

CORNEA AND ANTERIOR SEGMENT

Surgically induced astigmatism following manual small incision cataract surgery versus phacoemulsification in age-related cataract: a comparative analysis

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Background: Cataract surgery is among the most common and successful procedures globally.^{1,2} While phacoemulsification is the more advanced method, manual small incision cataract surgery (MSICS) remains prevalent in developing countries due to its affordability, shorter duration, and comparable visual outcomes.³⁻⁵ There is limited comparative data from Nigeria on corneal astigmatism and refractive stability between MSICS and phacoemulsification. This study aims to compare these outcomes between the two techniques.

Materials and Methods: The study was a prospective hospital-based, comparative study of consecutive patients with age-related cataracts, randomized into 2 groups by randomly assigning letters A and B in a ratio of 1:1 to undergo MSICS (group A) or phacoemulsification (group B) using the superior

approach, comparing the surgically induced corneal astigmatism (SIA) between the two techniques. SIA was calculated through vector analysis using the Warren Hill SIA calculator and the Holladay SIA method while stable corneal astigmatism was defined as average keratometry readings (average K in dioptres) within $\pm 0.50D^6$ and axis within 30 degrees of the last follow-up.⁷ The results were compared between the two groups, with a p-value of less than 0.05 indicating statistical significance. Ethical approval was obtained from the Lagos State University Teaching Hospital Health Research Ethical Committee (HREC) and written informed consent was obtained from the patients.

Results: A total of 214 eyes were studied, with 107 in each surgical group. Age and gender distribution were similar ($p=0.153$ and 0.218) as seen in Table 1. Preoperative against-the-rule (ATR) astigmatism was more common in the phacoemulsification group (66.4%) than in the MSICS group (47.7%). By month 3, ATR astigmatism increased to 76.6% in the MSICS group compared to 49.5% in the phacoemulsification group. As shown in Table 2, the mean SIA in the MSICS group at months 1, 2 and 3 was $1.94D \times 19.3^\circ$, $1.83D \times 18.2^\circ$ and $1.72D \times 20.2^\circ$, respectively, while in the phacoemulsification group, the mean SIA was $0.92D \times 17.7^\circ$, $1.01D \times 16.4^\circ$ and $1.00D \times 15.8^\circ$ at months 1, 2 and 3, respectively. SIA differed significantly between the two groups at all postoperative time points ($p<0.001$). Final best corrected visual acuity was similar at month 3, with 95.3% of MSICS and 98.1% of phacoemulsification patients achieving 6/12 or better ($p=0.324$). By the first postoperative month, 96 eyes (89.7%) in the MSICS group and 89 eyes (83.2%) in the phacoemulsification group had achieved stable corneal astigmatism. By the second month, stability was observed in 95 eyes (88.8%) of the MSICS group and 106 eyes (99.1%) of the phacoemulsification group (Figure 1).

Table 1: Demographic distribution of eyes in the manual small incision cataract surgery and Phacoemulsification group

	MSICS	PHACO	P value
Age group [Frequency (%)]			0.390
51 – 60 years	19 (17.8%)	17 (15.9%)	
61 – 70 years	42 (39.3%)	37 (34.6%)	
71 – 80 years	42 (39.3%)	43 (40.2%)	
> 80 years	4 (3.6%)	10 (9.3%)	
Mean age (SD)years	68.2 (7.6)	69.8 (9.1)	0.153
Gender [Frequency (%)]			0.218
Male	56 (52.3%)	47 (43.9%)	
Female	51 (47.7%)	60 (56.1%)	
Laterality [Frequency (%)]			0.618
Right eye	50 (46.7%)	53 (49.5%)	
Left eye	57 (53.3%)	54 (50.5%)	

MSICS - manual small incision cataract surgery; PHACO - Phacoemulsification; SD- Standard deviation

Table 2: Comparison between average K (dioptres), centroid astigmatism (magnitude and axis) and SIA (magnitude and axis) between the two groups at preoperative, month 1, month 2, and month 3

	Pre-op	P value	Month 1	P value	Month 2	P value	Month 3	P value
Average K values								
MSICS	43.56D	0.089	43.96D	<0.001	43.84D	<0.001	43.79D	<0.001
PHACO	43.20D		42.96D		42.75D		42.71D	
Centroid astigmatism								
MSICS	1.05 x 18.6°	0.184	1.98 x 15.2°	<0.001	1.79 x 16.4°	<0.001	1.68 x 17°	<0.001
PHACO	1.17 x 14.3°		0.79 x 19.3°		0.70 x 20.8°		0.63 x 20°	
SIA								
MSICS			1.94 x 19.3°	<0.001	1.83 x 18.2°	<0.001	1.72 x 20.2°	<0.001
PHACO			0.92 x 17.7°		1.01 x 16.4°		1.00 x 15.8°	

MSICS - manual small incision cataract surgery; PHACO – Phacoemulsification; SIA - surgically induced corneal astigmatism

Discussion: This study found that postoperative ATR increased significantly among MSICS patients compared to phacoemulsification, a finding in line with earlier studies^{8,9} and likely due to larger incisions, wound construction, and cauterization in MSICS. Surgically induced astigmatism (SIA) was consistently higher in MSICS at all follow-up points, in line with previous evidence by Waghmare et al⁹, and Nair et al.¹⁰ Although more of the MSICS eyes stabilized by 1 month compared to phacoemulsification eyes, nearly all phacoemulsification eyes stabilized by the second month. Both procedures produced excellent visual outcomes, with over 96% of MSICS and 98% of phacoemulsification patients achieving 6/12 or better by three months. Nonetheless, phacoemulsification provided slightly better unaided visual acuity, reducing the likelihood of dependence on corrective lenses.

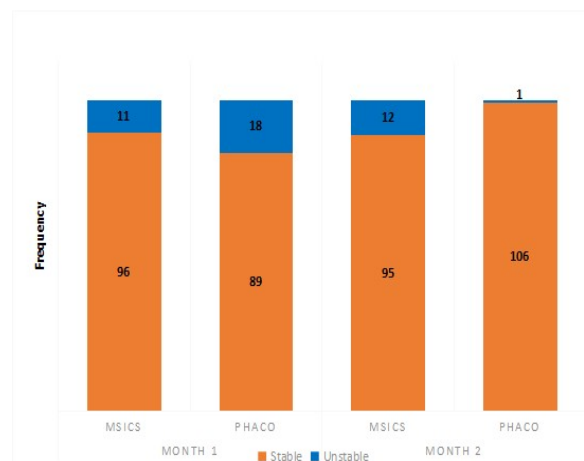


Figure 1: Time to corneal astigmatism stability between manual small incision cataract surgery (MSICS) and Phacoemulsification (PHACO).

Conclusion: Phacoemulsification resulted in lower and more stable SIA. However, both techniques provided excellent final visual outcomes. While Phacoemulsification is more desirable, MSICS is relevant in resource-limited settings.

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