

## Original Article

# Evaluation of macular thickness by optical coherence tomography after phacoemulsification & SICS in diabetic patients — a prospective study

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The aim of the study is to evaluate the change in macular thickness by optical coherence tomography after uncomplicated phacoemulsification versus uncomplicated manual SICS in known diabetic patients. The study was done at KPC Medical College, Jadavpur & Implant House, Kolkata. Total sample size was 50. Patients were randomised into two groups - 25 in phaco group and 25 in SICS group. Higher rise in Mean Central Foveal Thickness (MCFT) was noted in SICS group throughout the follow up. Significant difference in MCFT between phaco and SICS group was noted on 3rd day, 7th day, 3rd month and 6 month follow up. Clinically, significant macular oedema was not found at any point of time in any patient during this study. Significant higher macular thickness was observed in SICS group as compared to phaco group, so we should be more cautious to undertake SICS in those patients, who are at risk of developing CME or who have a higher macular thickness as seen in diabetic patients.

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**Key words :** OCT, Phacoemulsification, SICS, Mean Central Foveal Thickness (MCFT).

Cataract is the most common form of ocular surgery, but its true long-term effects on retinal functions are not yet fully understood. These retinal changes may be the result of remaining subclinical inflammation or may simply indicate poor recovery of eyes with aging retinal vasculature. In any case, the alterations need further investigation with the goal of developing improved therapies to prevent long-term consequences.

Over the years, cataract surgery has undergone and is undergoing continuous refinements. In recent years, the evolution of cataract surgery has involved a progressive decrease in size of the incision for the extraction of the cataractous 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. Due to the evolution in cataract surgery, the goal of surgery has been changed from one of "Restoration of Sight" to that of "Early Restoration of Visual Acuity"<sup>1</sup>.

One of the most common causes of post cataract surgery is decrease in visual acuity due to Cystoid Macular Oedema (CME). Progressive decrease in size of the incision for the extraction of opacified lens along with minimum handling of tissues due to improved surgical tech-

niques, have decreased the incidence of CME in skilled hands. Angiographic CME is approximately 50 to 75% after ICCE<sup>2</sup> and is up to 20 to 30% after conventional ECCE<sup>3</sup>. It is up to 19% after phacoemulsification (phaco)<sup>4</sup>, but angiographic CME doesn't necessarily reduce the visual acuity<sup>3</sup>. Studies have reported that the occurrence of CME varies between 1.5 to 2.3% for Phaco<sup>5</sup>. There are many recognised and suspected risk factors for the development of CME like diabetes mellitus, iris trauma and posterior capsular tear, etc. 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<sup>6</sup>.

Modern cataract surgery with phacoemulsification, self-sealing corneal incision and implantation of foldable IOL in the capsular bag as well as manual SICS seem to have reduced the prevalence of pseudophakic CME.

OCT is the new technology, which quantifies the thickness of retina and can differentiate between eyes with and without macular oedema. Various literatures are available comparing CME in phaco and manual SICS. However, there are very little data available comparing changes in above two groups of patients who are also suffering from diabetes mellitus.

### AIMS AND OBJECTIVES

(a) To evaluate the changes in macular thickness by OCT after uncomplicated phacoemulsification and uncomplicated manual SICS in known diabetic patients.

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(b) To compare the two groups to know if there is any significant difference between them.

**MATERIALS AND METHODS**

(a) Setting - The study was conducted at KPC Medical College, Jadavpur & Implant House, Kolkata.

(b) Design of Study - The study was a retrospective randomised study. All the cataract patients visiting OPD of Ophthalmology Department, KPC Medical College, who satisfied the inclusion and exclusion criterias were enrolled for the study.

A total 50 eyes of 50 patients with cataract were subdivided into two groups of 25 each, as follows –

Group 1 - Phacoemulsification through limbal 2.8 mm incision with foldable PCIOL implantation.

Group 2 - Manual SICS through 5.5 to 6.5 mm incision with sclerocorneal tunnel with PMMA PC IOL implantation.

**Inclusion Criteria :**

- (1) Patient having controlled diabetes of any duration.
- (2) Patient having cataract up to grade 3 nuclear sclerosis.

**Exclusion Criteria :**

- (1) Uncontrolled 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 corneal disease or uncontrolled hypertension.
- (9) Macular oedema due to other causes, e.g. secondary to venous occlusion.

**Ophthalmologic Evaluation :**

**(A) Pre-operative**

- (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 indirect ophthalmoscopy.
- (5) Macular OCT of the eye to be operated if possible.

**(B) Postoperative**

- (1) Postoperative evaluation was carried out on day 1, day 3rd, day 7th, 1 month, 3rd month and 6 th month.

(2) Each evaluation included –

- (a) Visual acuity.
- (b) OCT at day 3rd, day 7th, 1 month, 3 month and 6 month.

**RESULTS**

Mean Central Foveal Thickness (MCFT) in micron between the two groups (phaco and SICS) was calculated and tabulated. Data was statistically analysed using Student's t-test.

MCFT gradually increased from preop value till 1 month follow up in all patients in both surgical groups. After that MCFT decreased and came near to preop value at 6 month follow up in both the surgical groups. During postop period, highest MCFT was noted at 1 month follow up in both phaco and SICS group, ie 231.6 (SD=7.83) in phaco group and 241.8 (SD=7.35) in SICS group.

There was no significant difference between MCFT on preop day in phaco and SICS group (p = 0.41). But, MCFT was always higher in SICS group than the phaco group during the whole postop period. Significant difference in MCFT was noted on 3rd day, 7th day, 3 month and 6 month follow up (p value were 0.002, 0.001, 0.03 and 0.04, respectively) (Table 1).

**DISCUSSION**

The most common cause of unexpected poor vision following cataract surgery in modern era of "small incision cataract surgery" is cystoid macular oedema<sup>7</sup>, which is postulated to be due to prostaglandins, which are released following trauma and have been studied extensively as a potential causative factor for CME especially following cataract surgery<sup>8</sup>.

In a review study by Rostos *et al*, it was suggested that cataract surgery in diabetic patients might accelerate pre-existing diabetic macular oedema leading to poor visual outcome<sup>9</sup>. 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<sup>10</sup>.

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

Table 1 — Showing MCFT in two surgical groups on Preop Day, 3rd Day, 7th Day, 1 Month, 3 Month and 6 Month Postop Day

Group	Preop	3rd Day	7th Day	1 Month	3 Month	6 Month
Phaco	203.88	213.76	221.64	231.6	209.24	208
SICS	205.72	220.2	229.8	241.8	213.76	212.2

SICS group, clinically macular oedema was not diagnosed in any 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 ( $194.10 \pm 17.25$ ) was significantly ( $p=0.032$ ) more than phaco group ( $188.07 \pm 21.18$ ). 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<sup>11</sup>.

Dr Dimpy 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<sup>12</sup>.

Conciao L Lobo *et al* conducted a study on 32 eyes of 31 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<sup>13</sup>.

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%<sup>14</sup>.

Torron-Fernandez-Blanco showed in a prospective study of 260 consecutive phaco surgeries operated from September 2004 to March 2005, a low incidence of clinical CME. OCT showed increased macular thickness in both group of patients (non-diabetic and diabetics) in a small percentage of cases and significantly increased macular thickness in diabetic patients<sup>15</sup>.

Ray and D'Amico *et al* in 2002 stated that CME is the most common cause for suboptimal visual outcome after cataract extraction procedures and represents today the most common cause of unexpected visual loss after uneventful cataract surgery<sup>16</sup>.

Ursell *et al* (1999) investigated the existence of angiographic CME after phaco on 60th day after surgery. They reported 19% of angiographic CME in 103 eyes with no development of clinical CME in any of those eyes<sup>4</sup>.

Mentes *et al*, 2003; Flach *et al*, 1998 reported that following an uncomplicated phaco with an intact posterior

capsule, the rate for clinical CME is as low as 0-2%, but the incidence of angiographic CME is still nearly equal to the extracapsular technique<sup>17</sup>.

Loewenstein and Zur *et al* (2010) reported a rate of 0.1-2.35% for clinical CME following modern cataract surgery techniques<sup>18</sup>.

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).

In a review study by Rostos *et al*, it was suggested that cataract surgery in diabetic patients might accelerate pre-existing diabetic macular oedema leading to poor visual outcome<sup>9</sup>.

Dowler *et al*, 1995; Dowler and Hykin, 2001; Schatz, 1994; Pollack, 1992 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<sup>10</sup>.

Miltiadis K Tsilimbaris, Chrysanthi Tsika, Vasiliou niakonis. Alejandra Karavitaki and Ioannis Pallikans *et al* conducted a study in their institution where they prospectively examined macular thickness alterations after uncomplicated phaco in four different groups of patients. One group consisted of otherwise fit patients while the others included patients with diabetes, epiretinal membrane and glaucoma. They concluded that regardless of group, a statistically significant Mean Foveal Thickness (MFT) increase occurs one month after surgery, while this increase regresses six months after surgery. With regard to diabetic patients, these showed the greatest difference between postoperative and preoperative macular thickness indicating that the underlying pathophysiology is influenced significantly by the cataract extraction process. Despite these macular alterations, visual acuity improved significantly after cataract surgery in all patients in this study, while none of the patients showed clinical CME<sup>19</sup>.

Soon II Kwon *et al* reviewed records of 104 diabetic patients who underwent CME. They examined changes of macular thickness using OCT before cataract surgery and 1 week, 1 month, 2 month and 6 month after surgery. The incidence of cataract surgery in diabetic patients was 18%. Its peak incidence was at 1 month postsurgery and it resolved spontaneously in 68% of patients by 6 months postsurgery<sup>20</sup>.

In our study, we enrolled total 51 patients. One patient was dropped out as post capsular rent occurred during surgery. We missed 3 patients (1 from phaco group and 2 from SICS group) at 6 month follow up as the patients

didn't turn up.

There was no significant effect of age or sex on MCFT in our study, which is similar to the study done by Indranil Roy *et al*<sup>11</sup>.

MCFT rose steadily in both the groups during postop period, same observed by Indranil Roy *et al*<sup>11</sup>. Higher rise in MCFT was noted in SICS group throughout the follow up. Significant difference in MCFT between phaco and SICS group was noted on 3rd day, 7th day, 3rd month and 6 month follow up (p value was 0.002, 0.0001, 0.03, 0.04, respectively).

Highest MCFT was noted in 1 month follow up in both the groups-231.6um (SD=7.831) in phaco group and 241.08 um (SD=7.35) in SICS group. They came near to the preop value in both the groups in the last follow up at 6 month, 208um (SD=8.58) in phaco group and 212.2um (SD=5.33) in SICS group, but the values were still significantly higher than preop values in SICS group (p value 0.0001), whereas it was not significantly higher in phaco group (p value 0.07).

Clinically, significant macular oedema was not found at any point of time in any patient during this study. MCFT value never went above 300um in any patient in any follow up. This result is similar to the other studies.

We did not find any specific effect of diabetes mellitus on the results, but the higher preop MCFT than the other studies those were done in normal healthy patients suggests the effect of diabetes on macular thickness in both the groups, although clinically not significant.

### Conclusion :

Significant higher macular thickness was observed in SICS group as compared to phaco group. So, we should be more cautious to undertake SICS in those patients who are at risk of developing CME or who have a higher macular thickness as seen in diabetic patients.

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