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Original Research Article

Visual outcome and complications of phacoemulsification and manual small incision cataract extraction for age related cataract

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ABSTRACT

Background: The purpose of this study is to compare visual outcome and complications of manual small incision cataract surgery (MSICS) with posterior chamber IOL implantation (PC-IOL) and phacoemulsification with posterior chamber IOL implantation for age related cataract. The study compares the visual outcome and complications of MSICS and phacoemulsification with PC-IOL performed in 80 eyes at M & J Western Regional Institute of Ophthalmology (M&J WRIO) Ahmedabad, by assessing post operative Best corrected Visual acuity (BCVA), Surgically Induced astigmatism (SIA) and complications.
Materials and Methods: This was an Institutional based cohort interventional randomized, prospective study. MSICS and Phacoemulsification was performed on 80 eyes at M & J WRIO. The intraoperative complications were documented. The parameters that were examined on 1^{st} postoperative day, 1^{st} week, and 6 weeks postoperatively included uncorrected visual acuity, best corrected visual acuity (BCVA) at 6 weeks, intra ocular pressure by non -contact tonometry and keratometry at 6 weeks to rule out SIA.
Statistical analysis was performed using chi square test. p value <0.05 was taken as significant.
Results: MSICS & phacoemulsification had similar visual outcomes post-operatively. Phacoemulsification group produced less mean SIA (1.27 D) compared to MSICS group (1.29 D) and lesser (5%) complications than the MSICS group (10%). The comparison of all three parameters was not statistically significant between the two groups.
Conclusions: Visual outcomes, SIA and complications were comparably the same in MSICS & phacoemulsification. Therefore, MSICS can be excellent alternative to phacoemulsification.

1. Introduction

Senile cataract is characterized by a gradually progressive opacification of the crystalline lens with aging. Cataract represents the leading cause of preventable blindness. Blindness as defined by a presenting visual acuity <3/60 in the better eye has reduced from 5.3% in 2001 to 3.6% in 2007 to 1.9% as in 2015-2019 as per the National blindness and visual impairment survey of India report.[1,2] Studies show that both phacoemulsification and manual small incision cataract surgery (MSICS) have comparable safety and efficacy profiles for patients undergoing cataract surgery with senile cataract.[3–6] They are associated with low complication rates.[7,8] Phacoemulsification has been observed to have a better uncorrected postoperative visual acuity while MSICS is reported to be faster, cheaper and less machine dependant than phacoemulsification. Important reasons for poor visual outcome of cataract surgery are other ocular co-morbidities and operative complications. A number of studies have been done to compare the visual outcome and complications of the two surgeries.[9–11] Studies from western India in recent times are few. We undertook this study to document the visual outcome and complications of manual small incision cataract surgery

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versus phacoemulsification for age related cataract at our Institution. Hypothesising that the two surgeries are comparable in safety and efficacy for senile cataract in our set-up we can have a larger armamentarium of surgical options for these patients. MSICS being less machine dependant could serve as an excellent alternative to phacoemulsification giving good results in less resources. The study would also serve as a landmark study for district hospitals and smaller centres without access to high end machines, in that MSICS is an equally rewarding, effective and safe surgery.

2. Materials and Methods

The study was a randomized, prospective, interventional study in an institutional cohort. The study was carried out at our Western Regional Institute of Ophthalmology (WRIO). The study was approved by the institutional ethics committee. The study was started in the month of June 2019 for a period of 2 years. 80 consecutive patients with age related visually significant cataract attending the outpatient clinic of our WRIO during the period of June 2019 to June 2021 were assigned to undergo any of the two surgeries randomly as per the inclusion criteria. Informed consent was taken from all patients. The study hypothesis was that there is no major statistically significant difference between visual outcome, surgically induced astigmatism and complications between phacoemulsification and manual small incision cataract surgery for age related cataract.

The primary objectives of the study were: 1. Best corrected visual acuity at 6 weeks in the two groups.

The secondary objectives were: 1. Surgically induced astigmatism at 6 weeks in the two groups. 2. Major intraoperative and postoperative complications in the two groups. The inclusion criteria included all the patients >/=45 years of age, both male and female gender, normal depth of the anterior chamber, at least 5 mm pupillary dilatation, nuclear sclerosis (grade 1-4), posterior subcapsular cataract, cortical cataract. All patients below 45 years of age, mature cataract, brown cataract, traumatic cataract, subluxated cataract, complicated cataract, corneal disorders and other ocular comorbidities like retinal detachment, uveitis etc were excluded from the study. All the patients were subjected to a thorough preoperative examination which included age/gender, socio economic status, presenting complains in details (diminution of vision, onset, severity), systemic illness (diabetes mellitus, hypertension, tuberculosis, arthritis), personal history (smoking, alcohol), past history, drugs history, surgical history. The patients were subjected to a thorough ocular examination including visual acuity using illuminated snellen's chart, best corrected visual acuity (BCVA), Intra ocular pressure, slit lamp examination, lid/lacrimal apparatus, conjunctiva/sclera, cornea, anterior chamber depth (Von-Herick grading), iris / pupillary dilatation, lens (cataract grading), fundus examination by indirect ophthalmoscopy. Intra ocular lens (IOL) powering (A scan biometry-axial length + keratometry) was done with A-constant 118.4 by SRK-T formula. In eyes with axial length <22mm Hoffer Q formula was employed and Holladay formula in eyes with axial length >26mm. Other investigations included a complete blood count, random blood sugar, HIV, HBsAg testing, Intra Ocular Pressure (IOP) and Blood Pressure.The patients were randomized to either phacoemulsification surgery or to MSICS group by simple random method. MSICS was done as per standard technique. Peribulbar anaesthesia was given. A 7 mm tunnel was made after conjunctival peritomy, Continuous curvilinear capsulorrhexis was carried out. Nucleus was delivered using a wire Vectis after hydroprocedures. Intraocular lens implantation and ocular viscosurgical device(OVD) wash was done followed by closure. Phacoemulsification was also done under peribulbar anaesthesia. A 2.8 mm clear corneal tunnel was constructed. Two side ports were made. Continuous curvilinear capsulorrhexis and hydrprocedures were followed by phacoemulsification using the stop and chop technique. A foldable intraocular implant was implanted and OVD wash was followed by wound closure. Any intraoperative complications were documented. Postoperatively all patients were examined thoroughly on slit lamp and topical antibiotic-steroid combination eye drops were prescribed for six weeks in a tapering fashion. The patients were followed up on the 1^{st} postoperative day, one week, and 6 weeks postoperatively. The following were documented: presenting visual acuity, best corrected visual acuity at 6 weeks of postoperative period, intra ocular pressure by noncontact tonometry, keratometry at 1.5months of postoperative period to rule out surgical induced astigmatism. Statistical analysis was done using chi square test. p value <0.05 was taken as significant.

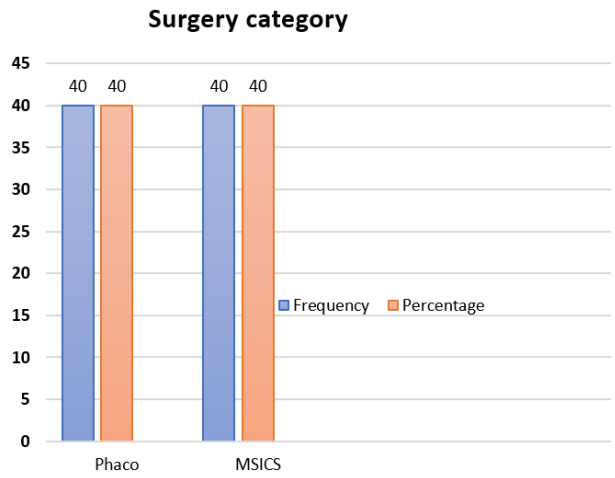
3. Results

The study included 80 cases. The cases were distributed equally between phacoemulsification and manual small incision cataract surgery.

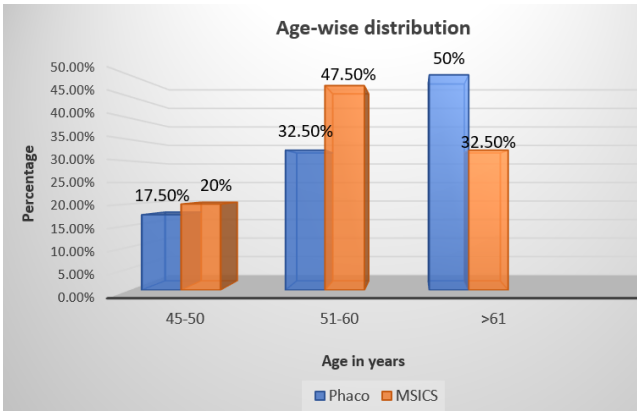
Graph 2 shows the age wise distribution of patients. Majority of patients in the MSICS group were between 51-60 years of age. In the phacoemulsification group majority of the patients were > 61 years.

Graph 3 shows the gender distribution. There were 35 males and 45 females. The male: female ratio is 0.7:1. In phacoemulsification group the male: female ratio is 0.42:1 while in the MSICS group it is 1.35:1.

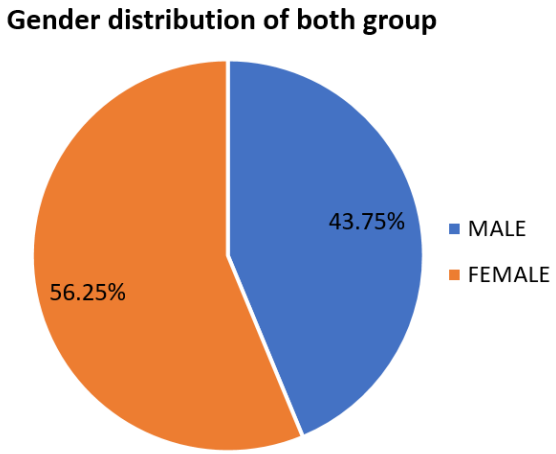
Graph 4 shows the socio- economic status of the patients. Majority of the patients presenting to us were of urban background. The urban: rural ratio was 3:1.



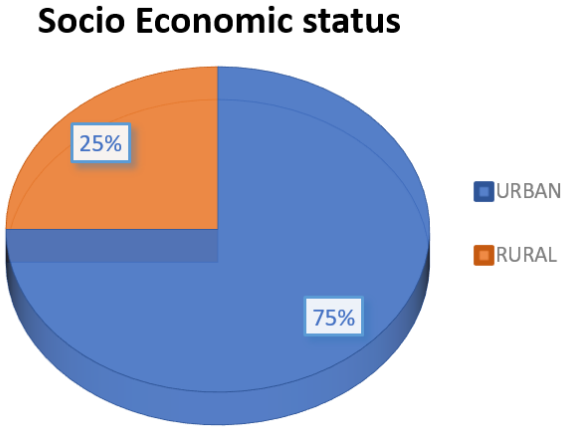
Graph 1: Surgery category



Graph 2: Age-wise distribution of the patients



Graph 3: Gender distribution



Graph 4: Socio economic status

Table 1: Grading of Cataract

a: Nuclear sclerosis		
Grade of Cataract	**Phacoemulsification**	**MSICS**
NS+1/NS+2	4(10%)	2(5%)
NS+2/NS+3	26(65%)	11(27.5%)
NS+3/NS+4	8(20%)	20(50%)
NS+4	0	3(7.5%)
b: Posterior subcapsular cataract		
Grade of Cataract	**Phacoemulsification**	**MSICS**
PSC+1	3(7.5%)	6(15%)
PSC+2	13(32.5%)	11(27.5%)
PSC+3	4(10%)	8(20%)
PSC+4 (Dense PSC)	4(10%)	8(20%)
c: Posterior polar cataract		
Grade of Cataract	**Phacoemulsification**	**MSICS**
PPC	0	3(7.5%)

1. At 6 weeks in the phacoemulsification group there was visual improvement in all patients. Some patients had not improved vision >6/12 because of posterior segment causes like age related macular degeneration, diabetic maculopathy, etc.
2. In the MSICS group 38 patients (95%) improved.

Table 2 shows the BCVA at 6 weeks. Overall visual improvement was good in both the groups with no statistically significant difference in the best corrected visual acuity at 6 weeks.

Table 3 shows the surgically induced astigmatism in the phacoemulsification and MSICS groups. The mean astigmatism was higher in the MSICs group (1.29D) as compared to the phacoemulsification group (1.27D) however the result was not statistically significant.

Table 5 shows the major intraoperative and postoperative complications. In the phacoemulsification group, corneal burn at the wound was seen in one patient due to increased

Table 2: BCVA at 6 weeks

BCVA	Phacoemulsification	MSICS
6/6-6/9	36(90%)	36(90%)
6/12-6/18	4(10%)	2(5%)
6/24-6/36	-	1(2.5%)
<6/60	-	1(2.5%)

p value for BCVA at 6 weeks period comparing the two groups is not significant at 0.709.

Table 3: Surgically induced astigmatism at 6 weeks postoperatively

Type of Surgery	No. of patients	MeanAstigmatism (diopters)	SD	MinimumAstigmatism (diopters)	MaximumAstigmatism (diopters)
Phacoemulsification	22	1.27	0.56	0.5	2
MISCS	35	1.29	0.57	0.5	2.5

p value is not significant at 0.8966 for Phacoemulsification versus MSICS surgically induced astigmatism

Table 4: Major intra operative and postoperative complication rate

Cataract Surgery Complications	Phacoemulsification	MSICS
	2(5%)	4(10%)

Table 5: Comparison of major intraoperative and postoperative surgical complications in phacoemulsification and MSICS patients

Complications	Phacoemulsification	MSICS
PCR with vitreous loss	-	3
PCR with Nucleus Drop	1	-
Iridodialysis	-	1
Phacoemulsification burn	1	-
Total	2	4

phacoemulsification time in grade four Nuclear Sclerosis. One patient with posterior polar cataract had posterior capsular rupture with Nucleus drop during hydrodissection step in the phacoemulsification group. An immediate pars plana vitrectomy was done with nucleus removal followed by a sulcus Intraocular lens over an intact capsulorrhexis. In the MSICS group three patients had posterior capsular rupture with minimum vitreous loss during Irrigation and Aspiration step . Anterior vitrectomy was done followed by a sulcus intraocular lens implantation over the capsulorrhexis edge. Iridodialysis extend from 5 to 6 o' clock was encountered in one patient of MSICS during nucleus delivery through wire vectis. The iridodialysis was sutured at the end of the surgery before wound closure.

All patients in the phacoemulsification and MSICS group, IOL implantation was done. Statistical analysis using chi square test for visual acuity, complications and astigmatism gives p value of >0.05 and hence holds no statistical significance.

4. Discussion

80 patients were randomized to undergo phacoemulsification or manual small incision cataract surgery with patients being distributed equally between the two groups. Phacoemulsification is the state-of-the-art surgery for cataract in contemporary times worldwide. Manual small incision cataract surgery continues to be practiced as it is a cheaper alternative and less technology dependant with a smaller learning curve.

The age range of the patients was from 45 years to 82 years. In the phacoemulsification group twenty patients (50%) were in the > 61 years category. Thus, there was a chance predominance of elderly age group in the phacoemulsification group. In the MSICS group there were 19 (47.5%) patients in the 51-60 years category. Thus, there was a chance predominance of middle-aged patients in the MSICS group as there was no statistically significant difference in the age distribution between the two groups.

The gender graph was a bit skewed towards the female side with the female: male ratio being 1:0.7. There were more urban patients than rural patients, 60 (75%) urban Vs. 20(25%) rural. This could perhaps be due to that ours being a tertiary care centre stationed at a metropolitan city caters to a large subset of urban population.

At six weeks of postoperative period 78 patients had a visual acuity ≥ 6/18. In the MSICS group 36 (90%) patients achieved a best corrected visual acuity of >/= 6/9 on the Snellen chart. Two patients achieved a corrected vision of 6/12. One patient had 6/24 and one had 6/60 best corrected vision six weeks postoperative. 36 (90%) patients in the phacoemulsification group had a visual acuity of >/= 6/9. Two each patients achieved maximum corrected vision of

6/12 and 6/18 respectively in the phacoemulsification pool.

In our study in the phacoemulsification group, corneal burn at the wound was seen in one patient due to increased phacoemulsification time in grade four Nuclear Sclerosis. One patient with posterior polar cataract had posterior capsular rupture with Nucleus drop during hydrodissection step in the phacoemulsification group. An immediate pars plana vitrectomy was done with nucleus removal followed by a sulcus Intraocular lens over an intact capsulorrhexis. In the MSICS group three patients had posterior capsular rupture with minimum vitreous loss during Irrigation and Aspiration step . Anterior vitrectomy was done followed by a sulcus intraocular lens implantation over the capsulorrhexis edge. Iridodialysis extend from 5 to 6 o' clock was encountered in one patient of MSICS during nucleus delivery through wire vectis. The iridodialysis was sutured at the end of the surgery before wound closure.

All patients in the phacoemulsification and MSICS group, IOL implantation was done. Statistical analysis using chi square test for visual acuity, complications and astigmatism gives p value of >0.05 and hence holds no statistical significance.

Semanyenzi SE et al. in their study reported that the two surgeries phacoemulsification and MSICS had comparable visual outcomes. Uncorrected visual acuity at three months postoperative was superior in the phacoemulsification pool.[11] Surgically induced astigmatism has been reported to be with the rule for superiorly placed incisions.[12] This regresses over the years to against the rule astigmatism due to constant eyelid motion leading to flattening of the vertical corneal meridian. A superotemporal or temporal placement of incision has been observed to lead to a decrease in the amplitude of the astigmatism induced due to the surgical incisions.[13,14] Iqbal et al. in their study on the comparison of the two surgeries report a quicker visual recover, less surgically induced astigmatism and lesser complications in phacoemulsification suregery. In our study though the mean SIA was lower in the phacoemulsification group, the result was not statistically significant.[15] Gogate P et al. in their comparative study concluded that phacoemulsification gave better anatomical and functional recovery as compared to MSICS at four weeks follow-up.[16] Dole K et al. in their comparative study concluded that both phacoemulsification and MSICS are safe and effective for visual rehabilitation. Phacoemulsification has the advantage of less mean corneal astigmatism, less anterior chamber inflammation, better UCVA in the immediate post-operative period.[17]

In another comparative study of the two surgeries, Gogate P et al concluded that there is no clinically significant difference between the endothelial cell count loss or visual acuity between phacoemulsification and MSICS although there was a small difference in astigmatic shift.[18] In another study the authors concluded that both the techniques of cataract surgery are safe and effective with respect to visual rehabilitation. Phacoemulsification cases has better UCVA at six weeks in a large number of patients.[19] In a meta-analysis of randomized controlled trials comparing the two surgeries by Zhang JY et al it was documented that phacoemulsification is superior to MSICS with respect to UCVA and causes less SIA. There were no statistically significant differences in visual rehabilitation, endothelial cell count loss and complication rates between the two surgeries.[20] Cook C et al. reported that phacoemulsification cases had better UCVA and BCVA at 8 weeks (p=0.02,p=0.03 respectively). SIA was also less in phacoemulsification eyes at 8 weeks(p=0.001). They encourage transition to phacoemulsification in Vision 2020 programs in Africa.[21] Gogate P et al in a study reported that there was no difference between phacoemulsification and MSICS for BCVA and UCVA of 6/18 and 6/60 respectively. Endothelial cell loss and complications were similar in the two groups. MSICS had statistically greater astigmatism and UCVA of 6/9 or worse, however near UCVA was better.[22] Jaggernath J et al concluded that MSICS was more useful for intumescent and hard cataracts and is the preferred technique for less resourced settings. MSICS is comparable to phacoemulsification in all aspects except SIA.[23] Kulkarni AN et al concluded that MSICS is almost as effective but less expensive than phacoemulsification.[24]

5. Conclusion

Phacoemulsification and small incision cataract surgery are comparable to each other in terms of best corrected visual acuity and surgically induced astigmatism at 6 weeks postoperatively. They have an equivocal rate of major intraoperative and postoperative complications. Thus, they form an excellent alternative to each other and remain an integral part of the cataract surgical armamentarium.

6. Source of Funding

None.

7. Conflict of Interest

Nil.

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