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Macular thickness analysis in hypermature cataract of early senile patients undergoing surgery

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Abstract:
Purpose: To study the changes of macular thickness (FMT) after uneventful cataract surgery (Small Incision Cataract Surgery - SICS and phacoemulsification- PHACO) in early senile age group of patients having hypermature cataract.
Methods: We examined 165 eyes of 165 healthy patients who underwent cataract surgery with intraocular lens (IOL) implantation at Regional Institute of Ophthalmology, Guwahati. All surgeries were performed by a single surgeon. One group underwent phacoemulsification (PHACO) procedure and another group underwent Small Incision Cataract Surgery (SICS) procedure. Optical coherence tomography (OCT) measurements were taken in the operated eye on preoperative day, 1st, 7th, 45th, 90th and on 180th day respectively after surgery using FMT protocol of OCT. All patients were aged between 40-55 years including both males and females. Patients below 40 and above 55 years were excluded. Patients with diabetes, hypertension, history of ocular trauma and previous surgery were excluded from the study.
Result: The macular thickness was found highest on the 45th day post operatively with a mean average value of 221.32±28.05 and resolved to normal on 180th day post operatively with mean average value of 192.67±27.95 in both male and female groups. No significant effect of age was found on central foveal thickness in our study. Highest central foveal thickness was observed on 45th day follow up in SICS group (226.84 µm ± 26.41) PHACO (214.85 µm ± 28.70) group respectively. SICS group had significantly higher thickness than PHACO group (P= 0.001).
Conclusion: This was a novel study as it was conducted on early senile patients with hypermature cataract. It was the first study of its kind and no such study was published earlier. This study shows significant increase in macular thickness up to 45th days which resolved to almost normal on 180th day post operatively in both the groups. Higher values were observed in SICS group.
Keywords: OCT, SICS, Phacoemulsification, Macular thickness, Hypermature cataract, senile group.

Introduction

A cataract means opacification of lens capsule or the crystalline lens, which does not allow light to enter the eye properly. Cataract is the main reason of avoidable blindness worldwide.[1,2,3] According to a recent survey assessment about blindness in the world cataract is responsible for 51% of the causes; it represents about 20 million people (2010)

Cystoid macular edema (CME) is a major problem of visual outcome after uneventful cataract surgery.[4] CME has been reported after cataract surgery in less than 2% of healthy population.[5] Possible role of surgical trauma with release of fluid in the extracellular spaces of the retina and formation of cysts in the outer plexiform and inner nuclear layers, e.g., blood retinal barrier disruption,[6] light toxicity and vitreo macular traction may play a role. Incidence of CME is reported to be about 0.1–2% after PHACO surgery in healthy populations. [7,8,9]

Optical coherence tomography (OCT) is an important diagnostic tool for analysing the structure of the retina. OCT is used for diagnosis of the retinal disease and it is considered as the gold standard for diagnosing CME, also useful for finding out the accurate thickness of the retina. In developing countries like India most of the patients undergoing SICS than PHACO due to the unavailability of costly machinery in remote areas.

PHACO procedure allows the surgeon to use vaccum to finish the surgery quickly similar to aspiration and irrigation of SICS procedure. But, variation of intraocular pressure may occur, resulting in the changes of macular thickness.

The present study was an attempt to compare the efficacy of SICS and PHACO in patients undergoing cataract surgery and to find the incidence of cystoid macular edema in uncomplicated cases in early senile age group.

In India, senile cataract in hypermature stage at the age of 40-55 years is not uncommon.[10] This study can give some new insight into the status of macula thickness after cataract surgery in early senile patient with hypermature cataract.

Materials and methods

The study was conducted in Regional Institute of Ophthalmology, Gauhati Medical College and Hospital, Guwahati. Total 165 eyes of 165 patient scheduled for cataract surgery in one eye at Regional Institute of Ophthalmology (RIO), Gauhati Medical College and Hospital (GMCH) Guwahati, where enrolled between June 2016 to December 2016.

All OCT examinations were performed by experienced optometrist of the department. Clinically significant CME was randomly defined as macular thickening associated with definite cystic changes detected by OCT. The OCT was performed for all patients using Stratus 3000 OCT (Carl Zeiss Meditec, Inc.) and acquisition protocol was fast macular thickness six radial scans on 1^{st}, 7^{th}, 45^{th}, 90^{th} and 180 days of post-operative days. Informed consent was signed by each participants. Institutional ethical clearance was obtained for the study.

Patients with hypermature cataract undergoing cataract surgery within the age group 40-55 years were taken for the study. Both male and female patients from any socio economic background were taken for the study. The study included only those patients, diagnosed as senile cataract without any prior history of eye surgery or trauma in the eye to be taken for the study.

Patients below the age group 40 and above 55 were excluded. Patients having any systemic disease like diabetes, hypertension or chronic systemic infection were not taken for the study. One eyed patients were excluded from the study. Patients who was having baseline ocular characters within normal limit were taken for this study. It included axial length of eyeballs, anterior chamber depth and intraocular pressure of the eye.

The non operative eye was having immature cataract or no cataract. As we were not able to take preoperative OCT evaluation reading in the eye with hypermature cataract, so the other eye was taken as a normal eye. OCT value was taken of the other eye and the data was compared with the operated eye. Those patients having hypermature cataract in both eyes were excluded from the study.

All selected cases of this study underwent either SICS or PHACO procedure by a single surgeon with sufficient experience in cataract surgery. All of the selected cases underwent surgery under peribulbar anaesthesia. Trypan blue-assisted continuous curvilinear capsulorrhexis (CCC) was created in each case. For SICS, a 6 mm frown incision was made on the superior or temporal sclera, 1.5 mm posterior to the limbus. The nucleus was then delivered by the sandwich technique. Implantation of a hydrophobic acrylic lens (Alcon, AcrySof IQ) in the capsular bag was done in all cases. PHACO was done using an Infinity vision system (Alcon, Inc.) with stop-and chop technique. Hydrophobic acrylic lens (Alcon, AcrySof IQ) was implanted in the capsular bag.

Postoperative treatment included Moxifloxacin eye drop for two weeks and prednisolone eye drop for 6 weeks. Prednisolone eye drop tapered as 1 drop 6 times daily for two weeks 4 times daily for two weeks and 2 times daily for two weeks. All patients were examined post operatively at day 1^{st}, 7^{th}, 45^{th}, 90^{th} and on 180^{th} days.

The results were evaluated using SPSS v 15 (SPSS Inc, Chicago, IL, USA). Paired sample *t* - test was used to compare the FMT parameters.

Results

We evaluated 165 eyes of 165 patients, 76 underwent SICS and 89 underwent PHACO procedure, 63 were male and102 were females . The age of patients, ranged from 40 to 55 of years, average age was 50.06 ± 4.22 years. (Table 1).

Table 1: Patients Characteristics in the study

Parameter	**Value**
No. of patients	165
Mean Age ± SD (Years)	50.06 ± 4.22
Range (Years)	40-55
No. of patients in Age group (Years):	
40-45	29
46-50	50
51-55	86
No. of Males	63

No. of females	102
PHACO	89
SICS	76

During follow up macular thickness changes were noticed while compared both the groups together. The fast macular thickness found to be highest at 45th day after surgery in comparison to the preoperative value. (Figure 2, Table 2).

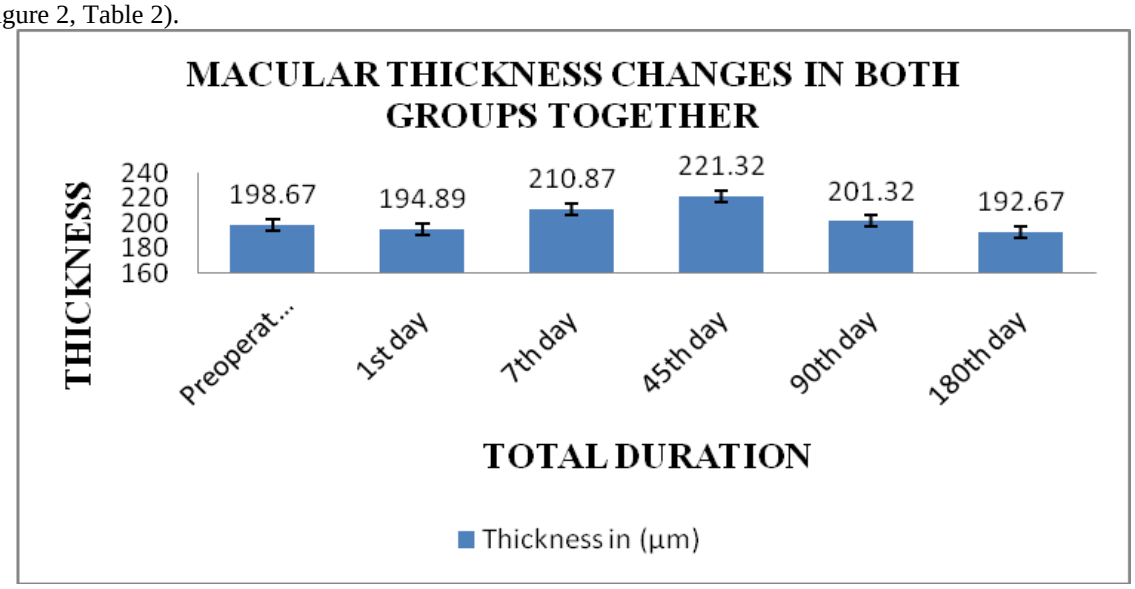

Figure 2: Average changes of Central foveal thickness in both SICS and PHACO group on preoperative day, 1st day,7th day,45th day,90th day and 180th day after surgery.

Table 2. Showing changes of central foveal thickness in both the groups on 1st, 7th,45th, 90th and 180th day after surgery.

Duration	Preoperative value	1st Day	7th Day	45th Day	90th Day	180th Day
Thickness in (µm)	198.67±27.42	194.89±30.49	210.87±27.18	221.32±28.05	201.32±28.98	192.67±27.95

A higher value of macular thickness was observed in SICS group on 45th day follow up compared to PHACO group.Macular thickness difference between PHACO and SICS found to be highest on 45th day of follow up with statistical significant (p = 0.001) SICS group showed macular thickness of 226.84±26.41 and PHACO group showed 214.85±28.70 respectively.

The values resolved to near normal during the final follow up at 180th day with a value of 194.74±29.05 in SICS and 190.26±26.58 in PHACO group. (Figure 3, Table 3)

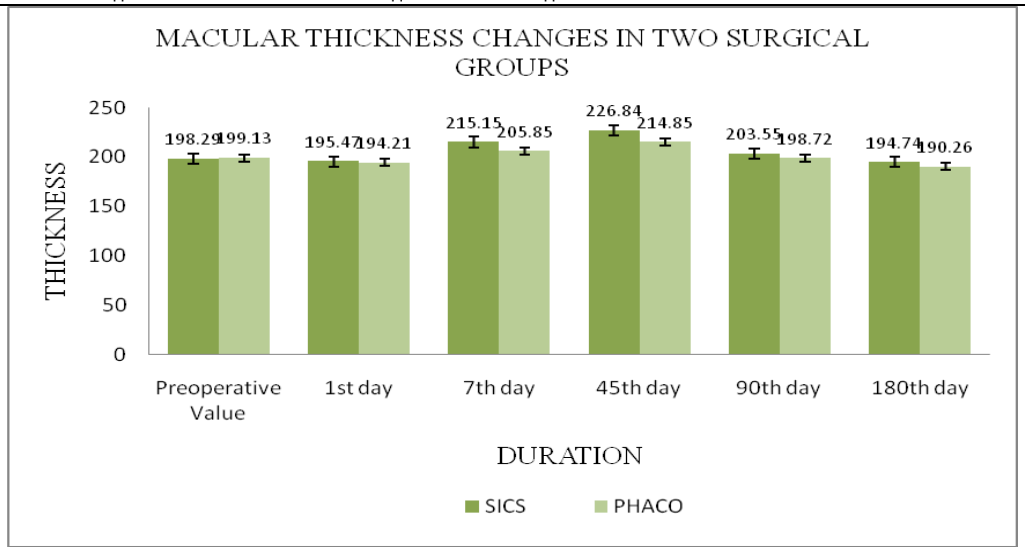

Figure 3 Comparison of macular thickness in SICS and PHACO group.

Table 3: Showing changes in macular thickness in two surgical groups of PHACO and SICS on 1st, 7th, 45th, 90th and 180th of post-operative days.

Time after surgery	PHACO (Mean ± SD)	SICS (Mean ± SD)	P value
Preoperative value	199.13±25.77	198.29±28.90	0.006
1st day	194.21±29.54	195.47±31.43	0.003
7th day	205.85±27.83	215.15±26.01	0.002
45th day	214.85±28.70	226.84±26.41	0.001
90th day	198.72±28.72	203.55±29.17	0.001
180th day	190.26±26.58	194.74±29.05	0.005

Discussion

OCT is an outstanding non-invasive device to detect sub clinical macular thickening in case of undefined poor visual outcome after an uneventful cataract surgery. It has helped many authors in the quantitative measurement of risk factors of intra-operative complication on the post-operative macular thickening.[11,12]

Since cataract is a major cause of avoidable blindness in the developing countries,[5-14] the key to the success of the Global Vision 2020: The right to sight initiative is a special effort to tackle cataract blindness. The condition where entire lens cortex becomes opaque is defined as hypermature cataract. This form of cataract is usually found in third world countries and it is not uncommon in the patients of presenile age group (40-55 years) in India.[13]

Cataracts become more common with age. Management of cataract is surgical removal of crystalline lens with implantation of Intra Ocular lens (IOL). Manual Small Incision Cataract Surgery (SICS) and Phacoemulsification (PHACO) are the most common forms of cataract surgical procedures. Among the complications of cataract surgery Cystoid Macular Edema (CME) is an important one.

The study on post cataract surgery and macular evaluation by optical coherence tomography analysis in hypermature cataract in early senile patients is a very novel study and no such published literature is available till date. This study shows the significant difference in parameters between PHACO and SICS group with PHACO group having lesser alterations during the early post operative period, indicating PHACO is the better choice for management of hypermature cataracts.

In a study of 224 patients categorized in two groups – PHACO and SICS, Dr. Indranil Roy found that CFT in SICS group was more than that of PHACO group on 1,st 7,th 42,nd and 180th day. On day 42 mean CFT in SICS group was 207.77 ± 26.34µm and that in PHACO group was 198.27 ± 23.03µm with a significant difference of (p = 0.007) on 180th day. The CFT in SICS group (194.10 ± 70.25µm) was significantly (p = 0.032) more than PHACO group[14] (188.07 ±21.18µm). Our result is similar to the study.

Parthapratim Mandal and Smiti Rani Srivastava conducted a study on 50 patients categorized in to PHACO and SICS group found that CFT was high in SICS group and a significant difference in CFT between

PHACO and SICS group was noted on 3rd day, 7th day, 3rd month and 6 month follow up which is similar to our study.[15]

Sambuddha Ghosh et al shows in their study that of the 224 patients with senile cataract after PHACO and SICS, on the 1st postoperative day, central macular thickness in SICS group and in PHACO group were 192.8 ± 17.9 μm and 192.1 ± 27.4 respectively, with no significant difference (p = 0.12). On the 7th day, in SICS group (198.9 ± 21.4 μm) was significantly (p = 0.04) more than PHACO group (193.1 ± 19.3 μm). On the 42nd day, in SICS group it was 207.8 ± 26.3 μm and in PHACO group 198.3 ± 23 μm, difference being significant (p = 0.007).[16]

Conclusion

Our study reveals that surgery on hypermature cataract of presenile patients affects the macular thickness. Significant increase of macular thickness was found from day 1 up to 180th day post operatively.

The changes of macular thickness found highest on the 45th day post operatively and gradually resolved to normal on 180th day post operatively.

The risk of development of significant CME was found to be more following SICS procedure as compared to PHACO surgical procedure. Our results demonstrated that OCT is a reliable and useful preoperative examination for patients undergoing cataract surgery. Hence one should be careful while under taking SICS procedure in cataract patients having risk of developing CME or have a higher macular thickness.

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