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ORIGINAL ARTICLE

A COMPARATIVE STUDY OF CONVENTIONAL MANUAL SMALL INCISION CATARACT SURGERY (C-MSICS) WITH MODIFIED MANUAL SMALL INCISION CATARACT SURGERY (M-MSICS)

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ABSTRACT: PURPOSE: A Comparative study of conventional manual small incision cataract surgery (C-MSICS) with modified manual small incision cataract surgery (M-MSICS) in terms of intra and postoperative complications, Best Corrected Visual Acuity, surgical duration and surgeon comfort. **METHODS**: In this prospective study, the patients having cataracts with nuclear sclerosis not more than early grade 3 were randomly assigned in 2-groups with 100- patients in each group[Group A (C-MSICS), Group B (M-MSICS)]. Following table explains the two techniques (Table 1) Both techniques were compared for each stage in terms of surgical duration and surgeon comfort [graded as comfortable (C1), convenient (C2) and difficult (C3)]. Also both techniques were compared in terms of Intra and postoperative complications and Best Corrected Visual Acuity. Follow ups in postoperative period were carried out on 1st and 3rd postoperative days, 2wks, 4wks and 6wks. **RESULTS**: Intraoperative complications were almost similar in 2-groups. As far as postoperative complications were concerned, in M-MSICS group the postoperative corneal edema on 1st POD was present in 2% cases as compared to 15% in C-MSICS ($p<0.05\%$). Postoperative surgical induced astigmatism at 6-weeks was +0.80D in M-MSICS group as compared to +1.40D in C-MSICS group($p<0.05\%$). Average Surgical duration for stage1&2 in both techniques was almost similar, however for stage3 it was more in M-MSICS group ($p<0.05$).The surgeon comfort for both techniques in stage1&2 was similar, but for stage3 it was more comfortable for C-MSICS. Visual outcome was almost similar in both techniques at 6-weeks. **CONCLUSION**: M-MSICS is better technique than C-MSICS in terms of less postoperative corneal edema, fast visual recovery & less postoperative surgical induced astigmatism. However this technique (M-MSICS) takes slightly more time and surgeon comfort is bit less for stage 3.

KEYWORDS: Manual small incision cataract surgery, Conventional manual small incision cataract surgery (C-MSICS), Modified manual small incision cataract surgery (M-MSICS)

INTRODUCTION: Cataract is leading cause of blindness in India accounting for 62.6% and the prevalence of blindness is 1.1%.[1] An estimated 4 million people become blind because of cataract every year,[2] which is added to a backlog of 10 million operable cataracts in India, whereas only 5 million cataract surgeries are performed annually in the country.[3]

Thus, a technique of cataract surgery that is not only safe and effective but also economical and easy for the majority of ophthalmologists to master, is the need of the hour.

MSICS is not only safe and economic but also have easy learning curve, so MSICS is ideal for developing countries. It was propagated for high-quality, high-volume cataract surgery.

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So the present study was undertaken to study the 2-techniques of MSICS i.e. Conventional Manual Small Incision Cataract Surgery(C-MSICS)[4] which included superior "straight scleral incision" (6.5mm), nucleus delivery with irrigating vectis technique technique and Modified Manual Small Incision Cataract Surgery (M-MSICS)[5,6] which included relatively small superior "frown shaped" scleral incision (5.5mm), "hydrodelineation" and "viscoexpression of nucleus".

The Intraoperative and postoperative complications were recorded and suitably managed. Surgery was divided into 3-stages and surgeon comfort along with surgery duration was recorded. Postoperatively, the visual outcome was recorded in the follow up period up to 6-weeks.

MATERIAL AND METHODS: This prospective study was carried out in the department of Ophthalmology at Indira Gandhi Medical College, Shimla (HP) over a period of 1-year. The patients were divided in two groups as follows:

Group A: Modified Manual Small Cataract Surgery (M-MSICS) –100 Patients

Group B: Conventional Manual Small Incision Cataract Surgery (C-MSICS)- 100Patients.

Inclusion Criteria:

1) Cases having operable cataract of different types with nucleus hardness[7] of any of these grades-I, II or early III.
2) Age group selected was between 35-65 yrs.

Exclusion Criteria:

1) Any evident ocular disease or complicated cataract
2) Patients having preoperative astigmatic error more than 0.75D.

Surgical Techniques:

(1) Conventional Manual Small Incision Cataract Surgery (C-MSICS): Surgery was divided into 3-states as follows:

Stage 1: From Application of wire speculum up to entry into the anterior chamber. 6.5 mm superior straight scleral incision was given.

Stage 2: After entry into the anterior chamber up to the delivery of the nucleus by irrigating vectis. Hydrodissection was performed prior to nucleus delivery.

Stage 3: After delivery of the nucleus up to the application of the subconjunctival injection of antibiotic and steroid.

(2) Modified Manual Small Incision Cataract Surgery (M-MSIS): Surgery was divided into 3-stages as follows:

Stage 1: From application of wire speculum up to entry into the anterior chamber. 5.5 mm superior "frowns shaped incision" was given.

Stage 2: After entry into the anterior chamber up to the delivery of the nucleus by viscoexpression technique. Hodrodelineation was performed prior to viscoexpression of nucleus.

Stage 3: After delivery of the nucleus up to the application of the subconjunctival injection of antibiotic and steroid.

At the end of surgery in both of the techniques, surgeon comfort and surgery duration recorded as per the Performa. (Table No. 2).

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RESULTS: The data were analysed by using Chi square test. In Chi square test, p value was calculated and a value of less than 0.05 implied Statistically Significant (SS) at 95% Confidence Interval (CI). The Chi square test was done by using SPS version-15.

The mean age of the patients was 57.1 years. The mean preoperative astigmatic error was 0.44 D. The preoperative cylindrical axis in both the groups was more of "against the rule" (ATR) type i.e. 67% & 65% respectively in M-MSICS and C-MSICS group.

Intraoperative Complications: Subconjunctival hemorrhage was seen in 3% and 4% cases respectively in M-MSICS and C-MSICS groups.

Posterior Capsular Rent (PCR) occurred in 2% cases in C-MSICS group, while there was no case of 'PCR' observed in M-MSICS group (NSS, p<0.05%).

Surgeon comfort for stage 1 and 2 of surgery was of grade C1 (comfortable) in M-MSICS group while it was grade C1 (comfortable) in 86% cases and grade C2 (convenient) in 14% cases for stage 3. In C-MSICS group, surgeon comfort was of grade C1 (comfortable) for all the 3-staes of surgery. The difference in surgeon comfort grading for stage-3 between M-MSICS group and C-MSICS group was statistically significant (p value < 0.001%). (Table No. 3).

The mean surgical duration for stage-1 and stage-2 in both groups was comparable (statistically non-significant). However the mean surgery duration to complete stage-3 and overall surgery duration was more in M-MSICS technique as compared to C-MSICS technique and the difference was statistically significant (p-value is 0.00). (Table No. 4)

The postoperative visual acuity with pin hole (VAPH) on 1st postoperative day (D1) was 6/18 or better in 96% cases in M-MSICS group as compared to 83% cases in C-MSICS group (Statistically Significant, p-value 0.01). On 3rd postoperative day (D3) the visual acuity with pin hole (VAPH) was 6/18 or better in 97% cases in M-MSICS group as compared to 83% cases in C-MSICS group (Statistically Significant, p-value 0.01). The difference in the visual acuity with pin hole (VAPH) after 1 week and at 2-weeks between the two groups was statistically non-significant. (Table No. 5)

Post-Operative Complications: (Table No 6) Hyphema was present in 1% cases in both the groups (Statistically Non- Significant).

Striate keratopathy was present in 2% cases in M-MSICS group while it was present in 15% cases in C-MSICS group (statistically significant, p value 0.01). (Graph No 1)

The mean surgical induced astigmatism (SIA) at 6-weeks was 0.79 D in M-MSICS group as compared to 1.40 D in C-MSICS group (Statistically Significant, p value 0.00). (Table No-6)

There was increase in no. of cases having 'Against the rule' (ATR) astigmatism axis, postoperatively from 66% to 82% (Non- Significant statistically).

DISCUSSION: Studies had found MSICS to be more effective and economical than ECCE and almost as effective as and more economical than phacoemulsification.[8] Thus, among small incision surgeries, MSICS is ideal for developing countries. It was propagated for high-quality, high-volume cataract surgery.[9,10,11] In our study we took comparatively younger age group (35-65 years) having cataracts with nucleus hardness of lower grades (Nuclear Sclerosis grade I, II or early III) keeping in view the fact that in M-MSICS group to deliver the nucleus from relatively small incision size the hydrodelineation was performed prior to nucleus delivery with viscoexpression technique.

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The mean preoperative astigmatism was 0.43 D. Astigmatism was calculated by simple subtraction method. In our study we excluded the cases having preoperative astigmatism > 0.75 D. This cut-off point for the preoperative astigmatic error in our study is taken keeping in view the fact that in patients with little (<0.75D) or no preexisting astigmatism, cataract surgery should be as astigmatically neutral as possible. Because as little as 0.75 D of astigmatism may cause ghosting and halos, correcting astigmatism in cataract surgery is desirable.[12]

The preoperative cylindrical axis in both the groups was more of 'against the rule' (ATR). Various studies reported that in general patients with senile cataracts have an against the rule astigmatism.[13,14] Posterior capsular rent (PCR) without vitreous loss was observed in 2% cases in C-MSICS group. No case of PCR was seen in M-MSICS group. Surgeon comfort was less for surgery stage-3 (cortical wash) in M-MSICS group as compared to C-MSICS group (Statistically Significant, p value < 0.001%).

The surgical duration to perform stage-3 (Cortical wash) and overall surgery duration was more in M-MSICS group as compared to C-MSICS group (Statistically Significant, p value = 0.001%). These above mentioned observations can be explained from the fact that in M-MSICS technique as viscoexpression technique was performed for nucleus delivery; it was observed that after performing viscoexpression of nucleus, there remains a sheet of lens matter behind over the posterior capsule after the nucleus delivery.

This remaining sheet of lens matter is although having protective role in preventing PCR[15, 16] but it takes slightly more time to remove this sheet as compared to other group where nucleus was delivered as a whole with irrigating vectis, so the surgeon comfort for stage-3 is also bit less and surgery duration is bit more in M-MSICS technique. Postoperative Complications : The reported incidence of 'Striate keratopathy' in our study was significantly lower in 'M-MSICS' group as compared to 'C-MSICS' group (Statistically Significant, p value 0.01).

The Significant Lower rate of postoperative 'Striate Keratopathy' in M-MSICS technique can be explained from the fact that as nucleus was delivered by viscoexpresion technique and viscosubstance are of corneal endothelium protective nature.[17,18,19] The visual recovery was significantly earlier (on first and third postoperative day) in case of M-MSICS than in C-MSICS. This can be explained from the fact the incidence of postoperative striate keratopathy was very less in M-MSICS group.

The surgical induced astigmatism (SIA) was significantly lower in M-MSICS group as compared to C-MSICS group. Majority of cases in C-MSICS (87%) group, had astigmatism between 1-2D which is considered as significant astigmatism according to Holmstrom's gradation.[20] This can be explained from the fact that, incision size[21] was more in C-MSICS group (6.5 mm) as compared to M-MSICS group (5.5 mm). It is worth to mention here that hydrodelineation was performed prior to the nucleus delivery with viscoexpression technique in M-MSICS technique.

In hydrodelineation, the fluid injection separates the epinucleus from the endonucleus, so the volume of nucleus is reduced and it can be delivered out by a relatively smaller incision size. Also "frown shaped incision" was given in M-MSICS technique and past studies in the literature have documented that frown shaped incision leads to less surgical induced astigmatism[22] as compared to straight incision. Postoperatively, there was increase in no. of cases having 'AIR' astigmatism in both the groups. Our observations are similar to the previous reports from various studies which

documented that superior scleral incision was associated with slight "against-the-rule" astigmatism postoperatively.

CONCLUSIONS : Finally it can be concluded that Modified manual small incision cataract surgery (M-MSICS) is better technique than Conventional manual small incision cataract surgery (C-MSICS) in terms of : (A) Postoperative Corneal edema is significantly less (B) Visual recovery is significantly less early (C) Surgical induced astigmatism is significantly less (D) Lesser chances of "PCR" (E) As surgeon comfort for stage-2 (nucleus delivery) was similar for the two groups, so it can be concluded that nucleus delivery with viscoexpression technique can be comfortably performed.

The only problem observed in M-MSICS technique was that in some cases the surgeon comfort for stage-3 (cortical matter aspiration) of surgery, was bit less and so it takes more time to complete stage 3 of the surgery as compared to C -MSICS and hence the overall surgery duration was also more as compared to the C-MSICS technique. So it can be concluded that although for beginners the conventional manual small incision cataract surgery (C-MSICS) is more comfortable but with the experience one may switch over to the modified technique of manual small incision cataract surgery (M-MSICS) keeping in view all the advantages of M-MSICS technique.

However multicentric studies are required for the further assessment of these two techniques of manual small incision cataract surgery, so that the remedial measures can be taken to improve the quality of cataract surgeries being performed by the MSICS techniques. It will also help in improving the quality of cataract surgery services being imparted to the patients under NPCB.

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STAGES OF SURERY	C-MSICS	M-MSICS
STAGE 1: Incision, Tunnel making up to entry in to AC	6.5 mm Superior 'straight' scleral incision	5.5 mm Superior 'frown shaped' Scleral incision
STAGE 2: Nucleus Delivery	Nucleus delivery with Irrigating vectis	Hydrodelineation and Nucleus delivery with viscoexpression technique
Stage-3: Cortical wash, PCIOL Implantation		

Table 1: Stages of surgery along with the difference between two techniques

PCIOL- Posterior chamber intraocular lens implantation.

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STEPS	C1	C2	C3	Surgery duration(seconds)
STAGE 1: Incision, Tunnel making up to entry in to AC				
STAGE 2: Nucleus Delivery				
STAGE 3: Cortical wash, PCIOL Implantation				

Table 2: Performa for Grading of Surgeon Comfort and recording of Surgical Duration

Surgeon comfort grading as: C1- comfortable, C2-convenient, C3-Difficult.

	M-MSICS		C- MS1CS		Chi square	p-value
	C1(Comfortable)	C2(Convenient)	C1(Comfortable)	C2(Convenient)	-	-
Stage1	100(100%)	0(0.0%)	100(100%)	0(0.0%)	-	-
Stage2	100(100%)	0(0.0%)	100(100%)	0(0.0%)	-	-
Stage3	86(86.0%)	14(14.0%)	100(100.0%)	0(0.0%)	51.8	<0.001*

Table 3: Distribution of Surgeon Comfort

*Statistically significant.

Group	M-MSICS		C- MS1CS		t	df	P value
	Mean	SD	Mean	SD			
Stage1	242.04	7.35	239.79	11.37	1.66	198	0.10
Stage2	338.00	8.77	337.82	14.41	0.11	198	0.92
Stage3	391.69	18.31	380.48	5.77	5.84	198	0.00**
Total	**971.73**	**25.39**	**958.09**	**20.43**	**4.19**	**198**	**0.00****

Table 4: Surgical Duration (In Seconds)

** Significant at 0.01 level (t=2.58)

	M-MSICS			C- MS1CS				
	6/18 or better	6/24-6/60	<6/60	6/18 or better	6/24-6/60	<6/60	Chi-Square	P value
D1	96(96%)	4(4%)	0	83(83%)	17(17%)	0	15.3	0.01*
D3	97(97%)	3(3%)	0	83(83%)	17(17%)	0	12.3	0.03*
1W	99(99%)	1(1%)	0	94(94%)	6(6%)	0	8.2	0.9
2W	99(99%)	1(1%)	0	97(97%)	3(3%)	0	2.2	0.53
6W	99(99%)	1(1%)	0	98(98%)	2(2%)	0	1.7	0.6

Table 5: Distribution of Postoperative Visual Acuity with Pin Hole (VAPH)

*Significant at 0.05 level,D1-Day one, D3- Day three, 1W- at one week,2W- at two weeks,6W- at six weeks.

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Complication	M-MSICS	C- MS1CS	Total	Chi-Square	P value
Hyphema	1(1%)	1(1%)	2(1.0%)	For striate keratopathy it is 9.9 and for rest it is 3.81	For striate keratopathy it is 0.01* and for rest it is 0.28
Striate keratopathy	2(2%)	15(15%)	17(8.5%)		
Residual Cortex	1(1%)	1(1%)	2(1.0%)		
PCO	1(1%)	1(1%)	2(1.0%)		
Total	**5(5.0%)**	**18(18.0%)**	**23(12.5%)**		

Table 6 : Distribution Of Post-Operative Complications

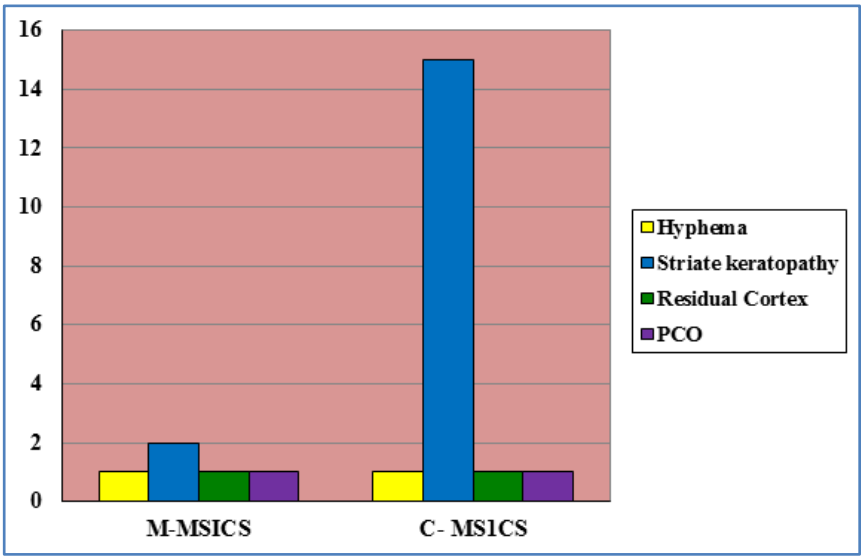
*Statistically significant (p value less than 0.05), PCO- Posterior capsular opacification.

SIA	M-MSICS	C- MS1CS	Total	Chi-Square	P value
<0.25	1(1%)	0(0.0%)	1(0.5%)	138.0	.00**
0.25-1	92(92%)	10(10.0%)	102(51.0%)		
1-2	7(7%)	87(87.0%)	94(47.0%)		
>2	0(0.0%)	3(3%)	3(1.5%)		
Mean±SD	0.79±0.24	1.40±0.27	1.10±0.40		
Total	**100**	**100**	**200**		

Table 7: Distribution of Surgically Induced Astigmatism (SIA) at 6-weeks (In Dioptre)

**Significant at 0.01 level (t=2.58)

Graph 1: Depicting the incidence of postoperative complications especially the striate keratopathy



Graph 1

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