

Association Between Myopia and Central Corneal Thickness among Patients in a Tertiary Care PAF Hospital

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ABSTRACT

Objectives: Central corneal thickness (CCT) measurement is important in the estimation of intraocular pressure (IOP). It is also important when decision has to be made regarding refractive surgery. Studies conducted to determine the relationship between myopia and CCT have produced debatable outcomes. While some studies have found a negative correlation between CCT and the degree of myopia, many others have reported no significant correlation between the two. We attempt to study the relationship between them among patients attending the Ophthalmology department of a tertiary care hospital in Pakistan.

Methodology: This cross-sectional study was conducted at the department of Ophthalmology, PAF Hospital, E9 Islamabad. The study was conducted over a period of four months, from March to June, 2024. Fifty participants were enrolled using non-probability, consecutive sampling. The central corneal thickness was measured and compared in myopic and emmetropic patients.

Results: Out of total 100 eyes, 50 were myopic while the other 50 were emmetropic. There was a statistically significant difference between the corneal thickness of myopic and emmetropic eyes. ($P=0.009$). CCT was found to be thinner in myopic patients. However, no correlation was seen between CCT and the degree of myopia ($P=0.055$). Our study found no significant relation between CCT and age or gender.

Conclusion: There was a statistically significant difference between the mean CCT of emmetropes and myopes, with myopic eyes having thinner corneas. However, no significant difference was seen in the CCT according to the degree of myopia.

Keywords: Cornea, Emmetropia, Myopia

Authors' Contribution:

^{1,2}Conception; Literature research; manuscript design and drafting; ^{3,4}Critical analysis and manuscript review; ^{5,6}Data analysis; Manuscript Editing.

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Introduction

Worldwide, the most common cause of reversible loss of vision is the presence of a refractive error and it is highly prevalent in Pakistan as well.¹ Myopia, or nearsightedness, is a type of refractive error that can be caused by various reasons. The excessive elongation of the eyeball is one of the most important reasons. Both environmental and genetic factors have also been recognized to cause myopia

and its progression.² Spectacles and contact lenses are commonly used to correct this condition, along with different types of refractive surgery.³ There is also an association of myopia with several other ocular complications such as cataract, glaucoma, retinal detachment, optic disc anomalies and most importantly maculopathy.⁴ People with a refractive power of <-3 diopters are categorized as low myopes, those with a refractive power of between -

3 to -6 diopters as moderate myopes, and those with a refractive power of >-6 diopters as high myopes.⁵ Along with the alarming increase in the prevalence of myopia, there has subsequently been a considerable increase in the number of laser refractive procedures performed for the correction of myopia. These laser procedures involve the removal of a certain amount of the corneal tissue and thereby causes a reduction in its thickness. The normal range of the central corneal thickness (CCT) is usually between 537µm and 550µm and in order to undergo safe refractive surgery, the patient must have a thickness of at least 500µm.⁶ A cornea that is thin is a recognized risk factor for post refractive complications such as corneal haze, ectasia and an overall poor postsurgical result.⁷ Another issue with a thinned cornea is the error in the estimation of the intraocular pressure (IOP). A thin cornea leads to an underestimation of the IOP and thus can lead to the underdiagnosis of glaucoma or worsening of its progression. A positive correlation was also found between the IOP and CCT in different studies.⁶ Hence, the central corneal thickness (CCT) is a major factor in determining the type of refractive surgery that a patient with myopia should undergo.⁷

Studies conducted to determine the relationship between myopia and CCT have produced debatable outcomes. While some studies have found a negative correlation between CCT and the degree of myopia, many others have reported no significant correlation between the two.⁸ Due to the increase in burden of myopia followed by refractive surgery in Pakistan and because of the contradictory results of studies conducted on the association between CCT and myopia, we attempt to study the relationship between them among patients attending the Ophthalmology department of a tertiary care hospital in Pakistan.

Methodology

This cross-sectional study was conducted at the department of Ophthalmology, PAF Hospital, E9

Islamabad. The study was conducted over a period of four months, from March to June 2024, after the approval of the ethical committee. Calculation of the sample size was done with the help of WHO calculator⁽⁸⁾ and 50 participants (100 eyes) were enrolled using non-probability, consecutive sampling. Participants were of both the genders, aged 10-65 years, and were diagnosed as having myopia. Participants younger than 10 and older than 65 years of age were excluded from the study, as were those who had history of any ocular surgery or trauma, presence of any anterior or posterior segment pathology, who were current user of any topical medication and uncooperative patients with physical or mental limitations.

After taking consent and history from the patients, their refraction was carried out by the same optometrist. Patients were given a glasses prescription with which their visual acuity was 6/6 in both their eyes. The prescription was then recorded. Central corneal thickness was then measured by the optical biometer (NIDEK Optical Biometer AL Scan). Subjects were asked to sit with their chin up and their forehead touching the forehead bar, lateral lid canthus was aligned with the engraved lines on the device. They were asked to look at the fixation target. Multiple images were captured by the device and it measured the CCT. Three consecutive readings were taken and an average CCT was recorded. Refraction and CCT measurements were taken by the same optometrist as there was no possibility of bias. All the data was then recorded on a structured questionnaire. The collected data was entered and then analyzed using SPSS version 26. All the quantitative variables, such as age and CCT was shown as mean and SD, whereas frequency and percentage were used to show qualitative variables like gender and myopic status. A p value ≤ 0.05 was considered significant.

Results

In this study we examined 100 eyes of 50 participants including both males (52%) and females

(48%) of the ages between 12-64 years with a mean age of 25.27 ± 10.50 years. 50 eyes were myopic while the other 50 were emmetropic. Myopes were further divided into low (44%), moderate (44%) and high (22%) according to their spherical equivalence. The central corneal thickness measured ranged between $445 \mu\text{m}$ to $599\mu\text{m}$ with a mean of $535.66\mu\text{m} \pm 32.22\mu\text{m}$. The mean CCT in the emmetropic group was $544.04\mu\text{m} \pm 31.970\mu\text{m}$ whereas it was $527.28\mu\text{m} \pm 30.537\mu\text{m}$ in the myopic group. There was a statistically significant difference between these two means ($P=0.009$) and so CCT was found to be thinner in myopic patients. However, no correlation was seen between CCT and the degree of myopia ($P=0.055$). Our study found no significant relation between CCT and age or gender, $P=0.587$ and $P=0.915$ respectively.

Table I: Mean central corneal thickness in each group			
Refractive Error	Frequency	Mean CCT	Standard Deviation
Emmetrope	50	544.04	31.970
Low myope	22	522.91	22.579
Moderate myope	22	530.50	37.186
High myope	6	531.50	32.223
Total	100	535.66	32.223

Discussion

Throughout the world, different studies conducted have revealed different results and conclusions. A study was carried out in a school in Malaysia which compared the central corneal thickness in low and moderate myopes. Their conclusion was that the difference between the 2 groups was not significantly different. The values in both groups were similar. Low myopic group CCT was $552.16 \pm 27.17 \mu\text{m}$, while the moderate myope group CCT was $552.05 \pm 43.02 \mu\text{m}$. The P value was 0.99.⁹ Our study also showed no difference between the

groups of myopia. Similarly, the results from an Indian study including 70 subjects showed comparable results for the measurement of CCT in low, moderate and high myopic groups. The mean values of CCT were $521.62 \mu\text{m}$, $561.78 \mu\text{m}$ and $562.88 \mu\text{m}$ respectively.¹⁰ The study conducted by Shobita et al had also shown no significant difference. There was no correlation seen between the CCT and myopic error. (Pearson $r = 0.129$, $P=0.065$).¹¹

In a Nigerian study, the investigator measured the central corneal thickness of 80 myopic and 80 emmetropic eyes. There was a significant difference between both the study groups ($P=0.001$). The mean CCT was found to be $530.34 \pm 49.00\mu\text{m}$ in the myopic group while it was $533.82 \pm 38.03\mu\text{m}$ in the control group. However, when the means were compared between the different degrees of myopia and CCT, no correlation was found ($r=0.0$, $r^2=0.0$, $CI= 0.45-0.45$).¹² In another study, the investigator concluded that there was no significant difference between the CCT measured in myopes and emmetropes. They had also subdivided the myopic group according to severity and found no difference in those groups.¹³ A study that was also carried out in Pakistan, in a tertiary care hospital, showed that there was no statistically significant difference between the CCT measured in myopic patients compared to the emmetropic group. The mean CCT of the control group was $522.30\mu\text{m}$ with a standard deviation of $\pm 29.563\mu\text{m}$, while the mean CCT of the myopic group was $515.18\mu\text{m}$ with a standard deviation of $\pm 28.972 \mu\text{m}$.¹⁴ Another Chinese study showed that the central corneal thickness was significantly thicker in patients with high myopia ($P=0.004$).¹⁵ Different studies have found different results regarding the association between CCT and myopia. There may be several different reasons for this. For instance, central corneal thickness measurements show diurnal variation. There are also differences in the CCT that occur due to hormonal changes such as in pregnancy as well. The use of contact lenses can also lead to a difference in the CCT measurements.

In this study, we found that there was a statistically significant difference ($P=0.009$) between the mean CCT of myopes and emmetropes. However, no correlation was seen between the different degrees of myopia ($P=0.055$). This study is not free of limitations, notably due to performing this study on only two devices so the results may differ if other devices are used. Secondly, the results may also vary according to the presence and degree of cataract of patients undergoing biometric calculation. Therefore, a similar study should be conducted which should include and classify patients with cataract along with their postoperative refractive status.

Conclusion

There was a statistically significant difference between the mean readings of the AL measured by the IOL master and applanation ultrasound biometer, both the devices cannot be used interchangeably.

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