



E-ISSN: 2663-8274  
P-ISSN: 2663-8266  
[www.ophthalmoljournal.com](http://www.ophthalmoljournal.com)  
IJMO 2020; 2(2): 73-76  
Received: 21-05-2020  
Accepted: 30-06-2020

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## Effect of cataract surgery on macular thickness in diabetic patients

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**DOI:** <https://doi.org/10.33545/26638266.2020.v2.i2b.43>

### Abstract

**Purpose:** To study the effect of cataract surgery on macular thickness in diabetic patients.

**Materials and Method:** This prospective comparative study enrolled 100 diabetics and 100 non-diabetics undergoing cataract surgery fulfilling inclusion criteria. Complete ocular examination was done for both the groups preoperatively and postoperatively at 1 week, 1 month and 3 months including central macular thickness evaluation using optical coherence tomography.

**Result:** 0020 Significant increase in mean central foveal thickness in diabetics and in non-diabetics post 1 month ( $P < 0.01$ ) of surgery was observed. Incidence of development of clinically significant macular edema was 14% in diabetics and 5% in non-diabetics post 1 month of surgery. No progression of diabetic retinopathy post operatively at any follow up visit was observed.

**Conclusion:** There was a statistically significant increase in macular thickness after cataract surgery in diabetic patients as compared to non-diabetic patients at 1 month, however at 3 month the difference was not significant.

**Keywords:** Cataract surgery, diabetes mellitus, macular thickness, optical coherence tomography

### Introduction

Diabetes mellitus (DM) is a metabolic disorder, occurring as a result of raised blood glucose levels [1]. In India, Incidence of diabetes between the age of 20 & 70 years is 8.7% [2]. Globally, roughly 180 lakhs of people are affected with cataract contributing in making it one of the major cause behind blindness [3].

In India, Cataract is the leading cause of blindness and various researches has shown that liquefaction of lens fibres precipitates more rapidly in diabetic individuals and at an early age [4, 5]. While the results of cataract extraction (CE) procedure are astounding, patients with diabetes may have more unfortunate visual outcomes in comparison to their counterparts. It can precipitate retinopathy more rapidly, induce rubeosis or lead to macular changes like macular oedema (ME) [6, 7]. ME is one of the most common causes of visual loss after uncomplicated cataract surgery nowadays [5]. Optical coherence tomography (OCT) is a very sensitive modality for visualization of ME [8]. It has shown to be able to detect subtle irregularities and has become essential for monitoring the pre and postoperative course. Both qualitative and quantitative data can be provided by OCT to investigate the interrelationship of edematous macula and CE in subjects with diabetic retinopathy (DR) [9]. The advantage of OCT for the assessment of ME is its accuracy and reproducibility [10]. Hence this study is planned to see the frequency of development of ME in diabetic patients as compared to non-diabetics and also to see the progression of ME after cataract surgery.

### Materials and Method

This prospective comparative study was conducted after clearance from College Research Committee and Ethical Committee of the institute. After obtaining informed consent total 200 subjects, 100 diabetics and 100 non-diabetics were enrolled during the study period between January 2019 to December 2019. All patients with Cataract of either gender above 18 years of age were included and sub-divided into Study group having diabetic patients with cataract and Control group containing non-diabetic patients and patients with any complication during cataract surgery, any ocular or systemic condition that can cause macular oedema, patients with history of ocular trauma, vitreoretinal surgery or glaucoma surgery in the same eye, patients with presence of any retinal or choroidal disease,

Other than diabetes in the same eye, patients with history of treatment for diabetic macular edema or proliferative diabetic retinopathy within 6 months prior surgery, patients with any other ocular / systemic co-morbidities which will hinder fundus examination and OCT and patients not signing the informed consent were excluded from the study. After taking a detailed ocular and systemic history. Each patient underwent best corrected visual acuity examination with logMar equivalent of snellen's chart, slit lamp examination of the anterior segment, Slit lamp biomicroscopy of the fundus using + 90D lens, intraocular pressure measurement using non-contact tonometer. On Dilated fundus examination diabetic retinopathy and clinically significant macular edema was graded as per early treatment diabetic retinopathy scale (ETDRS) criteria. Central macular thickness evaluation was done using macular cube scan 512\*128 protocol of optical coherence tomography Cirrus HD machine. Preoperative macular thickness was referred as baseline reference value. Study group patients were evaluated for fasting plasma glucose, post prandial blood glucose and HBA1C levels (where required). Cataract surgery was performed by the experienced surgeon. Follow up of the patients was done at 1 week, 1month and 3month. Complete ocular examination and OCT for macular thickness evaluation was done at 1st month and 3rd month.

The data was analysed and to find the significance in categorical data Chi-Square test was used and probability value 0.05 is considered as significant level.

**Results**

In the present study age of patients enrolled ranged between 41and 89 years, mean age of patients was 61.34 ±10.379 years. Both the groups had equal representation of male and female (Table 1) Diabetics were found to be associated with hyper dense and more of with grade 4 cataract (P<0.01). Improvement in visual acuity was observed in both the group but, non-diabetics achieved better visual acuity in comparison to diabetics (P<0.01). A significant increase in mean central foveal thickness (CFT) in diabetics and in non-diabetics post 1 month of surgery was observed however at 3 month the difference was not significant. Incidence of development of CSME on OCT was 14% diabetic eyes and 5% non-diabetic eyes post 1 month of surgery. No progression of DR post operatively at any follow up visit was observed. Out of the 52 patients presented with DR, 20 had pre-existing CSME and worsening was observed in patients with moderate and severe NPDR. All the Patients with mild, moderate and severe NPDR showed increment in the CFT from the baseline value but none of the patient of mild NPDR grade presented with new development of CSME on OCT.

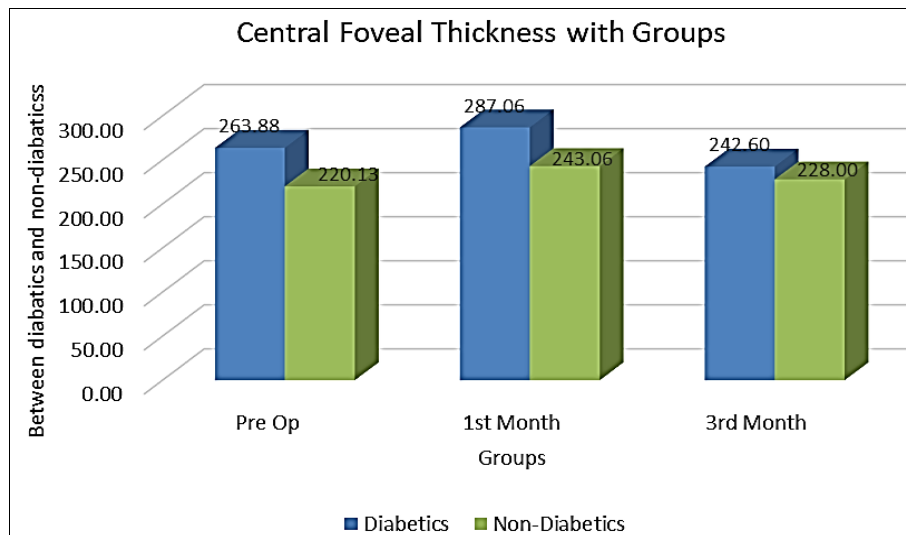


Fig 1: Comparison of central foveal thickness in study and control group

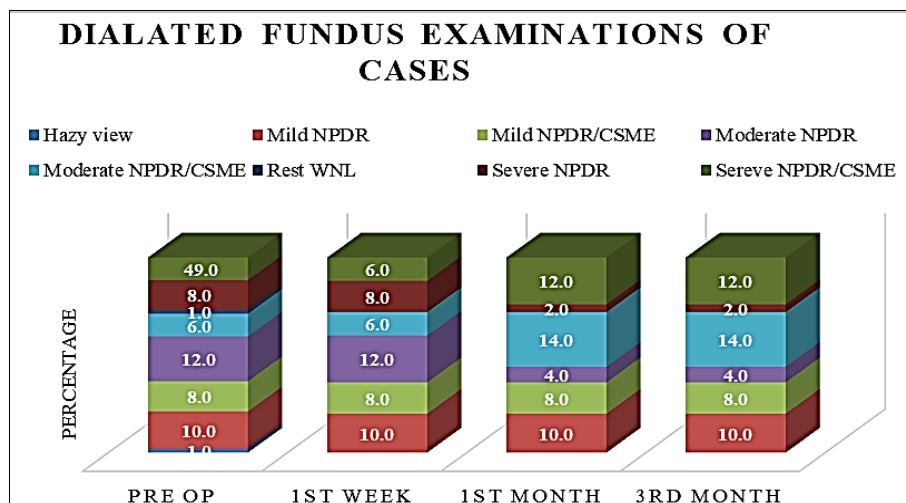


Fig 2: Comparison of dilated fundus examination pre and post OP in study

**Table 1:** Demographics

Demographics	Data
Patients (Diabetics: non-diabetics)	200 (100:100)
Sex (M: F)	104:96
Age (years)	61.34 ±10.379
Preoperative best corrected visual acuity in diabetics (logMAR)	1.25 ± 0.25
Preoperative best corrected visual acuity in non-diabetics (logMAR)	0.72 ± 0.62
Baseline central foveal thickness in diabetics(μm)	263.88 ± 84.70
Baseline central foveal thickness in non-diabetics(μm)	220.13 ± 37.06
Diabetic retinopathy (DR) stages	
No DR	49/100
Mild NPDR	10/100
Moderate NPDR	12/100
Severe NPDR	8/100
Pre-existing ME	20/100

**Table 2:** Comparison of central foveal thickness between diabetics and non-diabetics

	Groups	N	Mean	S. D.	t-value	p-value
Pre-Op	Diabetics	100	263.88	84.70	4.732	0.0005 **
	Non-Diabetics	100	220.13	37.06		
1st Month	Diabetics	100	287.06	106.64	3.864	0.0005 **
	Non-Diabetics	100	243.06	39.96		
3rd Month	Diabetics	100	242.60	67.48	1.650	0.101#
	Non-Diabetics	100	228.00	57.23		

\*\*Highly significant at  $P < 0.01$ , #No statistical significance at  $p > 0.05$

## Discussion

The Mean age of study population in present investigation was found to be 61.34 ±10.379 years in both the groups. This was lower compared to that seen in the study by Montes J *et al.* and by Chen XY *et al.* [11, 12]. Out of total diabetic patients, 23 patients had type 2 DM for more than 10 years and 77 patients had h/o DM for less than 10 years. Similarly, Singhi A *et al.* reported that 37 subjects had T2DM for more than 10 years and 63 subjects had T2DM for less than 10 years [13].

Diabetics were found to be associated with hyper dense and more of with grade 4 cataract. The difference was highly significant in distribution between Diabetics and Non-diabetics ( $P < 0.01$ ). In support of our study Schafer *et al.* in their study compared grades of cataract in diabetics and non-diabetics and found diabetics to be associated with higher grades of opacities (13%) in comparison to non-diabetics (8.4%) [14].

In this clinical study, Visual acuity improved in both the groups post-operatively at 3 months. However, non-diabetic {0.11 ± 0.22 decimals (approximately 6/6 p)} group achieved better visual acuity postoperatively in comparison to diabetics {0.43 ± 0.35 decimals (approximately 6/12 p)} this difference is due to the “diabetic retinal changes present” in diabetic group ( $P < 0.01$ ). In a study by Chen XY *et al.* Mean preoperative BCVA of diabetics in log MAR units was 0.57±0.47 (approximately 6/24) and Mean BCVA (log MAR) improved from 0.57 to 0.35 (approximately 6/12) at 1mo and 0.26 (approximately 6/9) at 3mo which is nearly comparable to our study [12].

On comparing Central Foveal Thickness between Diabetics and Non- diabetics, highly significant increase in mean CFT were found in diabetics as compared to non-diabetics at 1 month post-operative. In diabetics pre-operative mean CFT was 263.88±84.70, which increased to 287.06±106.64 post 1 month of surgery. In non-diabetics mean pre-operative CFT was 220.1±37.1, which increased post 1 month to 243.1±40.0 ( $P < 0.01$ ). Post 3 months of surgery a decline in

the mean CFT was observed in both diabetics from 287.06±106.64 to 242.60±67 and in non-diabetics from 243.1±40.0 to 228.00±57.23 ( $p > 0.05$ ). Chen XY *et al.* found a substantial amount of expansion in mean central subfield foveal thickness from baseline value (246.6 μm), at 1-month (267.6 μm) and at 3-month (272.1 μm) of follow up post operatively respectively ( $P < 0.01$ ), which is nearly comparable to our study [12]. Baker *et al.* assessed severity of DR in 229 (82%) eye post 16 week of surgery did not found any change in the severity of DR from baseline [15].

In the present study incidence of new development of CSME on OCT was 14% in diabetic patients and 5% in non-diabetic patients. The average increase in CFT post 1 month in diabetics and non-diabetics was 287.1±106.6 and 243.1±40.0 respectively. Although patients presented with all the grades of retinopathy show “increase in macular thickness” but most of the patients with Moderate and severe NPDR have developed CSME post 1 month of surgery. Also, Patients with “pre-existing CSME” presented with the “worsening of the ME” post 1 month of surgery and at 3 months of surgery a declining trend was seen in the incidence of CSME. Similarly, in a study by Chen XY *et al.* they discovered that post 1 month following surgery, 11 eyes with central macular involvement and 9 eyes with non-central involvement developed DME, 4 eyes with central involved and 6 eyes with non-central involvement “met the criteria of worsening of DME”. Post 3 months values were 20 eyes for central involved DME progression and 19 eyes for non-central involved DME progression [12].

Limitation of our study was 3 month follow up as some studies have showed increase of macular thickness at 6 months and at 1 year also. Another drawback may be small sample size so studies with large sample size may be required to access the risk of progression of macular thickness.

## Conclusion

In conclusion, this one-year study demonstrated that cataract

surgery causes a significant increase in macular thickness post 1 month of surgery in both diabetic and non-diabetics. Cataract surgery did not lead to the progression of stages of DR, although patients with all the three grades of DR showed increment in central foveal thickness from the baseline reference value. Also, a positive correlation was found in patients with presence of ME preoperatively for worsening of ME post operatively with a peak at 1 month and shows a declining trend at 3 months.

Eyes without Preoperative Central-Involved Diabetic Macular Edema. *JAMA Ophthalmol* 2013;131(7):870.

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