Macular thickness in healthy subjects and diabetics without diabetic macular edema

Mohammed Hussein Elagouz, MD. (1) Ali Mahmoud Ismail, MD. (2) Ashraf Mostafa Elhawwary, MD. (3) Seham Samir Shawky, MSc. (4)

From the department of Ophthalmology, Sohag Faculty of Medicine, Sohag University, Sohag, Egypt.

(1) Assistant professor of Ophthalmology. mohammed.elagouz@yahoo.com
(2) Professor and head of the Ophthalmology Department. Aliismail30002000@yahoo.com
(3) Lecturer of Ophthalmology. ashrafelhwary@gmail.com
(4) Resident of Ophthalmology. Sehamsamir512@gmail.com

Corresponding author: Mohammed Elagouz. Assistant professor of Ophthalmology, the department of Ophthalmology, Sohag Faculty of Medicine, Sohag University, 82524, Sohag, Egypt. Phone: +201005404085

Email: mohammed.elagouz@yahoo.com

*This paper is prepared from the master degree thesis of Dr. Seham Samir Shawky, resident of Ophthalmology at Sohag University Hospital

The authors declare that there is no conflict of interest regarding the publication of this paper.

Abstract

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

Methods: A 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 \pm 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 \pm 29.15) and (221.38 \pm 24.26) respectively. In addition, our findings showed that the macular thickness with mean (221.38 \pm 24.26), (231.30 \pm 29.34), and (256.48 \pm 39.62) gradually increased with the duration of DM with mean (5.48 \pm 4.39), (13.96 \pm 4.93), and (14.70 \pm 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 healthcare institutions. Of these complications, a retinal vascular disorder, retinopathy is considered the leading cause of blindness in the working age population and accounts for considerable adult work disability. Because macular thickness has been found to significantly correlate with visual acuity, 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.

Patients and Methods:
This Study is comparative prospective case control study. Subjects included are those with diabetes mellitus (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:** Diabetic 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 includes 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).
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

Table 1 : clinical and demographic data of all subjects

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Normal control</th>
<th>Diabetic with No DR</th>
<th>Diabetic with NPDR</th>
<th>Diabetic with PDR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age* (years)</td>
<td>46.72±14.00</td>
<td>57.38±11.29</td>
<td>57.10±6.94</td>
<td>52.96±7.32</td>
</tr>
<tr>
<td>(Male/Female) Percent</td>
<td>17/33</td>
<td>14/36</td>
<td>16/34</td>
<td>26/24</td>
</tr>
<tr>
<td>BCVA* (logmar)</td>
<td>0.42±0.18</td>
<td>0.62±0.23</td>
<td>0.86±0.19</td>
<td>1.00±0.17</td>
</tr>
<tr>
<td>Duration of DM*</td>
<td>-</td>
<td>5.48±4.39</td>
<td>13.96±4.93</td>
<td>14.70±4.17</td>
</tr>
<tr>
<td>Insulin/oral treatment Percent</td>
<td>-</td>
<td>12/38</td>
<td>35/15</td>
<td>31/19</td>
</tr>
</tbody>
</table>

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

**Sectors:**

Figure (1): Sectorized analysis of retinal thickness
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.

**Table (2) : Comparison between normal control and diabetic patient with varying degrees of diabetic retinopathy expressed as (mean ± SD )**

<table>
<thead>
<tr>
<th></th>
<th>Normal</th>
<th>Diabetic with no DR</th>
<th>Diabetic with NPDR</th>
<th>Diabetic with PDR</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS</td>
<td>233.34±29.15</td>
<td>221.38±24.26</td>
<td>231.30±29.34</td>
<td>256.48±39.62</td>
</tr>
<tr>
<td>IS</td>
<td>296.52±20.40</td>
<td>290.74±18.73</td>
<td>280.52±31.90</td>
<td>296.88±23.42</td>
</tr>
<tr>
<td>IN</td>
<td>299.66±17.90</td>
<td>293.02±16.81</td>
<td>278.74±28.86</td>
<td>313.60±26.04</td>
</tr>
<tr>
<td>II</td>
<td>296.18±17.62</td>
<td>288.96±21.99</td>
<td>284.02±29.71</td>
<td>307.54±28.76</td>
</tr>
<tr>
<td>IT</td>
<td>286.84±18.12</td>
<td>282.78±17.68</td>
<td>274.52±31.97</td>
<td>294.92±30.91</td>
</tr>
<tr>
<td>OS</td>
<td>261.12±16.21</td>
<td>260.62±15.73</td>
<td>257.66±23.68</td>
<td>289.98±27.08</td>
</tr>
<tr>
<td>ON</td>
<td>273.76±17.86</td>
<td>276.24±16.10</td>
<td>263.32±30.03</td>
<td>293.78±33.01</td>
</tr>
<tr>
<td>OI</td>
<td>255.40±18.04</td>
<td>257.80±18.98</td>
<td>256.04±23.43</td>
<td>285.52±51.46</td>
</tr>
<tr>
<td>OT</td>
<td>248.22±15.73</td>
<td>249.44±18.11</td>
<td>251.67±23.46</td>
<td>284.04±38.55</td>
</tr>
</tbody>
</table>

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. 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.

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.

**References**


3 - Esteves J, da Rosa CM, Kramer CK. Absence of diabetic retinopathy in a patient who has had diabetes


