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Study of manual multiphacofragmenatation through 3.2 mm incision in SICS

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Abstract
Purpose: To compare the surgical outcome and complications of manual multi-phacofragmentation (MPF) cataract surgery through a 3.2 mm incision and phacoemulsification (PE).
Setting: Department of Ophthalmology, Govt. Medical College, Aurangabad.
Methods: In this study, 20 eyes of 20 patients were operated by MPF and 20 eyes of 20 patients were operated by phacoemulsification. This technique uses a chopper, an IOL dialer, an irrigating vectis for nuclear fragments. With these instruments, the nucleus is fragmented into multiple small pieces that are extracted from the anterior chamber. Intraoperative and postoperative complications were recorded.
Results: Mean ECD decrease was 5.67% in Group 1 and 6.24% in Group 2 at the end of 6 weeks, that falls within 95% confidence interval.In our study, un-corrected visual acuity of 6/6 to 6/18 was achieved by 80% of group 1 study population and 90% of group 2 study population. In our study, After surgery, 6 eyes (30%) had corneal edema in both groups.
Conclusion: Manual multiphacofragmentation is feasible over phacoemulsification in soft cataracts.

Keywords: manual phacofragmentation, SICS, phacoemulsification, incision

1. Introduction

Cataract remains a major cause of preventable blindness, and the World Health Organization report estimates around 20 million people are blind from cataract worldwide, making it the leading cause of visual loss [1, 2]. By the year 2020, the estimated number of persons with blinding cataract will exceed 40 million worldwide. Despite the 10–12 million cataract operations performed globally, cataract blindness is still thought to be increasing by 1–2 millions/year [2, 3].

Cataract is the opacification of the normally transparent lens of the eye and occurs as a result of lens protein denaturation. This cloudiness can cause a decrease in vision and may lead to eventual blindnes [3]. Surgery is the only effective method for the treatment of cataracts [3]. Early visual rehabilitation and better unaided vision can be achieved mainly by reducing the incision size and sutureless surgeries [4]. Microincision Phacoemulsification through a sub 2-mm incision was reported in the mid1980s. [5]. The evolution of cataract surgical techniques over the past several decades has been associated with a progressive decrease in the size of the cataract incision. [4]. Wound size has progressively decreased from 12.0 mm in intracapsular cataract surgery to about 10.5 mm in early extracapsular surgery and to 5.5–7.0mm in MSICS [8, 6]. and to 3.0 mm in Phacoemulsification [7].

Current surgical techniques used in cataract surgery have two fundamental objectives:

1. to induce minimum post-operative astigmatism [8, 11].
2. to achieve rapid rehabilitation of patient's sight after surgery [9].

To meet these objectives, it is necessary to perform cataract surgery using a small incision. It has been shown that the smaller the surgical incision, smaller the residual postoperative astigmatism. Of all the techniques described for cataract operations, phacoemulsification is the one that allows working with smaller incisions [6]. However this technique requires long learning curve with expensive and complicated instrumentation and equipment [10]. Using manual multiphacofragmenatation (MPF) soft and hard nuclei can be removed through a 3.2 mm clear corneal incision [12, 13]. Also endothelial cell loss is equivalent to those of phacoemulsification and visual outcomes are excellent [14, 15]. In phacosection, the nucleus is divided into 2/3 parts and delivered with viscosandwich technique. Thus phacosection helps in reducing size of incision in manual SICS [16]. Despite widespread adoption of phacoemulsification, there is still a pressing need for manual SICS that can deliver comparable results with quicker and cheaper methods by prechopping the nucleus [17].

2. Material and methods

40 eyes of 40 patients (19 female and 21 male) with soft cataract were randomized to undergo either manual phacofragmentation (group1, 20eyes) or phacoemulsification surgery (group 2, 20 eyes) with implantation of posterior chamber, foldable, acrylic intraocular lens performed by single surgeon through 3.2 clear corneal incision at 12 o'clock.

The main parameters were corneal endothelial cell density, best corrected visual acuity and intraoperative and post-operative complications.

2.1 Primary objective

- To assess the feasibility of manual multiphacofragmentation through 3.2 mm incision over phacoemusification.

2.2 Secondary objectives

- To assess visual outcome after manual multiphacofragmentation cataract surgery through 3.2 mm incision.
- To evaluate postoperative corneal endothelial cell density after manual multiphacofragmentation cataract surgery through 3.2 mm incision.
- To evaluate complication after manual multiphacofragmentation cataract surgery through 3.2 mm incision.

2.3 Inclusion criteria

- Patients seen in the out-patient department of Ophthalmology who are young adults.
- Patients having nuclear cataract ≤ grade 2
- Patients having cortical or subcapsular cataract
- Patients with traumatic cataract
- Patients having no associated systemic disorder.

2.4 Exclusion criteria

- Patients not willing to be a part of the study.
- Patients having nuclear cataract more than or equal to grade 3
- Patients having preexisting corneal degeneration or dystrophy
- Patients >65 years age and <12 years
- Patient unfit for surgery due to very poor general condition.

2.5 Surgical Technique

All cataract surgery was performed by the same surgeon using the manual MPF technique. To perform MPF, good mydriasis is essential. A capsulorhexis was made with a cystitome through a superior and temporal paracentesis. A 3.2 mm CCI was made at 12 o'clock with a 45 degree stab incision knife and a disposable angled crescent knife. After the anterior chamber was entered with a disposable 3.2 mm keratome, balanced salt solution (BSS) was injected through the incision between the anterior capsule and the cortex at 12 o'clock. The BSS was injected slowly and continuously until the "wave of dissection" was visible on the posterior capsule. The injection of BSS was continued until the nucleus was partially luxated into the anterior chamber. Then, the nucleus was completely luxated with a cannula, cystitome, or spatula.

Once the nucleus was luxated into the anterior chamber, sodium hyaluronate 1.4% was injected into the surrounding area to fill the anterior chamber. The nucleus was then fragmented by burring two dialer and / or chopper through 2 sideports each and applying opposing forces in the middle of nucleus manually. Thus, nucleus gets fragmented in two or more fragments of size around 2-3 mm. These nuclear fragments are then expressed out by visco-expression technique or irrigating vectis. The remaining lens cortex was aspirated with an irrigation/aspiration (I/A) Simcoe cannula or by gentle irrigation of the anterior chamber with BSS using a cannula while the posterior lip of the incision was depressed. The viscoelastic material was then injected into the capsular bag, and a foldable intraocular lens (IOL) was implanted. The viscoelastic material was then aspirated with anI/A cannula. The corneal endothelium and visual acuity was evaluated preoperatively and post op day 1, 7, 30 days and 40 days after surgery with the TOPCON SP.3000P specular microscopy and snellen's visual acuity testing. Intraoperative and postoperative complications were recorded.

3. Results

Table 1: Distribution of Age

Group	Mean	N	Std. Deviation	Minimum	Maximum	Range	Median
MPF	39.5500	20	7.57749	26.00	56.00	30.00	40.0000
PE	55.5500	20	6.61318	43.00	64.00	21.00	60.0000
Total	47.5500	40	10.72010	26.00	64.00	38.00	46.5000

Table 2: Distribution of Gender

SEX		GROUP		Total
		MPF	PE	
F	Count	7	12	19
	% of Total	17.5%	30.0%	47.5%
M	Count	13	8	21
	% of Total	32.5%	20.0%	52.5%
Total	Count	20	20	40
	% of Total	50.0%	50.0%	100.0%

Table 3: Eye involved.

EYE		Group		Total
		MPF	PE	
LE	Count	7	10	17
	% of Total	17.5%	25.0%	42.5%
RE	Count	13	10	23
	% of Total	32.5%	25.0%	57.5%
Total	Count	20	20	40
	% of Total	50.0%	50.0%	100.0%

Table 4: Endothelial Count 4

GROUP	N	Mean	Std. Deviation	T	P VALUE
MPF	20	2183.6000	278.24873	1.915	0.063
PE	20	2017.3000	271.01818		

Table 5: Pre-op Endothelial Count

GROUP	N	Mean	Std. Deviation	T	P VALUE
MPF	20	2094.5500	281.92486	1.782	0.083
PE	20	1937.1500	276.63205		

Table 6: POD-1

GROUP	N	Mean	Std. Deviation	T	P VALUE
MPF	20	2075.8000	283.99381	1.75	0.087
PE	20	1919.6000	278.26538		

Table 7: POD-7

GROUP	N	Mean	Std. Deviation	T	P VALUE
MPF	20	2067.7000	284.40114	1.86	0.070
PE	20	1902.9500	274.02525		

Table 8: POD-30

Group	N	Mean	Std. Deviation	T	P Value
MPF	20	2059.8000	288.34110	1.89	0.066
PE	20	1891.4500	274.88820		

Table 9: Cornea

POD-1-CORNEA		GROUP		Total
		MPF	PE	
Clear	Count	14	14	28
	% of Total	35.0%	35.0%	70.0%
Mild SK+	Count	3	3	6
	% of Total	7.50%	7.50%	15.0%
Mod SK	Count	2	3	5
	% of Total	5.0%	7.5%	12.5%
Sev SK+	Count	1	0	1
	% of Total	2.5%	0.0%	2.5%
Total	Count	20	20	40
	% of Total	50.0%	50.0%	100.0%

Table 10: POD-1 CORNEA

	Value	Df	P VALUE
Pearson Chi-Square	1.200	3	0.753

Chi-Square Tests POD-1

Table 11: POD-7 CORNEA

POD-7-CORNEA		GROUP		Total
		MPF	PE	
Clear	Count	17	19	36
	% of Total	42.5%	47.5%	90.0%
Mild SK	Count	2	1	3
	% of Total	5.0%	2.5%	7.5%
Mod SK	Count	1	0	1
	% of Total	2.5%	0.0%	2.5%
Total	Count	20	20	40
	% of Total	50.0%	50.0%	100.0%

Table 12: Chi-Square Tests POD-7

	Value	Df	P VALUE
Pearson Chi-Square	1.444	2	0.486

Table 6: Visual outcome

	DAY 1		DAY 7		DAY 30		DAY 40	
Visual Acuity	Group I	Group II	Group I	Group II	Group I	Group II	Group I	Group II
6/6-6/12	10(50%)	7(35%)	13(65%)	14(70%)	16(80%)	19(95%)	20(100%)	20(100%)
6/18-6/36	7 (35%)	10(50%)	7(35%)	6(30%)	4(20%)	1(5%)	0	0
6/60-FC 4M	0	2(10%)	0	0	0	0	0	0
FC3M-PL	3(15%)	1(5%)	0	0	0	0	0	0
TOTAL	20	20	20	20	20	20	20	20

X2= 4.059; P Value= 0.2552 X2= 0.114; P Value= 0.7357 X2= 2.057; P Value= 0.1516

4. Discussion

4.1 Endothelial cell density

In our study, Pre-operatively, the mean ECD in Group 1 was 2,183.6 +/- 278 cells/mm2 and in Group 2 was 2,017.3 +/- 271 cells/mm2 (p = 0.063). Mean ECD decrease was 5.67% in Group 1 and 6.24% in Group 2 at the end of 6 weeks,that falls within 95% confidence interval. This matches with study done by Pipat Kongsap, where they found mean ECD decrease was 7.61% in Group 1 and 7.19% in Group 2 at the end of 6 weeks.

4.2 Complication

In our study, After surgery, 6 eyes (30%) had corneal edema in both groups and, while that of study done by Francisco J Gutiérrez-Carmona, 5 eyes (10%) in group 1 had corneal edema, which resolved in post op 1 week follow up which goes hand in hand with our study.

4.3 Visual outcome

In our study, un-corrected visual acuity of 6/6 to 6/18 was achieved by 80% of group 1 study population and 95% of group 2 study population, While that of study done by Pipat Kongsap is 71.1% in group 1 study population which is comparable with our study.

5. Conclusion

From above discussion it can be concluded that—

- Using MPF, soft nuclei can be removed through a 3.2 mm CCI.
- The corneal endothelial cell loss after cataract surgery with the manual phacofragmentation is equivalent to those of phacoemulsification.
- The global endothelial cell loss 3 months after surgery did not show major changes from the preoperative count.
- Both surgical techniques allowed excellent visual results.
- The overall incidence of transient corneal edema in MPF study was small.
- This technique of small incision cataract surgery i.e. MPF through 3.2 mm incision, requires a shorter learning curve and less financial outlay than that required for phacoemulsification.
- It is an alternative for surgeons who do not have the resources to obtain phacoemulsification equipment in soft cataract.

Hence manual multiphacofragmentation is feasible over phacoemulsification in soft cataracts.

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