Manual Small Incision Cataract Surgery: A Suitable Option for Resource-Poor Settings

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ABSTRACT

Introduction: Phacoemulsification and manual small incision cataract surgery (MSICS) are sutureless surgeries with low complication rates and satisfactory visual outcomes. Compared to phacoemulsification, MSICS, a cost effective surgical technique, could better suit high volume surgery scenario of resource-poor settings. Objective was to compare preoperative macular thickness of patients undergoing uncomplicated phacoemulsification and MSICS and again postoperatively on days 1, 7 and 40 using optical coherence tomography (OCT).

Material and Methods: Randomized study at Rotary Eye Hospital, Malegaon. Patients of age 35-85years having undergone uneventful phacoemulsification or MSICS were included. Patients with co-existing ocular pathologies were excluded. Examination included indirect ophthalmoscopy, slit lamp biomicroscopy with 90 D lens and macular thickness measurements preoperatively and on days 1, 7 and 40postoperatively using OCT.

Results: Mean macular thickness in MSICS group was 187.71+/-17.22 µm preoperatively and 201.91+/- 18.95µm, 208.04+/- 18.66µm, 215.25+/- 19.38 µm, postoperatively on days 1, 7 and 40 respectively. Mean macular thickness in phacoemulsification group was 185.77+/- 15.64 µm preoperatively and 195.77+/-17.38 µm, 199.05+/- 16.87 µm, 203.76 +/- 17.48 µm postoperatively on days 1, 7and 40 respectively. Postoperative macular thickness (days 1, 7 and 40) was significantly higher in the MSICS group ($p= 0.013$, $p<0.000$ and $p<0.000$ respectively). There was neither clinical, nor OCT evidence of cystoid macular edema in either group.

Conclusion: The subclinical increase in macular thickness was higher following MSICS. However, final visual outcome remained unaffected. For resource-poor settings, MSICS still serves as a good means of offering comparable visual outcomes.

Key words: Phacoemulsification, Manual Incision Cataract Surgery, Resource-Poor Settings, Macular Thickness, Visual Outcome

INTRODUCTION

Globally, cataract is the leading cause of blindness and low vision in the world.[1] Both, phacoemulsification and MSICS are sutureless surgeries with low complication rates and satisfactory visual outcomes.[2] Phacoemulsification has become the treatment of choice over the past few decades. Manual small incision cataract surgery (MSICS) is a cost effective surgical technique suitable for high volume surgeries in resource-poor settings.[3] Cystoid macular edema (CME) is a common complication after cataract surgery. Conditionsthat affect the blood-retinal barrier like uveitis and diabetes increase the risk for CME. Risk factors also include surgical complications like rupture of posterior capsule, vitreous loss and iris incarceration.[4] Development of CME peaks between 4 and 12 weeks after surgery.[5] Lobo et al[6] reported that after uneventful MSICS, macular edema was associated with the presence of leaking sites located predominantly in the vascular regions of the central macula. They found 7 eyes (22%) with a degree of macular edema at 30 weeks after surgery. A German study by Grewing R et al concluded that uncomplicated cataract surgery does not influence retinal thickness in the immediate postoperative period in eyes without ocular pathologies.[7] An incidence of CME has been reported by Li in 8.1%cases after phacovitrectomy.[8] In a large study of 1659 cataract surgeries over 5 years, Henderson has reported an incidence of 2.35% of clinically significant postoperative CME.[9] Optical coherence tomography(OCT) evidence of cystoid macular edema after MSICS and phacoemulsification is reported to be 4% to 11%, as high as 41%.[10]

Phacoemulsification involves higher investment, higher cost of consumables[11] and greater average surgical time as compared to MSICS.[3] On the other hand, compared to phacoemulsification, MSICS is associated with more tissue trauma because of larger incision size and more iris manipulation. These may increase the chance of postoperative macular edema following MSICS compared to phacoemulsification.[12] Although phacoemulsification is the generally preferred method of cataract extraction, there is a need to seriously consider the scenario of high volume surgery in a resource-poor setting mainly for ill-affording patients. Only a few studies have reported macular thickness values following MSICS. Our study, conducted in one such resource-poor setting, was aimed at comparing visual outcomes post phacoemulsification and MSICS.

MATERIAL AND METHODS

We conducted a randomized comparative study at Rotary Eye Hospital, Malegaon, Maharashtra between October

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2012 and October 2013. Permission was obtained from the Ethics Committee of Rotary Eye Hospital, Malegaon. In this hospital, about 350 patients are examined in the out-patient department daily and about 40 cataract surgeries performed every day. About 80% patients are treated through charity. It is a predominantly rural to semi-urban demography. The Rotary Eye Hospital has facilities like a phacoemulsification unit and optical coherence tomography supported by dedicated and well-qualified ophthalmology consultants and trained staff. Our objective was to compare macular thickness of patients preoperatively and again postoperatively on days 1, 7 and 40 between patients undergoing uncomplicated phacoemulsification and MSICS using OCT. Information sheet about nature of study was designed for patients in their local language and informed consent was taken. Patients who consented to participate in the study were given appropriate concession in examination (OCT) charges. We included 220 eyes of 220 patients with cataract having undergone uneventful phacoemulsification or MSICSin the age group 35-85 years. Randomization was performed by block method. A total of 55 blocks of size 4 each with treatment allocation ratio of 1:1 for phacoemulsification and MSICS groups were created with the help of software. Thus, there were 110 eyes in each group. Patients having pre-existing corneal opacity, chronic iridocyclitis and other ocular inflammation, pre-existing macular pathologies like macular hole, macular scar, macular edema, old vitreous haemorrhage, and congenital cataract were excluded from the study. Demographic data was collected from each patient. Detailed history taking, laboratory investigations and ocular examinations were conducted for each patient as per routine standard of care. Macular thickness was measured by OCT preoperatively and on days 1, 7, and 40 postoperatively. Examination included testing for visual acuity, examination under slit lamp, and direct and indirect ophthalmoscopy. As a hospital policy, patients were called for correction of residual refractive error and spectacle prescription on day 40 post surgery. This ensured a follow-up rate of 100% in our study.

STATISTICAL ANALYSIS

Descriptive statistics were used for the categorical variables. ANOVA was used for comparison and calculating p value.

RESULTS

Our sample consisted of an almost equal distribution of males and females in both groups, predominantly in the age group of 55-85 years (Table 1).

Preoperatively, 54% patients in the MSICS group and 49% patients in the phacoemulsification (PE) group had best corrected visual acuity (BCVA) better than or equal to 6/18 (Table 2).

Postoperative BCVA on days 1, 7 and 40 in both groups are shown in table 3. Using one-way ANOVA for testing equality of variances, it was found that the difference in BCVA in the preoperative period and on postoperative day 1 between the 2 groups was insignificant (p=0.158 and 0.067 respectively). Variance in the BCVA on postoperative day 7 between the 2 groups was significant (p=0.04). On day 40, BCVA in the 2 groups showed absolutely no variation (p=1.00).

Table 4 shows mean macular thickness values in both MSICS and PE groups. Using one-way ANOVA to test equality of variances in macular thickness in both groups, it was found that the variance in the preoperative macular thickness between the 2 groups was insignificant (p=0.384).However, the postoperative macular thickness was significantly different on days 1, 7 and 40 (p=0.013, 0.0001, and 0.0001

	MSICS n (%)	PE n (%)
Age group (years)		
35-45	0 (0)	1 (1)
45-55	21 (19)	20 (18)
55-65	39 (36)	34 (31)
65-75	41 (37)	44 (40)
75-85	9 (8)	11 (10)
Sex		
Males	58 (53)	60 (55)
Females	52 (47)	50 (45)

Table-1: Demographic data of patients in both groups (n=110 each)

Preoperative BCVA		
BCVA	**MSICS n (%)**	**PE n (%)**
6/6	40 (36%)	33 (30%)
6/9	1 (1%)	1 (1%)
6/12	1 (1%)	1 (1%)
6/18	12 (11%)	14 (13%)
6/24	18 (16%)	18 (16%)
6/36	27 (25%)	21 (19%)
6/60	11 (10%)	22 (20%)
Total	110 (100%)	110(100%)

Table-2: Preoperative BCVA in MSICS and phacoemulsification (PE) (n=110 each)

Postoperative BCVA day 1			*P* value
BCVA	**MSICS n (%)**	**PE n (%)**	
6/6	26 (24%)	39 (35%)	NS
6/9	52 (47%)	47 (43%)	
6/12	23 (21%)	18 (16%)	
6/18	7 (6%)	4 (4%)	
6/24	2 (2%)	2 (2%)	
Postoperative BCVA day 7			
6/6	74 (67%)	87 (79%)	0.04
6/9	31 (28%)	21 (19%)	
6/12	5 (5%)	2 (2%)	
Postoperative BCVA day 40			
6/6	108 (98%)	108 (98%)	NS
6/9	2 (2%)	2 (2%)	
NS: Not significant			

Table-3: Postoperative BCVA in MSICS and phacoemulsification (PE) (n=110)

Macular thickness (time-point)	MSICS Mean ± SD (µm)	PE Mean ± SD (µm)	*P* value
Preoperative	187.71 ± 17.22	185.77 ± 15.64	0.384
Postoperative (Day 1)	201.91 ± 18.95	195.77 ± 17.38	0.013
Postoperative (Day 7)	208.04 ± 18.66	199.05 ± 16.87	<0.001
Postoperative (Day 40)	215.25 ± 19.38	203.76 ± 17.48	<0.001

Table-4: Macular thickness in MSICS & phacoemulsification (PE) groups (n=110 each)

respectively) between the 2 groups with greater mean postoperative macular thickness in MSICS group.

DISCUSSION

Cataract is the most important cause of preventable blindness in India. Phacoemulsification is the preferred method for its advantages such as requirement of small incision, better postoperative visual acuity and smoother postoperative course of rehabilitation. However, it is undoubtedly resource-intensive, and hence, the cost of equipment and the special training that is required prove to be the inhibiting factors for mass application in the developing world. Studies in the past have looked at macular thickness and visual outcomes post phacoemulsification and post MSICS. Georgopopulos G et alin 2008 found that following uncomplicated phacoemulsification, an increase in the foveal thickness was detected in the early postoperative period.[13] This returned to preoperative level 1 month after surgery. Similarly, Kecik D et al also found increase in the central retinal thickness, foveal volume and volume of the entire macula on days 30 and 90 and 12 months post uncomplicated phacoemulsification with intracapsular implantation of a foldable lens.[14]

There have not been too many studies that have compared macular thickness measured by OCT apart from looking at visual outcomes post phacoemulsification and MSICS. In agreement with our results, Ghosh S et al also found no significant association between type of procedure used (MSICS or phacoemulsification) and postoperative visual acuity.[12] In their study, visual acuity on the 42nd day also showed no significant difference (p=0.4). Similarly in our study, there was no significant difference (p=1.00) in BCVA after phacoemulsification and MSICS on the 40th day. There was no evidence of cystoid macular edema, either clinically or on OCT. Ghosh S et al found that on the first postoperative day, central subfield mean thickness (CSMT) in MSICS group was not significantly different than that in the phacoemulsification group (p=0.12). On days 7 and 42, the CSMT in MSICS group (198.9 +/- 21.4 µm and 207.8+/- 26.3 µmrespectively) were significantly greater (p=0.04 and p=0.007 respectively) than those in the phacoemulsification group (193.1 +/- 19.3 µm and 198.3+/- 23 µm respectively). Similarly, we observed significant difference in macular thickness after phacoemulsification and MSICS on day 1, day 7 and day 40 with greater mean thickness in MSICS group. However, as reported by Ghosh et al, we too did not observe clinically significant macular edema in any of our study subjects.

In their study conducted in Nepal, Ruit et al[2] compared BCVA at 6 months postoperatively after phacoemulsification and MSICS and found no significant difference in the two groups (p=0.30). The study by Gogate et al found that 68.2% patients in the phacoemulsification group and 61.25% in the small incision group had uncorrected visual acuity better than or equal to 6/18 at 1 week.[3] Majority (81.08%) patients of the phacoemulsification group and 71.1% patients of the small incision group were better than or equal to 6/18 at the 6-week followup for presenting visual acuity. Thus, although phacoemulsification gave better uncorrected visual acuity in a greater proportion of patients at 6 weeks, both phacoemulsification and small incision techniques were safe and effective for visual rehabilitation of cataract patients. Both, Ruit and Gogate concluded that MSICS may be more appropriate for treating advanced cataracts in the developing world as it was a significantly less expensive and a lesser technology dependent technique as compared to phacoemulsification. Gogate also argues that phacoemulsification requires a steeper learning curve as compared to the MSICS method.MSICS is significantly faster, less expensive and less technology dependent than phacoemulsification.

CONCLUSION

Though there is a theoretical risk of more postoperative inflammation following MSICS, there was no evidence of CME in our study subjects, either clinically or on OCT. Comparison of both surgical methods on the basis of cost-effectiveness and surgical ease was not the objective of our study. However, our study shows that phacoemulsification and MSICS, both, could achieve excellent visual outcomes. In view of these advantages, MSICS may be the more appropriate surgical procedure for treatment of advanced cataracts in resource-poor settings.

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