Khalij-Libya Journal
of Dental and Medical Research
http://journal.khalijedental.com.ly/ eISSN:2708-888X

Original Article

Changes of Corneal Thickness and Intraocular Pressure in Type II Diabetic Patients

Yasmena Abdulhadi *, Suliman Masuod, Wafa Lareibi, Mohamed Eldursi

Department of Ophthalmology, Benghazi University, Libya
Corresponding Email: y1979mma@gmail.com

ABSTRACT

Aims. The purpose of the present paper is to present the results of central corneal thickness & intraocular pressure measurements in diabetic patients with or without retinopathy, and compare the results with non-diabetic control patients. **Methods**. Total number was 152 patients were 152 eyes The study group was divided into 3 groups as following: 50 non diabetic (control). 50 diabetic type II with no diabetic retinopathy. 52 diabetic type II patient with diabetic retinopathy. Correlation analysis was performed to assess the association between glycosylated hemoglobin levels& Intraocular pressures and retinal changes among subgroups. **Results**. Demographic characteristics of study and control groups were similar (P>0.05). Mean CCT 553.62 with Std deviation (14.47) in control cases and 622.27 with Std deviation (507.09) in diabetic cases which is more than control however the distinction failed to reach applied math significance were (p value= > 0.05). additionally, CCT and diabetic retinopathy association was significant were CCT in diabetic patients with no retinal changes was 563.96 Std deviation (18.85) and in diabetic patients with retinopathy was 670.45 Std deviation (717.2) and P value = 0.004 (significant). There was significant correlation between increased corneal thickness and intraocular pressure were p-value = 0.002. **Conclusions**. We found that the central cornea of diabetic patients is thicker when compared with non-diabetic patients. Thicker central cornea associated with diabetes mellitus should be taken into consideration while obtaining accurate intraocular pressure measurements in diabetics.

Keywords: Central Corneal Thickness, Intra-Ocular Pressure, Cell Volume, Diabetes Mellitus, Best corrected visual acuity.

Citation: Abdulhadi Y, Masuod S, Wafa Lareibi W, Eldursi M. Changes of Corneal Thickness and Intraocular Pressure in Type II Diabetic Patients. Khalij-Libya J Dent Med Res. 2022;6(1):1–5. https://doi.org/10.47705/kjdmr.216101
Received: 11/11/21; **accepted**: 21/11/21

INTRODUCTION

Diabetes mellitus is a syndrome that characterized by hyperglycemia and is chronically associated with complications related to microvascular and/or macrovascular changes. Diabetic patients typically develop ocular changes not solely diabetic retinopathy however conjointly corneal changes as corneal endothelial damage and kerato-epitheliopathy like superficial punctate keratitis, recurrent corneal erosion, and persistent epithelial defects [1].

Diabetic endothelial cells have functional and morphological abnormalities. were the functional

abnormalities inducing increased corneal endothelial permeability, and the morphological abnormalities by decreasing the percentage of hexagonal cells in the corneas [2].

DM conjointly has vital prejudicious effects on the morphology, physiology and clinical appearance of the human cornea. Diabetic changes may manifest in the corneal epithelium, basement membrane, stroma and endothelium [3-5]. Stromal changes include as a result of increased central corneal thickness. Because of the structural alterations produced by collagen crosslinking that may cause increased stiffness of the cornea; this in turn may affect the measurement of intraocular pressure (IOP), causing over-estimation of the true intraocular pressure [4,5].

There are theories behind increased central corneal thickness, firstly in diabetics sorbitol accumulation within corneal endothelial cells, and secondly a decrease in Na+/K+ ATPase activity, and induce dysfunction of the corneal endothelium cell layer leading to corneal hydration which translates to increased CCT measurements [6-8]. Because of those changes the diabetic patients have a high risk of developing persistent stromal edema after intraocular surgical procedures [9].

The very sensitive indicator of health of cornea is central corneal thickness and its serves as an index for corneal hydration and metabolism. So, measurement of CCT is very important and can change the decisions regarding cataract and refractive surgeries and avoiding fallacy during estimation of IOP in diabetics [8].

This was a retrospective, observational, and quantitative study. The purpose of the present paper is to present the results of central corneal thickness & intraocular pressure measurements in diabetic patients with or without retinopathy, and compare the results with non-diabetic control patients.

METHODS

Data settings and patients

This study involves a total of 152 patient examined in Almotakadem private eye clinic from September 2019 to September 2020, aged from 30yrs to 79 yrs. Reading from only right eyes were used in analysis. If there were asymmetrical retinopathies the more serious affected eye has been chosen. The study group was divided into 3 groups as following: 50 non diabetic (control), 50 diabetic type II with no diabetic retinopathy, 52 diabetic type II patient with diabetic retinopathy.

Examination Methods

All cases had clear corneas and anterior chambers was quiet no signs of inflammations noted. The control group had no systemic diabetes and no ocular abnormalities. Further, the HbA1C were done to all patients. Detailed ocular examination were performed Best corrected visual acuity (BCVA), biomicroscopic examination of anterior segments done and dilated fundus examination with stereoscopic 66 lens performed.

Central corneal thickness (CCT) was determined with Oculus Pentacam HR and intraocular pressure was measured by air buff tonometry Tomy.

Exclusion criteria

The study exclusion criteria were all patients with, glaucoma or any history of ocular surgeries excluded, patients with anterior chamber vascularization and contact lens wearer, Eyes with corneal pathologies like pterygium, corneal dystrophies keratoconus, keratoconjunctivitis sicca, ptosis, ocular trauma, and active or any previous eye infection or inflammation.

Main outcome measure of the study was to evaluate the relationship between diabetes and CCT. The secondary outcome measure was to evaluate the relationship of retinopathy and HbA1c with CCT.

Experimental procedures

CCT was measured using oculus pentacam HR, with each patient sated comfortable on chair and eyes fixating on target were 3 consecutive measures taken and considered in analysis where the average was calculated as done with CCT.

Data was presented as frequencies and mean ±SD. Statistical analyses performed by using Statistical Package for the Social Sciences (SPSS version 23.0; IBM Corporation, Armonk, N.Y., USA). P-values of 0.05 or less will be considered as statistically significant.

RESULTS

One hundred and fifty-two patients included in this study were 55% females and 45% was males (Table 1).

Table 1. Distribution of patient according to Gender.

Gender	No.	%
Male	68	44.7
Female	84	55.3
Total	152	100.0

In Table (2), the age group were varying from 30 to 73 year. Majority of the patients belonged to age group 52-62 years (43.4%), whereas the least common age group was >72 (2%). Mean Age of patients was Mean ± St.D = 55.5± 10.2.

Table 2. Distribution of patient according to Age

Age / years	No.	%
30-40	18	11.8
41-51	27	17.8
52-62	66	43.4
63-73	38	25.0
> 73	3	2.0
Total	152	100.0

About 50 control patients (32.9%) were included in the study as in table (3) and 102 (67.1%) diabetic patients also included for evaluation of CCT. Central corneal thickness CCT/ *µm:*553.62 with Std deviation (14.47) in control cases and 622.27 with Std deviation (507.09) in diabetic cases were not statistically significant (p value= > 0.05). However, CCT and diabetic retinopathy association was significant were CCT in diabetic patients with no retinal changes was 563.96 Std deviation (18.85) and in diabetic patients with retinopathy was 670.45 Std deviation (717.2) and P value = 0.004 (significant).

And the level of HbA1c was not affecting the CCT in our study were p-value was = 0.263

Table 3. A total number & mean CCT of control and diabetic patients included in the study

Patient	No.	%	Mean	Std. Deviation
Control	50	32.9	553.62/ *µm*	14.477
Type II diabetes	102	67.1	622.27/ *µm*	507.094
Total	152	100	599.69/ *µm*	416.068

Table 4. Relation between CCT and IOP

Items	Mean	Std. Deviation	N
Central Corneal Thickness (CCT)/ um	599.69	416.068	152
Intra Ocular Pressure (IOP)	16.855	2.9533	152

There was significant correlation between increased corneal thickness and intraocular pressure were *p*-value = 0.002. Increasing corneal thickness led to increased IOP so the Correlation is significant as seen in table (4).

DISCUSSION

The central corneal thickness has become a very exciting ocular parameter the power of its importance owing because it's an indicator of corneal health status, were the decisions for any refractive

surgeries and estimation of intraocular pressure are sometimes dependent on CCT amongst other variables.

In present study we found Mean CCT 553.62 ± 43.4 μm in control cases and 622.27μm ± 14.6 in diabetic cases were not statistically significant (p value= > 0.05).

This is supports other study done by Kenji Inoue et; al in Japan were compared the endothelial structure and thickness of the cornea in diabetic and non-diabetic patients & they found no significant difference between CCT in the diabetic group to non -diabetic individuals in their research the corneal endothelial cell structure was damaged, but CCT was not increased in type II diabetic patients [10]. However, Paulsen et; al establish that Type II diabetic subjects did not differ from the non-diabetic control subjects with regards to endothelial cell density, hexagonality or variation in CV, but showed a significant increase in CCT [11]. That was not correlated with other studies done before as Kumari et; al who conducted a case control study were measured central corneal thickness in 100 patients out of which 50 were diabetic and 50 were non-diabetic and concluded that the diabetic patients had thicker cornea as compared to the non–diabetics [12]. And Kaur et; al conducted a cross sectional study on 240 eyes, in which 120 eyes of diabetic patient and 120 eyes of non -diabetic patient and found that in the diabetic group, the mean CCT and mean endothelial cell density varies significantly from non-diabetic controls. They also concluded that CCT was significantly thicker for diabetics with duration of >10 years and HbA1c >7[13].

Amira et al., had documented that type 2 DM resulted in a significant reduction of ECD and increased CV (polymegathism). Also, diabetic cornea had increased CCT and lower percentage of hexagonal cells than in the cornea of normal subjects, but this is not statistically significant. In addition to that DM duration, HbA1c levels, and severity of DR had no significant correlations with CCT, CV, hexagonality, or ECD [14].

Yoo & Tae was detected that ECD, CV, hexagonality, and CCT showed significant differences between long durations of diabetes (≥10 years) and control in all age. However, only CV and CCT showed significant differences between short durations of diabetes (<10 years) and control. In addition, high HbA1c (≥7%) patients showed differences in ECD, CV, and CCT, and low HbA1c patients (<7%) showed only differences in CV and CCT [15].

In our study there was association between CCT and diabetic retinopathy and it was significant were CCT in diabetic patients with no retinal changes was 563.96 Std deviation (18.85) and in diabetic patients with retinopathy was 670.45 Std deviation (717.2) and P value = 0.004 (significant). And there is a strong association between retinal changes and CCT and which was a highly significant, and the Level of HbA1c was not affecting the CCT in our study, however There was significant correlation between increased corneal thickness and intraocular pressure.

CONCLUSION

In conclusion increased corneal thickness should be kept in mind when measuring and evaluating IOP in diabetic patients. It should be investigated in further studies whether corneal thickness could be an indicator of the metabolic status of DM. Measurement of the CCT with noncontact methods are better option. Such as using of pentacam as a newer noncontact technology for the measurement of corneal thickness have shown better repeatability and reproducibility in many studies done before.

Disclaimer

The article has not been previously presented or published and is not part of a thesis project.

Conflict of Interest

There are no financial, personal, or professional conflicts of interest to declare.

REFERENCES

1. Pr Herse. Review of Manifestation of Dm in Anterior Eye and Cornea:Am J Optom Physiol Optics. 1988; 65; 224- 30
2. Y Kaji, T Usui, T Oshika. Advanced glycation end products in diabetic corneas: Invest Ophthalmol Vis Sci. 2000;41:362– 368.
3. N Kara, Y Yildirim, T Univar, T Kontbay. Corneal biomechanical properties in children with diabetes mellitus: Eur J Ophthalmol. 2013;23:27–32.
4. Y Goldich, Y Barkana, Y Gerber. Effect of diabetes mellitus on biomechanical parameters of the cornea: J Cataract Refract Surg. 2009;35:715–719.
5. A Kotecha, F Oddone, C Sinapis. Corneal biomechanical characteristics in patients with diabetes mellitus: J Cataract Refract Surg. 2010;36:1822–1828.
6. C O'Donnell, N Efron, A Boulton. J. M. A prospective study of contact lens wear in diabetes mellitus:J Ophthalmic Physiol Opt. 2001;21:127–138.
7. MZ Ziadi, P Moiroux, P D'Athis . Assessment of induced corneal hypoxia in diabetic patients: J Cornea. 2002;21:453– 457.
8. C Sady, S Khosrof, R Nagaraj. Advanced Maillard reaction and crosslinking of corneal collagen in diabetes: Biochem Biophys Res Commun. 1995;214:793–797.
9. A Rio-Cristobal, R Martin. Corneal assessment technologies Current status: Surv Ophthalmol. 2014;59:599–614.
10. K Inoue, S Kato, Y Inoue, S Amano, T Oshika. The corneal endothelium and thickness in type II diabetes mellitus: Japanese journal of ophthalmology. 2002 Jan 1;46(1):65-9.
11. A Storr-Paulsen, A Singh, H Jeppesen, JC Norregaard, J Thulesen. Corneal endothelial morphology and central thickness in patients with type II diabetes mellitus: Acta ophthalmologica. 2014 Mar;92(2):158-60.
12. R Kumari, BC Saha. Central Corneal Thickness and Diabetes: A Study of Correlation in Terms of Duration and Glycemic Control.Apr 13 2017;1:2.
13. P Kaur, B Singh, BS Bal, I Kaur, V Brar. Central Corneal Thickness in Type 2 Diabetic Patients And its Correlation with Duration Hba1c Levels and Severity of Retinopathy: group (NPDR). 2016;47(569.4):15-04.
14. El-Agamy Amira, Alsubaie Shams. Corneal endothelium and central corneal thickness changes in type 2 diabetes mellitus: Clin Ophthalmol. 2017; 11: 481–486.
15. Kim Yoo Jin & Gi Kim Tae. The effects of type 2 diabetes mellitus on the corneal endothelium and central corneal thickness: Scientific Reports volume 11, Article number: 8324 (2021).