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Comparison of Central Corneal Thickness In between Well Controlled Type 2 Diabetic Individuals versus Poorly Controlled Type 2 Diabetic Individuals - A Comparative Study

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Abstract: ***Variations in central corneal thickness, whether thicker or thinner, can result in the overestimation or underestimation of intraocular pressure, a key modifiable risk factor for glaucoma. However, research on the relationships between diabetes, random glucose levels, and glycated hemoglobin A1c (HbA1c) with central corneal thickness (CCT) remains inconsistent. This study was conducted to evaluate the corneal thickness changes in between the uncontrolled diabetic patients and controlled diabetic patients. In this hospital based observational cross sectional study enrolled samples were 512 with equal number of sample size in each group (Controlled Diabetic eyes = 256 and Uncontrolled Diabetic eyes = 256). Participants were classified as having controlled diabetes if they were HbA1c level less than 7%, indicating good glycaemic control and having uncontrolled or poor diabetic control if they were HbA1C level equal to or greater than 7%. All subjects underwent FBS PPBS HbA1C & full ophthalmic examination. The participants with uncontrolled diabetes mellitus had higher CCT in as compared to patients with controlled status of diabetes mellitus. Although diabetics had thicker corneas, the CCT values did not show any significant change between well controlled & uncontrolled type 2 diabetic patients. CCT is an important parameter for refractive surgery and estimating IOP.***

Keywords: Type 2 diabetic, Corneas, Duration, Central Corneal Thickness (CCT), Association

1. Introduction

Diabetes mellitus is a significant and growing global health concern, driven by sedentary lifestyles and an aging population. Diabetes mellitus affects multiple systems of the body, like neuropathy, nephropathy and retinopathy. In addition to the retina different parts of the eye suffer due to longstanding high blood sugar levels like blepharitis, orbital cellulitis, recurrent hordeola, early cataract, secondary glaucoma's etc. In Diabetics both structural & physiological changes occur in all the corneal layers. Data from a population - based study indicated that individuals with diabetes tend to have thicker corneas.[1] Similarly, central corneal thickness (CCT) has been shown to be linked to the onset and progression of glaucoma.[2] Changes were attributed to abnormalities in tear secretion, reduced corneal sensation, spks, recurrent corneal erosions, PEDs, corneal endothelial damage etc.[3]

CCT is an important indicator of the corneal endothelium pumps function. Hyperglycaemia can cause endothelial cell changes that alter the corneas ability to maintain hydration, leads to cornea to become hydrated, which increases corneal thickness.[4] Several authors tackled the former and their reports were somewhat contradictory, while the least tackled issue was the relationship between pachymetric findings and the state of diabetic control as evidenced by the level of glycosylated haemoglobin [HbA1C].[5 - 8] In this sense, This study was conducted to evaluate the corneal thickness changes in between the uncontrolled diabetic patients and controlled diabetic patients.

2. Materials and Methods

This hospital based observational cross sectional study was conducted in the Department of Ophthalmology of tertiary care hospital from October 2022 to April 2024. In this study, Individuals above age of 40 years attending outpatient Department of Ophthalmology were enrolled. Sample collection method was done by “Simple Random Sampling Technique”.

$$\text{Sample size (n)} = \frac{4PQ}{L^2}$$

According to our outpatient department out of 100 patient’s 20 patients are diabetics. Here P = 20 (diabetic patients), Q = 1 – p and L = allowable error at 95% confidence interval.

Sample size (n) = 256

In this study, total enrolled samples were 512 with equal number of sample size in each group (Controlled Diabetic eyes = 256 and Uncontrolled Diabetic eyes = 256). Participants were classified as having controlled diabetes if they were HbA1c level less than 7%, indicating good glycaemic control and having uncontrolled or poor diabetic

control if they were HbA1C level equal to or greater than 7%.

Inclusion criteria
- Age >40 years
- Patients willing to participate

Exclusion criteria
- Any ocular diseases except refractive errors.
- Type - 1 Diabetes Mellitus.
- Any prior history of ocular surgeries
- Any medical diseases other than diabetes mellitus.
- Mentally challenged patients who are not able to give informed consent.

All subjects underwent FBS PPBS HbA1C & full ophthalmic examination. Visual acuity (BCVA), Slit lamp examination, IOP measurement and bio microscopic fundus examination were recorded. Central corneal thickness was measured by using ultrasonic pachymeter and mean CCT was compared between the two groups.

Statistical analysis
Results did by software of Excel and SPSS 25 version. Appropriate statistical tests were applied for checking data follow normality test. If data follow normality test then we apply parametric test (t - test), if data not follow normality then we apply Non parametric test.

3. Results

The participants with uncontrolled diabetes mellitus had higher CCT (555.31) micrometer in right eye as compared to patients with controlled status of diabetes mellitus (552.59) micrometer. However, the difference between the two groups was not statistically significant.

The participants with uncontrolled diabetes mellitus had higher CCT (555.25) micrometer in left eye as compared to patients with controlled status of diabetes mellitus (553.06) micrometer. However, the difference between the two groups was not statistically significant.

Table 1: Association of control status of diabetes mellitus and central corneal thickness

Status of Diabetes Mellitus	Mean (SD)	P value
Right Eye		
Controlled (HbA1c<6.5)	552.59 (21.59)	0.501
Uncontrolled (HbA1c>6.5)	555.31 (17.78)	
Left eye		
Controlled (HbA1c <7)	553.06 (22.83)	0.606
Uncontrolled (HbA1c >7)	555.25 17.43)	

4. Discussion

In the current study participants with uncontrolled DM had higher CCT as compared to controlled DM. The difference between the 2 groups was not statistically significant. In uncontrolled cases due to glycosylation, increase the crosslinking of the lamellar corneal collagen, resulting thickening. George et al reported that there were no significant changes in CCT measurements with varying postprandial blood sugar levels in type 2 DM patients.9 On the other hand Tha et al reported a positive correlation b/w HbA1c &CCT in the 3 groups [uncontrolled DM, controlled DM, healthy volunteers].1[0] Altay et al studied type2 DM where HbA1c>7% & measured their CCT before & after reaching glycemic control (HbA1c<7%) they found significant difference b\w mean CCT values.1[1] Park et al reporting significantly thicker corneas in Diabetics but they found no significant differences b\w controlled & uncontrolled DM CCT values.[12]

In conclusion, this study is helpful for better understanding of central corneal thickness in diabetic individuals. In this study although Diabetics had thicker corneas, the CCT values did not show any significant change between well controlled & uncontrolled type 2 diabetic patients. CCT is an important parameter for refractive surgery and estimating IOP. So it could be of great assistance in diagnosis and management of Glaucoma in Diabetic patients, useful for better prognosis in refractive surgeries. However more studies with larger numbers of different types of diabetic patients may still be required to resolve this apparent discrepancy in the results between the different studies.

Conflict of interest: There are no conflicts of interest

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Author's contribution
1) Concept, Design of study, Acquisition of data
2) Design of study, Analysis, Interpretation of data
3) Design of study, Acquisition of data, Analysis, Interpretation of data

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