Macular thickness in healthy subjects and diabetics without diabetic macular edema

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Abstract

Purpose: To compare macular thickness values in normal subjects and diabetic patients without diabetic macular edema (DME) using optical coherence tomography (OCT).

Methods : comparative prospective case control study was conducted on **150** eyes with varying stages of diabetic retinopathy compared with **50** normal control.

We used the **Topcon,3D OCT-2000** machine to perform the fast macular scan which gives **3** concentric circles : **1 , 3** and **5** mm. centered on the fovea . The mean ± standard deviation of macular thickness by area in these eyes were analyzed and compared.

Results: OCT findings demonstrated that the macula in the diabetic patients with no diabetic retinopathy group was significantly thinner than that of the control group with mean **(233.34±29.15)** and (**221.38±24.26)** respectively.

In addition, our findings showed that the macular thickness with mean **(221.38±24.26) ,(231.30±29.34)** and **(256.48 ±39.62)**gradually increased with the duration of DM with mean (**5.48±4.39) ,(13.96±4.93**) and (**14.70±4.17)** respectively probably because of an increase in vascular permeability in the diabetic retinas .

Conclusion: OCT will allow the detection of early changes and designing a personalized, noninvasive treatment .the role of neurodegeneration in the pathogenesis of DR is a solid basis for proposing neuroprotection as an effective strategy for preventing or arresting DR.

Keywords: OCT , Diabetic retinopathy , Macular thickness .

Introduction

Diabetes mellitus (DM) has been known as a potentially disabling chronic disease with multiple complications. Therefore, the complications associated with longer duration of the disease have become one of the challenges faced by health care institutions[(1)]. Of these complications, a retinal vascular disorder, retinopathy is considered the leading cause of blindness in the working age population[(2)] and accounts for considerable adult work disability.[(3)] Because macular thickness has been found to significantly correlate with visual acuity[(4)], knowledge of normal population thickness would be essential for studying and evaluating macular thickening due to various ocular pathologies(DR). Optical coherence tomography (OCT) is a noninvasive technology that enables clinicians to detect and monitor subtle changes in macular thickening[(5-8).]

Patients and Methods :

This Study is comparative prospective case control study. Subjects included are those with diabetes miletus (DM) with varying stages of diabetic retinopathy (DR) and divided into 4 subgroups:

Group 1: Diabetic patients without DR, **Group 2:**Diabetic patients with non-proliferative DR(NPDR) and without DME, **Group 3:**Diabtic Patients with proliferative DR (PDR) and without DME, **Group 4:**Normal controls. Each group include **50** eyes with exclusion criteria includes patients with diabetic macular oedema (DME) or other macular diseases, patients with history of retinal laser treatment, Patients with chronic glaucoma.

All cases of the study were taken at Sohag ophthalmological investigation centre. complete informed consent was obtained from all patients.

We used the **Topcon,3D OCT-2000** machine to perform the fast macular scan which gives **3** concentric circles **: 1 , 3** and **5** mm. centered on the fovea .The **3** and **5** circles are each divided into nasal , temporal , superior and inferior quadrants

The mean ± standard deviation of macular thickness by area in these eyes were analyzed and compared .

Results

This study include **200** eyes classified into:**50** control group, **50** diabetic patient with no DR, **50** diabetic patient with NPDR(without DME), **50** diabetic patient with PDR(without DME).

These subjects included **73** male **(36.5%)** and **127** female **(63.5%)** .The mean age of control,NDR,NPDR and PDR groups were**(46.72±14.00),(57.38±11.29),(57.10±6.94)**and**(52.96±7.32)** respectively.The clinical data and demographics of all subjects are shown in table **(1).**

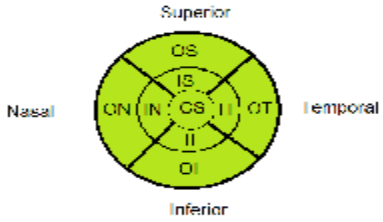
Table 1 : clinical and demographic data of all subjects
(*)= mean ± SD

Parameters	Normal control	Diabetic with No DR	Diabetic with NPDR	Diabetic with PDR
Age* (years)	**46.72±14.00**	**57.38±11.29**	**57.10±6.94**	**52.96±7.32**
(Male/Female) Percent	**17/33 34%:66%**	**14/36 28%:72%**	**16/34 32%:68%**	**26/24 52%:48%**
BCVA* (logmar)	**0.42±0.18**	**0.62±0.23**	**0.86±0.19**	**1.00±0.17**
Duration of DM*	-	**5.48±4.39**	**13.96±4.93**	**14.70±4.17**
Insulin/oral treatment Percent	-	**12/38 24%:76%**	**35/15 70%:30%**	**31/19 62%:38%**

OCT was used to examine 200 eye . the mean ± SD of macular thickness by area in these eyes are reported in table (1)

Sectors:

CS : Central subfield ,
IS : inner superior
IN : inner nasal
II : inner inferior
IT : inner temporal ,
OS : outer superior ,
ON : outer nasal ,
OI : outer inferior ,
OT : outer temporal



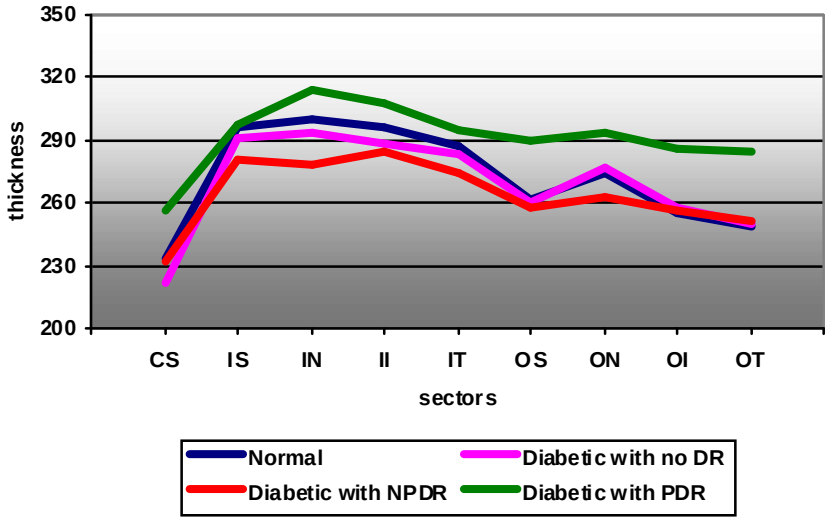


Figure (1): Sectorized analysis of retinal thickness

Table (2) : Comparison between normal control and diabetic patient with varying degrees of diabetic retinopathy expressed as (mean ± SD)				
	Normal	**Diabetic with no DR**	**Diabetic with NPDR**	**Diabetic with PDR**
CS	**233.34±29.15**	**221.38±24.26**	**231.30±29.34**	**256.48±39.62**
IS	**296.52±20.40**	**290.74±18.73**	**280.52±31.90**	**296.88±23.42**
IN	**299.66±17.90**	**293.02±16.81**	**278.74±28.86**	**313.60±26.04**
II	**296.18±17.62**	**288.96±21.99**	**284.02±29.71**	**307.54±28.76**
IT	**286.84±18.12**	**282.78±17.68**	**274.52±31.97**	**294.92±30.91**
OS	**261.12±16.21**	**260.62±15.73**	**257.66±23.68**	**289.98±27.08**
ON	**273.76±17.86**	**276.24±16.10**	**263.32±30.03**	**293.78±33.01**
OI	**255.40±18.04**	**257.80±18.98**	**256.04±23.43**	**285.52±51.46**
OT	**248.22±15.73**	**249.44±18.11**	**251.67±23.46**	**284.04±38.55**

Our OCT findings demonstrated that the macula in the diabetic patients with no diabetic retinopathy group was significantly thinner than that of the control group with mean **(233.34±29.15)** and **(221.38±24.26)** respectively.
In addition, our findings showed that the macular thickness with mean **(221.38±24.26) ,(231.30±29.34)** and **(256.48 ±39.62)**gradually increased with the duration of DM with mean **(5.48±4.39) ,(13.96±4.93) and (14.70±4.17)** respectively probably because of an increase in vascular permeability in the diabetic retinas.

Discussion

The early diagnosis and early detection of functional changes related to DR that occur prior to retinal morphology changes are important for preventing DR. study Our OCT findings demonstrated that the macula in the diabetic patients with no diabetic retinopathy group was significantly thinner than that of the control group with mean **(233.34±29.15) and (221.38±24.26)** respectively.
This results are comparable to Verma et al. who found reduction in foveal thickness in patients with DM and no retinopathy compared to healthy individuals [(9)].
Our findings that macula was thinner at the NDR stage but thicker in the PPDR stage would suggest that the neuronal abnormalities may precede the vascular abnormalities.
Furthermore, thicker maculas in the PPDR group than that in the normal group is consistent with the earlier reports [(10-12)].
This may be due to increase in serous leakage, probably led to the swelling of the retina.

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