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Original Research Article

Central macular thickness after uneventful phacoemulsification and MSICS: A prospective comparison

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ARTICLE INFO	A B S T R A C T
Article history: Received 16-09-2024 Accepted 20-11-2024 Available online 30-12-2024	 Aim: The aim of this study was to evaluate and compare central macular thickness using spectral domain OCT in patients undergoing small incision cataract surgery and phacoemulsification. Materials and Methods: This prospective, comparative and observational study was conducted on 120 cataract patients. They were equally divided into Group 1 and Group 2. Group 1 patients who underwent phacoemulsification and Group 2 who underwent MSICS. In both groups macular thickness using OCT
<i>Keywords:</i> Cystoid macular edema phacoemulsification MSICS	 was recorded preoperatively and postoperatively at 1 day, 1, 4, 6 weeks. Macular thickness changes were analyzed and compared. Results: There was an increase in central macular thickness Post cataract surgery which was more (240.07 ± 21.28) in patients who underwent small incision cataract surgery up to 6 weeks as compared to the patients who underwent phacoemulsification was (220.73 ± 12.75) with p value < 0.05. However, there was no significant association with the age, gender and preoperative central macular thickness. Conclusion: Increase in macular thickness remained subclinical and there was no significant association with the age, gender and pre-operative central macular thickness.
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1. Introduction

Senile cataract presents after the age of 45-55 years or more. It represents the effect of various combinations like chemical alteration and photolytic cleavage of lens proteins (crystalline) which leads to the accumulation of high molecular mass proteins, change in the refractive index of the lens with scattering of light and reduced transparency, and also cumulative damage of environmental effects in consideration with the genetic predisposition encoded in genes for lens proteins.¹ Multiple surgical techniques are available for curative intent of senile cataract such as phacoemulsification and MSICS, each with its own advantages and disadvantages. One of the most common postoperative complications is cystoid macular edema (CME) following uneventful cataract surgery.

Although the pathogenesis of CME after uneventful cataract surgery is multifactorial, primary cause is the leakage of fluid with low protein and lipid content into the extracellular cavity from perifoveal capillaries, due to the deterioration of the blood – retinal barrier (BRB) with disruptions of tight junctions in both inner and outer parts of BRB. The anterior segment inflammation is due to Surgical interventions resulting in the leakage from the iris vessels with the release of prostaglandins (PGs), followed by increase in the vascular permeability of macula, due to diffusion of these inflammatory mediators into the vitreous and retina, finally resulting into the fluid accumulation in the inner nuclear and outer plexiform retinal layers.²

Incidence of CME is less (1%) with modern techniques like Phacoemulsification in comparison to MSICS (2%).³ One of the possible explanation to this can be a larger

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incision in older techniques (SICS) predisposing to increase risk of iris trauma followed by more inflammation in comparison to phacoemulsification. If complications happen during cataract extraction, such as posterior capsular rupture, vitreous damage or loss, severe trauma to iris, or vitreous traction at the wound, there may be significant increase in the incidence (up to 20%) of clinically apparent CME.⁴ However, the incidence of CME, which can be evidenced only as a perifoveal capillary leakage (angiographic leakage) without clinically significant macular edema has been shown upto 9-19% and more after cataract surgery.^{5,6} Nowadays, OCT has become an advanced and important diagnostic tool to evaluate and manage retinal disorders. The aim of this prospective study is to compare Central Macular Thickness by using Spectral Domain OCT (Heidelberg Germany, Carl Zeiss Meditec) a device which uses 840 ± 10 nm light with a power at the pupil of 750 μ W. The depth of resolution in tissue is 5 μ m, and the transverse resolution is 15 μ m. Each image covered a 6×6 mm area centered on the fovea, acquired at 26,000 A-scan/second and composed of 256 to 1024 Ascan/fram in patients undergoing Small Incision cataract surgery and Phacoemulsification.

2. Material and Methods

Patients who presented with senile cataract on clinical diagnosis were included in this prospective observational study conducted at Regional Institute of Ophthalmology (RIO), Institute of Medical Sciences, Banaras Hindu University from October 2022 to June 2024. A total of 120 study subjects were enrolled in RIO OPD who were having Senile Cataract of age group 45 to 75 years with negative viral markers, without any ocular or systemic pathology. Patients with preexisting macular pathologies, history of previous intra ocular surgery or laser treatment, using topical medications like steroid, prostaglandin analogues and diuretics, also the patients with Intraoperative complications that could cause macular edema after surgery were excluded from the study. Informed consents were obtained from all study subjects after getting ethical clearance from institute of ethical committee of IMS BHU. All the patients or attendant were described regarding the purpose of study and method of investigations needed to be performed like Visual acuity using Snellen's chart and pin hole, best corrected visual acuity, Slit lamp examination and Spectral domain OCT.

These 120 patients were divided into two groups based on the procedure of cataract surgery under which they were operated (phacoemulsification and MSICS). The pre – operative central macular thickness was measured using SD-OCT. Follow-up central macular thickness measurement was performed the day after the surgery, at 1 week, 4 weeks and 6 weeks post-operatively. Patients were prescribed standard postoperative topical medications. Detailed slit lamp examination was done on every visit.

All the data were entered in predesigned and pretested proforma and data were analysed by using IBM SPSS, statistical program for social sciences (Trial version of California) version 25.0. Descriptive analysis was carried out by mean and standard deviation for quantitative variables, frequency and proportion for categorical variables. The association between categorical variables was assessed by cross tabulation and comparison of percentages. For normally distributed Quantitative parameters the mean values were compared between study groups using Independent sample t-test (2 groups). Chi square test was used to test statistical significance. P value < 0.05 was considered statistically significant.

3. Results

Out of total 120 cases included in the final analysis,

The mean age was 58.13 ± 7.77 years in phacoemulsification group and 59.38 ± 6.72 years in SICS group. The difference between two groups was statistically not significant (p value - 0.348).



Figure 1: Mean age of study subjects in both group

Among the study population male participants were 68 (56.7%) and remaining 52 (43.3%) were female participants.

Table 1: Distribution of cases according to laterality

Eye	Frequency	Percentage
Left	53	44.2%
Right	67	55.8%
Total	120	100%

The difference in the proportion of gender between two groups was not statistically significant (p value 0.713).

The mean pre op central macular thickness was 188.93 ± 13.17 in phacoemulsification group and 190.98 ± 18.57 in SICS group. The difference between two groups was statistically not significant (P value >0.05).



	Phacoemulsification	SICS	Unpaired t test p value
Pre-operative	188 ± 13.17	190.98 ± 18.57	0.487
1 st POD	200.87 ± 15.26	221.45 ± 22.83	< 0.001
1 st week	213.15 ± 12.88	230.02 ± 22.77	< 0.001
4^{th} week	221 ± 13.86	235.60 ± 20.30	0.001
6 th week	220.73 ± 12.75	240.07 ± 21.28	< 0.001



Figure 2: Represents OCT macula in phacoemulsification (left) and SICS (right) at pre-operative and consecutive follow up at 1^{st} POD, 1^{st} week, 4^{th} week and 6^{th} week (above to below)

 Table 2: Distribution of cases according to sex and surgical procedure

Gender	PhacoemulsificationSICS		Total
Male	35 (58.3%)	33 (55%)	68 (56.7%)
Female	25 (41.7%)	27 (45%)	52 (43.3%)
Total	60 (100%)	60 (100%)	120 (100%)
	Chi square: 0. 0.713 (ins		

The mean pre op central macular thickness was 188.93 \pm 13.17 (baseline), 200.87 \pm 15.26 at 1st POD follow up,

 213.15 ± 12.88 at 1st week follow up, 221 ± 13.86 at 4th week and 220.73 ± 12.75 at 6^{th} week follow up in group 1 patients. The differences in the central macular thickness score at post op 1st day, 1st week, 4th week and 6th week follow up period with baseline value were statistically significant (P value <0.05).

(Figure 3) The mean pre op central macular thickness was 190.98 ± 18.57 (baseline), 221.45 ± 22.83 at post op 1^{st} week follow up, 230.02 ± 22.77 at 1st week follow up, 235.60 ± 20.30 at 4th week and 240.07 ± 21.28 at 6th week follow up in group 2 patients. The differences in the central



Figure 3: Shows CMT values atdifferent follow up visits in SICS



Figure 4: Shows CMT values at different follow up visits in phacoemulsification

macular thickness score at post op 1^{st} day, 1^{st} week, 4^{th} week and 6^{th} week follow up period with baseline value were statistically significant (P value <0.05)(Figure 4).



Figure 5: Shows comparison of CMT at different consecutive follow up visitsin Phacoemulsification and SICS

The mean post op 1^{st} day, 1^{st} week, 4th week and 6^{th} week central macular thickness was 200.87 ± 15.26 , 213.15 ± 12.88 , 221 ± 13.86 and 220.73 ± 12.75 in group 1 patients and 221.45 ± 22.83 , 230.02 ± 22.77 , 235.60 ± 20.30 and 240.07 ± 21.28 in group 2 patients which is found

to be statistically significant between two groups (P value <0.05)(Figure 5).

4. Discussion

Central macular edema is one of the major causes of poor vision after a cataract surgery. Peak edema may vary between 4 and 12 weeks following the cataract surgery.⁷ After modern technique of phacoemulsification, complications are reduced to an extent. Thickness is significantly increased in the inner macular area⁸ while oedema is evident in the central macular region.⁹ Initially. many studies have used FFA as a gold standard for the estimation of macular thickness following the cataract surgery and the incidence of angiographic central macular oedema came up to 20%.^{10,11} In our study, Mean age of patient was 58.13 \pm 7.77 years in Group 1 and 59.38 \pm 6.72 years in Group 2. There was no significant difference in age of the patients of both groups. Mean age in our study is slightly more than the mean age taken by Ritu Agarwal et al¹² in their study (phacoemulsification group - 53.38 ± 6.97) (SICS group - 55.59 ± 5.62) and slightly less as compared to the mean age taken by Shaik Nasreen et al¹³ in their study (phacoemulsification group- 62.2 ± 10.4)(SICS group- 60.75 ± 11.5). There was a preponderance of Male patients (group 1- 58.3% males)(group 2 55% males) in both of the groups, similar to the study of Mehboob Dad et al¹⁴ (57.7% males) and Perente et al¹⁵ (>50%males). Preoperative Central macular thickness was taken as baseline value (Group 1- 188 ± (13.17)(Group 2- 190 ± 18.57) which was less as compared to baseline preoperative mean value (201.3 \pm 24.8) taken by Mehboob Dad et al.¹⁴ In both groups, post-operative central macular thickness at day 1, after 1 week, 4 weeks and 6 weeks were compared with the pre-operative central macular thickness which was taken as baseline. In our study, in Group 1, central macular thickness continued to increase from day 1 to 4 weeks (221 ± 13.86) and after that became stable till 6 weeks(220.73 ± 12.75) while in Group 2, central macular thickness continued to increase from day 1 to 6 weeks (240.07 \pm 21.28), while in Ritu Agarwal et al¹² study CMT continued to increase in both groups upto 3 months (phacoemulsification group- 256.45 ± 17.36) (SICS group- 264.35 ± 23.96). This increase was found to be statistically significant at all intervals in both groups. Although, overall more edema was seen in Group 2 whether at post op day 1 or after that. There was no significant postoperative visual impairment related to post-operative central macular edema, seen in the study conducted by Burkhard von Jagow et al,¹⁶ while in our study we have not included the required data for the same. Our study of Group 1 was consistent with the results of Lars H.B. Mackenbrock et al¹⁷ as they concluded increased retinal thickness and volume significantly after the uneventful phacoemulsification which was reaching its maximum at 4 weeks post operatively.

Table 4: Comparison of mean CMT between group 1 and group 2 at different consecutive	e follow up visits
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Follow Ups	Group 1	P value	Group 2	P value
1 st POD	200.87 ± 15.26	< 0.001	221.45 ± 22.83	< 0.001
1 st week	213.15 ± 12.88	< 0.001	230.02 ± 22.77	< 0.001
4^{th} week	221 ± 13.86	< 0.001	235.60 ± 20.30	< 0.001
6 th week	220.73 ± 12.75	< 0.001	240.07 ± 21.28	< 0.001

We have found the similar results of Group 2 with Garvita Dabas et al¹⁸ study as they also observed maximum macular edema at 6 weeks after the uneventful small incision cataract surgery. Our results do not correlate with the observations of Georgopopulos et al¹⁹ as they found that retinal thickness increased on post op day 1(171.8 \pm 21), decreases after 2 weeks (159.7 \pm 19) and returned to the initial levels on week 4(152 \pm 17.1). Some other studies concluded peak edema at 12 weeks postoperatively after uneventful phacoemulsification^{20,21} which is also inconsistent with our study, as we have observed decline(220.73 \pm 12.75) in edema in phacoemulsification group within 6 weeks postoperatively. Our study falls in line with the results of Sumedha Sharma et al²² and strengthens the observation of more increased in post op CMT following SICS as compared to phacoemulsification.

5. Conclusion

In this single centered prospective study, we observed increase in CMT post cataract surgery which is more in patients who underwent SICS in comparison to patients who underwent phacoemulsification. However, CME caused post phacoemulsification regress after 4 weeks of follow up showing faster recovery rate in comparison to post SICS procedure in which CME continued to develop even at 6^{th} week. We conclude that newer techniques like phacoemulsification have low probability of CME postsurgery and hence, post-operative complications are less than older techniques like MSCIS.

6. Limitations

Although, limitations of this study involve bounded sample size, as we have not included variable factors which may be associated with post-operative central macular edema. Also, the study is conducted at one center in a particular time; it might have been extended to other centers also. Large scale, multicenter studies are required for the better evaluation. The similar study should be carried in the future with increased sample size and for a longer duration with other associated factors with post-operative central macular edema.

7. Source of Funding

None.

8. Conflict of Interest

None.

References

- Leske MC, Chylack LT, He Q, Wu SY, Schoenfeld E, Friend J, et al. Risk factors for nuclear opalescence in a longitudinal study. LSC Group. Longitudinal Study of Cataract. *Am J Epidemiol*. 1998;147(1):36–41.
- Şahin AK, Kükner A, Ulaş F, Doğan Ü. Effect of nepafenac 0.1% on retinal thickness after cataract surgery in patients without risk factors for cystoid macular edema. *Int J Ophthalmol.* 2020;13(12):1901–7.
- Chaudhary C, Bahadhur H, Gupta N. Study of cystoid macular edema by optical coherent tomography following uneventful cataract surgery. *Int Ophthalmol.* 2015;35(5):685–91.
- Bradford JD, Wilkinson CP, Bradford RH. Cystoid macular edema following extracapsular cataract extraction and posterior chamber intraocular lens implantation. *Retina Phila Pa*. 1988;8(3):161–4.
- Ursell PG, Spalton DJ, Whitcup SM, Nussenblatt RB. Cystoid macular edema after phacoemulsification: relationship to bloodaqueous barrier damage and visual acuity. J Cataract Refract Surg. 1999;25(11):1492–7.
- Mentes J, Erakgun T, Afrashi F, Kerci G. Incidence of cystoid macular edema after uncomplicated phacoemulsification. *Ophthalmologica*. 2003;217(6):408–12.
- Ginsburg AP, Cheetham JK, Degryse RE, Abelson M. Effects of flurbiprofen and indomethacin on acute cystoid macular edema after cataract surgery: functional vision and contrast sensitivity. J Cataract Refract Surg. 1995;21(1):82–92.
- Jurecka T, Bátková Z, Ventruba J. Macular edema after an uncomplicated cataract surgery. *Cesk Slov Oftalmol*. 2007;63(4):262– 73.
- Lobo CL, Faria PM, Soares MA, Bernardes RC, Cunha-Vaz JG. Macular alterations after small-incision cataract surgery. J Cataract Refract Surg. 2004;30(4):752–60.
- Jampol LM, Sanders DR, Kraff MC. Prophylaxis and therapy of aphakic cystoid macular edema. *Surv Ophthalmol.* 1984;28(Suppl 2):535–9.
- Peterson M, Yoshizumi MO, Hepler R, Mondino B, Kreiger A. Topical indomethacin in the treatment of chronic cystoid macular edema. *Graefes Arch Clin Exp Ophthalmol.* 1992;230(5):401–5.
- Agarwal R, Gupta P. Macular changes after cataract surgery: a prospective study. Int J Sci Res. 2019;p. 1–3. doi:10.36106/1903725.
- Nasreen S, Sudha R. Study of changes in macular thickness following uneventful cataract surgery. *Indian J Clin Exp Ophthalmol.* 2020;6(4):629–32.
- Dad M, Tahir MA, Cheema A, Nawaz HN. Change in macular thickness after uncomplicated phacoemulsification surgery using optical coherence tomography in a tertiary care hospital. *Pak J Med Sci.* 2023;39(5):1488–91.
- Perente I, Utine CA, Ozturker C, Cakir M, Kaya V, Eren H, et al. Evaluation of macular changes after uncomplicated phacoemulsification surgery by optical coherence tomography. *Curr Eye Res.* 2007;32(3):241–7.
- Jagow BV, Ohrloff C, Kohnen T. Macular thickness after uneventful cataract surgery determined by optical coherence tomography. *Graefes Arch Clin Exp Ophthalmol.* 2007;245(12):1765–71.

- Mackenbrock LHB, Baur ID, Łabuz G, Auffarth GU, Khoramnia R. Impact of Phacoemulsification Parameters on Central Retinal Thickness Change Following Cataract Surgery. *Diagnostics (Basel)*. 2023;13(17):2856.
- Dabas G, Shukla P, Mithal K, Bhartiya S, Singh VP, Agarwal S. Central macular thickness change after uneventful small-incision cataract surgery - An observational study. *Indian J Ophthalmol.* 2022;70(11):3995–9.
- Georgopoulos GT, Papaconstantinou D, Niskopoulou M, Moschos M, Georgalas I, Koutsandrea C. Foveal thickness after phacoemulsification as measured by optical coherence tomography. *Clin Ophthalmol Auckl NZ.* 2008;2(4):817–20.
- Cagini C, Fiore T, Iaccheri B, Piccinelli F, Ricci MA, Fruttini D. Macular thickness measured by optical coherence tomography in a healthy population before and after uncomplicated cataract phacoemulsification surgery. *Curr Eye Res.* 2009;34(12):1036–41.
- Kusbeci T, Eryigit L, Yavas G, Inan UU. Evaluation of cystoid macular edema using optical coherence tomography and fundus fluorescein angiography after uncomplicated phacoemulsification surgery. *Curr Eye Res.* 2012;37(4):327–33.
- 22. Sharma S. Comparison of central macular thickness after SICS (Small Incision Cataract Surgery) and phacoemulsification cataract

surgery using OCT (Optical Coherence Tomography). Int J Sci Res. 2019;16:2319–2.

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