

## Relationship between central corneal thickness in Myopic and Emmetropic patients

Abdul Hameed Siddiqui, Afshan Mateen Shaikh, Munira Shakir, Maria Khan, Asmatullah Khan

### Abstract:

Corneal thickness is an important indicator of corneal health. Its alteration may be indicative of different pathologies. Central Corneal Thickness (CCT) is an essential tool in the assessment and management of corneal disease. Myopia is one of the most common eye disorders worldwide. Some studies concluded that eyes with myopia have more flattened corneas, deeper anterior chambers and major white-to-white corneal diameters when compared with low-myopic, emmetropic and hyperopic eyes. Corneal thickness is also implicated in the measurement of intraocular pressure (IOP). A thin CCT might be a risk factor for the progression of Primary Open Angle Glaucoma.

**Objective:** This study aims to compare the CCT in Myopic and Emmetropic patients aged between 18-55 years, seen in an ophthalmology out-patient department in an urban area of Pakistan

**Material and Methods:** This was a cross-sectional, observational study of 205 patients aged between 18-55 years, presenting to the Ophthalmology Department of Liaquat National Hospital, Karachi from August 2016 till February 2017.

**Results:** Of 205 patients 61% were males and 39% were females. 55.1% were myopic patients and 44.9% were emmetropic patients. Mean CCT in Myopic patients were 538.45  $\mu\text{m}$  and 529.06  $\mu\text{m}$  in emmetropic patients with P-value of 0.047 that is statistically significant.

**Conclusion:** In contrast to studies conducted before, our study showed a high value of mean CCT in Myopic as compared to Emmetropic patients. More studies are needed to further investigate this relationship.

**Keywords:** Central corneal thickness, myopia, emmetropia, intraocular pressure

### Introduction:

Central corneal thickness is an essential tool in the assessment and management of corneal disease. Its alteration may be indicative of different pathologies,<sup>1</sup> Corneal thickness is also implicated in the measurement of intraocular pressure (IOP) or when planning corneal refractive surgery.<sup>2,3</sup> Factors influencing the thickness of the corneal pachymetry include the time of day, patient age, the use of contact lenses or the presence of any corneal degeneration.<sup>4</sup> The influence of refractive error on corneal thickness has not yet been clearly established.<sup>5-7</sup>

Myopia is one of the most common eye disorders

worldwide. It affects around 25% of the population in the West and over 80% in some Asian regions.<sup>8</sup> Changes related to myopic eyes include elongated axial length (AL) and stretching of the retina, choroid and sclera.<sup>9</sup> Some studies concluded that eyes with myopia have more flattened corneas, deeper anterior chambers and major white-to-white corneal diameters when compared with low-myopic, emmetropic and hyperopic eyes.<sup>10</sup> Myopic individuals may have a higher incidence of primary open angle glaucoma (POAG).<sup>11</sup> In addition, a thin CCT might be a risk factor for the progression of POAG.<sup>12</sup> Thus, if myopia is correlated with CCT, CCT might be connected with the higher incidence

### Received

Date: 13th December, 2018

### Accepted

Date: 9th September, 2019

### Liaquat National Hospital, Karachi

AH Siddiqui

AM Shaikh

M Shakir

M Khan

A Khan

### Correspondence:

Dr. Afshan Mateen Shaikh

Ophthalmology

Department, Liaquat

National Hospital,

Karachi

Cell No: +92 331-2726560

email: dram.shaikh@

hotmail.com

Table 1: Frequency of patients according to gender (n=205)

	Frequency (n)	Percentage%
Male	125	61
Female	80	39
Total	205	

Table 2: Descriptive statistics of age groups (n=205)

	≤ 35 years (n=108)	> 35 years (n=97)
Mean±SD	25.34±6.01	45.17±5.66
95%CI	24.19–26.48	44.03–46.31
Median (IQR)	24.00 (10)	45.00 (10)
Range	17	18
Minimum	18	37
Maximum	35	55

Table 3: Frequency of patients according to diagnosis group (n=205)

	Frequency (n)	Percentage %
Emmetropia	92	44.9
Myopia	113	55.1
Total	205	

Table 4: Descriptive statistics of right eye CCT ( $\mu\text{m}$ ) (n=205)

Mean ±SD	534.23±34.42
95%CI	529.49 to 538.97
Median (IQR)	533.00 (52)
Range	164
Minimum	466
Maximum	630

Table 5: Comparison of mean right eye CCT according to diagnosis group (n=205)

	Mean	SD	P-Value
Emmetropia (n=92)	529.06	29.96	0.047*
Myopia (n=113)	538.45	37.26	

Independent t-test was applied

\*Significant at 0.05 levels

of development and progression of glaucoma in myopic individuals.

The aim of this study is to compare the CCT in Myopic and Emmetropic patients aged between 18-55 years, seen in an Ophthalmology out-patients department in an urban area of Pakistan.

#### Materials and methods:

This was a cross sectional study of patients presenting to the Ophthalmology Department of Liaquat National Hospital, Karachi from August

2016 to February 2017. Sample size was calculated from WHO calculator, total sample size was 205-patients considering mean SD of CCT in myopic group 527.7 $\mu\text{m}$  (SD 0.35) margin of error 4.8% and confidence interval 95%.

Verbal informed consent from all patients were obtained for collection of data. Only Myopic and emmetropic patients within the age group between 18 to 55-years of both gender were included in this study. All those suffering from corneal pathologies, ocular diseases, trauma and with systemic diseases were excluded. The study was initiated after getting approval from Ethics review committee of Liaquat National Hospital Karachi.

All demographic information like name, age, sex was recorded and a detailed history was taken. All participants went through standard eye examination which included measurement of vision by using Snellen chart and slit lamp examination to exclude ocular diseases and other corneal pathologies. All this information was collected on a specially designed proforma (attached in the end). CCT was measured by using an ultrasonic Pachymeter in an upright position. All readings were taken in the morning to eliminate the effect of diurnal variation. Five readings of CCT were obtained from each eye but the reading of right eye was used for analysis. All values were recorded, but the minimum value of corneal thickness for each eye was used for analysis. All data collection was done by researcher herself. Data was then entered and analyzed on statistical package for the social sciences software (SPSS, version 21). Quantitative variables (i.e. age and central corneal thickness) were presented as mean and standard deviation. Qualitative variables (i.e. gender, myopia and emmetropia) were presented in terms of frequency and percentages. To compare the significance between both groups and comparison of mean CCT between both group independent sample t-test was applied. P-value  $\leq 0.05$  were considered as significant.

#### Results:

Of 205-patients the results showed that there

were 125-male and 80-female patients. The frequency distribution was presented in table-1. The overall mean age of study subjects was  $34.72 \pm 11.56$  years. The age was further stratified in 2-groups. The frequency and percentage of patients among these groups are presented in table-2. Among 205-study subjects, 92(44.9%) were presented with emmetropia and 113(55.1%) with myopia as presented in table-3.

In our study the overall mean right eye CCT of study subjects was  $534.23 \pm 34.42 \mu\text{m}$ . The detailed descriptive statistics of right eye CCT are presented in table-4. Stratification with respect to diagnosis group was done to compare mean right eye CCT by independent t-test. The results showed that there was significant difference in mean CCT with diagnosis group ( $p=0.047$ ). The detailed result of mean comparison are presented in table-5.

#### **Discussion:**

Corneal thickness is an important indicator of corneal health, so in clinical practice it is of great importance to obtain the most reliable corneal pachymetry value for each patient. Central Corneal Thickness (CCT) can affect the measurement of Applanation Tonometry. Various methods have been used in past studies to measure central corneal thickness. They include Optical Pachymetry, Ultrasound Pachymetry, Orbscan, Optical Coherence Tomography (OCT), Laser Interferometry and Ultrasound Bio-microscopy. Ultrasound Pachymetry is considered to be the standard of measuring central corneal thickness.<sup>13,14</sup>

Myopia is one of the most common eye disorders worldwide. It affects around 25% of the population in the West and over 80% in some Asian regions.<sup>15</sup> Some studies concluded that eyes with myopia have more flattened corneas, deeper anterior chambers and major white-to-white corneal diameters when compared with low-myopic, emmetropic and hyperopic eyes. Myopic individuals may have a higher incidence of primary open angle glaucoma (POAG).<sup>16</sup> In addition, a thin CCT might be a risk factor for

the progression of POAG.<sup>17,18</sup> Both myopia and thin CCT are risk factors for POAG.

We obtained a mean corneal thickness value of  $534.32 \pm 34.42 \mu\text{m}$  in all patients, Emmetropic group was  $528.89 \pm 30.08$  and myopic group  $538.33 \pm 37.59$ . This mean is similar to that obtained in other studies<sup>19</sup> in Pakistan mean CCT was found 531.08, in Spain mean of  $544.34 \mu\text{m}$  was found, in Saudi Arabia 543.80 and in Latin individuals 546.90 which was lower than that reported in an American Caucasian population. We should also bear in mind that the use of different pachymeters may also influence the final CCT value result obtained.

In our study, there were no statistically significant differences in the CCT values with age groups, unlike other authors<sup>20</sup> who reported that age was a factor that lowers CCT. However, we believe that CCT is not only influenced by age, but also influences IOP, and evidently glaucoma. Therefore, we indicate the need to adjust the IOP in relation to corneal thickness.<sup>21</sup>

In contrast to the studies conducted before our results showed that there was significant difference in mean CCT with diagnosis group ( $p=0.047$ ) with high mean CCT value in myopes as compared to emmetropic patients but more studies are needed to further investigate this relationship.

#### **Conclusion:**

Central corneal thickness (CCT) is an important factor to rule out different corneal pathologies. Myopic patients are at greatest risk of primary Open Angle Glaucoma. So central corneal thickness needs to be measure in every patient especially myopic patients to rule out glaucoma at its early stage so that we can prevent patients from blindness

**Conflict of interest:** None

**Funding source:** None

#### **Role and contribution of authors:**

Dr. Abdul Hameed Siddiqui, collected the data,

references and did the initial writeup.

Dr. Afshan Mateen Shaikh, collected the data and helped in interpretation of data.

Dr. Munira Shakir, collected the references and helped in introduction writing.

Dr. Maria Khan, collected the data and helped in discussion writing

Dr. Asmatullah Khan, critically review the article and made final changes.

### References:

- Li Y, Meisler DM, Tang M, Lu AT, Thakrar V, Reiser BJ, et al. Keratoconus diagnosis with optical coherence tomography pachymetry mapping. *Ophthalmol.* 2008;115(12):2159-66.
- Sharma N, Singhvi A, Vajpayee RB. Reasons for not performing LASIK in refractive surgery candidates. *J Refract Surg.* 2005;21(5):496.
- Mangouritsas G, Mourtzoukos S, Mantzounis A, Alexopoulos L. Comparison of Goldmann and Pascal tonometry in relation to corneal hysteresis and central corneal thickness in nonglaucomatous eyes. *Clin Ophthalmol.* 2011;5:1071.
- Doughty MJ, Zaman ML. Human corneal thickness and its impact on intraocular pressure measures: a review and meta-analysis approach. *Surv Ophthalmol.* 2000;44(5):367-408.
- de Medeiros FW, Sinha-Roy A, Alves MR, Wilson SE, Dupps WJ. Differences in the early biomechanical effects of hyperopic and myopic laser in situ keratomileusis. *J Cataract Refract.* 2010;36(6):947-53.
- Gros-Otero J, Arruabarrena-Sánchez C, Teus M. Central corneal thickness in a healthy Spanish population. *Archivos Sociedad Española Oftalmología.* 2011;86(3):73-6.
- Srivannaboon S. Relationship between corneal thickness and level of myopia. *J Med Assoc Thai.* 2002;85(2):162-6.
- Meng W, Butterworth J, Malecaze F, Calvas P. Axial length: an underestimated endophenotype of myopia. *Med Hypotheses.* 2010;74(2):252-3.
- Shen M, Fan F, Xue A, Wang J, Zhou X, Lu F, et al. Biomechanical properties of the cornea in high myopia. *Vis Res.* 2008;48(21):2167-71.
- AlMahmoud T, Priest D, Munger R, Jackson WB. Correlation between refractive error, corneal power, and thickness in a large population with a wide range of ametropia. *Invest Ophthalmol Vis Sci.* 2011;52(3):1235-42.
- Marcus MW, de Vries MM, Montolio FG, Jansonius NM. Myopia as a risk factor for open-angle glaucoma: a systematic review and meta-analysis. *Ophthalmol.* 2011;118(10):1989-94.
- De Moraes CG, Juthani VJ, Liebmann JM, Teng CC, Tello C, Susanna R, et al. Risk factors for visual field progression in treated glaucoma. *Arch Ophthalmol.* 2011;129(5):562-8.
- Marsich MW, Bullimore MA. The repeatability of corneal thickness measures. *Cornea* 2000; 19: 792-795
- Bechmann M, Thiel MJ, Neubauer AS et al. Central corneal thickness measurement with a retinal optical coherence tomography device versus standard ultrasonic pachymetry. *Cornea* 2001; 20: 50-54
- Meng W, Butterworth J, Malecaze F, Calvas P. Axial length: an underestimated endophenotype of myopia. *Med Hypotheses.* 2010;74(2):252-3.
- De Moraes CG, Juthani VJ, Liebmann JM, Teng CC, Tello C, Susanna R, et al. Risk factors for visual field progression in treated glaucoma. *Arch Ophthalmol.* 2011;129(5):562-8.
- Erickson DH, Goodwin D, Rollins M, Belaustegui A, Anderson C. Comparison of dynamic contour tonometry and Goldmann applanation tonometry and their relationship to corneal properties, refractive error, and ocular pulse amplitude. *Optometry.* 2009;80(4):169-174.
- Martinez de la Casa JM, Garcia Feijo J, Vico E, et al. Effect of corneal thickness on dynamic contour, rebound and goldmann tonometry. *Ophthalmology.* 2006;113(12):2156-2162.
- Sánchez-Tocino H, Bringas-Calvo R, Iglesias-Cortiñas D. Correlation between intraocular pressure, pachymetry and keratometry in a normal population. *Arch Soc Esp Oftalmol.* 2007;82(5):267-272.
- Lekskul M, Aimpun P, Nawanopparatskul B, et al. The correlations between Central Corneal Thickness and age, gender, intraocular pressure and refractive error of aged 12-60 years old in rural Thai community. *J Med Assoc Thai.* 2005;88(Suppl 3):S175-S179.
- Lester M, Mete M, Figus M, Frezzotti P. Incorporating corneal pachymetry into the management of glaucoma. *J Cataract Refract Surg.* 2009;35(9):1623-1628.