

Assesment of Corneal Thickness in Type II Diabetic Patients Ageing between 40 to 60 Years

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ABSTRACT

Purpose: To assess the corneal thickness of type 2 diabetic patients ageing between 40 to 60 years.

Methodology: This was cross sectional study in nature and data was collected from tree tops hospital and university of Lahore. After informed consent, all patients diagnosed with type 2 diabetes were included in this study followed by measurement of corneal thickness. The data was collected regarding age, duration of diabetes, level of HbA1c test result and medications. When it came to entering and analyzing the data, IBM Spss version was employed. Pearson's correlation test was applied to find the significance of data. P-value less than 0.05 was considered as significant.

Results: There were total 104 patient with age ranges between 40 years to 60 years. In this research there were 58 persons who were suffering type 2 diabetes from 5 years (55.8%). There 18 and 18 (17.3%) patients were suffering from the diabetes for last 10 and 15 years respectively. Only 10 patients had diabetes for last 20 years. The difference in corneal thickness values between the subsections of patients with no DR, with NPDR and PDR was statistically non-significant ($p = 0.810$). Pearson's correlation analysis showed that duration of DM ($r = 0.022$, $p = 0.809$), HbA1c ($r = 0.103$, $p = 0.251$), and severity of DR ($r = 0.022$, $p = 0.805$) did not show any significant correlation with CCT.

Conclusion: As the age of the patient increases the central corneal thickness is affected by diabetes. Which results in loss or decreased vision and many other problems.

Keywords: Cornea, Pachymetry, Diabetes, Diabetic Retinopathy.

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INTRODUCTION:

The cornea is primary diffractive element of the eye, contributing for over 70% of total refraction (43 of 60 D). The cornea is approximately 535 m (0.535 mm) thick and is made up of five layers. The corneal epithelium is the outer part, which covers the eye from bacteria while also taking oxygen and other nutrients.¹ Bowman's membrane protects the corneal structure and serves as a barrier against viruses. The outcome of Pachymetry mainly depends on the accurate measurement of the central corneal thickness.²

Diabetes can affect any eye structure. Diabetic retinopathy is perhaps the most prevalent type of retinopathy.³ The endothelium's primary function is to keep corneal transparency by controlling edema and

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stromal hydration. Any of these components that are malfunctioning may cause a loss of transparency and/or functionality.⁴

A pass research study was done in 2010 by Lingam Vijaya to analyze the various aspects of central corneal thickness (CCT) and its linkage to intraocular pressure, age, and gender. It was a population-based study where both urban and rural populations were targeted in South India (ratio for rural-to-urban population was, 3924:3850).⁵ A total number of 7774 subjects of age 40 years or more were assessed in a base hospital.⁶

A study examined the relationship of CCT and diabetic hyperglycemia in 2008. It was a research study targeting Malay adult community in Singapore.⁷ 3280 adults of 40–80 years participated in the study who were selected by a procedure of age-stratified random sampling. The results obtained showed a normal distribution of CCT with 541.2 µm mean. 748 subjects were diabetic (23.0%). Besides age and gender, CCT was thicker in diabetic patients as compared to healthy adults (547.2 µm vs. 539.3 µm).⁸ The researchers concluded that there is no association of hyperglycemia and CCT is not depending on age and IOP levels.^{9,10}

Diabetic keratopathy is a term that refers to a variety of structural and functional abnormalities of the cornea in diabetic patients, particularly in the epithelium and endothelium.¹¹

Type 2 diabetes is a condition in which the body's ability to control and utilize sugar (glucose) as the source is impaired. Too much sugar circulates in the bloodstream as a result of this lengthy (chronic) disease. High blood sugar levels can lead to cardiovascular, neurological, and immune system problems in the long run.¹²

METHODOLOGY

This retrospective cohort study was approved by the Ethical Review Board of College of Ophthalmology and Allied vision Sciences (1469/23) and was conducted at Diagnostic clinic, Mayo Hospital, Lahore from March, 2023 to September, 2023. Sample size was calculated by a

formula whose level of significance was 5%, standard deviation 30.9 and test values of population mean was 540.15 Using non-probability convenient sampling method total sample size was 80 patients of age group 30 to 60, later divided into normal tension and primary open angle glaucoma of 40 each after informed consent. Patients with corneal edema, diabetes, and allergic to dorzolamide-timolol fixed dose combination were excluded. Data was analyzed using SPSS version 25.00. Wilcoxon signed ranks test and chi-square test were used for the significance of the study. Data p-value <0.005 considered significant. All the tests were performed after patient's informed consent. Intraocular pressure and central corneal thickness were measured by Goldmann applanation tonometer and ultrasound Pachymeter respectively.

RESULTS

Table -1: Age Representation

Sr. #	Age	Frequency	Percentage
1	40-45 years	18	17.3%
2	46-50 years	33	31.7%
3	51-55 years	33	31.7%
4	56-60 years	20	19.2%
Total		104	100%

Table -2: Duration Of Type 2 Diabetes

Sr. #	Duration	Frequency	Percentage	P-value
1	5 years	58	55.8 %	0.810
2	10 years	18	17.3 %	
3	15 years	18	17.3 %	0.805
4	20 years	10	9.6 %	
Total		104	100 %	

Table -3: Corneal thickness in Right Eye

Sr. #	Age	Frequency	Percentage
1	Less than 530 µm	5	4.8 %
2	530 µm-570 µm	82	78.8 %
3	Greater than 570 µm	17	16.3 %
Total		104	100 %

Table -4: Corneal thickness in Left Eye

Sr. #	Age	Frequency	Percentage
1	Less than 530 µm	6	5.8 %
2	530 µm-570 µm	77	74 %
3	Greater than 570 µm	21	20.2 %
Total		104	100 %

DISCUSSION

Earlier studies shows that the range of thick mean CCT in the population was between 619 and 628 μm in men and between 618.2 and 624.2 μm in women. A difference in mean CCT was found between right and left eyes in the total study population the thickness of the clear outer surface of the eye. The thinner the cornea the higher risk of developing glaucoma. The thinner corneas are also associated with an increased severity of visual field loss and a more rapid progression of the disease. Central corneal thickness is affected by the age and diabetes. And the vision of people who are old and also of those who are suffering from diabetes might be compromised due to the effect of the older age and diabetes.

In 2017, Qamar Ul Islam carried out a research to compare the corneal thickness CCT of the patients which were having diabetes mellitus. In this study the researcher compared the corneal thickness of patients with age matched subjects to those which are without diabetes mellitus. He also checked the relationship of corneal thickness with the severity of the diabetic retinopathy. This study was cross sectional in nature and was comparative in which the comparison is made. In this study the patients who were suffering from the diabetes mellitus regardless of gender and were between the ages of 20-80 years were admitted in this study. And also, a control group whose participants were not suffering from the diabetes mellitus was taken to compare the results.

In this study 126 participants who were suffering from the diabetes mellitus and 126 participants who were healthy were evaluated in this study. Mean corneal thickness of diabetic participants was $512.21 \pm 32.68 \mu\text{m}$ while mean of corneal thickness of control group was $498.83 \pm 28.98 \mu\text{m}$ ($p = 0.001$). The difference in corneal thickness values between the subsections of patients with no DR, with NPDR and PDR was statistically non-significant ($p = 0.810$). Pearson's correlation analysis showed that duration of DM ($r = 0.022$, $p = 0.809$), HbA1c ($r = 0.103$, $p = 0.251$), and severity of DR ($r = 0.022$, $p = 0.805$) did not show any significant correlation with CCT.

This study shows that there exists a relationship between central corneal thickness and age as well as type 2 diabetes and central corneal thickness. This research aimed to find the effect of age on the central corneal thickness in people who are suffering from type 2 diabetes and research showed that people with older age have increased central corneal thickness. And that diabetes also increases the central corneal thickness. In this study 104 patients were selected who were suffering from diabetes.

The central corneal thickness right and left eye of patients was measured and then the data was analyzed. Sample was also divided into age groups of 40-45, 46-50, 51-55, and 56-60 years. According to this data the maximum people CCT within normal ranges. But 16.3 percent of people have corneal thickness increased which is $>570 \mu\text{m}$ and only 4.8 percent people have less than normal central corneal thickness. Previous researches shows that with diabetes the central corneal thickness of patients is increased and so is the case with age and central corneal thickness. , Central corneal thickness of left eye of patients who are in age group of 40-60 years is only 5.8 percent of people are having $<530 \mu\text{m}$ corneal thickness and 74 percent of people are having central corneal thickness which is normal. While 20.2 percent of the patients are having $>570 \mu\text{m}$ central corneal thickness.

Radha S et al proposed in year 2018 that retinopathy is the most important reason of ocular morbidity in the patients who are suffering from the diabetes mellitus. In this study they also proposed that hyperglycemia can affect all the organs of the human body and can also affect the morphology and functions of the cornea and can cause compromise on the transparency of the cornea. This study was mainly focused on the status of cornea to diabetes mellitus and to identify the risks that can affect the corneal thickness.

Given the Prevalance of diabetes, major limitation of this research was small sample size and it was gathered from two centers.

CONCLUSION

Irrespective of gender, the central corneal thickness of people increases with the passage of age. And in people who are in age of 40-60 and are diabetic the tendency of increase in central corneal thickness is more.

Conflict of Interest: None to declare

Ethical Approval: The study was approved by the Institutional Review Board / Ethical Review Board No. REC-UOL-200-01-2024.

Author Contributions: Rashid Asghar: Concept, Design, Data Collection, Drafting.

Tahir Shaukat: Literature Review, Data Collection & Analysis.

Barkat Islam: Data Collection and Critical Review.

Abdul Basit: Data Collection

REFERENCES

- Chen G, Li W, Tzekov R, Jiang F, Mao S, Tong Y. Ranibizumab monotherapy or combined with laser versus laser monotherapy for diabetic macular edema: a meta-analysis of randomized controlled trials. *PLoS One*. 2014;9(12):e115797. [10.1371/journal.pone.0115797](https://doi.org/10.1371/journal.pone.0115797).
- Antonetti DA, Silva PS, Stitt AW. Current understanding of the molecular and cellular pathology of diabetic retinopathy. *Nat Rev Endocrinol*. 2021;17(4):195-206. [10.1038/s41574-020-00451-4](https://doi.org/10.1038/s41574-020-00451-4).
- Dai L, Wu L, Li H, Cai C, Wu Q, Kong H, et al. A deep learning system for detecting diabetic retinopathy across the disease spectrum. *Nat Commun*. 2021;12(1):3242. [10.1038/s41467-021-23458-5](https://doi.org/10.1038/s41467-021-23458-5).
- Arima M, Nakao S, Kaizu Y, Wada I, Yamaguchi M, Fujiwara K, et al. Diabetic vascular hyperpermeability: optical coherence tomography angiography and functional loss assessments of relationships among retinal vasculature changes. *Sci Rep*. 2021;11(1):1-9.
- Aziz F, Sternad C, Sourij C, Knoll L, Kojzar H, Schranz A, et al. Glycated haemoglobin, HOMA2-B, C-peptide to glucose ratio and type 2 diabetes clusters as predictors for therapy failure in individuals with type 2 diabetes without insulin therapy: A registry analysis. *Diabetes Obes Metab*. 2023. [10.1111/dom.15409](https://doi.org/10.1111/dom.15409).
- Ehrhardt N, Cedeno B, Montour L, Sinclair K, Ferguson G, Berberian P, et al. Effectiveness of a culturally tailored diabetes education curriculum with real-time continuous glucose monitoring in a Latinx population with type 2 diabetes: the CUT-DM with CGM for Latinx randomised controlled trial study protocol. *BMJ Open*. 2023;13(12):e082005. [10.1136/bmjopen-2023-082005](https://doi.org/10.1136/bmjopen-2023-082005).
- Everett LA, Paulus YM. Laser Therapy in the Treatment of Diabetic Retinopathy and Diabetic Macular Edema. *Curr Diab Rep*. 2021;21(9):35. [10.1007/s11892-021-01403-6](https://doi.org/10.1007/s11892-021-01403-6).
- Fang W, Lin ZX, Yang HQ, Zhao L, Liu DC, Pan ZQ. Changes in corneal nerve morphology and function in patients with dry eyes having type 2 diabetes. *World J Clin Cases*. 2022;10(10):3014-26. [10.12998/wjcc.v10.i10.3014](https://doi.org/10.12998/wjcc.v10.i10.3014).
- Balaratnasingam C, Inoue M, Ahn S, McCann J, Dhrami-Gavazi E, Yannuzzi LA, et al. Visual acuity is correlated with the area of the foveal avascular zone in diabetic retinopathy and retinal vein occlusion. *Ophthalmology*. 2016;123(11):2352-67.
- Zhang C, Gu L, Xie H, Liu Y, Huang P, Zhang J, et al. Glucose transport, transporters and metabolism in diabetic retinopathy. *Biochim Biophys Acta Mol Basis Dis*. 2023:166995. [10.1016/j.bbadis.2023.166995](https://doi.org/10.1016/j.bbadis.2023.166995).
- Bhanushali D, Anegondi N, Gadde SG, Srinivasan P, Chidambara L, Yadav NK, et al. Linking Retinal Microvasculature Features With Severity of Diabetic Retinopathy Using Optical Coherence Tomography Angiography. *Invest Ophthalmol Vis Sci*. 2016;57(9):OCT519-25. [10.1167/iovs.15-18901](https://doi.org/10.1167/iovs.15-18901).

12. Blanco T, Musayeva A, Singh RB, Nakagawa H, Lee S, Alemi H, et al. The impact of donor diabetes on corneal transplant immunity. *Am J Transplant.* 2023;23(9):1345-58.10.1016/j.ajt.2023.05.027.
13. Fentie D, Solomon Y, Abebe F, Derese T, Tigstuu F, Hailemariam T. Diabetic peripheral neuropathy and their associations with overweight/obesity and impaired blood glucose among diabetic patients in Eastern Ethiopia: Institutional-based study. *SAGE Open Med.* 2023;11:20503121231220784.10.1177/20503121231220784.
14. Samara WA, Shahlaee A, Adam MK, Khan MA, Chiang A, Maguire JJ, et al. Quantification of diabetic macular ischemia using optical coherence tomography angiography and its relationship with visual acuity. *Ophthalmology.* 2017;124(2):235-44.
15. Fong D, Strauber S, Aiello L, Beck R, Callanan D, Danis R, et al. Writing Committee for the Diabetic Retinopathy Clinical Research Network. Comparison of the modified Early Treatment Diabetic Retinopathy Study and mild macular grid laser photocoagulation strategies for diabetic macular edema. *Arch Ophthalmol.* 2007;125(4):469-80.
16. Fong DS, Aiello LP, Ferris FL, 3rd, Klein R. Diabetic retinopathy. *Diabetes Care.* 2004;27(10):2540-53.10.2337/diacare.27.10.2540.
17. Ms A, Joice PPS, Varughese M, Babu Sayana S. Enhancing Type 2 Diabetes Management: Exploring the Synergistic Impact of Vestibular Exercise and Yoga. *Cureus.* 2023;15(11): e48539.10.7759/cureus.48539.
18. Kaiserman I, Kaiserman N, Nakar S, Vinker S. Dry eye in diabetic patients. *Am J Ophthalmol.* 2005;139(3):498-503.10.1016/j.ajo.2004.10.022.
19. Liang D, Cai X, Guan Q, Ou Y, Zheng X, Lin X. Burden of type 1 and type 2 diabetes and high fasting plasma glucose in Europe, 1990-2019: a comprehensive analysis from the global burden of disease study 2019. *Front Endocrinol (Lausanne).* 2023;14:1307432.10.3389/fendo.2023.1307432.
20. Liu X, Qiu Y, Chen D, Xiong J, Xia B, Chen C, et al. Significance of monitoring the levels of thyroid hormone antibodies and glucose and lipid metabolism antibodies in patients suffer from type 2 diabetes. *Open Med (Wars).* 2023;18(1):20230876.10.1515/med-2023-0876.
21. Fuerst N, Langelier N, Massaro-Giordano M, Pistilli M, Stasi K, Burns C, et al. Tear osmolarity and dry eye symptoms in diabetics. *Clin Ophthalmol.* 2014;8:507-15.10.2147/OPT.H.S51514.