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Original Research Article

Comparative Evaluation of Central Corneal Thickness Among Diabetic And Non-Diabetic Patients Using Pachymeter

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ABSTRACT

Background: The corneal changes in diabetic patients, while perhaps less recognized than retinal complications, are equally important. Diabetes mellitus has a significant effect on morphological, metabolic, physiological and clinical aspects of the cornea. The aim of the present study is to comparatively evaluate central corneal thickness among diabetic and non-diabetic patients using pachymetry.

Materials and Methods: The study was conducted on eyes of 50 patients, 25 diabetic and 25 non diabetic visiting the outpatient department after explaining the nature of the study and obtaining their written consent. Inclusion criteria were 25 patients with history of diabetes mellitus and 25 non diabetic patients.

Results: A total of 50 patients participated in our study, 25 patients were diabetic and 25 were non-diabetic. Out of 25 patients in Diabetic patients group, 15(60%) were male, and 10(40%) were females. Out of 25 patients in Non-Diabetic patients group, 13(52%) were male and 12 (48%) were females. 35 (70%) diabetic eyes have CCT in the range of 561-590 µm (mean value= 567.68±21.81 µm). 29 (58%) non diabetic eye have CCT in range of 531-560 µm (mean value=537.98±15.85 µm), which was found to be statistically significant (p<0.001).

Conclusion: As the age increases, mean CCT decreases in both diabetic and non-diabetic patients and diabetic eyes have higher CCT than non-diabetics.

Keywords: CCT (Central Corneal thickness), Optical Pachymeter, Non-diabetic and Diabetic population.

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INTRODUCTION

Diabetes mellitus is a common endocrine disorder, incidence of which varies from region to region. According to W.H.O estimates by the year 2030, there will be approximately 370 million diabetics in the world. In India alone, there will be around 80.9 million diabetics, thus by the year 2030, India will be approximately 21.8% of the global burden of the disease, achieving status of the diabetic capital of the world.[1] Vascular and non-vascular complications associated with this disease are the most important causes of morbidity and mortality in such patients. Generally there is delay of 4 to 7 years in the diagnosis of type 2 diabetes; about 20% of patients have already developed some micro vascular complications at the time of diagnosis.[2]

The cornea changes in diabetic patients, while perhaps less recognized than retinal complications, are equally important.[3] Diabetes mellitus has a significant effect on morphological, metabolic, physiological and clinical aspects of the cornea. Morphological changes manifest in the corneal epithelium, epithelium basement membrane and basement membrane complex, stroma and endothelium. The hemostasis of these structures can be altered by the diabetes in both the non-stressed and stressed cornea, causing myriad primary and postoperative manifestations. Other corneal complications of diabetes include dry eyes, superficial punctate keratopathy, recurrent corneal erosions, neutrophilic corneal ulcerations[4,5].

Measurement of the central corneal thickness (CCT) is performed for both diagnostic and therapeutic purposes. There are various ways of measuring corneal thickness. The most commonly used clinical methods are optical and ultrasound pachymetry, and there are a number of published studies that address the reliability and repeatability of these measurement.[6] So, the aim of the present study is to comparatively evaluate central corneal thickness among diabetic and non-diabetic patients using pachymetry.

MATERIALS AND METHODS

The present study was conducted in the Department of Ophthalmology, Government Medical College, Amritsar. The ethical approval for the study was obtained from the ethical committee of the college before commencing the study. The study was conducted on eyes of 50 patients, 25 diabetic and 25 non diabetic visiting the outpatient department after explaining the

nature of the study and obtaining their written consent. Inclusion criteria were 25 patients with history of diabetes mellitus and 25 non diabetic patients.

Exclusion Criteria

- Any abnormality of cornea such as keratoconus, keratopathy;
- Glaucoma;
- Corneal and intraocular surgeries;
- Systemic collagen related diseases;
- Soft and hard contact lens wearer; Systemic diseases such as hypertension, arthritis, and thyroid disease.

Material Required Were

1. Snellens chart for measuring the best corrected visual acuity
2. Non-contact tonometer for measuring intraocular pressure,
3. A pachymeter for measuring central corneal thickness,
4. Local anaesthetic.

Procedure to Measure CCT

Cornea was anaesthetized using a drop of xylocaine (2%). Patients were instructed to fixate on target straight ahead. The pachymeter probe was placed perpendicularly in the centre of cornea to obtain the corneal thickness. A total of 3 readings were taken and the average of the 3 readings was taken as the final value. Similar procedure was repeated for the other eye. The CCT was recorded for both eyes in micro meters (µm). The corneal thickness of diabetic patients was compared with non-diabetic patients and the results were analysed statistically.

Statistical Analysis

The descriptive and inferential statistical analysis of the data was done using SPSS software for windows. Student's t-test and chi-square test were used to check the significance of the data. A p-value of less than 0.05 was defined to be statistical significant.

RESULTS

A total of 50 patients participated in our study, 25 patients were diabetic and 25 were non-diabetic. Table 1 shows gender wise distribution of patients. Out of 25 patients in Diabetic patients group, 15 (60%) were male, and 10 (40%) were females. Out of 25 patients in Non-Diabetic patients group, 13 (52%) were male and 12 (48%) were females. It was not found to be statistically significant. [Figure 1]

Table 1: Gender wise distribution of patients

Gender	Diabetic Patients	Non-Diabetic patients	P-value
Male	15 (60%)	13 (52%)	0.569
Female	10 (40%)	12 (48%)	
Total	25(100%)	25 (100%)	

Figure 1: Bar diagram illustrating the Gender wise distribution of patients

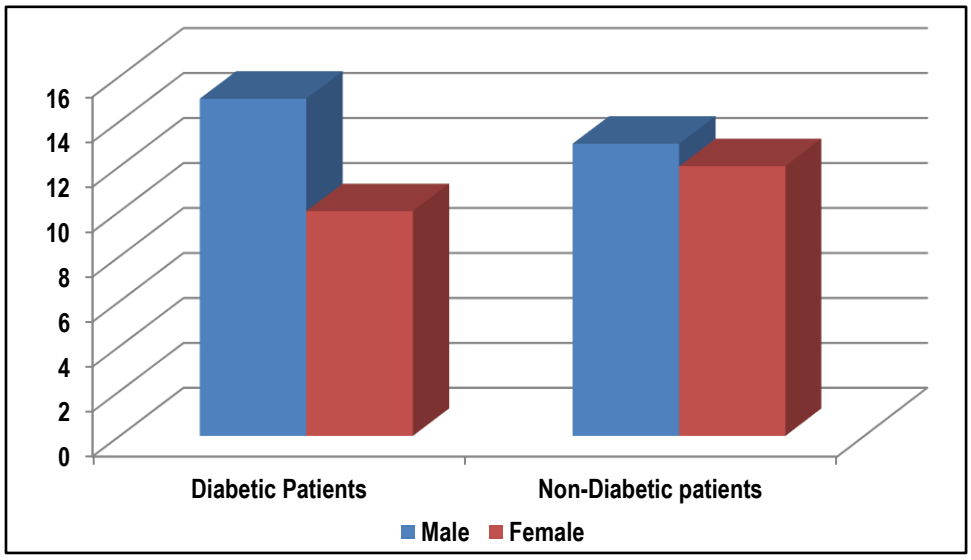

Table 2: Distribution of CCT in Diabetic and Non Diabetic eyes

CCT (µm)	No. of Diabetic eyes, N (%)	No. of Non-diabetic eyes, N (%)	P-value
500-530	4 (8)	16 (32)	<0.001
531-560	9 (18)	29 (58)	
561-590	35 (70)	5 (10)	
591-620	2 (4)	0 (0)	
Total	**50**	**50**	
Mean+- SD	**567 ± 21.81**	**537.98± 5.85**	

Table 2 shows distribution of CCT in diabetic and non-diabetic patient's eyes. We observed that 35 (70%) diabetic eyes have CCT in the range of 561-590 µm (mean value= 567.68±21.81 µm). 29 (58%) non diabetic eye have CCT in range of 531-560 µm (mean value=537.98±15.85 µm), which was found to be statistically significant (p<0.001). [Figure 2]

In our study, maximum no of diabetic patients were in 51-60 years age group which was not found to be statistically. Maximum corneal thickness is found in 31-40 year age group (569.50+-23.99) and minimum corneal thickness is found in 71-80 year age group (512.83+-5.27) which was found to be statistically significant (p<0.001) both in diabetes vs non diabetes.[Table 2,3]

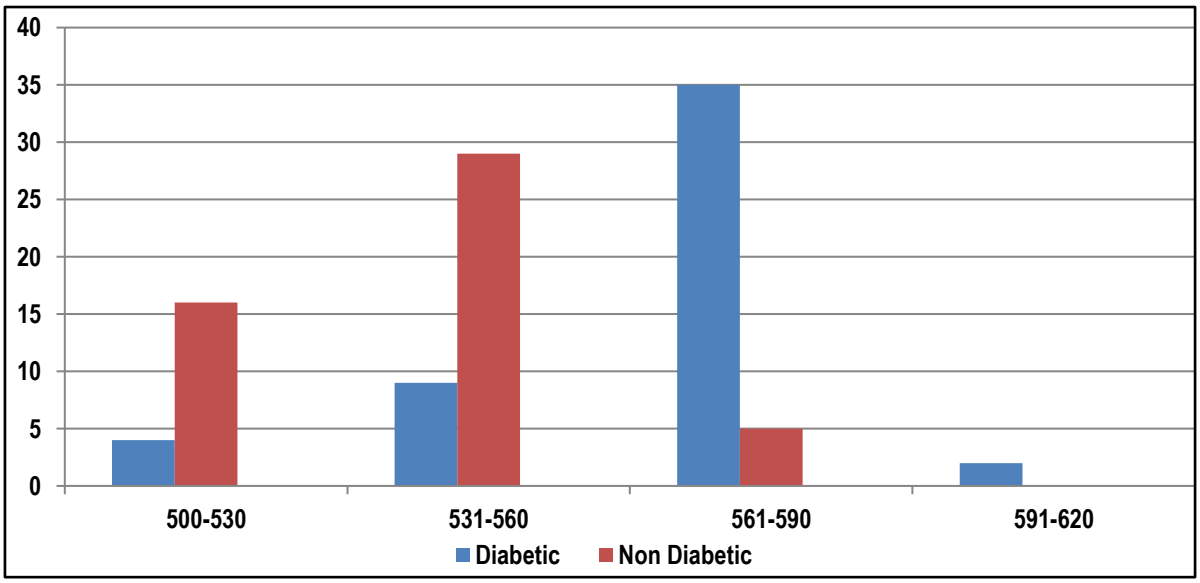

Figure 2: Bar diagram showing Distribution of CCT in Diabetic and Non Diabetic eyes

Table 3: Age wise distribution of CCT

CCT (µm)	Age groups (years)					P-value
	31-40	41-50	51-60	61-70	71-80	
500-530	0	0	6 (16.66%)	8 (44.44%)	6 (100%)	<0.001
531-560	5 (41.66%)	16 (57.14%)	8 (22.22%)	9 (50%)	0	
561-590	5 (41.66%)	12 (42.86%)	22 (66.11%)	1 (5.56%)	0	
591-620	2 (16.66%)	0	0	0	0	
Total no. of eyes	12	28	36	18	6	
Mean ± SD	569.50 ± 23.99	560.57 ± 19.22	556.53 ± 20.61	535.61 ± 18.64	512.83 ± 5.27	

Table 4: Age wise distribution of CCT compared between diabetic and non-diabetic patients

Age groups (years)	No. of eyes		CCT µm [Mean ± SD]	
	Diabetic patients	Non-Diabetic patients	Diabetic eyes	Non-Diabetic eyes
31-40	2	10	619.50 ± 0.71	559.50 ± 6.06
41-50	12	16	582.17 ± 2.37	544.38 ± 2.85
51-60	22	14	572.27 ± 5.12	531.79 ± 4.76
61-70	10	8	550.90 ± 6.15	516.50 ± 6.61
71-80	4	2	515.00 ± 5.23	508.50 ± 0.71

DISCUSSION

In our study our study eye was considered one case. Maximum no of diabetic patients were in 51-60 years age group which was not found to be statistically significant. Maximum no of corneal thickness is found in 31-40 year age group (569.50±23.99) and minimum corneal thickness is found in 71-80 years age group (512.83±5.27) which was found to be statistically significant (P<0.001) both in diabetes and non-diabetics. Mc Namara et al pointed that corneal structures are altered in diabetic patients, suggesting that hyperglycemia affects control over corneal hydration, thus varying corneal thickness in diabetic patients.[7] Some researchers describe in literature how cornea in diabetic patients exhibit tendency towards greater statistically significant corneal thickness due to pleomorphism and polymegathism compared to non-diabetic corneas, similar results to those found in the present series.[8,9]

In our series, average corneal thickness in non-diabetic patients was 537.98 microns similar to the data reported by other authors.[10] It is worth mentioning certain works in literature proving that patients suffering from diabetes type 2 show damaged corneal endothelial structures, but found no increase in central corneal thickness for those patients. Others authors found a correlation between the duration of diabetes and changes in cornea, suggesting that such changes, especially at the endothelial level, should be assessed and confirmed before performing intraocular or corneal surgery in chronic diabetes, a hypothesis that justifies the relative contraindication to corneal refractive surgery in diabetic.[11,12] With respect to central corneal thickness in diabetic patients, Busted et al[8] Interpreted that corneal thickness is present during the early stages of the disease and may be one of the most noticeable clinical changes in diabetic patients. Lee et al[13] stated that in a very recent paper that diabetic patients with history of more than 10 years showed corneal morphological abnormalities compared to non-diabetics, especially in terms of variability coefficients in cell size, thus finding a correlation between central corneal thickness and duration of diabetes. The corneal endothelium plays an important role in the maintenance of the corneal transparency. The evaluation of the density and thickness of this layer is a wide range of disorders such as contact lens related complication, glaucoma, dry eye and diabetes mellitus. The outcome of various intraocular surgeries including keratoplasty, vitrectomy and refractive surgeries also rely on the status of the cornea.[14]

Diabetes causes changes in the endothelial cell morphology.[15] The corneal endothelial is known to demonstrate pleomorphism and ploymegathism. A significant correlation of the endothelial cell density and duration of the disease was found suggesting a cumulative effect of diabetes. These factors were also correlated with age, It is possible that morphological changes with age may be responsible for the decreased density and increased thickness of cornea, as significant correlation was also observed in the controls. Mathebula SD et al[16] evaluated central corneal thickness in diabetic patients and compared the results with controls without diabetes mellitus. Sixty-five diabetic patients (65 eyes) constituted the study group, and 50 eyes were from the healthy control group (50 non-diabetic patients). The study group was subdivided into group 1 (no diabetic retinopathy, n = 35), group 2 (mild to moderate nonproliferative diabetic retinopathy, n = 20), and group 3 (proliferative diabetic retinopathy, n = 10). Central corneal thickness measurements in microns were determined using ultrasound pachymetry. The mean central corneal thickness was significantly greater in the study group (567.14 μm ± 14.63 μm) than in the control group (531.14 μm ± 5 μm). In addition, the mean central corneal thickness was found to be greater in group 3 (577 μm ± 12 μm) than in groups 1 (562 μm ± 13 μm) and 2 (566.86 μm ± 15 μm), but the difference did not reach statistical significance. They found that the mean central corneal thickness for diabetic patients was thicker than that of the healthy controls. El-Agamy A et al evaluated the role of blood glucose levels on central corneal thickness (CCT) in diabetic and non-diabetic population. 93 cases of diabetes and 90 of non-diabetic subjects were randomly selected from the patients attending ophthalmology outpatient department. Average CCT in diabetic population was 529.8 micron and in non-diabetic patients was 524.7 microns. Blood glucose levels ranged between 90mg% to 460mg% in diabetic population with a mean value of 214mg%, while in non-diabetics it ranged between 80mg% to 160mg% with a mean of 134mg%. There was no significant correlation between blood glucose levels and the CCT values. The authors concluded that CCT values in diabetic population is not significantly higher than in non-diabetic population.[17]

CONCLUSION

From the above results, we conclude that as the age increases, mean CCT decreases in both diabetic and non-diabetic patients and diabetic eyes have higher CCT than non-diabetics.

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