



**A PROSPECTIVE CLINICAL STUDY TO EVALUATE CENTRAL FOVEAL THICKNESS  
OF CATARACT PATIENTS AFTER UNCOMPLICATED SMALL INCISION  
CATARACT SURGERY BY OPTICAL COHERENCE TOMOGRAPHY**

**Dr. Manoj Balke<sup>1\*</sup>, Dr. Saba Firdos Khan<sup>2</sup> and Dr. Chandni Karole<sup>3</sup>**

<sup>1</sup>Senior Resident, M.G.M. Medical College Indore.

<sup>2</sup>Senior Resident, S.S. Medical College Rewa.

<sup>3</sup>Assistant Professor, Index Medical College & Hospital Indore.

**\*Corresponding Author: Dr. Manoj Balke**

Senior Resident, M.G.M. Medical College Indore.

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**ABSTRACT**

**aims and objective:** To assess and evaluate changes in best corrected visual acuity and the foveal thickness in an uncomplicated cataract surgery in an early post-operative period using optical coherence tomography. **Methodology:** A prospective clinical study, in which 100 eyes were assessed at baseline, post day-1, week-2 and month -1 using optical coherence tomography after successful SICS with IOL implantation. BCVA and central foveal thickness (CFT) was assessed on every visit. BCVA was recorded on Snellen's chart, later converted to LOGMAR, while CFT was measured using OCT. **results:** The mean pre-operative CFT was  $234.88 \pm 15.90 \mu\text{m}$ , which increased to  $254.20 \pm 16.01 \mu\text{m}$  on day 1, and  $246.50 \pm 14.93 \mu\text{m}$  on week 2, which significantly reduced to  $237.52 \pm 15.23 \mu\text{m}$  at month 1. Mean pre-operative BCVA was LOGMAR 0.53. BCVA improved significantly to 0.23(6/9p), 0.18(6/9p) and 0.14(6/9) at day 1, week 2 and month 1. The estimated correlation coefficient between pre-operative and post-operative CFT and BCVA were significant ( $p < 0.05$ ). **Conclusion:** Following SICS increase in central foveal thickness was seen in early post operative period which returned to baseline by the end of 1 month post operative period. Significant improvement in BCVA can be attributed to decrease in CFT.

**KEYWORDS:** Cataract, Central Foveal Thickness, Optical Coherence Tomography, Small Incision Cataract Surgery.

**INTRODUCTION**

Postoperative cystoid macular edema (CME) is a well established complication of routine phacoemulsification or extra capsular cataract extraction and intraocular lens (IOL) implantation. Large studies report an incidence of visual loss from CME of 0.4%–2%.<sup>[1-7]</sup> In CME, visual acuity is inversely related to the foveal thickness<sup>[2]</sup>; subclinical CME appears in about 20% of the patients and can be detected by fluorescein angiography.<sup>[3-9]</sup>

Increased foveal thickness following cataract extraction and IOL has also, been associated with decreased visual acuity, measured 1 week postoperatively by optical coherence tomography (OCT).<sup>[8,13]</sup>

OCT is a fairly new technique for high-resolution cross sectional imaging of the retina which can quantify the development and resolution of foveal and extra foveal macular thickening.<sup>[5]</sup>

OCT bases itself upon low coherence interferometry. In this LASER interference is shortened to a distance of micrometer by using broadband light sources[sources that can emit light over a broad ranges of frequencies.

Light in an OCT system is broken into two arms-a sample arm[containing item of interest ]&a reference arm[usually a mirror]. The combination of reflected light from the sample arm and reference arm give rise to an interference pattern but only if light from both arm has travelled "same optical distance". By scanning the mirror in the reference arm, a reflectivity profile of the sample can be obtained. Areas of the sample that reflect back a lot of light will create greater interference than the areas that don't.

**Key benefits of OCT**

- Live sub surface image at near –microscopic resolution.
- Instant, direct imaging of tissue morphology.
- No preparation of sample or subject.
- No ionizing radiation.

Spectral domain OCT extract spectral information by distributing different optical frequencies onto a different stripe via a dispersive element. Thereby the information of the full depth scan can be acquired with a single exposure.

Degree of macular thickness is significantly co-related with visual acuity. Traditional investigation for evaluating macular thickness such as fundus photography, slit lamp biomicroscopy and fluorescein angiography can provide only qualitative information, which is relatively insensitive to subtle changes in macular thickness.

OCT reliably detect and quantify subtle changes in macular thickness thus making objective monitoring of disease progression and efficacy of different therapeutic modalities in various ocular disease plausible.

Based on previous research (Degenring et al 2007; Biro et al 2008), it was hypothesized that the foveal thickness would be increased postoperatively. In line, pre- and postoperative foveal thicknesses associations were examined for the first time. The second hypothesis of our study was based on Cheng and colleagues (2002) findings that the best corrected visual acuity inversely relates to foveal thickness in the early postoperative period.

The purpose of the current study was to examine the effect of SICS with IOL implantation to the central foveal thickness by OCT during a 4-week postoperative period, in eyes without CME.

#### MATERIAL AND METHODS

This prospective cohort study was conducted between April 2015 to March 2016. 100 eyes of 100 Patients attending the OPD in Upgraded Department of Ophthalmology N.S.C.B. Medical College Jabalpur, scheduled for routine SICS with IOL implantation were included. Other eye of same patients act as control.

**Informed consent was obtained from all the subjects.**

#### Inclusion Criteria

- Patients of cataract who can be evaluated by OCT.
- Age between 18 to 70 years.
- All surgeries done by single surgeon.

#### Exclusion Criteria

- Age less than 18 and more than 70.
- Patients with history of

Uveitis

Diabetes

ARMD(Age related Macular degenerations)

Glaucoma.

- Intra operative complications.
- Media opacities(corneal opacity and mature cataract).
- Unreliable and unco-operative patients were also excluded.

Complete ophthalmologic examination and OCT measurements were taken through a dilated pupil, preoperatively and postoperatively day 1, 2 weeks, and 1 month.

VA was recorded on Snellen's chart and converted into logMAR for statistical analysis.

We divide our subjects in group A(controls) and group B (cases).

#### OBSERVATION AND RESULT

All the statistical analysis was performed using STATA 12.0, College Station, TX-USA.

Statistical significance was considered at  $\alpha < 0.05$ . Results were derived from paired t-tests for mean differences.

Regarding our first hypothesis, paired T-Tests (Table 2), compared CFT and BCVA preoperatively and on post operative day 1, week 2, and week 4 revealing increases for day 1 and week 2 ( $p$  values  $< 0.05$ ) but no differences for week 4 was insignificant.

The estimated correlation coefficients between the preoperative and the day1 ( $r = 0.79$ ,  $p = 0.001$ ), week 2 ( $r = 0.90$ ,  $p = 0.05$ ) and week 4 ( $r = 0.98$ ,  $p < 0.05$ ) postoperative CFT were significant (Table 7).

The BCVA was improved on day 1 of the postoperative period ( $p = 0.001$ ).The  $r$  coefficient between the preoperative visual acuity and the visual acuity on day 1 postoperatively was  $r = 0.55$

**Table 1: Age wise distribution of studied subjects.**

Age Group (Years)	No. of Patients	Percentage of Patients
40-45	10	10%
46-50	14	14%
51-55	14	14%
56-60	22	22%
61-65	16	16%
65-70	24	24%

**Table 2 Distribution of the Studied Subjects Based On Sex.**

Sex	No. of Patients	Percentage of Patients
Male	64	64%
Female	36	36%

**Table 3 Descriptive statistics and values of main parameters.**

<b>Sample</b>	<b>100</b>
Female	36%
Male	64%
Mean Age group	57.75 ± 8.19
BCVA Preop	0.53 ± 0.12
BCVA Postop Day 1	0.23 ± 0.09
CFT Preop	234.8 ± 15.9
CFT Postop Day 1	254.2 ± 16.1
CFT Postop Weeks 2	246.5 ± 14.9
CFT Postop Month 1	237.52 ± 15.2

**Table 4 Comparison Of Cft(Um) Preoperatively And Postoperatively In Group A And Group B.**

Group	CFT (um)			
	Preop CFT	Postop Day1 CFT	Postop Week2 CFT	Postop Month1 CFT
Group A	236.26±14.74	236.28±14.89	236.18±14.54	236.28±14.70
Group B	234.8±15.9	254±16.1	246.5±14.9	237.52±15.2

**Table 5 Comparison Of Bcva Preoperatively And Postoperatively In Group A And Group B**

Group				
	PreopBCVA	Postop Day1 BCVA	Postop Week2 BCVA	Postop Month1 BCVA
Group A	0.31±0.20 snellen(6/12) approx	0.31±0.20 snellen(6/12) approx	0.31±0.20 snellen(6/12) approx	0.31±0.20 snellen(6/12) approx
Group B	0.53±0.12 Snellen(6/24) approx	0.23±0.09 snellen(6/12) approx	0.18±0.04 snellen(6/9) approx	0.14±0.04 snellen(6/9) approx

**Table 6: Comparison of CFT, BCVA values pre- and postoperatively (T-Tests).**

Preoperative CFT 234.8 ± 15.9 BCVA 0.53 ± 0.12	Postop Day 1 CFT 254.2 ± 16.1 BCVA 0.23±0.09	% change 8.31± 3.38 -56.26±15.43	P<0.05 t =12.30
	Postop Weeks2 CFT 246.5 ± 14.9 BCVA 0.18±0.04	5.02±2.41 -65.28±11.19	P<0.05 t =11.62
	Postop Month 1 CFT 237.52 ± 15.2 BCVA 0.14±0.07	1.16±1.40 -72.8±14.75	P<0.05 t =6.73

**Table 7 Correlation matrix (foveal thickness).**

	Foveal thickness Preoperative	Foveal thickness 1 day	Foveal thickness 2 Weeks	Foveal thickness 3 Weeks
Foveal thickness Preoperative	-			
Foveal thickness 1 day	0.79 p<0.05	-		
Foveal thickness 2 Weeks	0.90 p<0.05	0.96 p<0.05	-	
Foveal thickness 3 Weeks	0.98 p<0.05	0.84 p<0.05	0.93 p<0.05	-

**DISCUSSION**

We found that preoperative thickness of the retina was significantly smaller (234.8 ± 15.9) than the thickness of the retina on day 1 (254.2 ± 16.1) and week 2 (246.5 ± 14.9) and returned to the initial levels on month 1 (237.52 ± 15.2).

The estimated correlation coefficients between preoperative and postoperative thickness of the retina were significant (p <0.05).

Georgopoulos GT et al. (2008)<sup>[4]</sup> found that the thickness of the retina preoperatively was significantly smaller than the thickness of the retina on day 1 and week 2 and

returned to the initial levels on week 4. The estimated correlation coefficients between preoperative and postoperative thickness of the retina were significant ( $p < 0.05$ ).

Biro and colleagues (2008)<sup>[5]</sup> found no differences in foveal and perifoveal retinal thickness between preoperative and postoperative day 1. However, increases in the foveal and perifoveal area thickness were found on postoperative days 7, 30, and 60.

Cheng and colleagues (2002)<sup>[6]</sup> observed no increases in mean foveal thickness in week 1.

In our study we found that BCVA inversely related to the foveal thickness on postoperative day 1 ( $r=0.03$ ).

Sourdille et al. (1999)<sup>[6]</sup>, as well as Cheng and colleagues (2002)<sup>[7]</sup> found that the BCVA inversely related to the foveal thickness in the early postoperative period.

#### LIMITATIONS

- Age less than 18 and more than 70.
- Patients with history of
  - Uveitis
  - Diabetes
  - ARMD(Age related Macular degenerations)
  - Glaucoma.
- Intra operative complications.
- Media opacities(corneal opacity and mature cataract).

#### CONCLUSION

- Study shows that preoperative CFT values were minimal which increased on postoperative day 1 and week 2 and returned to level of preoperative values at 1 month after cataract surgery.
- BCVA was poorer preoperatively due to cataract, after surgery BCVA improves, further improvement was seen as CFT decreases with time.
- In our study, positive correlation was detected between visual acuity and foveal thickness in postoperative day 1.
- OCT serves as a useful tool in diagnosis of post operative CME.

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