

**Original article:**

## **Optical coherence tomography analysis of macula –preoperative & postoperative diabetic patients undergoing cataract surgery**

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### **ABSTRACT:**

**OBJECTIVE:** To assess the incidence and progression of macular edema (ME) after cataract surgery in diabetic patients using Optical Coherence Tomography (OCT).

**DESIGN:** Prospective interventional study. 30 diabetic eyes undergoing cataract surgery. Each eye underwent 7-field fundus photography no more than 1 week before surgery. Optical coherence tomography testing was performed within 1 week before surgery and at 4 and 12 week postoperative visits. Best-corrected visual acuity (BCVA) was recorded at each visit. Macular edema was defined as an increase of foveal thickness on OCT > 30% from preoperative base-line.

**RESULTS:** The incidence of ME on OCT was 23.33% and progression of ME was 12.5%. The mean change in foveal thickness of > 30% at 4th week and 12th week was 62.5 um and 70.63 um respectively, whereas of foveal thickness < 30% at 4th week and 12th week was 5.91um and 5.57 um, respectively. Eyes with no diabetic retinopathy developed minimal thickening of 15.11 μm and 17.94 μm, the group with mild non-proliferative diabetic retinopathy had the largest increase in foveal thickness —of 24.63 um and 30.25 um, the group with moderate non-proliferative diabetic retinopathy had increase in foveal thickness— 41.25 um and 14 um at 4th & 12th week after surgery respectively. This increase in foveal thickness was correlated inversely with VA improvement. Duration of diabetes=10 years, insulin dependence, risk factors like hypertension, HbA1c & level of diabetic retinopathy were associated with reduced visual improvement.

**CONCLUSIONS:** Diabetic eyes have a high incidence of increasing foveal thickness on OCT after cataract surgery, associated with decreasing vision at 4 weeks, with gradual visual recovery at 12 weeks. Early interventions with various proved methods of management to overcome this preventable decreasing vision could improve outcome in diabetics after cataract surgery.

**KEYWORDS :** Optical Coherence Tomography – OCT, FT – Foveal Thickness, BCVA – Best Corrected Visual acuity, Macular Edema - ME

### **INTRODUCTION**

Macular edema (ME) is a common cause of visual loss. Abnormal fluid accumulation within the retina and a concomitant increase in retinal thickness usually result from the breakdown of the blood-retinal barrier. ME is clinically defined as an increase in the retinal tissue resulting in an increase in foveal thickness. This process can be found most common in those with diabetic retinopathy, retinal vein occlusion, uveitis, and other ocular disorders. Diabetic patients pose a great challenge as they have a tendency for early formation of cataracts and propensity to develop macular edema after cataract surgery. Diabetic macular edema is a major cause of vision loss after cataract surgery. Traditional methods for evaluating macular edema, such as slit-lamp bio-microscopy, stereoscopic

photography, and fluorescein angiography, are relatively insensitive to small changes in retinal thickness and are qualitative at best.

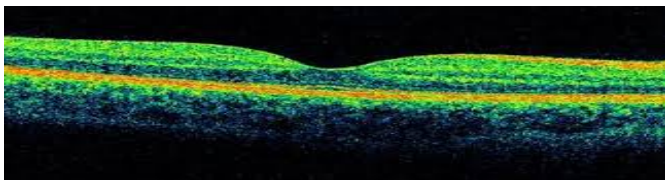
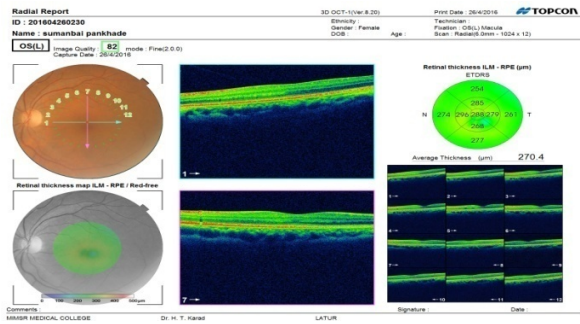
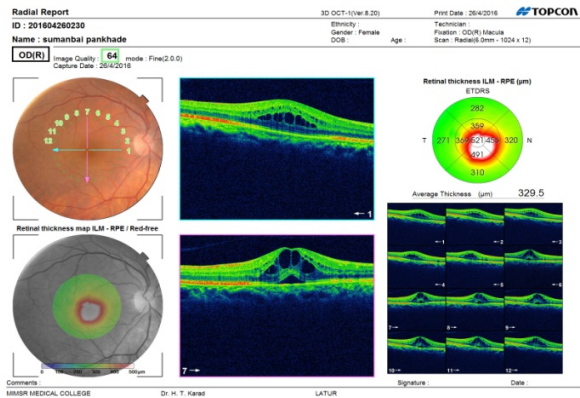
The introduction of optical coherence tomography (OCT) has enabled clinicians to reliably detect and measure small changes in macular thickness and to quantitatively evaluate the efficacy of different therapeutic modalities. OCT has been shown to be highly reproducible in measuring macular thickness in normal individuals and diabetic patients. Although widely recognized, the true incidence of macular edema after cataract surgery has not been clearly defined in literature. Hence this study is taken to assess the incidence and progression of macular edema in diabetic patients after cataract surgery using optical coherence tomography (OCT). Patients with diabetes mellitus have an increased risk of developing cataract and postoperative complications. Macular edema after cataract surgery can be a frequent and complex problem, especially in patients with pre-existing diabetic retinopathy. Furthermore, it has been clearly shown that cataract surgery favours the progression of diabetic retinopathy. For all these reasons, when cataract surgery is indicated for a diabetic patient, it is essential to thoroughly examine the patient's retinopathy before surgery, as this conditions the postoperative functional visual prognosis. Dowler J.G, Sehmi K.S, Hykin P.G, suggested that prior clinically significant macular edema is a strong risk factor for subsequent thickening of macula in diabetic patients after cataract surgery detected by optical coherence tomography. CME can be diagnosed using noncontact stereoscopic bio-microscopy/contact lens bio-microscopy, fluorescein angiography (FA), and optical coherence tomography (OCT).

Recent publications by Browning et al and Brown et al have suggested that OCT is superior to contact lens bio-microscopy for detecting diabetic ME (DME), especially in mild cases. Bio-microscopy of the macula is a difficult, subjective and often an inconclusive examination of recently operated eyes due to photophobia and light diffraction in the eye or in the intraocular lens. It is commonly recognized that the clinical assessment of ME may be subjective and variable. According to earlier reports, stereoscopic fundus examination usually only detects retinal thickening of ~ 100 µm. Using comparison between contact lens bio-microscopy and OCT in detection of diabetic ME, Brown et al found overall agreement between the results of the two methods to be 69%, which was only 23% in cases of mild foveal thickening and 85% when the eyes with mild foveal thickening were excluded. This suggests that contact lens bio-microscopy is relatively insensitive for detection of mild foveal thickening apparent by OCT.

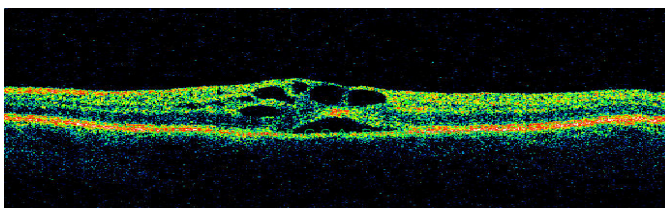
#### **Material and methods**

**SOURCE OF DATA:** Study participants consist of diabetic patients with varying levels of retinopathy, attending at in Ophthalmology OPD at Rural Medical College, Loni, Ahmednagar, Maharashtra. **STUDY DESIGN:** It was a Hospital based prospective study (Interventional Case Series). **DURATION:** 1 year (oct 2017 to sept 2018). **SAMPLE SIZE:** 30 patients. **INCLUSION CRITERIA:** Diabetic patients with senile immature cataract with varying levels of retinopathy including absence of retinopathy and uncomplicated small incision cataract surgery done by an experienced surgeon. **EXCLUSION CRITERIA:** Diabetic patients with severe NPDR, PDR, prior intraocular surgery of any type, history of uveitis or presence of any retinal or choroidal disease, other than diabetes, that could affect retinal thickness. **METHODS:** Each eye underwent 7-field fundus photography no more than 1 week before surgery. Optical coherence tomography testing was performed within 1 week before surgery and at 4 and 12 week postoperative visits. Best-corrected visual acuity (BCVA) was recorded at each visit. Macular edema was defined as

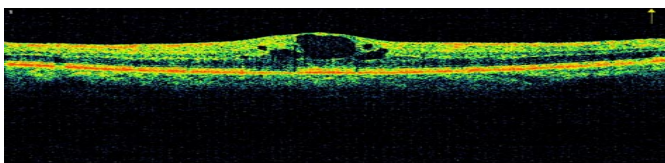
an increase of foveal thickness on OCT > 30% from preoperative baseline. Main Outcome Measures: Change in foveal thickness.



Before surgery



Post-op day 4<sup>th</sup> week of surgery



Post-of 12<sup>th</sup> week of surgery

## Results

The incidence of ME on OCT was 23.33% and progression of ME was 12.5%. The mean change in foveal thickness of > 30% at 4th week and 12th week was 62.5  $\mu$ m and 70.63  $\mu$ m respectively, whereas of foveal thickness < 30% at 4th week and 12th week was 5.91  $\mu$ m and 5.57  $\mu$ m, respectively. Eyes with no diabetic retinopathy developed minimal thickening of 15.11  $\mu$ m and 17.94  $\mu$ m, the group with mild non-proliferative diabetic retinopathy had the largest increase in foveal thickness —of 24.63  $\mu$ m and 30.25  $\mu$ m, the group with moderate non-proliferative diabetic retinopathy had increase in foveal thickness— 41.25  $\mu$ m and 14  $\mu$ m at 4th & 12th week after surgery respectively. This increase in foveal thickness was correlated inversely with VA improvement. Duration of diabetes = 10 years, insulin dependence, risk factors like hypertension, HbA1c & level of diabetic retinopathy were associated with reduced visual improvement.

## Discussion

Our prospective cohort study reports the incidence of foveal thickness changes on OCT in diabetic patients undergoing cataract surgery. As cataract formation is common in people with diabetes, obtaining preoperative and postoperative OCT scans at 4th and 12th weeks allowed us to quantify changes in foveal thickness and to follow the progression. Several published reports have confirmed the

which did not had macular edema at 4th week (had increase in foveal thickness but didn't satisfy the criteria of foveal thickness > 30% of preoperative value ) developed macular edema at 12th week. therefore the incidence of ME on OCT was 23.33% and progression of ME was 12.5%.reproducibility of OCT measurements among diabetic patients, even in the setting of pronounced thickening of the retina on OCT. OCT has been able to demonstrate a moderate correlation between retinal thickness and best-corrected visual acuity, and it has been able to demonstrate 3 basic structural changes of the retina, i.e., retinal swelling, cystoid edema, and serous retinal detachment. The design of our study required that ME be defined by changes in foveal thickness, as detected by OCT. Study eyes with an increase in foveal thickness of > 30% experienced significant loss of vision and demonstrated spongy edematous abnormalities on OCT. Moreover, a cut-off of 30% was sufficiently high to prevent overlap with the 10% coefficient of variation reported for repeat OCT testing. Therefore, for the purposes of our study we concluded that an increase of foveal thickness of > 30% was a reasonable and useful cut-off to define ME. In our study, 8 eyes (26.67%) were identified as developing ME at 4th week, of these 8 eyes, all 7 continued to have increases of foveal thickness above their preoperative baseline out to 12th weeks, which limited their visual recovery whereas 1 eye foveal thickness decreased at 12th week. 1 of the study eye

In our study, level of diabetic retinopathy was associated with increased foveal thickening. The study group with no diabetic retinopathy developed minimal increases in foveal thickening, of 14.89  $\mu$ m and 17.94  $\mu$ m at 4th and 12th week after surgery, respectively. The worse the level of diabetic retinopathy at baseline, the more likely the foveal thickness increased at 4th and 12th week after surgery. The group with mild non-proliferative diabetic retinopathy had the largest increase in center point thickness—of 24.63  $\mu$ m and 30.25  $\mu$ m at 4th and 12th week after surgery respectively. The group with moderate non-proliferative diabetic retinopathy had increase in foveal thickness 41.25  $\mu$ m and 14  $\mu$ m at 4th and 12th week after surgery respectively. This increase in foveal thickness was correlated inversely with VA improvement.

**Study limitations-** It is a non-randomised study with small study population and a relatively short follow up period of 6 months.

### **Conclusion**

Diabetic eyes have a high incidence of increasing foveal thickness on OCT after cataract surgery, associated with decreasing vision at 4 weeks, with gradual visual recovery at 12 weeks. Early interventions with various proved methods of management to overcome this preventable decreasing vision could improve outcome in diabetics after cataract surgery.

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