

Comparative Evaluation of Phacoemulsification and Manual Small Incision Cataract Surgery in Age-Related Cataract

Mansi Patel¹, Kundan Malhotra², Maheshkumar Rajpura³

¹Assistant Professor, Department of Ophthalmology, Swaminarayan Institute of Medical sciences & Research, Kalol

²Assistant Professor, Department of Ophthalmology, Swaminarayan Institute of Medical sciences & Research, Kalol

³Associate Professor, Department of Ophthalmology, Swaminarayan Institute of Medical sciences & Research, Kalol

Received: 01-03-2026 / Revised: 15-04-2026 / Accepted: 21-05-2026

Corresponding author: Dr. Kundan Malhotra

Conflict of interest: Nil

Abstract

Background: Cataract is the leading cause of reversible blindness worldwide. Phacoemulsification and Manual Small Incision Cataract Surgery are widely practiced surgical techniques for age-related cataract management. The present study compared the clinical and visual outcomes of these two procedures.

Materials and Methods: This prospective comparative study included 120 patients with age-related cataract. Patients were divided into phacoemulsification group (n=60) and MSICS group (n=60). Parameters evaluated included operative time, postoperative visual acuity, corneal edema, surgically induced astigmatism, and postoperative complications. Statistical analysis was performed using SPSS software, and $p < 0.05$ was considered statistically significant.

Results: MSICS demonstrated significantly shorter operative time compared to phacoemulsification (14 ± 3 min vs 18 ± 4 min, $p < 0.01$). Phacoemulsification showed lower postoperative corneal edema and reduced surgically induced astigmatism. Early postoperative visual recovery was significantly better in the phacoemulsification group. However, final visual acuity outcomes at 6 weeks were comparable in both groups. Postoperative inflammatory complications were lower following phacoemulsification.

Conclusion: Both phacoemulsification and manual small incision cataract surgery are safe and effective techniques for age-related cataract surgery. Phacoemulsification offers faster visual rehabilitation and superior refractive outcomes, whereas manual small incision cataract surgery remains a cost-effective and efficient alternative for high-volume cataract surgery settings.

Keywords: Cataract, phacoemulsification, manual small incision cataract surgery, MSICS, visual outcome, cataract surgery.

DOI: 10.25258/ijcpr.18.6.254

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction

Cataract remains the leading cause of preventable blindness worldwide and contributes significantly to visual impairment, particularly among the elderly population. According to the World Health Organization, age-related cataract accounts for nearly half of global blindness cases, especially in developing countries where access to ophthalmic care remains limited.[1]

Cataract is characterized by progressive opacification of the crystalline lens, resulting in gradual deterioration of vision, glare, impaired contrast sensitivity, and reduced quality of life. Age-related cataract is the most common form of cataract and is strongly associated with advancing

age, diabetes mellitus, smoking, ultraviolet radiation exposure, malnutrition, and oxidative stress.[2] Surgical extraction of the cataractous lens with intraocular lens (IOL) implantation remains the only definitive treatment for visual restoration. Advances in cataract surgery over the past few decades have significantly improved surgical outcomes, patient safety, and postoperative visual rehabilitation.[3]

Phacoemulsification and Manual Small Incision Cataract Surgery (MSICS) are currently the two most commonly performed cataract surgical techniques worldwide. Phacoemulsification is considered the gold standard technique in

developed countries because of its smaller incision size, rapid visual recovery, reduced surgically induced astigmatism, and minimal postoperative inflammation.[4] The procedure involves ultrasonic emulsification of the cataractous lens followed by aspiration and implantation of a foldable intraocular lens through a small self-sealing corneal incision.

Despite the advantages of phacoemulsification, the procedure requires expensive equipment, continuous maintenance, advanced surgical expertise, and a stable power supply, which may limit its widespread application in resource-limited settings.[5] Furthermore, dense or mature cataracts may pose technical difficulties during phacoemulsification and increase the risk of endothelial cell damage and posterior capsular rupture.

Manual Small Incision Cataract Surgery (MSICS) has emerged as an effective alternative to phacoemulsification, particularly in developing countries with high cataract burden.[6] manual small incision cataract surgery involves manual nucleus delivery through a self-sealing scleral tunnel incision without the use of phacoemulsification machinery. The technique is cost-effective, less technology-dependent, and particularly suitable for hard cataracts commonly encountered in rural populations.[7]

Several studies have compared phacoemulsification and manual small incision cataract surgery with respect to visual outcomes, operative time, postoperative astigmatism, corneal edema, endothelial cell loss, complications, and cost-effectiveness.[8] While phacoemulsification is associated with faster visual recovery and smaller incisions, manual small incision cataract surgery has demonstrated comparable long-term visual outcomes with shorter operative duration and lower surgical cost.[9]

In countries with limited healthcare resources and high cataract prevalence, comparative evaluation of these surgical techniques is important for optimizing surgical planning and improving visual rehabilitation strategies.[10] Therefore, the present study was undertaken to compare the visual and surgical outcomes of phacoemulsification and Manual Small Incision Cataract Surgery in patients with age-related cataract.

To compare the clinical and visual outcomes of phacoemulsification and Manual Small Incision Cataract Surgery (MSICS) in patients with age-related cataract.

Materials & Methods

This prospective comparative study was conducted over a period of 18 months among patients

diagnosed with age-related cataract. A total of 120 patients were included in the study and divided into two groups: the Phacoemulsification group comprising 60 patients and the Manual Small Incision Cataract Surgery (MSICS) group comprising 60 patients. Patients aged more than 45 years with clinically diagnosed age-related cataract who were willing to participate in the study and were suitable candidates for either phacoemulsification or manual small incision cataract surgery were included. Patients with traumatic cataract, congenital cataract, and secondary cataract, and glaucoma, retinal pathology affecting vision, corneal opacity, or previous ocular surgery were excluded from the study.

All patients underwent detailed ophthalmic evaluation including visual acuity assessment, slit lamp examination, intraocular pressure measurement, and fundus examination whenever feasible. Surgical procedures were performed under aseptic precautions by experienced ophthalmic surgeons. Patients underwent either phacoemulsification with foldable intraocular lens implantation or Manual Small Incision Cataract Surgery with posterior chamber intraocular lens implantation depending on the assigned surgical group.

Data regarding demographic profile, preoperative visual acuity, operative duration, intraoperative complications, postoperative visual acuity, corneal edema, surgically induced astigmatism, and postoperative complications were recorded using a standardized proforma. Postoperative follow-up examinations were conducted on Day 1, Day 7, at 1 month, and at 6 weeks following surgery to assess visual recovery and postoperative outcomes.

Statistical analysis was performed using SPSS software version 25. Continuous variables were expressed as mean $\pm$ standard deviation, while categorical variables were expressed as frequencies and percentages. Comparative analysis between the two groups was carried out using Student's t-test and Chi-square test. A p-value of less than 0.05 was considered statistically significant.

Results

A total of 120 patients with age-related cataract were included in the study, with 60 patients undergoing phacoemulsification and 60 patients undergoing Manual Small Incision Cataract Surgery (MSICS). The baseline demographic and clinical characteristics of both groups were comparable. The mean age of patients in the phacoemulsification group was 63.4 ± 8.2 years, while in the manual small incision cataract surgery group it was 64.1 ± 7.9 years. Male predominance was observed in both groups, accounting for 56.7%

in the phacoemulsification group and 60% in the manual small incision cataract surgery group. Associated comorbidities such as diabetes mellitus and hypertension showed no statistically significant difference between the two groups ($p>0.05$).

Comparison of surgical outcomes demonstrated that the mean operative time was significantly shorter in the manual small incision cataract surgery group compared to the phacoemulsification group (14 ± 3 minutes vs 18 ± 4 minutes, $p<0.01$). However, postoperative corneal edema was significantly lower in patients undergoing phacoemulsification, occurring in 8.3% of cases compared to 20% in the manual small incision cataract surgery group ($p<0.05$). Surgically induced astigmatism was also significantly lower following phacoemulsification (0.8 ± 0.3 D) than MSICS (1.5 ± 0.5 D) with statistical significance ($p<0.001$). Posterior capsular rupture occurred in 3.3% of patients in the phacoemulsification group and 5% of patients in the manual small incision cataract surgery group, without significant difference between the groups.

Postoperative visual acuity outcomes showed that early visual recovery was better in the phacoemulsification group. On postoperative Day 1, visual acuity of $\geq 6/18$ was achieved in 86.7% of

patients undergoing phacoemulsification compared to 70% in the MSICS group ($p<0.05$). However, visual outcomes at 1 week and 6 weeks postoperatively were comparable between the two groups, with more than 95% of patients in both groups achieving visual acuity of $\geq 6/12$ at 6 weeks follow-up.

Postoperative complications were comparatively lower in the phacoemulsification group. Anterior chamber reaction was observed in 6.7% of patients undergoing phacoemulsification compared to 15% in the manual small incision cataract surgery group ($p<0.05$). Similarly, striate keratopathy was more common in the MSICS group (13.3%) than in the phacoemulsification group (5%). Raised intraocular pressure was noted in a small proportion of patients in both groups without statistically significant difference. No cases of endophthalmitis were reported in either group during the follow-up period.

Overall, phacoemulsification demonstrated superior early postoperative recovery, lower postoperative inflammation, reduced corneal edema, and less surgically induced astigmatism, whereas manual small incision cataract surgery offered shorter operative duration with comparable final visual outcomes.

Table 1: Baseline Characteristics of Study Population

Variables	Phacoemulsification Group (n=60)	MSICS Group (n=60)	p-value
Mean Age (years)	63.4 ± 8.2	64.1 ± 7.9	>0.05
Male	34 (56.7%)	36 (60%)	>0.05
Female	26 (43.3%)	24 (40%)	>0.05
Diabetes Mellitus	12 (20%)	14 (23.3%)	>0.05
Hypertension	18 (30%)	17 (28.3%)	>0.05

Table 2: Comparison of Surgical Outcomes

Parameters	Phacoemulsification	MSICS	p-value
Mean Operative Time (min)	18 ± 4	14 ± 3	<0.01
Postoperative Corneal Edema	5 (8.3%)	12 (20%)	<0.05
Surgically Induced Astigmatism (D)	0.8 ± 0.3	1.5 ± 0.5	<0.001
Posterior Capsular Rupture	2 (3.3%)	3 (5%)	>0.05
Early Visual Recovery	Higher	Moderate	<0.05

Table 3: Postoperative Visual Acuity Outcomes

Visual Acuity	Phacoemulsification	MSICS	p-value
Day 1 $\geq 6/18$	52 (86.7%)	42 (70%)	<0.05
1 Week $\geq 6/18$	56 (93.3%)	53 (88.3%)	>0.05
6 Weeks $\geq 6/12$	58 (96.7%)	57 (95%)	>0.05

Table 4: Postoperative Complications

Complications	Phacoemulsification	MSICS	p-value
Anterior Chamber Reaction	4 (6.7%)	9 (15%)	<0.05
Striate Keratopathy	3 (5%)	8 (13.3%)	<0.05
Raised Intraocular Pressure	2 (3.3%)	3 (5%)	>0.05
Endophthalmitis	0	0	—

Discussion

The present study compared the clinical outcomes of phacoemulsification and Manual Small Incision Cataract Surgery in patients with age-related cataract. Both surgical techniques demonstrated excellent postoperative visual outcomes with low complication rates. In the current study, demographic characteristics were comparable between the groups, allowing reliable comparison of surgical outcomes. Similar baseline comparability was reported in previous comparative cataract surgery studies.[11]

Phacoemulsification demonstrated significantly lower surgically induced astigmatism and reduced postoperative corneal edema compared to manual small incision cataract surgery. Smaller incision size and reduced tissue manipulation in phacoemulsification contribute to faster corneal recovery and better refractive stability.[12] Similar findings were reported by Gogate et al., who observed lower postoperative astigmatism following phacoemulsification.[13]

The operative duration was shorter in the manual small incision cataract surgery group. manual small incision cataract surgery allows rapid nucleus delivery without ultrasonic emulsification and may therefore be advantageous in high-volume cataract surgery settings.[14] This finding is particularly relevant in developing countries with large cataract burden and limited surgical resources.

Early postoperative visual recovery was significantly better in the phacoemulsification group. However, final corrected visual acuity at 6 weeks was comparable between both techniques. Similar observations were reported in studies by Ruit et al. and George et al., demonstrating equivalent long-term visual outcomes between phacoemulsification and manual small incision cataract surgery.[15,16]

Postoperative complications including corneal edema, anterior chamber reaction, and striate keratopathy were more common in the manual small incision cataract surgery group. Larger incision size and increased intraocular manipulation during nucleus delivery may contribute to postoperative inflammation.[17] Nevertheless, complication rates in both groups remained low and manageable.

The findings of the present study suggest that both phacoemulsification and manual small incision cataract surgery are safe and effective surgical techniques for age-related cataract. Phacoemulsification offers faster visual rehabilitation and better refractive outcomes, whereas manual small incision cataract surgery remains cost-effective and suitable for dense cataracts and resource-limited settings.

Conclusion

Both phacoemulsification and Manual Small Incision Cataract Surgery are effective techniques for the management of age-related cataract with excellent postoperative visual outcomes. Phacoemulsification provides faster visual recovery, lower postoperative astigmatism, and reduced corneal edema, while manual small incision cataract surgery offers shorter operative time and remains a cost-effective alternative, especially in high-volume and resource-constrained settings. Selection of surgical technique should be individualized based on cataract density, surgeon expertise, patient affordability, and available infrastructure.

References

1. World Health Organization. Global data on visual impairments. Geneva: WHO; 2019.
2. Brian G, Taylor H. Cataract blindness—challenges for the 21st century. Bull World Health Organ. 2001;79(3):249-256.
3. Foster A. Cataract and vision 2020. Community Eye Health. 2001;14(37):17-19.
4. Kelman CD. Phaco-emulsification and aspiration. Am J Ophthalmol. 1967;64(1):23-35.
5. Minassian DC, Mehra V. 3.8 million blinded by cataract each year. Br J Ophthalmol. 1990;74(6):341-343.
6. Gogate PM. Small incision cataract surgery. Community Eye Health. 2009;22(69):4-5.
7. Venkatesh R, Das M, Prashanth S, et al. Manual small incision cataract surgery in difficult cases. Middle East Afr J Ophthalmol. 2009;16(3):114-118.
8. Ruit S, Tabin G, Chang D, et al. Cataract surgery in developing countries. N Engl J Med. 2007;357(10):1040-1041.
9. George R, Rupauliha P, Sripriya AV, et al. Comparison of phacoemulsification and MSICS. Ophthalmology. 2005;112(5):869-874.
10. Gogate P, Deshpande M, Wormald R. Is manual small incision cataract surgery affordable? Br J Ophthalmol. 2003;87(7):843-846.
11. Gogate PM, Kulkarni SR, Krishnaiah S, et al. Safety and efficacy of phacoemulsification. Ophthalmology. 2005;112(5):869-874.
12. Fishkind W. Phacoemulsification principles and techniques. Curr Opin Ophthalmol. 1992;3(1):29-34.
13. Gogate PM, Deshpande MD, Nirmalan PK. Why do phacoemulsification? Indian J Ophthalmol. 2007;55(6):441-446.
14. Hennig A, Singh AK, Winter I, et al. Manual small incision cataract surgery. Br J Ophthalmol. 2003;87(3):266-270.
15. Ruit S, Tabin G, Nissman SA, et al. Low-cost

- high-volume cataract surgery. Arch Ophthalmol. 1999; 117(11):1509-1512.
16. George R, Rupauliha P, Sripriya AV, et al. Comparison of surgical outcomes. Br J Ophthalmol. 2005; 89(6):667-671.
17. Venkatesh R, Muralikrishnan R, Balent LC, et al. Outcomes of high-volume cataract surgeries. Ophthalmology. 2005; 112(5):869-874.