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CORRELATION OF VISUAL ACUITY WITH FOVEAL THICKNESS ON 3D-OCT IN DIABETIC MACULAR EDEMA.

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ABSTRACT

It was a prospective, non randomized & cross-sectional study done at Index Medical College Hospital and Research Centre, Ophthalmology OPD from DECEMBER 2016 to JUNE 2017, we had taken 160 patients who had clinically significant macular edema, out of these, 20 patients were excluded from the study: 4 patients had vitreous haemorrhage, 8 had cataract, 4 were with hard exudates and 4 patients had epiretinal membrane. Thus, the analysis was carried out on 140 patients with 140 eyes. More than one third of the patients were between 51-60 years (40.6%) followed by >60 (32.8%) and 40-50 (26.6%) years. More than half of the patients were males (58.6%). The mean BCVA was 0.54±0.40 and CFT was found to be 350.24±155.98. However, the mean CST was observed to be 387.16±154.93. There was moderate positive significant correlation of BCVA with CFT (r=0.52, p=0.0001) and CST (r=0.53, p=0.0001).

KEYWORDS: SD 3D OCT, CST, CFT.

INTRODUCTION

Diabetic retinopathy (DR) is a vascular disorder affecting the microvasculature of the retina. It is estimated that diabetes mellitus affects 4 per cent of the world's population, almost half of whom have some degree of DR at any given time. DR occurs both in type 1 and type 2 diabetes mellitus and has been shown that nearly all type 1 and 75 per cent of type 2 diabetes will develop DR after 15 year duration of diabetes as shown in earlier epidemiological studies. In the western population, DR has been shown to be the cause of visual impairment in 86 percent of type 1 diabetic patients and in 33 per cent of type 2 diabetic patients.[2]

In India with the epidemic increase in type 2 diabetes mellitus as reported by the World Health Organization (WHO), diabetic retinopathy is fast becoming an important cause of visual disability.[2]

In both insulin dependent and non insulin dependent Diabetes Mellitus, the major cause of visual impairment in diabetic retinopathy is due to macular edema.

Gradual onset blurring of vision is a classical presentation and in advanced cases, thickening and cystic changes appears leading to profound vision loss. Due to diversified presentations of Diabetic macular edema (DME), objective assessment by spectral domain 3D optical coherence tomography (SD 3D OCT) have become an valuable tool and integral part of the diagnosis and treatment of this condition.

MATERIAL AND METHODS

We prospectively screened diabetic patients for DME between DECEMBER 2016 to JUNE 2017 at EYE OPD, INDEX MEDICAL COLLEGE HOSPITAL AND RESEARCH CENTRE, Indore.

Inclusion criteria

1. Patients of any age, any type of Diabetes Mellitus, irrespective of duration of disease and clinical control, with any VA and refraction with spherical equivalent between +5.00 to -5.00 D, clinical evidence of diabetic retinopathy with clinically significant macular edema, as defined by the Early Treatment Diabetic Retinopathy Study(EDTRS).
2. The OCT retinal thickness of at least 220µm in the central subfield (CST) were taken with a good scan quality image.[3]

Exclusion criteria

1. Marked retinal swelling: It attenuates the measurement beam and causes shadowing of the outer retinal layers.
2. Eyes with hard exudates: It causes intense shadowing effects, on horizontal and vertical OCT scan line across the central fovea.
3. The presence of any other macular abnormality such as epiretinal membrane or vitreomacular traction or
4. Significant media opacities (eg. Cataract of Grade III or more on LOCS grading, vitreous hemorrhage, corneal opacity) that can result in a poor OCT signal
5. History of cataract surgery within span of 6 months.

6. Macular ischemia as evidenced by enlargement of FAZ.

Methods

All the patients refracted and BCVA was measured using the standard ETDRS LOGMAR decimal visual acuity chart read at 4 meters.

Patient's history is noted in relation to presenting complaints, duration of diabetes, treatment history and medical history. Detailed slit-lamp examination of anterior segment and posterior segment examination by slit-lamp bio-microscopy using 78D and indirect ophthalmoscope using 20D is done.

In addition to above routine examinations, 3D OCT scan was performed in all eyes suspected of DME using 3D OCT(TOPCON 3D OCT-1Ver 8.2 MAESTRO). OCT is a non contact non invasive, micron resolution cross-sectional study of retina which correlates very well with the retinal histology.

The Topcon 3D OCT-1 Maestro is the latest instrument from Topcon to combine spectral domain (SD) OCT with color fundus photography.

We performed full field 3-D retinal topography with full field scan program that covers an area of 6.0 x 6.0 mm with 2.0 mm depth and gives 9 radial scans at the centre of fixation.

We defined the central subfield thickness (CST) as the average retinal thickness of the 1mm central scanned area seen on ETDRS grid on 3D retinal topography scan.

CFT is measured by the caliper at the centre of horizontal and vertical scan in the ETDRS grid view of 3D macula. The investigators were masked to the BCVA status when interpreting OCT images.

RESULTS AND DISCUSSION

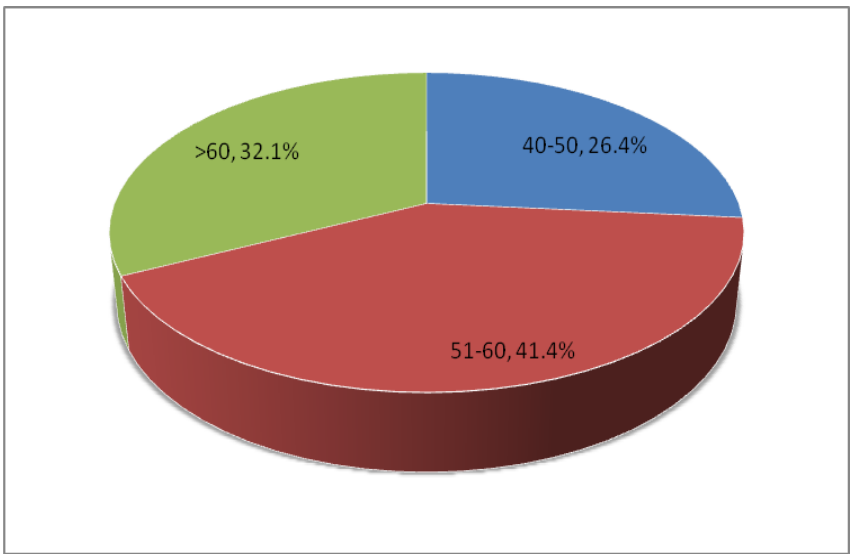
It is a prospective, non randomized & cross-sectional study done at INDEX MEDICAL COLLEGE HOSPITAL & RESEARCH CENTRE, OPHTHALMOLOGY OPD from DECEMBER 2016 to JUNE 2017.

A total of 160 patients were found who had clinically significant macular edema which was demonstrated by SD 3D-OCT scan. Of these, 20 patients were excluded from the study: 4 patients had vitreous hemorrhage, 8 had cataract, 4 were with hard exudates and 4 patients had epiretinal membrane. Thus, the analysis was carried out on 140 patients with 140 eyes.

Table-1: Distribution of patients according to age

Age in years	No. (n=140)	%
40-50	37	26.4
51-60	58	41.4
>60	45	32.1
Mean±SD (Range)	56.16±7.97 (40-75)	

Table-1 - distribution of patients according to age. More than one third of the patients were between 51-60 years (41.4%) followed by >60 (32.1%) and 40-50 (26.4%) years.

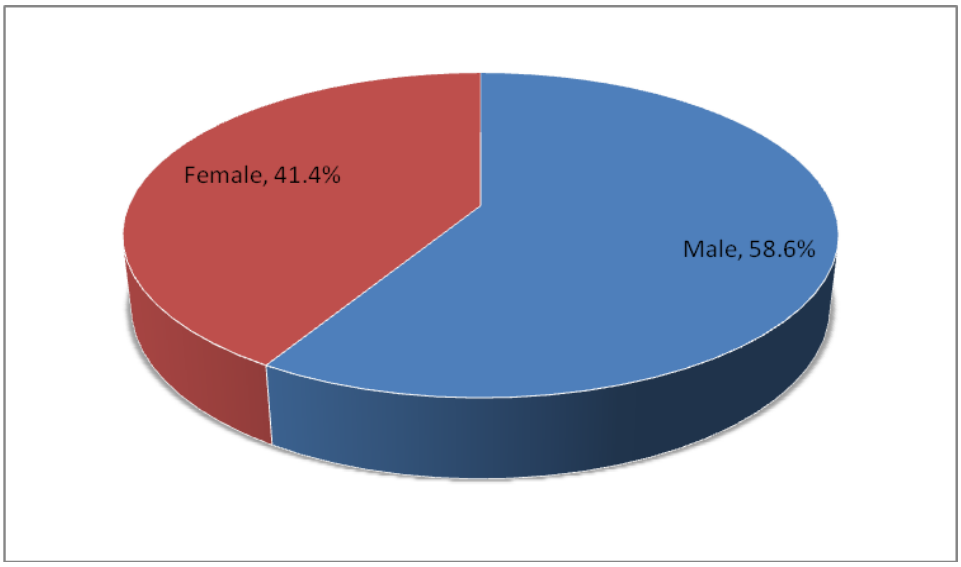


Graph 1: Distribution of patients according to age

Table-2: Distribution of patients according to gender

Gender	No. (n=140)	%
Male	82	58.6
Female	58	41.4

Table-2: shows the distribution of patients according to gender. More than half of the patients were males (58.6%).

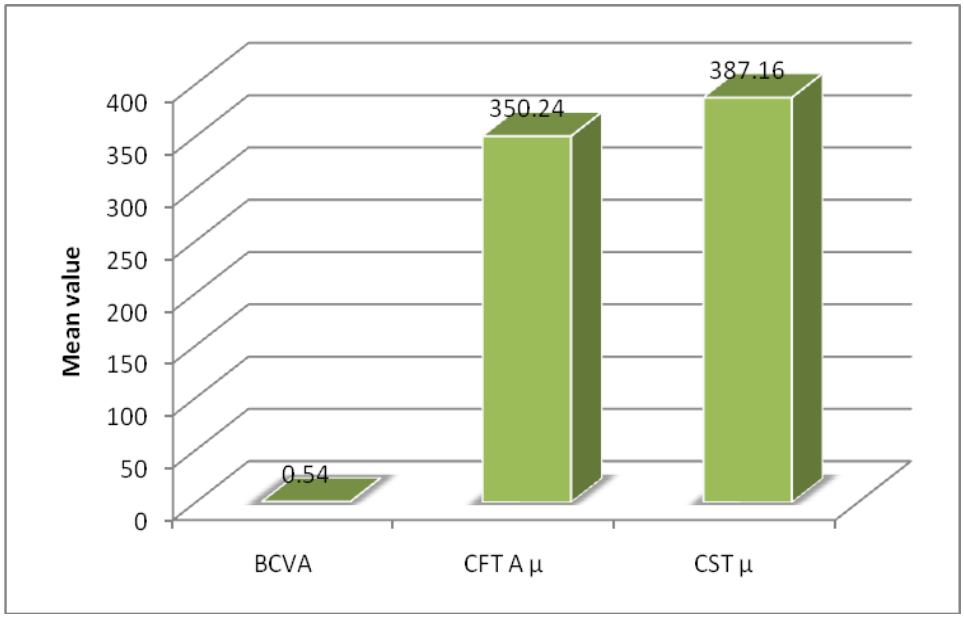


Graph 2: Distribution of patients according to gender

Table-3: Distribution of patients according to indices

Indices	Mean±SD (n=140)
BCVA	0.54±0.40
CFT A µ	350.24±155.98
CST µ	387.16±154.93

Table-3 & Graph 3 shows the distribution of patients according to indices. The mean BCVA was 0.54±0.40 and CFT A was found to be 350.24±155.98. However, the mean CST was observed to be 387.16±154.93.



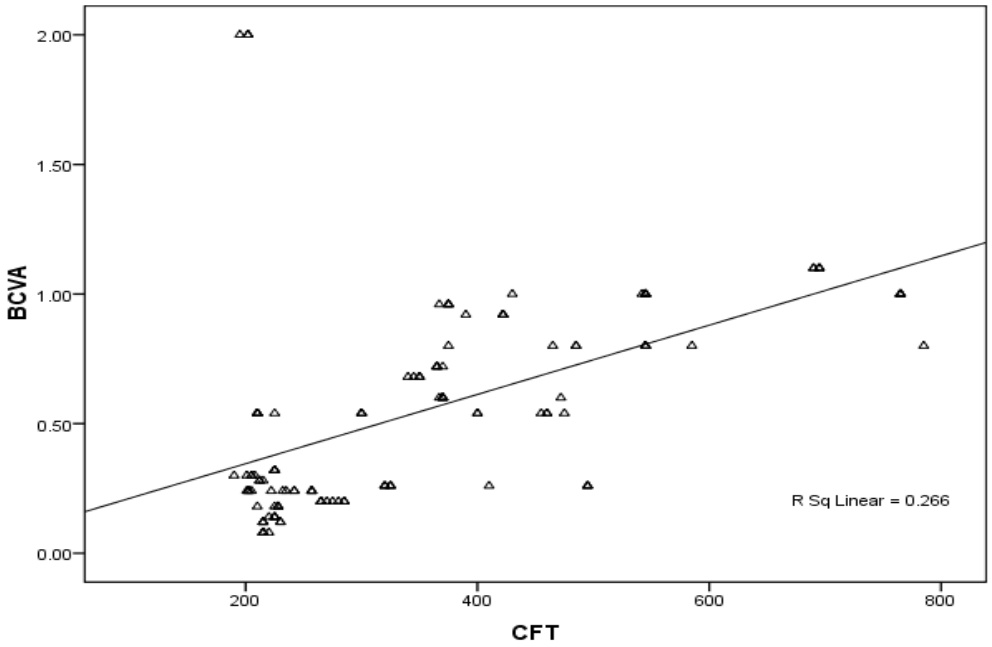
Graph 3: Distribution of patients according to indices

Table-4: Correlation of macular thickness with BCVA

Macular thickness	BCVA	
	Correlation coefficient	p-value
CFT A µ	0.52	0.0001*
CST µ	0.53	0.0001*

*Significant.

Table-4 & Graph 4 shows the correlation of BCVA with macular thickness. There was moderate positive significant correlation of BCVA with CFT (r=0.52, p=0.0001) and CST (r=0.53, p=0.0001).



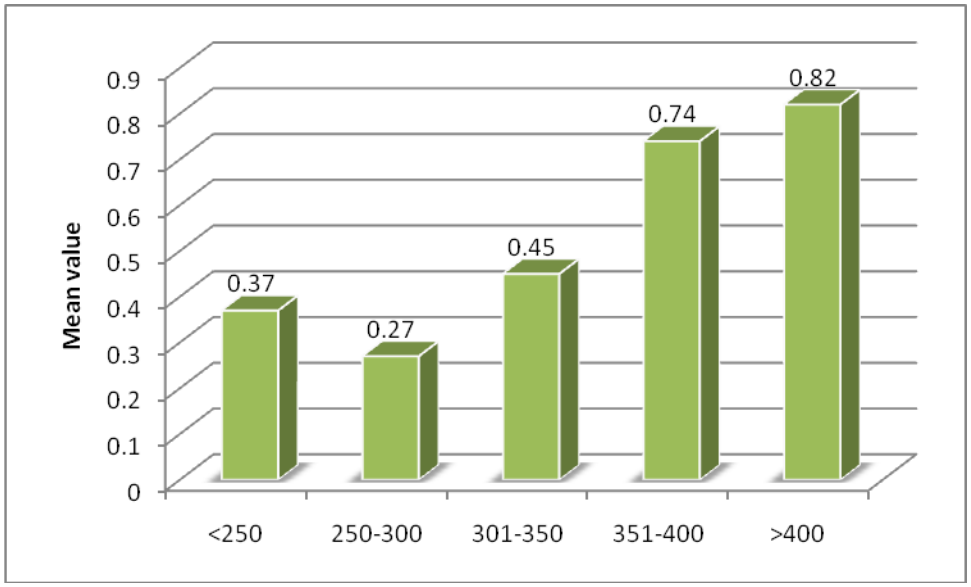
Graph 4: Scatter diagram showing correlation between BCVA and CFT

Table-5: Comparison of BCVA among CFT levels

CFT	No. of patients	BCVA
<250	55	0.37±0.47[a,b]
250-300	15	0.27±0.13[c]
301-350	11	0.45±0.21
351-400	20	0.74±0.15 [a]
>400	39	0.82±0.25 [b, c]
p-value[1]		0.0001*

[1]ANOVA test, [a,b,c]p=0.001 (Post hoc tests).

There was significant (p=0.0001) difference in BCVA among the CFT levels. The post-hoc analysis revealed that BCVA was significantly (p=0.001) different between CFT level <250 and >400 as well as 351-400 (Table-5 & Graph 5).



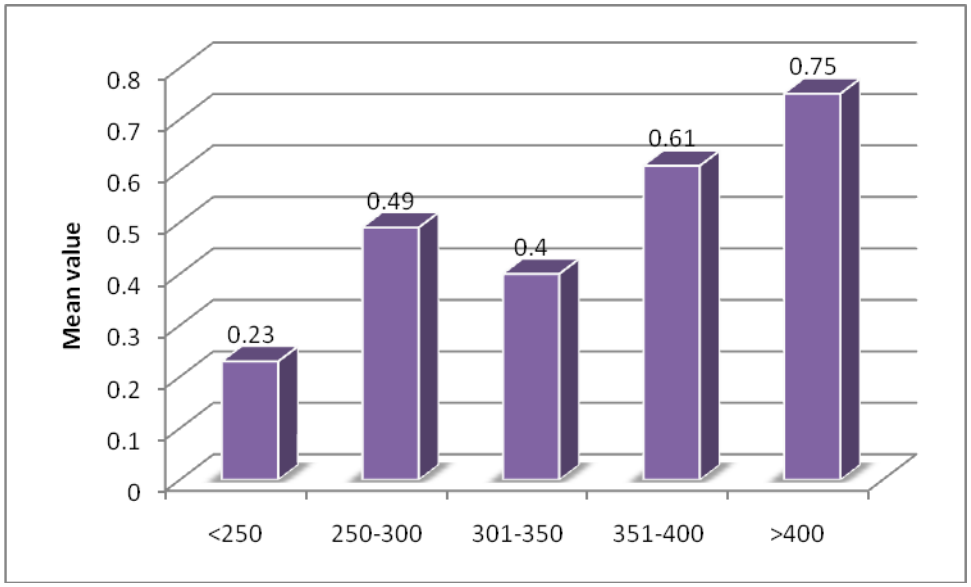
Graph 5: Comparison of BCVA among CFT levels

Table-6: Comparison of BCVA among CST levels

CST	No. of patients	BCVA
<250	32	0.23±0.13 [a,b]
250-300	25	0.49±0.67 [c]
301-350	14	0.40±0.18
351-400	8	0.61±0.20 [a]
>400	61	0.75±0.27 [b, c]
p-value[1]		0.0001*

[1]ANOVA test, [a,b,c]p=0.001 (Post hoc tests).

There was significant (p=0.0001) difference in BCVA among the CST levels. The post-hoc analysis revealed that BCVA was significantly (p=0.001) different between CST level <250 and >400 as well as 351-400 (Table-6 & Graph 6).



Graph 6: Comparison of BCVA among CST levels

The results are presented in mean ±SD and percentages. The Unpaired t-test was used to compare the indices between the two strata. The one way analysis of variance (ANOVA) with Tukey's post-hoc comparison tests was used to compare the BCVA among different CFT and CST levels. The Pearson correlation coefficient was calculated to find the correlation between the two continuous variables. The p-value<0.05 was considered

significant. All the analysis was carried out on SPSS 16.0 version (Chicago, Inc., USA).

Several studies have reported correlations between macular thickness and visual acuity in eyes with DME using OCT.

TABLE 12: CORRELATION BETWEEN FOVEAL THICKNESS & BCVA BY VARIOUS AUTHORS

Authors	Parameter studied	Eyes number	Year	Coefficient
Hee MR[5]	CFT	74	1995	0.67
Hee MR[6]	CST	182	1998	0.79
Otani[7]	CST	59	1999	0.64
Sanchez[8]	CFT	148	2002	0.9
Massin[9]	CST	15	2003	0.32
Laursen[10]	CST	23	2004	0.29
Bandello[11]	CST	29	2005	0.79
Kim[1]	CST	168	2006	0.40
Diabetic retinopathy clinical research network[12]	CFT	251	2007	0.52
Maalej[4]	CFT	314	2011	0.87

CONCLUSION

- Clinically diagnosis of DME was confirmed by findings of 3D OCT.
- CST and CFT was significantly increased in DME patients
- There was significant correlation between CST & CFT with BCVA.
- Correlation of CST with BCVA is better than CFT with BCVA.

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