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Original Research Paper

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# A CLINICAL STUDY OF CORRELATION BETWEEN CENTRAL CORNEAL THICKNESS AND DIABETES MELLITUS- IN TERMS OF DURATION AND GLYCAEMIC CONTROL.

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| **Dr. Shashank Ghawate*** | Associate Professor, Dept. of Ophthalmology, Smt. Kashibai Navale Medical College and GH, Narhe, Pune. *Corresponding Author |
| **Dr. Neha Ghawate** | Assistant Professor, Dept. of Ophthalmology, Smt. Kashibai Navale Medical College and GH, Narhe, Pune. |
| **Dr. Asawari Chavan** | Junior resident (PG), Dept. of Ophthalmology, Smt. Kashibai Navale Medical College and GH, Narhe, Pune. |

**ABSTRACT** Diabetes mellitus has evolved as an important cause of concern because of its adverse pathological effects on various ocular tissues. The central corneal thickness (CCT) denotes the overall functional status of cornea. This study evaluates the effects of diabetes mellitus on CCT by comparing the CCT of diabetic and non-diabetic patients and its association with duration of diabetes mellitus and the glycaemic index.

**Material and Methods:** A study with 100 patients, 50 diabetics (type 2) and 50 non diabetics, was conducted at tertiary eye care centre. Along with complete routine ophthalmic examination, CCT assessment of each eye was done using ultrasound pachymeter. Blood investigation was done to measure the HbA1c level in diabetics.

**Results:** The mean CCT in diabetics was 537.49 ± 2.18 $\mu$m and in non-diabetic was 497.05 ± 4.14 $\mu$m and the difference between the two groups was clinically significant ($p=0.04$). . The CCT was thicker for diabetics with duration of >10 years than with<10 years ($p=0.79$) and with HbA1c >7% than HbA1c <7% ($p=0.52$) though the difference was not statistically significant.

**Conclusion:** Diabetic patients have thicker cornea as compared to the non–diabetics. There is a direct correlation of CCT and diabetes, so measurement of Central corneal thickness in Diabetic patients becomes an important tool to assess the health of the cornea.

**KEYWORDS :** Central Corneal Thickness, Pachymeter, Diabetes mellitus, HbA1C.

## INTRODUCTION:

Diabetes mellitus has emerged as an important cause of concern because of its adverse pathological effects on ocular tissues. Main indicators of diabetes in ocular tissues are retinopathy, cataract and glaucoma. The metabolic status of the cornea is affected by the changes in blood glucose levels[1-4]. Chronic metabolic stress caused by hyperglycaemia has shown to affect the corneal endothelial cells that are responsible in maintaining stromal hydration by actively removing water by endothelial pumping mechanism. Hence, it is possible that central corneal thickness (CCT) may change according to the irregularities of blood glucose levels[5].

Ultrasound pachymetry is the current standard for corneal thickness measurement[6]. Our study aimed at evaluating the correlation between CCT and diabetes mellitus in terms of duration of diabetes mellitus and glycaemic control.

## MATERIALS AND METHODS:

Ethical clearance was obtained from the institutional ethical committee and a cross sectional study was conducted in ophthalmology outpatient department of our tertiary health care centre.

Fifty previously diagnosed patients of diabetes and 50 age matched non-diabetic individuals were enrolled in the study after obtaining informed consent.

Patients with corneal pathologies like pterygium, keratoconus, corneal degenerations and dystrophies, prior history of ocular surgeries, history of contact lens use, those on topical or systemic steroids, and those who denied consent were excluded from the study.

Detailed medical history regarding duration of diabetes was obtained from the diabetic patients. All patients underwent detailed ophthalmologic examination. In addition to routine examination, CCT measurements were performed using Tomey Ultrasound pachymeter under topical anaesthesia. The same examiner took all the pachymetry readings to avoid inter examiner bias. Total 10 readings were taken for each eye and average was recorded as the final reading.

Simultaneously, fasting and postprandial blood sugar levels along with the Glycosylated haemoglobin (HbA1C) were obtained. Diabetic patients were then classified into two groups

1) Based on duration of diabetes mellitus- less than 10 years and more than 10 years
2) Based on HbA1C levels- more and less than 7% And CCT measurements were compared with the age matched controls.

## STATISTICAL ANALYSIS:

Data analysis was done using SPSS 15. For comparison, Student t-test, Pearson correlation coefficient and Chi-square test were applied. The p-value <0.05 was considered significant and 95% confidence limit was used.

## RESULTS:

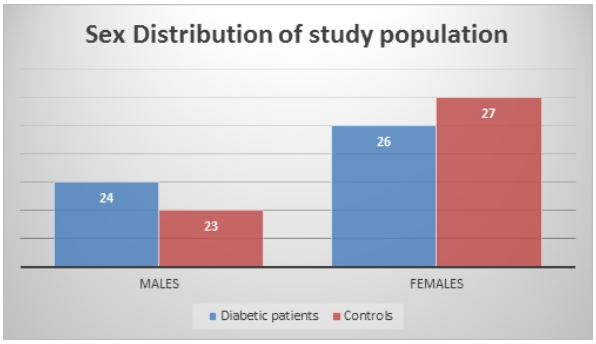


**Fig 1: Sex distribution of Study population**

Out of total 100 study subjects, 47 were males and 53 were females (Fig. 1). Average age of entire study population was 60.14 years.

**Table 1: Mean CCT comparison of Diabetic and Non- diabetic**

| Patients | Number | Mean CCT(μm) | SD (+/-) | P value |
|---|---|---|---|---|
| Diabetic | 50 | 537.49 | 10.87 | 0.04 |
| Non-diabetic | 50 | 497.05 | 20.65 | |

The mean CCT for Diabetic patients was 537.49 ± 2.18 μ and that in Non diabetic group was 497.05 ± 4.14 μ. The CCT of diabetic patients was higher than the non-diabetic subjects and the difference of CCT between the two groups was statistically significant as the p value was 0.04 (Table 1).

**Table 2: Central corneal thickness comparison with duration of Diabetes mellitus**

| Duration of DM | Number | Mean CCT (μm) | SD | P value |
|---|---|---|---|---|
| < 10 years | 28 | 530.77 | 8.45 | 0.79 |
| ≥ 10 years | 22 | 546.45 | 6.3 | |

Out of 50 Diabetic patients, 22 had diabetes for ≥ 10 years with mean CCT of 546.45 ± 1.96 μm, compared to 530.77 ± 2.26 μm recorded in patients with diabetes for less than 10 years. The statistical difference was not significant as p value was 0.79 (Table 2).

**Table 3: Central corneal thickness comparison with HbA1C levels**

| HbA1C | Number | Mean CCT (μm) | SD | P value |
|---|---|---|---|---|
| ≤7% | 30 | 537.15 | 9.65 | **0.52** |
| > 7% | 20 | 537.45 | 11.01 | |

Out of 50 diabetic patients, 20 patients had HbA1C of more than 7% while the rest 30 had ≤ 7%. The CCT comparison between the two groups is as depicted in Table 3. The difference was statistically not significant as p value was 0.52.

## DISCUSSION

Diabetes Mellitus (DM) is one of the most common non-communicable diseases in the world which potentially can affect every structure of the eye. Diabetic patients not only develop diabetic retinopathy but also corneal endothelial damage and keratoepitheliopathy in the form of superficial punctate keratopathy, recurrent corneal erosions and persistent epithelial defects[7,8].

Cornea is the most important refractive element in the human ocular system providing 40-45 D of the total refraction. Corneal thickness is a sensitive indicator of health of cornea and serves as an index for corneal hydration and metabolism. It is also an important indicator of patency of endothelial pump. Normal central corneal thickness is an accurate measurement of corneal thickness and is important in many ophthalmic circumstances like accurate IOP measurements, preoperative evaluation in intraocular surgeries especially keratorefractive procedures, assessment of postoperative healing process etc.

In diabetic patients, corneal endothelial dysfunction and increased corneal hydration may affect corneal thickness[2,5,9].

Several studies have investigated the relationship between corneal thickness and diabetes and reported variable results. Lee et al. found that CCT was significantly higher in diabetic patients (588.2 ± 2.7 μ) compared to the control group (567.8 ± 3.8 μ)[9]. Ozdamar et al.[10] also found higher CCT values in patients with DM compared with control group. We also have found the similar positive correlation in our study and the results are statistically significant.

On the other hand, some other studies reported no significant difference in corneal thickness in patients with diabetes. Inoue et al.[7] and Wiemer et al.[1] found no significant difference in CCT between diabetics and controls. Keoleian et al.[11] also reported no difference in CCT between subjects with Diabetes mallitus and healthy controls.

In our study, we also evaluated the relation of central corneal thickness with duration of Diabetes mellitus and found positive correlation, but the result was not statistically significant. Lee et al. found that CCT was significantly higher in patients with longer duration of DM, over 10 years, (595.9 ± 4.2 μ) compared to the ones with less than 10 years duration (582.2 ± 3.7 μ)[9]. In contrast, Wiemer et al.[1] reported no association between diabetes duration and CCT.

Glycaemic status (HbA1c) should be considered when examining the eye of diabetic patients as it reflects changes in blood glucose levels over a period of two to 3 months and gives an overall idea of patient's general tendency to diabetes control [10,12]. According to American Diabetes Association, mean HbA1C level should be below 7% in order to avoid micro and macrovascular complications[13]. Ozdamar et al. did not found statistically significant correlations between HbA1c and CCT in the diabetic subgroups[10]. In our study too, we did not find any significant correlation between the two.

### Limitations of study:

Further more elaborate study considering corneal changes in Diabetes Mellitus can be done involving large sample size, multiple parameters and more than one centre.

## CONCLUSION :

In our study we found a significant positive correlation between CCT and Diabetes and we also found a positive correlation with the diabetes duration though statistically not significant. Thus measurement of Central corneal thickness in Diabetic patients becomes an important tool to assess the health of the cornea and identifying those at high risk of developing further severe complication like glaucoma.

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