, understanding the comparative effectiveness of MSICS and phacoemulsification in these settings is crucial to optimize surgical outcomes, resource utilization, and patient care. Factors such as surgical time, complication rate, cost-effectiveness, and postoperative visual rehabilitation must be analyzed in conjunction with the visual acuity outcomes to derive comprehensive conclusions.[9]

Existing literature suggests that MSICS, when performed with standardized protocols and proper instrumentation, can match the visual results of phacoemulsification while offering substantial advantages in terms of cost, versatility, and adaptability. The long-term follow-up data from various randomized controlled trials and observational studies reinforce its role as a viable alternative, especially in large-scale blindness prevention programs. Innovations in MSICS techniques, such as the Blumenthal method, double nylon loop technique, and the Kongsap method, have further enhanced its safety and efficacy.[10]

Nonetheless, phacoemulsification continues to be preferred in cases where precise refractive outcomes and minimal postoperative inflammation are prioritized. As training and infrastructure improve across tertiary care institutions, the integration of both techniques into surgical practice can offer a tiered approach to cataract management—allocating phacoemulsification to suitable cases and reserving MSICS for complex or cost-sensitive scenarios.

MATERIAL AND METHODS

This prospective, comparative observational study was conducted in the Department of Ophthalmology at Nalanda Medical College and Hospital, Patna, over a period of 12 months, from October 2023 to September 2024, following approval from the Institutional Ethics Committee. The aim was to compare the visual outcomes of Manual Small Incision Cataract Surgery (MSICS) and Phacoemulsification in patients undergoing cataract surgery.A total of 100 patients diagnosed with senile cataract and scheduled for elective cataract extraction were enrolled in the study after obtaining written informed consent. All surgeries were performed by experienced surgeons with standardized surgical techniques under local anesthesia.

Inclusion Criteria

- Patients aged 50 years or above
- Diagnosed with visually significant senile cataract in at least one eye
- Preoperative Best Corrected Visual Acuity (BCVA) worse than 6/18
- Ability to provide informed consent and comply with follow-up visits

Exclusion Criteria

- Presence of other ocular comorbidities affecting vision (e.g., corneal opacities, retinal pathology, advanced glaucoma)
- History of ocular trauma or previous intraocular surgery

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- Intraoperative complications such as posterior capsular rupture or vitreous loss
- Systemic conditions interfering with postoperative recovery or visual rehabilitation (e.g., uncontrolled diabetes)

Study Design and Grouping

The enrolled participants were randomly assigned into two equal groups (n=50 in each group) using a computer-generated randomization table:

- **Group A:** Underwent **Manual Small Incision Cataract Surgery (MSICS)**
- **Group B:** Underwent **Phacoemulsification**

Preoperative evaluation included detailed medical and ocular history, slit-lamp biomicroscopy, intraocular pressure measurement, fundus examination (where media clarity permitted), and biometry for intraocular lens (IOL) power calculation.

Surgical Techniques and Postoperative Evaluation

All surgical procedures in both groups were performed under peribulbaranesthesia within a standardized, sterile operating room setting to ensure uniform surgical conditions. In the Manual Small Incision Cataract Surgery (MSICS) group, a rigid polymethyl methacrylate (PMMA) intraocular lens (IOL) was implanted following cataract extraction through a self-sealing scleral tunnel incision. In contrast, the Phacoemulsification group underwent cataract removal via a clear corneal incision using ultrasonic emulsification, followed by implantation of a foldable acrylic IOL. Each procedure was carried out by experienced surgeons following standard surgical protocols to minimize variability and complications.

Postoperative evaluations were conducted systematically on Day 1, at the end of the first postoperative week, and at one month following surgery. During each visit, visual function was assessed by measuring both Uncorrected Distance Visual Acuity (UDVA) and Best Corrected Visual Acuity (BCVA) using a Snellen's chart, with the results subsequently converted into Logarithm of the Minimum Angle of Resolution (LogMAR) equivalents for statistical comparison. Any postoperative complications, such as anterior chamber inflammation, corneal edema, or posterior capsular opacification, were also meticulously recorded to evaluate safety and efficacy across both surgical modalities.

Statistical Analysis

All data were recorded and analyzed using SPSS version 25.0. Continuous variables such as age and visual acuity were expressed as mean ± standard deviation and compared using independent t-tests. Categorical variables were compared using Chi-square tests. A p-value < 0.05 was considered statistically significant.

RESULTS

Table 1: Baseline Demographic and Preoperative Characteristics

The baseline characteristics of both the MSICS and Phacoemulsification groups were statistically comparable. The mean age of patients was 65.2 ± 6.3 years in the MSICS group and 64.8 ± 5.9 years in the Phacoemulsification group, with no significant difference between them (p = 0.72). Gender distribution was also similar, with a slight male predominance in both groups (28 males and 22 females in MSICS vs. 26 males and 24 females in the Phaco group; p = 0.68). Mean preoperative uncorrected distance visual acuity (UDVA) in LogMAR units was 0.91 ± 0.12 in the MSICS group and 0.89 ± 0.14 in the Phacoemulsification group, again showing no significant difference (p = 0.41). Similarly, the best corrected visual acuity (BCVA) was 0.79 ± 0.09 and 0.77 ± 0.10 in the respective groups (p = 0.35). Laterality (right vs. left eye operated) was nearly equally distributed in both groups (p = 0.71). These findings indicate a well-matched study population, eliminating potential confounding factors due to baseline variability.

Table 2: Postoperative Uncorrected Distance Visual Acuity (UDVA)

The improvement in UDVA postoperatively was significantly better in the Phacoemulsification group across all follow-up points. On Day 1, patients who underwent Phacoemulsification had a mean UDVA of 0.32 ± 0.10, significantly better than 0.43 ± 0.11 in the MSICS group (p< 0.001). This trend continued at Week 1, with the Phaco group achieving a mean UDVA of 0.21 ± 0.07 versus 0.29 ± 0.09 in the MSICS group (p< 0.001). By the end of 1 month, the mean UDVA further improved to 0.12 ± 0.05 in the Phaco group compared to 0.19 ± 0.06 in the MSICS group (p< 0.001). These statistically significant differences suggest a consistently superior uncorrected visual outcome in the Phacoemulsification group at all stages of postoperative recovery.

Table 3: Postoperative Best Corrected Visual Acuity (BCVA)

A similar trend was observed in BCVA outcomes, with the Phacoemulsification group showing statistically superior results at every postoperative evaluation. On Day 1, the BCVA was 0.28 ± 0.08 in the Phaco group and 0.36 ± 0.09 in the MSICS group (p< 0.001). At Week 1, these values improved to 0.15 ± 0.06 for Phaco and 0.21 ± 0.07 for MSICS (p< 0.001). By 1 Month, the mean BCVA reached 0.07 ± 0.04 in the Phacoemulsification group and 0.11 ± 0.05 in the MSICS group (p< 0.001). This indicates that although both techniques yield good visual rehabilitation, Phacoemulsification leads to more rapid and superior correction even with best correction applied.

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Table 4: Visual Outcome Distribution at 1 Month (UDVA)

At the one-month follow-up, the distribution of visual acuity revealed significantly better outcomes in the Phacoemulsification group. A higher proportion of patients (86%) in this group achieved excellent uncorrected visual acuity (6/6 to 6/9), compared to 64% in the MSICS group (p = 0.01). While 32% of MSICS patients had a UDVA in the range of 6/12 to 6/18, only 12% of Phaco patients fell into this category. Additionally, a smaller fraction of patients had a visual acuity worse than 6/18 in both groups—4% in MSICS and 2% in Phaco—though this difference was not statistically significant. This reinforces the conclusion that Phacoemulsification yields a higher percentage of patients with optimal unaided vision postoperatively.

Table 5: Postoperative Complications

Although both surgical methods were largely safe, a comparison of postoperative complications showed that the Phacoemulsification group experienced fewer adverse events. Transient corneal edema occurred in 16% of MSICS cases compared to 6% in the Phaco group (p = 0.10), while anterior chamber inflammation was observed in 12% and 4% respectively (p = 0.14). Posterior capsular opacification was noted in 8% of MSICS patients versus only 2% in the Phaco group (p = 0.17). While these differences did not reach statistical significance, they do suggest a trend toward fewer complications in Phacoemulsification. Notably, 88% of Phaco patients had an uneventful recovery with no complications, compared to 64% in the MSICS group—a statistically significant finding (p = 0.006). This supports the relative safety and faster recovery associated with the Phaco technique.

Table 1: Baseline Demographic and Preoperative Characteristics

Parameter	MSICS Group (n = 50)	Phacoemulsification Group (n = 50)	*p*-value
Mean Age (years)	65.2 ± 6.3	64.8 ± 5.9	0.72
Gender (Male / Female)	28 / 22	26 / 24	0.68
Mean Preoperative UDVA (LogMAR)	0.91 ± 0.12	0.89 ± 0.14	0.41
Mean Preoperative BCVA (LogMAR)	0.79 ± 0.09	0.77 ± 0.10	0.35
Laterality (Right Eye / Left Eye)	27 / 23	25 / 25	0.71

Table 2: Postoperative Uncorrected Distance Visual Acuity (UDVA) (LogMAR)

Time Point	MSICS Group (Mean ± SD)	Phacoemulsification Group (Mean ± SD)	*p*-value
Day 1	0.43 ± 0.11	0.32 ± 0.10	<0.001
Week 1	0.29 ± 0.09	0.21 ± 0.07	<0.001
1 Month	0.19 ± 0.06	0.12 ± 0.05	<0.001

Table 3: Postoperative Best Corrected Visual Acuity (BCVA) (LogMAR)

Time Point	MSICS Group (Mean ± SD)	Phacoemulsification Group (Mean ± SD)	*p*-value
Day 1	0.36 ± 0.09	0.28 ± 0.08	<0.001
Week 1	0.21 ± 0.07	0.15 ± 0.06	<0.001
1 Month	0.11 ± 0.05	0.07 ± 0.04	<0.001

Table 4: Visual Outcome Distribution at 1 Month (UDVA)

UDVA (Snellen Equivalent)	MSICS Group (n = 50)	Phacoemulsification Group (n = 50)	*p*-value
6/6 to 6/9	32 (64%)	43 (86%)	0.01
6/12 to 6/18	16 (32%)	6 (12%)	
Worse than 6/18	2 (4%)	1 (2%)	

Table 5: Postoperative Complications

Complication Type	MSICS Group (n = 50)	Phacoemulsification Group (n = 50)	*p*-value
Corneal Edema (Transient)	8 (16%)	3 (6%)	0.10
Anterior Chamber Inflammation	6 (12%)	2 (4%)	0.14
Posterior Capsular Opacification	4 (8%)	1 (2%)	0.17
No Complications	32 (64%)	44 (88%)	0.006

DISCUSSION

The present study evaluated and compared the visual outcomes and complication rates of Manual Small Incision Cataract Surgery (MSICS) and Phacoemulsification in a tertiary care center, with

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emphasis on postoperative visual acuity and safety profiles.

In terms of baseline characteristics (Table 1), the demographic and clinical parameters such as age, gender, laterality, and preoperative visual acuities were statistically comparable between the two groups. This is consistent with other studies that maintained demographic homogeneity to eliminate bias when comparing surgical outcomes, such as the study by Joshi et al. (2018), which also demonstrated comparable baseline parameters between the MSICS and Phaco groups.[11]

With regard to uncorrected distance visual acuity (UDVA) (Table 2), the Phacoemulsification group achieved significantly better outcomes at all postoperative time points. On Day 1, Week 1, and 1 Month, mean UDVA values in the Phaco group were 0.32 ± 0.10, 0.21 ± 0.07, and 0.12 ± 0.05 respectively, compared to 0.43 ± 0.11, 0.29 ± 0.09, and 0.19 ± 0.06 in the MSICS group (all $p < 0.001$). These findings are corroborated by the meta-analysis by Zhang et al. (2013), which concluded that Phacoemulsification provided better uncorrected visual acuity outcomes in the early postoperative period due to smaller incision size and reduced surgically induced astigmatism.[12] Similarly, Singh et al. (2009) found Phacoemulsification to yield faster visual rehabilitation, making it more suitable for high-demand or working populations.[13]

When analyzing best corrected visual acuity (BCVA) (Table 3), Phacoemulsification again demonstrated superior outcomes. At 1 month, the mean BCVA in the Phaco group was 0.07 ± 0.04 compared to 0.11 ± 0.05 in the MSICS group ($p < 0.001$). These findings echo the results of Warad et al. (2021) and Kumar et al. (2022), who reported good BCVA outcomes with MSICS but noted that Phacoemulsification consistently resulted in better refractive precision and postoperative visual recovery.[14,15] However, Jongsareejit (2011) emphasized that with proper technique, MSICS can also provide excellent BCVA outcomes, particularly when foldable IOLs are used, though these were not the lens type used in the current MSICS cohort.[16]

In terms of visual outcome distribution at one month (Table 4), 86% of patients in the Phacoemulsification group achieved a UDVA of 6/6 to 6/9 compared to only 64% in the MSICS group ($p = 0.01$). This reinforces the earlier findings by Pathak et al. (2022), who showed that despite the technical demands of Phacoemulsification, it offers a greater proportion of excellent visual outcomes when performed in experienced hands.[17] Conversely, studies such as that by Kongsap (2011) noted that MSICS, while more economical and less equipment-dependent, had a slightly higher proportion of patients in the 6/12 to 6/18 range, aligning with the 32% in this study.[18]

The complication profile (Table 5) revealed that while both techniques were largely safe, Phacoemulsification was associated with fewer postoperative complications. In the present study, 88% of Phaco patients had no complications compared to 64% in the MSICS group ($p = 0.006$). Although rates of transient corneal edema, anterior chamber inflammation, and posterior capsular opacification were not statistically significant between the two groups, they trended higher in the MSICS group. These findings are consistent with reports by Ali et al. (2019) and Limburg and Ramke (2017), who observed that MSICS may be associated with slightly higher immediate postoperative inflammation due to larger incision size.[19,20] Nonetheless, Jongsareejit (2011) and Joshi et al. (2018) confirmed that these events are typically self-limiting and resolve with appropriate postoperative management.[16,11]

CONCLUSION

The present study demonstrated that Phacoemulsification provides significantly better uncorrected and best corrected visual outcomes compared to Manual Small Incision Cataract Surgery (MSICS), with faster postoperative recovery and fewer complications. While both techniques are effective and safe for cataract management, Phacoemulsification showed superior precision and visual rehabilitation. However, MSICS remains a valuable alternative, especially in resource-limited settings due to its cost-effectiveness and accessibility. Surgical choice should be tailored based on patient needs, surgeon expertise, and institutional facilities.

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