DOI: 10.21276/aimdr.2018.4.4.OT2

Original Article ISSN (O):2395-2822; ISSN (P):2395-2814

Changes in the Central Corneal Thickness in Diabetes Mellitus Patients with age and Gender Matched Healthy Controls in North Indian Population

Bhavesh Makkar[1], Tanmay Srivastav[1], Deepak Mishra[1], M.K.Singh[1]
[1]Department of Ophthalmology, Institute of Medical Sciences, BHU, Varanasi, UP, India.

Received: June 2018
Accepted: June 2018

ABSTRACT

Background: Since diabetes mellitus affects the all part of body including ocular structures so we planned a study to compare the central corneal thickness in diabetes mellitus patients with age and sex matched healthy controls in North Indian population. The aim of our study was to compare the central corneal thickness in diabetes mellitus patients with age and sex matched healthy controls in North Indian population. **Methods:** It was a prospective clinical study done at tertiary care centre on two hundred patients. Out of them 100 were diabetic and 100 were healthy subjects. The CCT measurement was done in enrolled patient using a non contact ultrasonic pachymeter probe gently placed in the mid pupillary axis of the cornea in undilated eye. All CCT and IOP recordings were done between 12- 2 pm keeping in mind the diurnal fluctuations. Data was analysed by SPSS Software version16. **Results:** CCT was higher in diabetics having duration > 10 years than those having duration < 10 years.Central corneal thickness values increased from patients with no diabetic retinopathy to those with proliferative retinopathy. **Conclusion:** The cornea of diabetics is significantly (P≤0.001) thicker than normal healthy subjects.

Keywords: Central corneal thickness, Diabetes Mellitus, Prospective Study.

INTRODUCTION

Diabetes Mellitus is a global health problem. It affects about 415 million adults and by 2040 the figure will reach 640 million.[1] The microvascular and macrovascular changes due to altered glucose level causes morphological and functional changes in different organs. None of the tissue of the eyes is spared by diabetes. The common complications noted in the eyes are diabetic retinopathy, neovascular glaucoma, refractive changes and cataract progression. Anatomical as well as physiological changes occur in the cornea. Previous studies by Busted et al.and Schultz et al.[2,3] concluded increased polymegathism, polymorphism with increased central corneal thickness (CCT) and normal endothelial cell density (ECD). Other recent studies by Roszkowska et al., Inoue et al., Lee et al., reported that the corneal morphological changes was associated with decreased ECD leading to altered endothelium function causing corneal hydration and increased CCT.[4,5,6] Similar to kidney, retina or any other organ, in cornea also functional abnormalities may be detected much before any clinically evident lesion develops. Increase in corneal thickness is one of the earliest clinically detectable changes of the diabetic eye.[2] CCT is an important parameter in selecting suitable patients for refractive surgery, when assessing glaucoma risk and in evaluation of physiological and pathological variations of the corneal structure.[7]

The aim of our study was to compare the central corneal thickness in diabetes mellitus patients with age and sex matched healthy controls in North Indian population.

Name & Address of Corresponding Author
Dr. Deepak Mishra
Assistant Professor in Ophthalmology,
Institute of Medical Sciences,
BHU, Varanasi, UP, India.

MATERIALS AND METHODS

It was a prospective clinical study done at Department of Ophthalmology, IMS, BHU, Varanasi between Jan 2016 to Oct 2017.The study was conducted on 200 patients. 100 were diabetic and 100 were healthy subjects. Right eye of every individual was studied and left eye was taken up in case of any disease in the right eye. Exclusion criteria: History of ocular infection, inflammation, surgery or photocoagulation. Diagnosed cases of glaucoma and individuals using any form of eye drops or ointment or history of

contact lens use. Individuals having dry eye disease. Informed consent of each patient was taken. After recording the visual acuity and detailed examination on slit lamp patient was subjected to specular microscopy, pentacam examination, Intraocular pressure (IOP) measurement and fundus examination. Dry eye was ruled out by Schirmer test. Endothelial cell count was done using non contact specular microscope. The CCT measurement was done in seated patient using a non contact ultrasonic pachymeter probe gently placed in the mid pupillary axis of the cornea in undilated eye. The mean of three reading was taken. IOP was measured by Goldmann applanation tonometer. All CCT and IOP recordings were done between 12- 2 pm keeping in mind the diurnal fluctuations. Fundus examination was done with both indirect ophthalmoscopy and with + 90 D lens. Early treatment of Diabetic Retinopathy Study (ETDRS) was used to classify the patients into three groups- Group 1 with no diabetic retinopathy changes, Group 2 – Non proliferative diabetic retinopathy changes and Group 3 with proliferative diabetic retinopathy changes. CCT was then compared between diabetics and healthy subjects.CCT was further compared among diabetic patients based on duration of diabetes, severity of disease and ECD. Data was analysed using SPSS software version16.

RESULTS

Total 200 patients were enrolled in the study out of which 100 were diabetic and 100 were non diabetic.

	Diabetics n=100	**Non diabetic n=100**	**P Valve**
Mean age in years	54 years	52 years	0.64
Males	74	68	0.71
Females	26	32	0.53

Corneal parameters of diabetics and controls

Corneal parameters	**Diabetics**	**Non diabetics**	**P Valve**
Endothelial cell count	2478+/- 500 cells/sq mm	2690+/- 450 cells/sq mm	0.01
Central corneal thickness (CCT)	564.24+/-32.3	530.60+/- 29.7	0.01

Variation of CCT (microns) with duration of diabetes

Duration of diabetes	**Number of patients**	**CCT (microns)**	**ECD (cells/mm)**	**IOP (mm Hg)**
< 10 years	66	552.4+/-56	2550+/-280	16.9+/- 1.1
>10 years	34	574.3+/-19	2469+/-88	17.2+/- 1.8

CCT was higher in diabetics having duration > 10 years than those having duration < 10 years.

Central corneal thickness values increased from patients with no diabetic retinopathy to those with proliferative retinopathy.

Group	**Number of patients**	**CCT**
Group I (NDR)	57	567.1 +/- 12.87
Group II (NPDR)	33	570.4+/-14.56
Group III (PDR)	10	575.11+/-15.55
Controls	100	530.60+/-29.70

DISCUSSION

Central corneal thickness gives an important information about the corneal health status. It is a key parameter for estimation of IOP and used preoperatively in refractive surgery. CCT is more in diabetics compared to non diabetics. Various hypothesis have been put forward but exact pathogenesis is still not known. According to Su et al,[8] McNamara et al and Weston et al,[9,10] increase in glucose level alters the endothelium and hydrates the cornea ultimately leading to increase in CCT. According to Busted et al.[2] corneal dysfunction causes increased corneal thickness early in the disease much before any structural changes in the endothelium.The study by Lopez et al.[11] concluded greater pleomorphism and polymegathism is the main cause of increase in CCT. According to Kruger et al.[12] corneal collgen crosslinking may lead to increased corneal thickness and stiffening of the cornea that alters the accurate measurement of IOP.
In our study we found mean CCT more in diabetics than non diabetics and it was found to be statistiscally significant. There was significant correlation between increased CCT and ECD and duration of diabetes. In our study CCT increases with severity of retinopathy but it was statistically not significant. Similarly non diabetics showed lower IOP than diabetics but it was satistically not significant. Increase in CCT in diabetics in our study was supported by Stella et al,[13] Beata et al,[14] Lee et al and Roszkowska et al,[4,6] who reported thicker cornea and decreased ECD. Weston et al.[10] and Busted et al.[2] also recorded increased CCT without any change of ECD. However a study by Schultz et al,[3] Inoue et al and Weimer et al,[5,15] did not supported our study findings and showed no changes in CCT between diabetics and healthy subjects. Possible explanation for increased CCT in diabetics is increased permeability of corneal endothelium. There is increase in stromal swelling pressure due to sorbitol accumulation or from glycosylation of corneal collagen.[16] All these mechanisms are affected by ECD, endothelial morphology, glycemic control and duration of diabetes thus supporting the findings of our study. In our study the CCT was more in diabetics with proliferative retinopathy than those with having non proliferative retinopathy changes. This was in accordance with the study done by Ozdamar et al and Choo et al.[17,18] The findings

of our study was also supported by studies of Toygar et al and Mathebula et al.[19,20] The studies by Busted et al.[2] and Wiemer et al.[15] showed that CCT increased in diabetics regardless of the severity of retinopathy.

Limitations

The only limitation of this study was only ECD was taken into consideration and not hexagonality and CV to associate CCT with morphology of endothelium.

CONCLUSION

The cornea of diabetics is thicker than normal healthy subjects. It correlated well with duration and severity of the retinopathy changes in the eye. ECD was also found to be less in thicker corneas. Routine assessment of CCT in diabetics helps in judging the accurate IOP. CCT, corneal endothelial structure and retinopathy assessment is useful to prevent visual disability by early detection and management.

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How to cite this article: Makkar B, Srivastav T, Mishra D, Singh MK. Changes in the Central Corneal Thickness in Diabetes Mellitus Patients with age and Gender Matched Healthy Controls in North Indian Population. Ann. Int. Med. Den. Res. 2018; 4(4):OT07-OT09.

Source of Support: Nil, **Conflict of Interest:** None declared