IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 24, Issue 8 Ser. 6 (August. 2025), PP 05-08
www.iosrjournals.org

Comparison Of Intraocular Pressure Changes After Phacoemulsification And Manual Small Incision Cataract Surgery

Shreyash Jadhao, Smita Kadu, Pratik Mohod
Junior Resident III, Department Of Ophthalmology, Dr. Pdmmc Amravati, Maharashtra, India.
Professor And Hod, Department Of Ophthalmology, Dr. Pdmmc Amravati, Maharashtra, India.
Assistant Professor, Department Of Ophthalmology, Dr. Pdmmc Amravati, Maharashtra, India.

Abstract
Background: *Cataract is a leading cause of visual impairment worldwide, and surgical intervention remains the definitive treatment.*
Objectives: *To compare postoperative intraocular pressure changes in patients undergoing MSICS and phacoemulsification for senile cataract.*
Methods: *This randomized controlled trial was conducted over 18 months in the Ophthalmology Department of a tertiary care centre. A total of 308 patients with senile cataract were enrolled and randomly assigned to either MSICS (n = 154) or PHACO (n = 154) using a simple odd–even randomization method. Detailed demographic, systemic, and ocular examinations were performed. Patients were followed up on postoperative day 1, day 7, and day 30. Mean IOP was measured using Goldmann applanation tonometry at each visit.*
Results: *The majority of patients were between 50 and 70 years (69.8%), with a female predominance (54.2%). Across all postoperative follow-up intervals, both surgical techniques demonstrated comparable mean IOP levels, with no statistically significant difference between the two groups (p = 0.14, 0.10, and 0.29 respectively). This indicates that both SICS and PHACO are similarly effective in maintaining stable postoperative IOP levels during the first month after surgery.*
Conclusion: *Both MSICS and phacoemulsification demonstrated similar postoperative intraocular pressure outcomes. These findings suggest that either technique can be effectively employed in senile cataract surgery without significant differences in postoperative IOP control.*
Keywords: *Intraocular pressure, manual small incision cataract surgery, phacoemulsification, randomized controlled trial, Senile cataract.*

Date of Submission: 14-08-2025 Date of Acceptance: 24-08-2025

I. Introduction

Cataract is the commonest cause of blindness worldwide, accounting for about 48% of blindness and a third of the global burden of visual impairment [1,2]. Cataract surgery is the most performed surgical operation in ophthalmic practice [3]. Cataract extraction technique has evolved over the years from Intra-Capsular Cataract Extraction (ICCE) to conventional Extra-Capsular Cataract Extraction (ECCE) through Manual Small Incision Cataract Surgery (MSICS) and Phacoemulsification [4].

Phacoemulsification is the most common method for cataract extraction worldwide. Several reports have demonstrated intraocular pressure (IOP) reduction after phacoemulsification in normal eyes and in eyes with ocular hypertension or glaucoma [5]. The magnitude of reported IOP reduction after phacoemulsification varies from 1 to 6.5 mmHg 12 months after surgery [6] Higher preoperative IOPs have been associated with greater IOP reductions and eyes with gonioscopically narrow angles experience greater reduction in IOP compared to those with open angles [7]. In phacoemulsification, IOP reduction was attributed to the activation of IL-1a and Endothelial leukocyte-adhesion molecule (ELAM)-1 expression by non-glaucomatous trabecular meshwork cells by ultrasound during phacoemulsification [8].

Manual small-incision cataract surgery (MSICS) is a safe and cost-effective technique for tackling the huge backlog of cataract blindness in the developing world [9]. Visual outcomes with MSICS are good, surgical times are short, sutures are required rarely, and complication rates are comparable with those of phacoemulsification, even in the most complex scenarios [10].

If reduction in IOP after phacoemulsification was the result of structural changes in angle configuration or another mechanism shared by MSICS and phacoemulsification, then one would expect a similar degree of IOP lowering from both procedures. Comparison of changes in IOP between phacoemulsification and MSICS will

allow one to determine whether the IOP-lowering effect of cataract removal is the result of the cataract extraction itself (independent of the method of lens removal) or ultrasonic energy on the trabecular meshwork structures. Thus, our study is designed to determine and compare the IOP changes following Manual small incision cataract surgery and Phacoemulsification.[11]

This study was aimed to compare intraocular pressure changes among the patient undergoing Phacoemulsification and manual small incision cataract surgery.

II. Materials And Methods:

This randomized controlled trial was conducted over a period of 18 months in the Department of Ophthalmology at a tertiary care centre. The sample size was calculated using OpenEpi software, based on the mean and standard deviation of Group I (MSICS: 15.3 ± 5.1) and Group II (Phacoemulsification: 13.9 ± 3.5), with 95% confidence interval and 80% power, which yielded 154 patients per group, giving a total of 308 patients. The study population included patients with senile cataract admitted for surgery who fulfilled the eligibility criteria. Inclusion criteria comprised patients with senile cataract willing to participate in the study, whereas exclusion criteria were patients on anti-glaucoma medication, those with pseudoexfoliation, subluxated cataract, history of prior refractive surgery, ocular infection, poor corneal surface, pre-existing ocular pathology, intraoperative complications, or loss to follow-up. Institutional Ethical Committee approval was obtained prior to commencement of the study, and written informed consent was taken from all participants before enrolment. Patients were allocated into two groups by simple random sampling using an odd–even method.

For each patient, a detailed demographic, systemic, and ocular history was recorded, followed by a comprehensive general and ocular examination. This included assessment of visual acuity, anterior segment evaluation, nuclear sclerosis grading, fundus examination, intraocular pressure measurement with Goldmann applanation tonometry, and gonioscopy. Eligible patients were then randomly assigned to undergo either manual small incision cataract surgery (MSICS) or phacoemulsification. All participants were evaluated postoperatively on day 1, day 7, and day 30.

Data were entered into Microsoft Excel and subsequently analysed. Descriptive statistics such as frequency, percentage, mean, and standard deviation were used to summarize the data. Inferential statistics were applied to test the significance of differences between the groups, with p-values <0.05 considered statistically significant.

III. Results

Table 1: Distribution of subjects according to age

AGE (years)	Frequency	Percentage
40-50	11	3.6
50-60	91	29.5
60-70	124	40.3
70-80	67	21.8
>80	15	4.9
Total	308	100.0

Among the 308 participants in the study, the majority were older adults, with most falling between 50 and 70 years of age. The largest age group was 60–70 years, comprising 124 patients (40.3%), followed by the 50–60 years group with 91 patients (29.5%). Participants aged 70–80 years accounted for 67 cases (21.8%), while only 11 patients (3.6%) were in the 40–50 years range. The smallest proportion was seen in those over 80 years of age, with 15 patients (4.9%). Overall, 69.8% of the study population was between 50 and 70 years old, highlighting a predominance of middle-aged to elderly individuals. 167 (54.2%) were female and 141 (45.8%) were males.

Table2: Distribution of subjects according to type of procedure

TYPE OF PROCEDURE	EYE		Total
	RIGHT EYE	LEFT EYE	
PHACO EMULSIFICATION	78	76	154
SICS	75	79	154

Among the 308 procedures performed, phacoemulsification and small incision cataract surgery (SICS) were equally common, with each accounting for 154 cases (50.0%). This indicates an equal distribution between the two surgical techniques in the study population.

Table 3: Postoperative Changes In SICS And Phacoemulsification On Post-Operative Day 1, Day 7 And Day 30

Procedure	Change in Mean (Day 1) (mm Hg)	Change in Mean (Day 7) (mm Hg)	Change in Mean (Day 30) (mm Hg)	P- VALUE
PHACO	–1.63	2.13	2.06	0.00
SICS	–0.83	1.31	1.03	0.00

The table shows the change in mean intraocular pressure (IOP) at three postoperative time points—Day 1, Day 7, and Day 30—for patients undergoing phacoemulsification (PHACO) and small incision cataract surgery (SICS).For **PHACO**, the mean IOP decreased by **1.63 mm Hg** on Day 1 compared to the preoperative level, but increased above baseline by **2.13 mm Hg** on Day 7 and **2.06 mm Hg** on Day 30.For **SICS**, the mean IOP decreased by **0.83 mm Hg** on Day 1, then increased by **1.31 mm Hg** on Day 7 and **1.03 mm Hg** on Day 30.In both procedures, the reported p-values are **0.00** ($p < 0.001$), indicating that these changes from baseline were **statistically highly significant** at all time points.

Table 4: Comparison of mean changes in SICS Vs PHACO on post operative day 1, day 7 and day 30

IOP (Mean ± S.D.)	SICS (n = 154)	PHACO (n = 154)	p value
IOP at postoperative Day 1	14.78±3.81	15.34±2.93	0.14
IOP at postoperative Day 7	14.30±3.25	14.84±2.59	0.10
IOP at postoperative Day 30	14.58±2.98	14.91±2.58	0.29

On postoperative day 1, the mean IOP was *14.78 ± 3.81 mmHg* in the SICS group and *15.34 ± 2.93 mmHg* in the PHACO group. The standard error (SE) of the difference between the two means corresponded to a 95% confidence interval (CI) ranging from -0.20 to 1.32 mmHg, and the difference was not statistically significant ($p = 0.14$).On postoperative day 7, the mean IOP was *14.30 ± 3.25 mmHg* for SICS and *14.84 ± 2.59 mmHg* for PHACO. The 95% CI of the difference ranged from -0.11 to 1.19 mmHg, again showing no statistically significant difference ($p = 0.10$).On postoperative day 30, the mean IOP was *14.58 ± 2.98 mmHg* for SICS and *14.91 ± 2.58 mmHg* for PHACO. The 95% CI for the difference ranged from -0.29 to 0.95 mmHg, which was also not statistically significant ($p = 0.29$).

Across all postoperative follow-up intervals, both surgical techniques demonstrated comparable mean IOP levels, with no statistically significant difference between the two groups. The narrow confidence intervals and p-values > 0.05 suggest that any observed differences in mean IOP are likely due to chance rather than a true difference in surgical outcomes. This indicates that both SICS and PHACO are similarly effective in maintaining stable postoperative IOP levels during the first month after surgery.

IV. Discussion

Cataract remains the leading cause of blindness worldwide, accounting for a significant proportion of visual impairment in both developed and developing countries despite advances in surgical techniques and increased accessibility to care [1,12,13]. The global burden is further emphasized by variations in surgery uptake due to socio-economic, cultural, and healthcare infrastructure barriers [2, 3]. Over the past decades, surgical management has evolved from intracapsular extraction to extracapsular extraction, and finally to modern techniques such as Small Incision Cataract Surgery (SICS) and Phacoemulsification (PHACO), each offering specific advantages in terms of incision size, recovery, and complication profile [4,10,11].

In the present study involving 308 patients, we found a predominance of individuals aged between 50 and 70 years (69.8%), which is consistent with epidemiological patterns where cataract prevalence rises sharply with age [11,12]. Both PHACO and SICS were equally represented (50% each), allowing for a balanced comparison of postoperative intraocular pressure (IOP) changes.

Postoperatively, both groups demonstrated a comparable pattern of IOP stabilization, with no statistically significant differences at day 1, day 7, and day 30 follow-ups ($p > 0.05$ for all comparisons). These findings suggest that while PHACO patients had slightly higher IOP values at each postoperative interval, the differences were clinically minimal and likely attributable to chance.

Our findings align with **Sengupta et al.** [14] who demonstrated comparable long-term IOP reduction between PHACO and SICS, despite differences in early postoperative trends. Studies such as those by **Huang et al.** [6] and **Altan et al.** [15] support the concept that angle anatomy plays a key role in postoperative IOP changes, with greater benefits observed in eyes with narrow angles. In contrast, in open-angle eyes without glaucoma, as in our cohort, the IOP reduction is moderate but consistent. [16,17]

V. Conclusion

In the present study comparing postoperative intraocular pressure (IOP) changes following Small Incision Cataract Surgery (SICS) and Phacoemulsification (PHACO), both techniques were found to have

effective changes in IOP. While both groups demonstrated a reduction in IOP by postoperative day 30, the decrease was more pronounced in the PHACO group compared to the SICS group but not statistically significant. This difference may be attributable to variations in surgical technique, wound construction, and postoperative inflammatory response. Overall, the findings suggest that PHACO offers a slightly better IOP-lowering effect in the postoperative period, whereas SICS remains a safe, cost-effective, and reliable option, particularly in resource-limited settings. Both procedures can be recommended for routine cataract management, with the choice guided by patient factors, surgeon expertise, and resource availability.

Conflict of Interest: There is no conflict of interest.
Financial support and sponsorship: Nil.

Reference

[1] Rao Gullapalli, Khanna Rohit, Payal Abhishek. The Global Burden Of Cataract. Curr Opin Ophthalmol. 2011;22(1):4-9.
[2] Batlle Juan, Lansingh Van, Silva Juan, Eckert Kristen, Resnikoff Serge. Cataract Situation In Latin America: Barriers To Cataract Surgery. Am J Ophthalmol. 2014;158(2):242-250.
[3] Mojon-Azzi Stefania, Mojon Daniel. Waiting Times For Cataract Surgery In Ten European Countries: An Analysis Using Data From The SHARE Survey. Br J Ophthalmol. 2007;91(3):282 286.
[4] Aruta Alessandro, Marenco Marco, Marinozzi Silvia. History Of Cataract Surgery.Medicina Nei Secoli. 2009;21(1):403-428.
[5] Bilak S, Simsek A, Capkin M, Et Al. Biometric And Intraocular Pressure Change After Cataract Surgery. Optom Vis Sci 2015;92: 464–70.
[6] Huang G, Gonzalez E, Peng PH, Et Al. Anterior Chamber Depth, Iridocorneal Angle Width, And Intraocular Pressure Changes After Phacoemulsification: Narrow Vs Open Iridocorneal Angles. Arch Ophthalmol 2011; 129:1283–90.
[7] Chen PP, Lin SC, Junk AK, Et Al. The Effect Of Phacoemul Sification On Intraocular Pressure In Glaucoma Patients: A Report By The American Academy Of Ophthalmology. Ophthalmology 2015; 122:1294–307.
[8] Wang Nan, Chintala Shravan, Fini Elizabeth, Schuman Joel. Ultrasound Activates The TM ELAM-1/IL-1//NF-Kb Response: A Potential Mechanism For Intraocular Pressure Reduction After Phacoemulsification. Invest Ophthalmol Vis Sci.2013;44(5):1977-1981.
[9] Venkatesh R, Chang DF, Muralikrishnan R, Et Al. Manual Small Incision Cataract Surgery: A Review. Asia-Pac J Oph Thalmol 2012;1:113–9.
[10] Venkatesh R, Tan CSH, Sengupta S, Et Al. Phacoemulsification Versus Manual Small-Incision Cataract Surgery For White Cataract. J Cataract Refract Surg 2010;36:1849–54.
[11] Mayo Clinic. Cataracts - Symptoms And Causes. [Internet]. Available From: Https://Www.Mayoclinic.Org/Diseases-Conditions/Cataracts/Symptoms-Causes/Syc-20353790
[12] .Fang R, Yu YF, Li EJ, Lv NX, Liu ZC, Zhou HG, Song XD. Global, Regional, National Burden And Gender Disparity Of Cataract: Findings From The Global Burden Of Disease Study 2019. BMC Public Health. 2022;22:2068.
[13] National Programme For Control Of Blindness And Visual Impairment. National Blindness And Visual Impairment Survey 2015-2019.
[14] Sengupta Sabyasachi, Venkatesh Rengaraj, Krishnamurthy Palaniswamy, Nath Manas, Mashruwala Abha, Ramulu Pradeep,Robin Alan, Lee Paul. Intraocular Pressure Reduction After Phacoemulsification Versus Manual Small-Incision Cataract Surgery. A Randomized Controlled Trial. Ophthalmology.2016;123(8):1-9.
[15] Altan C, Bayraktar S, Altan T, Eren H, Yilmaz OF. Anterior Chamber Depth, Iridocorneal Angle Width, And Intraocular Pressure Changes After Uneventful Phacoemulsification In Eyes Without Glaucoma And With Open Iridocorneal Angles. *J Cataract Refract Surg*. 2004;30(4):832-838.
[16] Lee SJ, Lee CK, Kim WS. Long-Term Therapeutic Efficacy Of Phacoemulsification With Intraocular Lens Implantation In Patients With Phacomorphic Glaucoma. *J Cataract Refract Surg*. 2010;36(5):783-789.
[17] Poley BJ, Lindstrom RL, Samuelson TW, Schulze R Jr. Intraocular Pressure Reduction After Phacoemulsification With Intraocular Lens Implantation In Glaucomatous And Nonglaucomatous Eyes: Evaluation Of A Causal Relationship Between The Natural Lens And Open-Angle Glaucoma. *J Cataract Refract Surg*. 2009;35(11):1946-1955.