

ORIGINAL ARTICLE

CORRELATION BETWEEN CENTRAL CORNEAL THICKNESS AND DIABETES IN SUDANESE PATIENTS

Yasser Seddeg Abdulghani¹, Tahir Osman Ali¹**Authors Affiliation** ¹Department of anatomy, Faculty of Medicine, The National Ribat University, Khartoum-Sudan**Correspondence:** Dr. Yasser Seddeg Abdulghani, E mail: yasseranatomy@gmail.com

ABSTRACT

Purpose: To determine the correlation between central corneal thickness (CCT), and diabetes in Sudanese patients.**Material and Methods:** This is a cross-sectional study conducted in the ophthalmology clinics of Khartoum state ophthalmic Hospitals. 160 subjects from different age groups were studied. An ultrasound pachymeter was used to measure CCT. The sample was divided into two groups, 80 of them were non-diabetic subjects, and 80 were diabetic patients.**Results:** The average central corneal thickness in diabetic patients was 541.61 ± 22.92 microns with a range between 513 and 586. The average central corneal thickness found in non-diabetic patients was 518.41 ± 34.09 microns with range of 448 to 555. The increase in central corneal thickness found in diabetic patients compared to non-diabetic patients was statistically significant ($p < 0.005$). Although CCT increase with increase of the duration of diabetes, it was not statistically significant. No statistically significant difference was shown between type 1 and type 2 diabetes.**Conclusion:** Diabetic patients had an increased central corneal thickness when compared with non-diabetic patients. This results correlate with previous studies done in Spain, America and others.**Keywords:** Central Corneal Thickness, Diabetes

INTRODUCTION

Diabetes mellitus is a syndrome characterized by inappropriate hyperglycemia and is chronically associated with microvascular and macro vascular complications [1].

Patients with diabetes mellitus often develop not only diabetic retinopathy but also corneal endothelial damage and keratoepitheliopathy such as superficial punctate keratitis, recurrent corneal erosion, and persistent epithelial defects [1,2].

Diabetes is a very frequent disease worldwide, having a considerable impact on society, not only due to its high prevalence but also because of its chronic complications and high mortality rate [3,4], affecting approximately 180 million people around the world [4]. Symptoms may or not appear from the onset, and thus go completely unnoticed [2,3]. This is the reason why it is necessary to take into account statistics pointing the existence of undiagnosed diabetics. Early diagnosis of diabetes allows prescribing an adequate treatment and avoiding potential complications, which is a key element in the development of this disease [1,3,4].

At the ocular level, main indicators of diabetes are diabetic retinopathy, cataracts and glaucoma [5], diabetic retinopathy being the most frequent cause of blindness for working age individuals and the second cause of blindness for the whole population after age-related macular degeneration [6]. Diabetic keratopathy is a fre-

quent disease that entails several alterations, especially in the epithelium and endothelium. Corneal epitheliopathy appears as punctate keratitis, decreased adherence to the basal membrane and corneal hyposthesia [6,7].

Alterations on the endothelium result in a deficient pumping function, as well as cell alterations, and possibly endothelial thickening and folds [7]. From the clinical perspective, diabetic keratopathy is interesting due to its associated nuisances, since they may become more severe in contact lens holders, and translates into a decreased corneal transparency and fluctuating vision [7,8].

The purpose of the present study is to determine whether there are any differences in the central corneal thickness of diabetic and non-diabetic patients in Sudanese subjects.

MATERIAL AND METHODS

A cross-sectional study was conducted in the ophthalmology clinics of Khartoum state ophthalmic Hospitals. Hundred sixty subjects, (80 healthy and 80 diabetic), were included in the study aged from 20 to 80 years. Diabetics (42 type 1 and 38 type 2) participated in this study were divided into 6 age groups 10 years apart (decade wise). Patients were asked about their duration of diabetes. And accordingly patients were classified into 3 groups; group 1 (duration less than 5 years),

group 2 (duration 5-10 years), and group 3 (more than 10 years). Routine eye ocular examination for both eyes was done including visual acuity, refractive error, and intraocular pressure (IOP) with tonometry.

Subjects included were those diabetics, with reliable visual fields and intra ocular pressure (IOP). Subjects excluded were those with history of glaucoma, ocular trauma, intraocular laser or surgery.

The CCT measurements were recorded from a seated patient using a non contact ultrasonic pachymeter probe (Pachmate™ DGH 55, DGH Technology Inc, PA) gently placed in the mid-pupillary axis of the cornea in the undilated eye. All measurements were taken by expert technician.

Data analysis: Data was analyzed using SPSS version 20 software. Means, standard deviations

and ranges were calculated for CCT and other variables. Influence of type and duration of diabetes was evaluated on CCT using independent t test.

Ethical approval: Local ethics committee approval was obtained for this study. Measurements were only taken after informed consent was taken.

RESULTS

The mean central corneal thickness in diabetic patients was 541.61± 22.92 microns with a range between 513 and 586. The average central corneal thickness found in non-diabetic patients was 518.41 ± 34.09 microns with range of 448 to 555 (see table 1). The increase in central corneal thickness found in diabetic patients compared to non-diabetic patients was statistically significant (p<0.005).

Table 1: Central Corneal Thickness (CCT) of diabetic and non-diabetic patients

Patients	N	CCT	
		Mean	Std. Deviation
Non-diabetic	80	518.41	34.09
Diabetic	80	541.61	22.92

Table 2: Central Corneal Thickness (CCT) of type 1 and type 2 diabetic patients:

Diabetes type	N	CCT	
		Mean	Std. Deviation
type 1	42	540.88	23.15
type 2	38	542.42	22.93

The mean central corneal thickness in type 1 diabetic patients was 540.88± 23.15microns. The mean central corneal thickness in type 2 diabetic patients was 542.42± 22.93 microns (see table 2). The increase in central corneal thickness found in type 2 diabetic patients compared to type 1 diabetic patients was not statistically significant (P=0.77).

Table 3: Central Corneal Thickness (CCT) in diabetic patients with different duration of the disease

Duration of DM	N	CCT	
		Mean	Std. Deviation
less than 5y	23	532.86	24.17
5-10 y	32	544.56	22.70
more than10y	25	546.87	20.38

The mean central corneal thickness of diabetic patients for less than 5 years duration was 532.86 ±24.17, 544.56 ±22.70 for patients with duration 5-10 years, and 546.87 ±20.38 for more than 10 years duration (see table 3). Although there was increase in central corneal thickness with increase duration of diabetes, it was not statistically significant (P=.072).

DISCUSSION

The central corneal thickness of diabetics is thicker than that of normal persons due to morphological changes of the diabetic cornea^[9,10]. Some experimental studies using mice or dogs reported a decrease in the corneal endothelium density, a decrease in hexagonality, and an increase in the coefficient of variation for cell size in the case of diabetes ^[11].

Lee et al^[12] showed that diabetics with ≥ 10 years duration have more corneal morphological abnormalities compared with the normal subjects and the central corneal thickness was significantly correlated with diabetic duration after controlling for age. Keolain et al^[13] reported that diabetics frequently had abnormal corneal endothelium in contrast to normal persons, but there were no significant differences in terms of function of the fluorescence permeability of the corneal thickness and endothelium. This means that the corneal endothelium of diabetics has a structural disorder, but the functional disorder of the corneal tissues is not affected. Busted et al^[14] showed that diabetic corneas were significantly thicker than the normal corneas, but there was no significant relation between central corneal thickness of diabetes and diabetes duration . Ziadi et al^[15] reported that it took longer for diabetics to recover from damaged corneal tissues compared with normal persons. As the corneal endothelium of diabetics has a structural disorder, a functional disorder of the diabetic corneal tissues can be caused by a stimulus like stress or trauma to the corneal tissue or from the lack of an adequate oxygen supply. It is thought that diabetes reduces the activity of Na⁺-K⁺ ATPase of the corneal endothelium, and this causes the morphological changes and permeability changes in the corneas ^[16].

According to the results of the present study, diabetic patients showed significant increase of central corneal thickness compared with normal persons. These results correlate with previous studies done worldwide. The study suggests that diabetics show thick corneas as one of the unnoticed signs for the diagnosis of the disease.

Thicker central cornea associated with diabetes mellitus should be taken into consideration while obtaining accurate intraocular pressure measurements in diabetics.

Also central corneal thickness should be one of the routine eye examinations in ophthalmic clinics in Sudan.

CONCLUSION

A significant correlation was found between increase CCT and diabetes, with positive correlation between thick cornea and the duration of the diabetes, indicating that patients with thick corneas are more likely to be found in an advanced stage of the disease. Measuring CCT in diabetic patients may help to identify those patients who are at higher risk of developing severe complications thus enabling the ophthalmologist to treat their disease more accurately.

REFERENCES

1. Daniel H W et al. Diabetes, Hyperglycemia, and Central Corneal Thickness. *Ophthalmology*. 2008; 115 (6) : 964-968
2. Ozdamar Y, Cankaya B, Ozalp S, Acaroglu G, Karakaya J, Ozkan SS. Is there a correlation between diabetes mellitus and central corneal thickness? *J Glaucoma*. 2010; 19(9):613-6.
3. Larsson LI, Bourne WM, Pach JM, Brubacker RF. Structure and function of the corneal endothelium in diabetes mellitus type 1 and 2. *Arch Ophthalmol*. 1996;114:9-14.
4. Gupta HL, Yadav M, Sundarka MK, Talwar V, Saini M, Garg P. A study of prevalence of health problems in asymptomatic elderly individuals in Delhi. *J Assoc Physicians India*. 2002; 50: 792-795.
5. Mariya Memon, Khalid Iqbal Talpur, Arsalan Rajpur, Mohammad Memon. Correlation between Intra Ocular Pressure, Central Corneal Thickness and Glaucoma Stage in Patients with Primary Open Angle Glaucoma. *Pak J Ophthalmol*. 2010; 26: 26-34.
6. Sonmez B, Bozkurt B, Atmaca A, Irkeç M, Orhan M, Aslan U. Effect of glycemic control on refractive changes in diabetic patients with hyperglycemia. *Cornea J*. 2005; 24: 531-537.
7. Schultz RO, Matsuda M, Yee RW. Corneal endothelial changes in type 1 and type 2. Diabetes mellitus. *Am J Ophthalmol*. 1984;98:401-10.
8. Bourne WM. Clinical estimation of corneal endothelial pump function. *Trans Am Ophthalmol Soc*. 1998;96:229-39.
9. Williams R, Airey M, Baxter H, Forrester J, Kennedy- Martin T, Girach A. Epidemiology of diabetic retinopathy and macular oedema: a systematic review. *Eye* 2004; 18: 963-983.
10. Caramonte P J et al. Variation of central corneal thickness in diabetic patients as detected by ultrasonic pachymetry. *ARCH SOC ESP OFTALMOL*. 2006; 81: 523-526.
11. O'Donnell C, Efron N. Corneal endothelial cell morphometry and corneal thickness in diabetic contact lens wearers. *Optom Vis Sci*. 2004; 81: 858-862.
12. Lee et al. Differences in corneal thickness and corneal endothelium-related to duration in diabetes. *Eye*. 2006; 20:315-8.
13. Keoleian GM, Pach JM, Hodge DO, Trocme SD, Bourne WM. Structural and functional studies of the corneal endothelium in diabetes mellitus. *Am J Ophthalmol*. 1992; 113:67-70.
14. Busted N, Olsen T, Schmitz O. Clinical observations on corneal thickness and the corneal endothelium in diabetes mellitus. *Br J Ophthalmol*. 1981;65:687-90.
15. Ziadi M, Moiroux P, d'Athis P, Bron A, Brun JM, Creuzot-Garcher C. Assessment of induced hypoxia in diabetic patients. *Cornea*. 2002;21:453-7.
16. Goday A. Epidemiology of diabetes and its non-coronary complications. *Rev Esp Cardiol*. 2002; 55: 657-670.