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# Measurement of Central Corneal Thickness in Type 2 Diabetic Patients and its Correlation with Duration, HbA1c Levels, and Severity of Retinopathy.

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## ABSTRACT

**Background:** The objective of the study is to assess the central corneal thickness (CCT) among type 2 diabetes mellitus patients and to correlate the central corneal thickness with duration of diabetes, HbA1c and severity of diabetic retinopathy. **Methods:** A hospital based descriptive study was conducted in Govt Medical College Kannur, Pariyaram, from April 2017 to March 2018.CCT of known diabetic patients was correlated with duration of diabetes, HbA1c and severity of retinopathy. **Results:** The mean central corneal thickness in diabetic patient was 550.1± 35.0µm with a range between 364 and 665 µm. Correlation of duration of diabetes and severity of diabetic retinopathy were not statistically significant. The CCT was thicker in patients with HbA1c more than 7% than HbA1c less than7% (p=0.005) which was statistically significant. **Conclusion:** We found that higher HBA1c level may be a marker for predicting the increase in CCT in patients with type II diabetes.

***Keywords:*** Central corneal thickness, diabetes, disease duration, disease severity, Glycosylated Hemoglobin.

## INTRODUCTION

Diabetes mellitus (DM) continues to be a tremendous health burden in the world affecting about 415 million adults which is likely to reach 642 million in 2040.[1] Diabetes mellitus can affect almost all structures of the eye, most common complication being diabetic retinopathy, cataract, neovascular glaucoma.

The morphologic and functional changes in the cornea include stromal and sub-basal nerve abnormalities,[2] low endothelial cell density and hexagonality,[3] reduction in corneal sensitivity,[4] increased corneal auto-fluorescence,[5] and recurrent corneal erosions,[6] were among the corneal changes observed in diabetic patient. A decrease in corneal endothelial function, leading to corneal hydration and consequently increase in corneal thickness (CCT) in patients with type I,[7-10] type II diabetes,[8] and proliferative retinopathy have been reported in some studies,[9-11] but others report that CCT was not increased in either type I or type II diabetic patients.[7,12,13] Thus, the functional and morphological abnormalities in diabetic endothelial cell and CCT remain to be fully understood.

The purpose of the study was to measure central corneal thickness (CCT) in type 2 diabetes mellitus (T2DM) patients and its correlation with duration of diabetes, HbA1c and severity of retinopathy.

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## MATERIALS AND METHODS

After obtaining approval of the institutional ethics committee , a hospital based descriptive study was carried out at Department of Ophthalmology, Govt. Medical College Kannur, Pariyaram in all self-reported type 2 diabetic patients after obtaining an informed consent from participants. A careful detailed history was taken regarding age, sex, duration of diabetes and HbA1c level. After recording the visual acuity, detailed examination on slit lamp, CCT measurement using PAC SCAN Plus A –Scan/Pachymeter was done and mean of three readings were recorded, IOP measurement was done using Goldmann applanation tonometer.

Patients with history of ocular infection, ocular trauma, surgery, photocoagulation, glaucoma, use of contact lens were excluded from study. One drop each of phenylephrine 10% and tropicamide 1% was then instilled into both eyes and the drops were repeated till the best possible mydriasis was obtained. For fundus examination both slit lamp biomicroscopy (90D) and indirect ophthalmoscopy

was done, retinopathy was classified as No DR, Mild NPDR, Moderate NPDR, Severe NPDR, PDR, Corneal parameters like CCT was correlated with duration of diabetes, HbA1c and severity of retinopathy.

**Statistics**

Data entry was done using Microsoft Excel 2007and analysis of data by SPSS version 17. Factors associated with CCT will be either categorical or continuous. Categorical variables was described using frequency and percentage whereas continuous variables was described using mean and standard deviation. Correlation of CCT with other factors was done using either Pearson's Correlation Coefficient or Spearman's Rank Correlation Coefficient Ordinary Variable). "P" value less than 0.05 will be considered significant.

## RESULTS

The study population consisted of 293 patients with type 2 DM, 182 (62.1%) were males and 111(37.9) female [Figure 1]. Mean patient age was 56.7 +11.2years [Figure 2], with duration of diabetic less than 10yrs 185(63.1%) and for more than or equal to 10 yrs 108(36.9%) [Figure 3]. The mean central corneal thickness of the entire study group was 550.1± 35.0µm (Mean±SD).

The mean CCT in male patient was (554.4± 33.4µm) higher as compared to the females (543.2 ± 36.5µm) the difference being statistically significant, (P=0.01) [Table 1]. Mean CCT in diabetics with duration of disease equal to or more than 10 years was higher (550.8±36.1µm) than those having it for less than 10years (549.7 ±34.4µm) implying positive correlation but the difference was not significant (P=0.714) [Table 2]. Central corneal thickness values increased from patients with no diabetic retinopathy (548.6±36.5µm) to those with proliferative retinopathy (556.2±34.7µm) but the increase was not statistically significant (P=0.129) [Table 3]. Diabetics with HbA1c less than 7% had CCT 541.1 ±27.2µm while those having HbA1cmore than or equal to 7% had higher CCT, that is 551.9±36.1µm which was statistically significant (P=0.005) [Table 4].

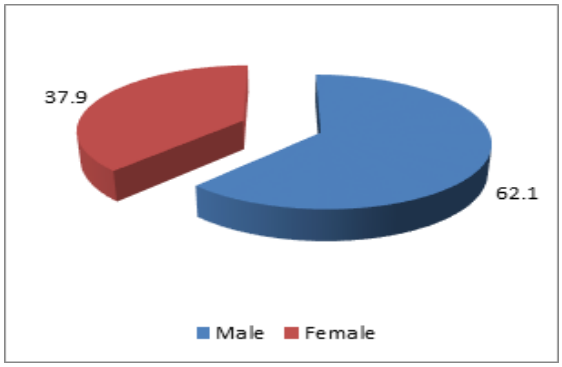


**Figure 1: Percentage distribution of the sample according to gender**

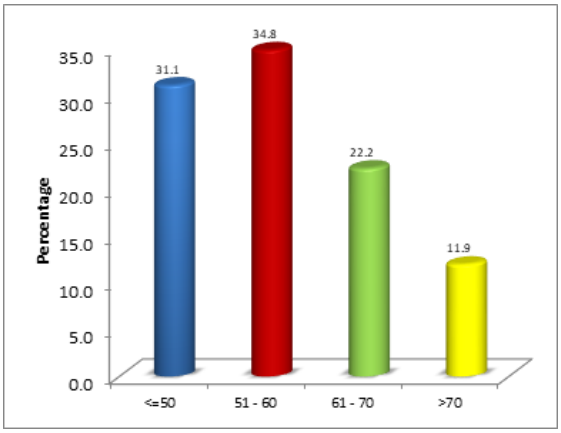


**Figure 2. Percentage distribution of the sample according to age.**

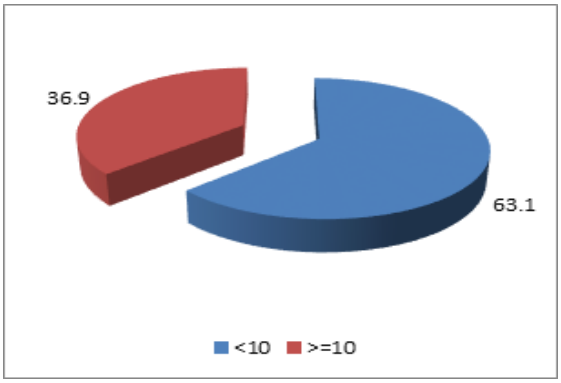


**Figure 3. Percentage distribution of the sample according to duration DM.**

**Table 1: Comparison of CCT based on gender**

| Gender | Mean | SD | N | t | p |
|---|---|---|---|---|---|
| Male | 554.4 | 33.4 | 364 | 3.8 | p<0.01 |
| Female | 543.2 | 36.5 | 222 | | |

**Table 2: Comparison of CCT based on DM**

| DM | Mean | SD | N | t | P |
|---|---|---|---|---|---|
| <10 | 549.7 | 34.4 | 370 | 0.37 | 0.714 |
| >=10 | 550.8 | 36.1 | 216 | | |

**Table 3: Comparison of CCT based on fundus**

| FUNDUS-BE | Mean | SD | N | t | P |
|---|---|---|---|---|---|
| No DR | 548.6 | 36.5 | 322 | 1.79 | 0.129 |
| Mild NPDR | 554.8 | 35.1 | 96 | | |
| Moderate NPDR | 544.5 | 34.2 | 86 | | |
| Severe NPDR | 556.6 | 21.2 | 42 | | |
| PDR | 556.2 | 34.7 | 40 | | |

**Table 4: Comparison of CCT based on HbA1c**

| HbA1c | Mean | SD | N | t | P |
|---|---|---|---|---|---|
| <7 | 541.1 | 27.2 | 98 | 2.81** | 0.005 |
| >=7 | 551.9 | 36.1 | 488 | | |

**: - Significant at 0.01 level

## DISCUSSION

The relation between CCT and diabetes mellitus has been reported differently in various studies. In our study the mean CCT was 550.1±35.0µm. According to Claramonte P J et al.[14] the average central

corneal thickness in diabetic patients was 571.96 ± 26.81µm with a range between 514 and 626 µm. The average central corneal thickness found in non-diabetic patients was 544.89 ± 35.36 µm with range of 448 to 649µm. The increase in central corneal thickness found in diabetic patients compared to non-diabetic patients was statistically significant (P<0.001, Student "t" test).Lee et al,[3] reported that the diabetic subjects had thicker corneas, less cell density and hexagonality, and more irregular cell size of the corneal endothelium than did the controls (P < 0.05). Roszkowska et al,[8] also reported a significant increase in CCT in diabetic patients. On the other hand Keoleian et al,[13] in a study to evaluate structural and functional status of corneal endothelium in diabetics concluded that the functional status of corneal endothelium was unaffected despite their structural abnormality. They reported no significant difference in corneal thickness in diabetics. Inoue K et al,[15] also reported no relation between CCT and diabetes. Busted et al,[9] and Olsen et al,[10] reported that the mean CCT was 544±26µm in diabetic patients with non proliferative retinopathy, and 566 ± 27 µm in diabetic patients with proliferative retinopathy; the difference between the groups was significant. Ravalico et al,[11] reported that the mean CCT was 543± 47µm in diabetic patients without retinopathy, 550±34 µm in diabetic patients with non proliferative retinopathy, and 569± 38 µm in diabetic patients with proliferative retinopathy. CCT in diabetic patients with proliferative retinopathy was significantly thicker. In our study we found a positive correlation between CCT and severity of diabetic retinopathy.

The mean CCT for male subjects in present study (554.4± 33.4µm) was higher as compared to the females (543.2± 36.5µm). Larsson et al,[7] reported significantly higher CCT in males (515.6± 33.8µm)than females (508.0 ± 32.8µm) with P value 0.001.The effect of duration of diabetes on corneal thickness was studied by Lee et al who reported that diabetic duration of over 10 years have more corneal morphological abnormalities as compared with normal ones. In our study also the mean CCT in subjects with diabetes of more than10years duration was higher (544.64±34.56µm) than those having it for less than10 years (518.98±31.21µm). We also found a significant correlation between CCT and HbA1c level. This observation was reinforced by Su DH,[13] et al by studying the effects of age, duration of DM, mean HbA1clevel and fasting blood sugar level on CCT in 3280 Malay adults and found that hyperglycaemia was associated with thicker central corneas. They also stated that currentHbA1c level was perfect predictor for CCT measurement. In contrast to our results, Larsson et al,[7] and Keoleian et al.[13] did not delineate any correlation between HbA1c and CCT.

## CONCLUSION

Based on this study a positive correlation was found between duration of diabetes, severity of diabetic retinopathy and statistically significant correlation with HbA1c levels. Higher HbA1c, marker of poor glycemic control was associated with thicker corneas in our study. One can also expect that severity of retinopathy and duration would affect corneal thickness so measuring CCT in diabetic patients may help to identify those patients who are at higher risk of developing severe complications.

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