

Comparison of Central Macular Thickness after SICS (Small Incision Cataract Surgery) and Phacoemulsification Cataract Surgery using OCT (Optical Coherence Tomography)

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Abstract: Purpose: To Compare the central macular thickness after SICS and Phacoemulsification cataract surgery using OCT. Methods: It was a study to compare the Central Macular thickness after SICS and Phacoemulsification cataract surgeries performed at Sankara Eye Hospital, Ludhiana. Those who opted for polymethylmethacrylate (PMMA) lenses underwent SICS. Those who opted for foldable lenses (acrylic hydrophilic) underwent phacoemulsification. Macular thickness was measured post-operatively on days 1, 7 and 45 using TOPCON OCT, with the Macular Cube function. Patients of age group 50-70 were included with Nuclear sclerosis grade II-III cataract with no posterior segment pathology. Results: 30 eyes of 24 patients underwent SICS and 30 eyes of 25 patients underwent Phacoemulsification. Patients who underwent SICS showed average Macular thickness of 198.32 μ m on Day 1, 203.32 on Day 7 and 212.22 on Day 45. Patients who underwent Phacoemulsification showed average Macular thickness of 193.73 on Day 1, 197.66 on Day 7 and 202.27 on Day 45. Conclusion: Presence of subclinical increase in the central macular thickness following cataract surgery was more following SICS than phacoemulsification and Maximum at post-op day 45.

Keywords: Central Macular Thickness, SICS (Small incision cataract surgery), Phacoemulsification, OCT

1. Introduction

According to the latest national survey, in India 51% of the blindness in the population above 50 years of age is cataract related. Millions of cataract surgeries are done in India every year. In recent years, the evolution of cataract surgery has involved a progressive decrease in size of the incision for the extraction of the degenerated crystalline lens. The reduction of incision size has resulted in greater safety and rapidity of surgical procedure with more rapid rehabilitation of the patient in the postoperative period. Both phacoemulsification and Manual SICS are sutureless surgeries with less complication rates and satisfactory visual outcomes. One of the most common causes of post cataract surgery decrease in visual acuity is Cystoid Macular Oedema (CME) which can compromise the result of a cataract surgery. The detection of CME can be done either through clinical examination, angiographic examination or optical coherence tomography examination. Of the three techniques, optical coherence tomography has the highest sensitivity, followed by angiography and then clinical examination. Cystoid macular edema (CME) is the formation of fluid-filled cystoid spaces between the outer plexiform and inner nuclear layers of the retina, resulting from disruption of the blood-retinal barrier. The specific etiology of aphakic and pseudophakic macular edema is not fully understood. Proposed etiologic factors include inflammation, type of cataract surgery, age of the patient, light toxicity, use of adrenergic drugs, vitreous loss, integrity of the posterior capsule, hypotony during cataract surgery, hypertension, and diabetes have been considered to be contributing factors for CME. The change in procedure from large-incision intracapsular cataract extraction to small-incision extra capsular phacoemulsification was associated with a clear decrease in the incidence of this complication. **This has been explained by less blood-aqueous barrier**

damage after phacoemulsification with an intact continuous curvilinear capsulorhexis than after extracapsular cataract extraction. There are also many proposed mechanisms for the development of post cataract surgery CME, but the most accepted mechanism appears to be prostaglandin-induced oedema.

The natural history of pseudophakic CME is spontaneous resolution of edema with visual improvement in 3 to 12 months in 80 percent of patients. Only a small proportion of patients will suffer chronic visual morbidity. Thus the present study was conducted to compare macular edema postoperatively in manual SICS versus phacoemulsification with the help of OCT.

Aims and Objectives

- 1) To evaluate the changes in macular thickness by OCT after uncomplicated phacoemulsification and uncomplicated manual SICS.
- 2) To compare the two groups to know if there is any significant difference between them.

2. Materials and Methods

- 1) Setting- The study was conducted at Sankara Eye Hospital, Ludhiana.
- 2) Design of Study- The study was a prospective randomised study. All the cataract patients were selected from camps conducted by Sankara Eye Hospital, Ludhiana.

A total 60 eyes of 49 patients with cataract were subdivided into two groups of 30 each, as follows-

- Group 1- Phacoemulsification through limbal 2.8 mm incision with foldable PCIOL implantation was done in 30 eyes
- Group 2- Manual SICS through 5.5 to 6.5 mm incision with sclerocorneal tunnel with PMMA PCIOL implantation was done in 30 eyes.

Inclusion Criteria

- 1) Age : 50-70 years
- 2) Nuclear sclerosis grade 2-3 cataract
- 3) No posterior segment pathology
- 4) Willing to participate and follow up regularly.

Exclusion Criteria

- 1) Diabetic patients.
- 2) Grade 4 and above nuclear sclerosis.
- 3) Complicated cataract surgery, e.g. PC rent.
- 4) Patients on long-term ocular medication due to various reasons like glaucoma, uveitis, etc.
- 5) Patients having any clinical macular change on stereoscopic slit lamp biomicroscopy.
- 6) Patients having history of any kind of previous ocular surgery.
- 7) Other degenerative condition of macula, e.g. ARMD.
- 8) Decompensated renal disease or uncontrolled hypertension.
- 9) Macular oedema due to other causes, e.g. secondary to venous occlusion.

Ophthalmologic Evaluation

A. Preoperative

- 1) Meticulous history taking to rule out exclusion criteria.
- 2) Visual acuity testing with Snellen's chart.
- 3) Detailed evaluation of anterior segment using slit lamp.
- 4) Detailed fundus evaluation under full mydriasis by 90D
- 5) Macular OCT of the eye to be operated.

B. Postoperative

- 1) Postoperative evaluation was carried out on day 1st, day 7th and day 45th
- 2) Each evaluation included-
 - a) Visual acuity.

- b) OCT at day 1st, day 7th and day 45th

3. Results

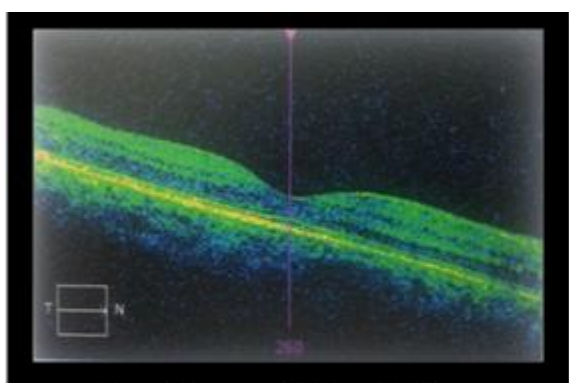
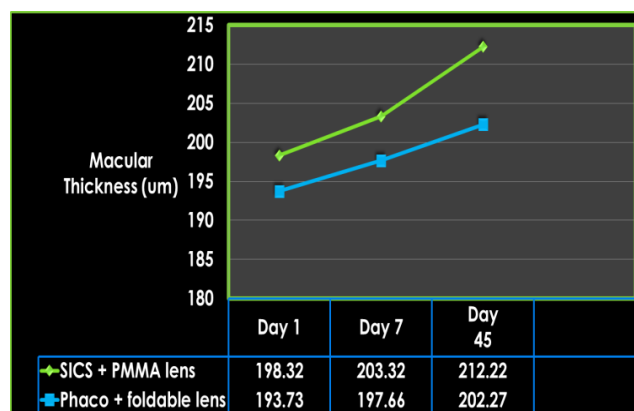
Average Central Macular Thickness (CMT) between the two groups (phaco and SICS) was calculated and tabulated. Data was statistically analysed using Student's t-test.

During postop period, highest average CMT was noted on 45th day follow up in both phaco and SICS group, i.e. 202.27 (S.D.=7.83) in phaco group and 212.22 (S.D.=7.35) in SICS group.

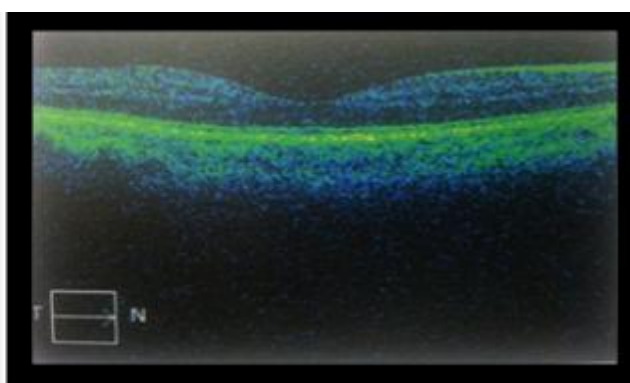
There was no significant difference between central macular thickness on preop day in phaco and SICS group (p=0.41). But, CMT was always higher in SICS group than the phaco group during the whole postop period. Significant difference in average CMT was noted on 7th and 45th day post cataract surgery.

Table 1: Showing average central macular thickness in Two Surgical Groups on Preop Day, 1st, 7th and 45th postop Day

Group	Preop	1 st day	7 th Day	45 th day
Phaco	188.56	193.73	197.66	202.27
SICS	189.34	198.32	203.32	212.22



Post OP Day 45 SICS: 260 Micrometre



Post OP Day 45 PHACO 232 Micrometrrddd

4. Discussion

After a cataract surgery, posterior diffusion of inflammatory factors, especially prostaglandins, is supposed to lead to

instability of the blood-retina barrier (BRB). The BRB is responsible for restricting movement of plasma constituents into the retina and in maintaining retinal homeostasis. A BRB breakdown leads to increased capillary permeability of the perifoveal network, and results in intraretinal fluid

accumulation both intra and extracellular. SICS has a larger incision, greater chances of insult to the iris, and thereby, higher inflammation. Phacoemulsification, being a closed chamber surgery, causes lesser inflammation when done well. The postoperative care and regular instillation of drops has a significant effect on the outcome of macular thickness. It was seen that patients with poorer educational and/or financial background showed poor compliance for medication. In most cases, uncomplicated cataract surgery does not change the macroscopic fundoscopic appearance of the retina. However, novel non-invasive imaging techniques such as cross-sectional imaging of the retina with the macular cube as seen on HD-OCT have shown that macular thickness may increase after surgery. This subclinical thickening can be detected in many cases of uneventful surgery, with a peak occurring 4–6 weeks after surgery.

In a review study by Rostos et al, it was suggested that cataract surgery in diabetic patients might accelerate preexisting diabetic macular oedema leading to poor visual outcome.⁹ Some other researchers suggested that even in the absence of diabetic macular oedema, diabetic patients tend to have a higher risk of developing CME after uncomplicated cataract extraction.¹⁰

Despite macular oedema being one of the most common cause of decreased visual acuity in post cataract surgery patients, there are very limited studies published evaluating the macular oedema in post cataract surgery patients and none of them compared the two techniques of cataract extraction with subsequent effect on macular oedema in diabetic patients.

Dr. Indranil Roy et al shows in a study that among 224 patients who were randomised to two groups- phaco and SICS group, clinically macular oedema was diagnosed in no patients in any visit. However, mean central foveal thickness in SICS group was more than that of phaco group on 1st, 7th, 42nd and 180th day. On day 42, mean central foveal thickness in SICS group was $207.77 \pm 26.34 \mu\text{m}$ and that in phaco group was $198.27 \pm 23.03 \mu\text{m}$, the difference being significant ($p=0.007$). On day 180, mean central foveal thickness in SICS group (194.10 ± 17.25) was significantly ($p=0.032$) more than phaco group (188.07 ± 21.18). Besides central fovea, significant difference was also observed in superior inner, nasal inner and inferior inner sector. So far as visual acuity is concerned, SICS was found to be as safe as phacoemulsification.¹ Dr. Dimpay Gothwal et al conducted a study on 100 eyes of 100 patients undergoing manual SICS between April 2007 and March 2008 showing that macular thickness was comparable preop and day 1 postop, increased in all patients at 4 weeks and 8 weeks and returned to near preop values in most patients by 12 weeks.

Conciao L. Lobo et al conducted a study on 32 eyes of 32 patients who had uneventful phaco with implantation of foldable IOL. The study showed that an increase in retinal thickness reached a maximum at 6 weeks in 13 of 32 eyes after which recovery was progressive. At 30 weeks, all eyes had good visual acuity, but 7 eyes still had macular oedema.

Dr. Sunandan Sood et al conducted a prospective study of 48 eyes of senile cataract undergoing phaco between June 2007

to January 2008 showing that in uncomplicated phaco foveal thickness and macular volume increased after surgery and it has significant correlation with visual acuity. There is spontaneous reduction in visual acuity at 3 months as compared to 1 month and incidence of CME was 8.33%.

Loewenstein and Zur et al (2010) reported a rate of 0.1–2.35% for clinical CME following modern cataract surgery techniques.

Powe et al (1994) showed in a large series comparing postoperative CME after ECCE and phaco in patients with no underlying systemic disease, no significant difference were found between the two techniques. Even though, the angiographic CME was slightly higher for ECCE, the clinical incidence was similar (0–6% for phaco compared to 0–7.6% for ECCE).

5. Conclusion

- Presence of subclinical increase in the central macular thickness following cataract surgery.
- More following SICS than phacoemulsification.
- Maximum around post-op day 45.
- Recovery was faster following phacoemulsification.
- It is known that the time taken for phacoemulsification surgery and the phaco time as well as the phaco energy may influence the outcome.
- However, these parameters were not evaluated in our study, as the same set of surgeons performed all surgeries, and nearly the same settings were used for all.
- Peak incidence of CME is after 1 month.
- It was seen that patients with poorer educational and/or financial background showed poor compliance for medication, and thereby showed higher thickness
- Although the increase in central macular thickness is subclinical, and seems to have no effect on the visual acuity (as measured by Snellen's), it has been noticed that the contrast sensitivity and reading speed are affected by the macular thickness.
- Equipment like HD-OCT help to evaluate these details, and work towards a tomorrow where we can further minimise these anatomical changes to the retina.

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