

Original article

Corneal status following modified Blumenthal technique of manual small incision cataract surgery (MSICS) compared to phacoemulsification in treatment of grade III or more nuclear sclerosis-cohort study

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Abstract

Objective: To evaluate the endothelial cell loss and central corneal thickness in modified Blumenthal technique of MSICS and Phacoemulsification. **Method:** A prospective study in which 50 cases of nuclear sclerosis grade III (LOCS III) or more were randomized in two groups of 25 each. Group A underwent modified Blumenthal MSICS. Lens expression was facilitated by viscoelastic injection through ACM and scleral pressure by iris reposer. Group B underwent 2.8 mm phacoemulsification. Specular microscopy and pachymetry were done at 1st POD, 1st, 3rd and 6th week. **Results:** No significant difference in endothelial cell loss and central corneal thickness between group A and group B ($p > 0.05$) was found. **Conclusion:** This technique of MSICS is not inferior, an innovative, safe and highly effective in hard cataracts.

Keywords: Blumenthal, nuclear sclerosis, phacoemulsification.

Introduction

Age related cataract remains a major cause of blindness throughout the world comprising of 51% of blindness. Majority cases of cataract are in developing countries¹. It is therefore important to establish the optimal technique of lens removal in cataract surgery.

Phacoemulsification machines are expensive to purchase and maintain, and they add relatively high costs of surgical consumables. The extensive surgical training that is required for phacoemulsification is unrealistic in health care systems with severe shortage of ophthalmologists. Finally, the brunescant hard cataracts that are typical of underserved populations make phacoemulsification

significantly more difficult, time consuming, and prone to complications².

In view of the lower cost of MSICS, this may be a favourable technique in the patient populations examined in these studies, where high volume surgery is a priority³. Manual small incision cataract surgery (MSICS) has emerged as a popular technique which offers all merits of phacoemulsification with added advantage of wider applicability, safety, easy learning curve, low cost and machine independence and suitable for high volume surgery. The landmark step in development of this surgery has been the concept of scleral-pocket tunnel, introduced by Dr. Richard Kratz⁴. It made nucleus delivery possible through a small external incision producing lesser postoperative astigmatism, faster stabilization of final refraction and greater postoperative comfort.

Received on: 19/09/14

Accepted on: 28/12/14

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Various techniques of nuclear delivery are being practiced by different surgeons all over the world. A new innovative modality for nucleus delivery known as modified Blumenthal has been developed where viscoelastic is injected through ACM and iris reposer is used to glide nucleus out of the section⁴.

Since the considerable handling of hard nucleus inside the anterior chamber takes place in SICS, there are chances of endothelial cell loss and corneal oedema postoperatively, on the other hand emulsifying hard cataracts requires more phaco power causing damage to endothelial cells and thus corneal oedema in phacoemulsification.

Both phacoemulsification and SICS achieved excellent visual outcomes with low complication rates. SICS is significantly faster, less expensive, and less technology dependent than phacoemulsification. SICS may be the more appropriate surgical procedure for the treatment of advanced cataracts in the developing world.

Cochrane database system REV. 2013 removing cataract by phacoemulsification may result in better UCVA in the short term (up to three months after surgery) compared to MSICS, but similar BCVA

This study aims to find out that whether modified Blumenthal technique of SICS is comparable, better or worse in terms of postoperative endothelial cell loss and corneal oedema in hard cataracts as compared to phacoemulsification.

Materials and methods

It was a prospective, randomized study done in subharti medical college Meerut in the year 2012 to 2013. Fifty cases of nuclear sclerosis grade III and more (LOCS III) scheduled for planned cataract extraction were divided in two groups of 25 each. Patients having endothelial cell count of less than 2000 cells/mm² and patients with endothelial dystrophies were excluded from this study. Patients with any

significant intraoperative complications like posterior capsular tear, descemet's membrane detachment etc. excluded from surgery

Group A underwent modified Blumenthal MSICS, which enables nucleus expression through a 5 – 6.5 mm sclerocorneal tunnel incision. A 6 mm or larger capsulorhexis, reduction in nuclear size by hydroprocedures and its prolapse manually into the anterior chamber were performed. The nucleus was then delivered out by injecting viscoelastic in anterior chamber through anterior chamber maintainer (ACM) and pressing the sclera by iris reposer. Two modifications from original conventional Blumenthal technique of MSICS were done in our technique. Instead of balanced salt solution, viscoelastic was injected through ACM during lens expression to build pressure for expression of nucleus out of the eye. Instead of lens glide, iris reposer was used to apply pressure on sclera to facilitate lens expression⁴.

Group B underwent routine phacoemulsification through 2.8 mm clear corneal incision. Follow ups were done at 1st POD, 1st week, 3rd Week and 6th Week. Specular microscopy and Pachymetry were done at each visit. All data was entered in the Microsoft excel spreadsheet. For comparison of data within a surgical group, paired t test was applied and for comparing between the two surgical groups, independent t test was applied.

Results

All patients in both the groups were in the age group of 51- 80 years. The mean age in group A was 57.8 years while the mean age in group B was 60.8 years. The maximum number of patients fell in the age group of 61 - 65 years (n = 10, 40 % in group A and n = 2, 8 % in group B). The age of the patients in both the groups matched well with no significant difference between them (p = 0.0934).

The male: female in both the groups was 16: 9. Hence sex distribution in both the groups

had male preponderance. Overall the right eye was operated on 26 cases (52%), of which 12 were in group A and 14 in group B. The left eye was operated in 24 cases (48%), of which 13 in group A while 11 were in group B.

Preoperative corneal endothelial cell density
Table 1: preoperative corneal endothelial cell density

	Group A	Group B
Mean	2316.40	2293.96
Standard deviation	114.4443	183.2586

(p =0.523)

The mean endothelial cell density in group A was found to be 2316.4±114.44 while in group B was found to be 2293.96±183.258. The difference between the two groups was not statistically significant (p=0.523).

Preoperative central corneal thickness (mm)
Table 2: Preoperative central corneal thickness

	Group A	Group B
Mean	0.513	0.502
Standard deviation	0.034	0.049

(p =0.94)

The mean central corneal thickness in group A was 0.513±0.034 and that of group B was 0.502±0.049. The difference between the two groups was not statistically significant (p=0.94).

Postoperative corneal endothelial cell density (ECD) and change in ECD

Table 3: Postoperative corneal ECD and change in ECD

	Group A ECD	LOSS	Group B ECD	LOSS	P value LOSS
1st DAY					
Mean	2143.04	7.4%	2088.08	8.9%	0.2279
Standard Deviation	143.7389		172.983		
1st WEEK					
Mean	2161.64	6.6%	2071.12	9.7%	0.0759
Standard deviation	158.071		192.80		

3rd WEEK					
Mean	2169.88	6.32%	2103.60	8.2%	0.193
Standard deviation	160.3476		193.01		
6th WEEK					
Mean	2183.44	5.7%	2133.56	6.9%	0.319
Standard deviation	166.071		184.02		

The mean endothelial cell density in cells/mm² at 1st day, 1st week, 3rd week and 6th week is tabulated above. In both the groups the mean endothelial cell density shows an increasing trend from 1st POD to 6th week. The mean endothelial cell loss in group A was 7.4% at 1st day, 6.6% at 1 week, 6.32% at 3 week and 5.2% at 6 week Correspondingly, the cell loss in group B was 8.9%, 9.7%, 8.2% and 6.9%. On comparing the two groups, the difference in endothelial cell loss was not found to be significant at any stage. Thus both the procedures had a similar effect on the corneal endothelium.

Table 4: Postoperative central corneal thickness (CCT) and change in CCT

	Group A ECD	% increase	Group B ECD	% increase	P value
1st day					
Mean	0.541		0.555		0.348
Standard deviation	0.039	5.33%	0.060	10.4%	
1st week					
Mean	0.529	3.03%	0.541	7.70%	0.409
Standard deviation	0.046		0.055		
3rd week					
Mean	0.523	3.13%	0.532	5.90%	0.480
Standard deviation	0.039		0.052		
6th week					
Mean	0.517	0.60%	0.522	3.90%	0.658
Standard deviation	0.035		0.049		

The mean central corneal thickness at 1st day, 1st week, 3rd week and 6th week is tabulated above. At no point of the time a statistically significant



difference between the two groups was found in terms of central corneal thickness. Percentage increase in CCT at 1st day was 10.4%, at 1st week 7.70%. At 3 week 5.90% and at 6 weeks 3.90% for group B correspondingly, for group A percentage increase was 5.35%, 3.03%, 3.13% and 0.60%.

Discussion

Several recent articles have compared manual SICS to Phacoemulsification and demonstrated almost equal outcomes. The proven advantage of phacoemulsification is a statistically significant benefit in induced astigmatism of about 0.4D, the clinical significance of this statistically significant difference is however debatable⁴. On the other hand, nucleus drop with phacoemulsification has a higher relative risk compared with manual SICS. Moreover how much ever we may espouse providing the gold standard for the entire cataract population, in reality even if that were desirable, “phacoemulsification for all” in India is neither practical nor feasible. The advantages of manual SICS as a low cost “equally effective” technique makes it an alternative, especially in an unequally developed country like India⁴. And also cataracts with higher stage of nuclear hardness requires more energy and effective phaco time to be employed in phacoemulsification which is hazardous for corneal endothelium whereas SICS have more safety in delivering such a hard cataract through less than 6mm of corneoscleral tunnel incision.

Several centres have reported significant success with high volume, low technology, low cost suture less manual SICS. Other studies have shown that manual SICS is clearly more cost effective than the alternatives.

Although a lot of studies are available comparing manual SICS with Phacoemulsification, but there is no study till date which has compared these two techniques for hard grade cataract (LOCS grade III or more). We conducted this

prospective randomized interventional study to compare modified Blumenthal’s technique of SICS with phacoemulsification in case of grade III or more of nuclear sclerosis.

The mean endothelial cell loss in group A was 7.4% in 1st day, 6.6% at 1st week, 6.32% at 3rd week and 5.21% at 6th week. Correspondingly the cell loss in group B was 8.9%, 9.7%, 8.2% and 6.9%. The difference in endothelial cell loss was not found to be significant at any stage. It indicates that both the procedures were equally safe in terms of corneal endothelial damage.

Bourne RR et al⁵ in 2004 found that an average of about 10% cell loss occurs both in phacoemulsification and ECCE with significantly higher risk of severe cell loss in patients with hard cataract when operated by phacoemulsification whereas Ronnie George et al in 2005 recorded loss of 4.72% of endothelial cells after ECCE, 4.21% loss after SICS and 5.41% loss after phacoemulsification after 6 weeks. Similar to our study was conducted by Malik et al⁶ in which they observed a cell loss of 5.5% at three months in nuclear sclerosis grade III or less operated by modified Blumenthal’s technique of SICS. Whereas Gogate et al⁷ in 2010 reported endothelial cell loss of 15.3% in MSICS at 6 weeks

In our study at day 1, the mean increase in CCT was 28 micrometres in group A and 53 micrometre in group B. In a study done in Nepal on postoperative day 1 an average increase in CCT was found to be 9 micrometres in MSICS group and 70 micrometres in phacoemulsification⁸, however in our study only hard cataract with nuclear sclerosis three or four were included whereas the Nepal study included all grades of cataract. At postoperative week 6, CCT in both groups almost reach the baseline, there was only 4 micrometres and 20 micrometres increase in thickness was noted in group A and group B respectively.

Conclusion

The modified Blumenthal technique of manual small incision cataract surgery is highly effective, safe, and reproducible in hard cataracts, involving minimal intraocular manipulation which can be performed in physiological conditions of a closed system.

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Source of support: nil. Conflict of interest: none