



COMPARATIVE STUDY ON EVALUATION OF MACULAR THICKNESS FOLLOWING PHACOEMULSIFICATION AND MANUAL SMALL INCISION CATARACT SURGERY BY OPTICAL COHERENCE TOMOGRAPHY

Ophthalmology

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ABSTRACT

Aim: To compare central macular thickness (CMT) following uneventful phacoemulsification with foldable acrylic lens and uneventful manual small incision cataract surgery (MSICS) with non-foldable polymethyl methacrylate (PMMA) lens implantation by using Optical coherence tomography (OCT). **Methods:** In this Prospective Randomised study, patients undergoing uneventful cataract surgery were divided into two groups, 25 patients who underwent phacoemulsification were included in group-P, whereas 25 patients who underwent SICS were included in group-S. Findings of Slit lamp examination, Best corrected visual acuity (BCVA), Fundus examination and Central macular thickness by using Spectral domain OCT were recorded for all cases pre operatively and post operatively at 1 day, 1 week, 1 month and 3 months follow up. Main outcome measured was post operative central macular thickness. **Results:** Statistically significant difference in mean CMT was observed between Phaco and SICS group at 1 day, 1 week, 1 month and 3 months follow up ($p < 0.001$). Mean CMT rose steadily during post operative period till 1 month and SICS group showed high rise during follow up. Mean CMT returned to near pre operative value by 3rd month in Phaco group compared to SICS group. **Conclusion:** Significant increase in CMT is observed in SICS group compared to Phaco group without effecting final visual outcome. SICS can be done more cautiously in patients who are at risk of developing macular edema.

KEYWORDS

Central macular thickness (CMT), Phacoemulsification (PHACO), Small incision cataract surgery (SICS), Cystoid macular edema (CME)

INTRODUCTION

Cataract is one of the leading causes of preventable blindness and has a significant impact on patients quality of life. The world health organisation (WHO) estimates that at least 20 million people are blind due to cataract, which accounts for 51% of blindness worldwide¹.

Sushruta performed the first documented method of treating cataracts with couching. Since then, cataract surgery has evolved, from intracapsular cataract surgery to phacoemulsification using microsurgical techniques. However, in third-world nations such as ours, the high cost of phacoemulsification techniques and disposable supplies, as well as the need for more advanced surgical training, are the primary limiting factors². MSICS can be considered a cost-effective alternative to phacoemulsification in such circumstances^{3,4}.

Cystoid macular edema (CME), also known as Irvine-Gass syndrome⁵, is one of the various causes of post-cataract surgery vision loss. With the advent of surgeries such as MSICS and phacoemulsification, the incidence of CME has decreased⁶. MSICS is reported to have a higher CME incidence due to the larger incision size and increased iris manipulation. Subclinical edema and even Clinical CME have been reported after cataract surgery in both MSICS and Phacoemulsification, with MSICS posing a greater risk. In the majority of cases^{7,8}, this edema did not affect the post-operative visual outcome over time.

This study aims to compare the central macular thickness using optical coherence tomography (OCT) after an uneventful MSICS and phacoemulsification procedure

MATERIALS AND METHODS:

A prospective, randomised study was conducted for a period of 4 months ie, from October 2022 to January 2023 at Alluri Sitarama Raju Academy of Medical Sciences in Eluru, Andhra Pradesh. Prior to the study, institutional ethics committee approval was obtained. All patients who gave informed consent and fulfilled the inclusion and exclusion criteria were included in the study.

The study population consisted of males and females ≥ 50 years of age. 50 patients with a cataract in one eye were divided into two groups of 25 patients each.

Group P: Phacoemulsification through limbal 2.8 mm incision with Foldable PCIOL implantation.

Group S: Manual small incision cataract surgery through 5.5 to 6.5 mm incision with sclerocorneal tunnel with PMMA PCIOL implantation.

Inclusion Criteria:

- Cataract patients with nuclear sclerosis up to grade 3.

Exclusion Criteria:

- Patients on long-term ocular medication for conditions such as glaucoma, uveitis, etc.
- Patients with clinically detectable macular changes on stereoscopic slit-lamp biomicroscopy.
- Patient with a history of prior ocular surgery of any kind.
- Cataract surgery that is complicated, such as vitreous loss and PCR.
- Other degenerative macular conditions, such as ARMD.
- Decompensated renal disease or uncontrolled hypertension.
- Uncontrolled diabetic patients
- Macular edema due to other causes e.g., Secondary to venous occlusion

All patients were evaluated in the preoperative phase with patient history and visual acuity (VA) been tested with Snellen's test types. The anterior segment was thoroughly evaluated using oblique illumination and slit-lamp examination, and the fundus was examined using a 90D and slit-lamp biomicroscope under full mydriasis. Spectral domain OCT was utilised to conduct macular OCT on all patients (TOPCON-3D maestro). Axial length was calculated using A-scan ultra sonography, and IOL power was calculated using the SRK II (Sanders, Retzlaff, and Kraff) formula.

The postoperative evaluation was performed on the first day, seventh day, first month, and third month. Corrected VA for distance has been calculated. OCT was performed on the first day, seventh day, first month, and third month. After surgery, patients received antibiotic-steroid eye drops that were gradually tapered over four weeks.

Statistical Analysis

The data was analysed in Microsoft Excel with Statistical Package for Social Sciences (SPSS) 26 trial version. All continuous variables (like age, CMT) were presented as mean $\pm$ SD and compared between groups by using an independent sample t-test. All qualitative variables were compared between groups by using chi-square test. A p-value < 0.05 is considered statistically significant.

RESULTS

Total 50 patients were included in the study, of which 25 patients underwent phacoemulsification and 25 patients underwent manual SICS respectively.

Table-1 Mean age distribution

Groups	No of patients	Mean±SD	P value
Group P	25	63.24 ± 3.5	0.08
Group S	25	65.36± 4.8	

Mean age for group P is 63.2 years and for group S is 65.3 years P value is >0.05, indicating that there is no significant difference in mean ages between the groups.

Mean Age Distribution

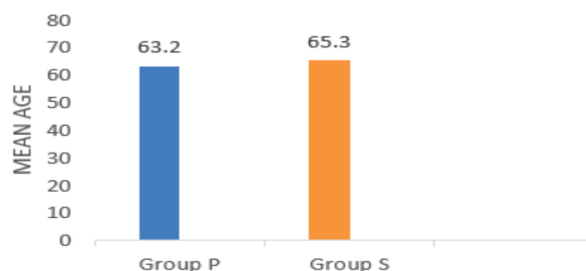


Figure-1 Mean Age Distribution

In Group P, minimum age is 57 years and maximum age is 70 years, where as in Group S, minimum age is 57 years and maximum age is 76 years.

Table 2: Sex Distribution

Sex distribution	GROUPS				Chi square value	P value
	P		S			
	N	%	N	%		
Male	11	44%	13	52%	0.321	0.7
Female	14	56%	12	48%		
Total	25	100%	25	100%		

About 44% and 52% are males in group P and group S respectively. Females accounts for 56% and 48% in group P and group S respectively. Statistically there is no significant difference in sex distribution between the groups.

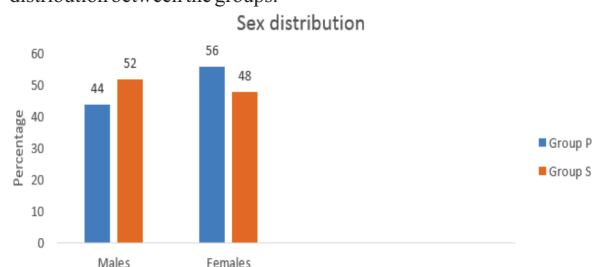


Figure 2: Sex Distribution

Visual acuity

Mean visual acuity pre-operatively in group P is 0.36±0.42 in decimals (~6/18p) and in group S is 0.18±0.27 in decimals (~6/36p) which is statistically significant (p<0.001). Post-operatively at the end of 3months Mean visual acuity in group P is 0.72±0.23 in decimals (~6/9) and in group S is 0.68±0.36 in decimals (~6/9p) which is not statistically significant (p>0.05)

Table-3: Comparison of Mean CMT between group P & S

	Pre-op	1st day	7th day	1st month	3rd month
Group P	204.72	215.32	224.60	235	209.20
Group S	205.36	218.56	231.16	240.40	215.32
p-value	0.24	<0.001	<0.001	<0.001	<0.001

Mean central macular thickness between the two groups was calculated and statistically analyzed using student's t-test. There was no statistically significant difference between Mean CMT preoperatively in both the groups (p=0.24). Mean CMT gradually increased from pre-op value till 1st month post-op in both the groups. By the end of 3rd month post-op, mean CMT reverted to near pre-

operative value. The highest Mean CMT in both the groups was at 1st month PHACO (235±2.87) and SICS (240.40±2.95). Mean CMT is always higher in SICS group compared to PHACO group during the complete 3 months period.

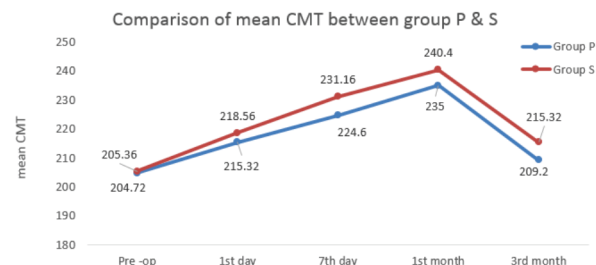


Figure-3: Comparison of Mean CMT between group P & S

DISCUSSION

Central Macular edema is an important and common cause of decreased visual acuity after cataract surgery. With the advancements in surgical techniques, it is now possible to perform surgeries more quickly and with fewer complications, conventional ECCE having fewer complications than ICCE due to the intact posterior capsule. Modern techniques such as MSICS and phacoemulsification surgeries have further reduced these complications^{7,9} Fundus fluorescein angiography has been the diagnostic gold standard for CME¹⁰ since its introduction. With the advent of OCT, which provides results in the office and is noninvasive, it is now possible to detect even mild CME with greater sensitivity than with FFA or clinical examination. OCT excels at describing the axial distribution of fluid and has excellent reproducibility.

In this study Mean age of patients is 63.24±3.5 years and 65.36±4.8 years in PHACO and SICS groups respectively. This is comparable to study by SaswatiBiswas et al,¹¹ which included patients with mean age group of 63.8 years & 62.7 years in PHACO&SICS groups respectively.

Males accounts for about 44% and 52% whereas females accounts for about 56% and 48% in PHACO and SICS groups respectively in this study which is comparable to study by SaswatiBiswas et al,¹¹ where males accounts for 52% and 36%; females accounts for 48% and 64% in PHACO and SICS groups respectively.

In this study Mean visual acuity pre-operatively in group P is 0.36±0.42 in decimals (~6/18p) and in group S is 0.18±0.27 in decimals (~6/36p) which is statistically significant (p<0.001). Post-operatively at the end of 3months Mean visual acuity in group P is 0.72±0.23 in decimals (~6/9) and in group S is 0.68±0.36 in decimals (~6/9p) which is not statistically significant (p>0.05). This is similar to the study by NasreenS et al¹² the mean difference between pre-operative visual acuity in SICS group and in phacoemulsification group shows statistically significant, p<0.001. The mean difference between the post-operative visual acuity in SICS group and in phaco procedure doesn't show any statistically significant, p=0.11.

In this study Mean CMT (µm) Pre-operatively is 204.72±2.03 and 205.36±1.8 in group P and S respectively. The difference was not significant between the two groups (p=0.244). A statistically significant rise in thickness of central macula was noticed postoperatively at 1 day, 1 week and 1 month (p<0.0001 PHACO group, p<0.0001 for SICS group) in all patients. A higher rise in Mean CMT is noticed in SICS group compared to PHACO group throughout the follow up. The highest Mean CMT in both the groups is at 1st month PHACO (235±2.87) and SICS (240.40±2.95). They came near to the pre-operative value in both the groups at 3 months follow up, 209.20±2.27 in PHACO group and 215.32±2.09 in SICS group, but the values were still significantly higher than preoperative values in SICS group than PHACO group. Clinically significant macular edema was not found at any point in time in any patient during this study.

Similar observations were made by SaswatiBiswas et al¹¹ after uncomplicated Phacoemulsification and manual SICS in diabetic patients. In both PHACO & SICS group MCFT rose steadily during post-operative period and SICS group shows high rise during follow up (p<0.001). The MCFT returned to near pre-op value by the 6th month.

Chaudhary et al⁸ found that statistically significant rise in thickness of macula was noticed postoperatively at 1 week and 1 month ($p = 0.001$ for MSICS group and $p < 0.05$ for phacoemulsification group), in all patients. It returned to near normal values by 3 months postoperatively. This increase was mostly sub clinical without affecting BCVA.

Gosh et al⁷ study demonstrates that Central subfield mean thickness, in MSICS group was significantly more than that in phacoemulsification on 7th day ($p = 0.04$) and 42nd day, ($p = 0.007$). Clinically macular oedema was not diagnosed in any of the patients at any visit. The increase in macular thickness was sub-clinical and did not affect final visual outcome in any patient.

Despite a higher theoretical risk of postoperative inflammation increase after MSICS, there was no clinical or OCT evidence of CME. In spite of this, the likelihood of a subclinical increase in CSMT was greater after MSICS than after phacoemulsification, which may be attributed to the greater tissue trauma and iris manipulation associated with MSICS. Surgical trauma to the iris, ciliary body, and lens epithelial cells is known to cause the release of phospholipids, as well as prostaglandins and other inflammatory mediators. These inflammatory mediators diffuse through the vitreous and disrupt the BRB, resulting in the accumulation of serum in the retina and the development of macular edema.^{13,14}

Limitations

This study has potential limitations, including a smaller sample size and a shorter follow-up period. In addition, this study did not include very dense or advanced cataracts, limiting information regarding the impact of associated variables on CME, such as a larger incision and more surgical manipulation in MSICS and greater Phaco power and duration in Phacoemulsification surgery. To compare the parameters, a study with a larger sample size, longer follow-up, and denser cataracts may be necessary.

CONCLUSION

Mean CMT has increased after both uncomplicated Phacoemulsification and SICS surgeries; it is highest at the one-month follow-up and returns to near pre-operative levels by the third month. Increase in mean CMT is greater in the SICS group than in the phacoemulsification group, but this difference has no effect on the final visual outcome. Patients who are at risk for developing macular edema can undergo SICS with greater caution.

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