

This Randomized Prospective Study to Evaluate the Anatomic and Functional Changes of the Corneal Endothelium in Cataract Patients Undergoing Phacoemulsification and MSICS

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Received: 16-11-2021 / Revised: 25-12-2021 / Accepted: 23-01-2022

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Conflict of interest: Nil

Abstract

Aim: To compare the effect of Phacoemulsification and Manual small incision cataract surgery (MSICS) on the corneal endothelium and to assess its impact on visual acuity and induced astigmatism.

Material & Method: This randomized prospective study was conducted on 140 cataract patients visiting Department of Ophthalmology, Patna Medical College & Hospital, Patna, Bihar, India. Patients were randomly divided into two groups by lottery method, comprising 70 patients each who underwent phacoemulsification (group 1) and manual small incision cataract surgery (group 2). Grading of the cataract was not taken into consideration while allotment of the patient's to either of the two surgical techniques.

Results: The difference in postoperative mean central corneal thickness was statistically not significant at all intervals in both groups. The difference in postoperative best corrected visual acuity at 6 weeks was not statistically significant (p value = 1.0). The difference was statistically significant between two groups (p value = 0.030). The mean postoperative astigmatism was less in Group 1 compared with Group 2 at 6 weeks. **Conclusion:** As the Manual small incision cataract surgery does not depend upon advanced technology and is more cost effective, it may be a favorable surgical procedure in those areas where high cost phacoemulsification techniques are still not accessible.

Keywords: Cataract Surgery, Endothelial Cell Changes, phacoemulsification, MSICS

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Introduction

The mean endothelial count (ECC) in the normal adult cornea ranges from 2000 to 2500 cells/mm², and the count continues to decrease with age. Previous cross-sectional studies have shown the normal attrition rate of corneal endothelial cells is 0.3-0.5% per year.[1,2] Cataract is responsible for 62.4% of blindness in India

and the prevalence of blindness is 5.3% [4].

Most common cause of cataract is the normal ageing process; other causes include injury, chronic eye disease and other systemic diseases such as diabetes mellitus [5]. The only effective treatment

of cataract is to remove the opacified lens surgically. No diet or medication can stop cataract formation. Cataract surgery aims to improve vision and thereby the quality of life of affected people [6].

In developing countries such as India, where there is a cataract backlog, MSICS with intraocular lens (IOL) implantation promises to be a viable cost-effective alternative to phacoemulsification.[7].With approximately 6 million cataract surgeries being performed in India every year, it is important to determine the safest surgical technique for the cataract surgery.

Thus, this study aims to compare the effect of Phacoemulsification and Manual small incision cataract surgery (MSICS) on the corneal endothelium and to assess its impact on visual acuity and induced astigmatism.

Material & Method:

This randomized prospective study was conducted on 140 cataract patients visiting Department of Ophthalmology, Patna Medical College & Hospital, Patna, Bihar, India for 1 year

Patients were randomly divided into two groups by lottery method, comprising 70 patients each who underwent phacoemulsification (group 1) and manual small incision cataract surgery (group 2). Grading of the cataract was not taken into consideration while allotment of the patient's to either of the two surgical techniques. Patients with senile cataract or presenile cataract of nuclear grade 2, 3 and 4 according to the LOCS III classification between the age group of 35-75 years, medically fit for cataract surgery under local anesthesia and patients with normal corneal endothelium were included in the study.

Patients with brown cataract, traumatic cataract, any corneal dystrophy and degenerations, past history of corneal or intraocular surgery, ocular diseases like

glaucoma and uveitis and intraoperative complications i.e. posterior capsular rupture, vitreous loss were excluded from the study.

The technique used in Manual small incision cataract surgery and phacoemulsification met the accepted standards worldwide.

A written informed consent was taken in patient's vernacular language. All surgeries were performed by single surgeon and same type of single piece foldable hydrophilic posterior chamber intraocular lens was implanted. All patients underwent complete ophthalmic examination followed by measurement of central corneal thickness, endothelial cell count (specular microscopy) and pentacam study to know the corneal topography was performed preoperatively and postoperatively at day 1, day 7, and day 28 and on 42nd day. Best corrected visual acuity was recorded at 6 weeks.

All the parameters were tabulated and data analysis was performed using statistical package for the social sciences, version 21.0 for windows (IBM corp. SPSS, 2012, Armonk, NY) applying Chi square test, student unpaired sample t test and paired sample t test. P value < 0.05 was considered statistically significant. The operative technique used in both procedures met the surgical standards prevalent worldwide.

Results:

The mean preoperative endothelial cell count in group 1 was 2672.2 ± 344.8 cells/mm². Postoperatively on day 1, the mean endothelial cell count was reduced to 2481.8 ± 368.8 cells/mm². In group 2 the mean preoperative endothelial cell count was 2660.8 ± 277.0 cells/mm². (Table 1).

In group 1, the mean baseline central corneal thickness before surgery was 0.58 ± 0.04 mm, which increased to 0.66 ± 0.06 mm a day after surgery and in

group 2, it was 0.50_0.04 mm before surgery which increased to 0.55_0.04 mm a day after surgery. The mean central corneal thickness was reduced closest to the preoperative value at day 42 in both the groups with a mean of 0.51 ± 0.03 mm in group 1 and 0.51 ± 0.03 mm in group 2. The difference in postoperative mean central corneal thickness was statistically not significant at all intervals in both groups.(Table 2).

In group 1, 68 cases and in group 2, 69 cases each had postoperative best corrected visual acuity better than 6/18.

The difference in postoperative best corrected visual acuity at 6 weeks was not statistically significant (p value = 1.0) (Table 3).

The difference in mean endothelial cell loss was not significant at different postoperative intervals in both the groups ($p > 0.05$). (Figure 1).

The difference was statistically significant between two groups (p value = 0.030). The mean postoperative astigmatism was less in Group 1 compared with Group 2 at 6 weeks. (Figure 2)

Table 1: Mean endothelial cell count (cells/mm²)

Groups	Preoperative Endothelial Cell count	Postoperative Endothelial Cell count Mean±S.D			
	Mean±S.D	Day 1	Day 7	Day 28	Day 42
Group 1	2672.2±344.8	2481.8±368.8	2381.9±402.1	2270.7±370.5	2182.6±333.6
Group 2	2660.8±277.0	2431.7±244.1	2302.7±299.0	2283.7±261.2	2118.4±227.8
p-value	0.721 (NS)	0.6812 (NS)	0.792 (NS)	0.762 (NS)	0.778 (NS)

Table 2: Postoperative Mean central corneal thickness (mm)

Groups	Postoperative Mean central corneal thickness ± S.D.(mm)			
	Day 1	Day 7	Day 28	Day 42
Group 1	0.66±0.06	0.62±0.05	0.60±0.04	0.55±0.03
Group 2	0.61±0.05	0.60±0.05	0.58±0.04	0.51±0.03
'p' value	0.392 (NS)	0.891 (NS)	0.308 (NS)	0.290 (NS)

Table 3: Postoperative best corrected visual acuity at 6 weeks

Best Corrected visual acuity (BCVA)	Group 1	Group 2
VA≤6/18	2	1
VA>6/18	68	69
p-value	0.001 (Sig.)	
Df		
'p' value		

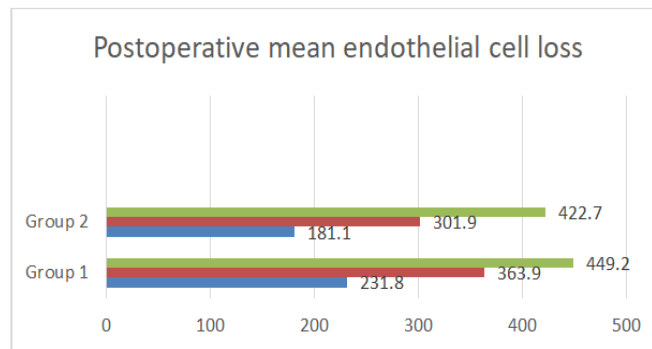


Figure 1: Postoperative mean endothelial cell loss (cells/mm²)

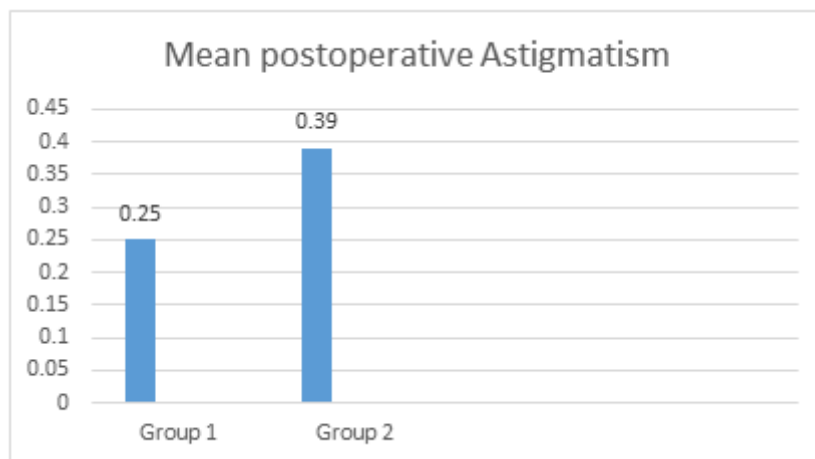


Figure 2: Mean postoperative Astigmatism (In diopters)

Discussion:

Manual small-incision techniques are gaining popularity as quick, relatively inexpensive techniques for large-scale cataract management in the developing world. Phacoemulsification has been shown to be safe for the corneal endothelium.[8-10]

However, postoperative visual acuity and complication rates are the same phacoemulsification and SICS.[11]

A study by Ganekal S et al. who compared the morphological and functional endothelial changes after phacoemulsification versus MSICS and found that at the end of 6 weeks the endothelial changes were not statistically significant between the 2 groups.[12] Various other studies also comparing the endothelial cell loss at 6 weeks between phacoemulsification and

manual small incision cataract surgery concluded statistically insignificant difference between the two groups.[13-15]

A study comparing phacoemulsification and conventional ECCE[7] reported a 10% reduction in endothelial cells in both groups. In a study comparing endothelial cell loss after conventional ECCE, MSICS, and phacoemulsification,[8] the ECC decreased by 4.72%, 4.21%, and 5.41%, respectively, with no significant difference between the three groups. Another study evaluated [9]endothelial cell damage after phacoemulsification and planned ECCE with different capsulotomy techniques. The mean cell loss was 11.8% in the phacoemulsification group, 12.8% in the ECCE group that underwent CCC and 10.1% in the ECCE group that underwent letterbox capsulotomy. The occurrence of posterior capsular rupture and vitreous loss at surgery leads to a statistically

significantly higher endothelial cell loss (18.9% vs. 11.5%; $P = 0.003$).[8]

In both the groups, 68 and 69 cases respectively had postoperative best corrected visual acuity better than 6/18. The difference in postoperative best corrected visual acuity at 6 weeks was not statistically significant ($p > 0.05$).[16] The result of this study is comparable with numerous studies. In a study by Gogate et al.[14] the corrected distance visual acuity at 6 weeks was better than 6/18 in 98.5% of patient's eyes in the phacoemulsification group and 97.3% of patient's eyes in the SICS group. Thus, there was no statistically significant difference in visual acuity between phacoemulsification and SICS. Similar results were found in a study by Ashok Rathi et al as there was no statistically significant difference between the MSICS & Phacoemulsification in terms of BCVA at post-operative 1 month.

A study conducted by Harakuni U et al. which observed SIA on 45th post-operative day in SICS group was +0.05 while in phaco group was -0.53 and this difference was statistically significant. SIA in phaco group was less compared to SICS group, showing phacoemulsification induced less postoperative astigmatism.[17] Study conducted by Khalaf M. et al. observed, at 3 months follow-up, the mean SIA was 2.08 in phaco group and in SICS group it was 2.96.[18,19]

Conclusion:

As the Manual small incision cataract surgery does not depend upon advanced technology and is more cost effective, it may be a favorable surgical procedure in those areas where high cost phacoemulsification techniques are still not accessible.

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