

# Correlational Study of Central Corneal Thickness (CCT) with Degree of Myopia in a Tertiary Care Hospital

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## Abstract

The present case study was conducted with 138 patients (276 eyes) with myopia in the Ophthalmology out-patient department. The aims of the study were to find mean values of degree of myopia and Central Corneal Thickness (CCT) and to find the correlation between myopia and central corneal thickness. Data was also collected on the gender, age, laterality of the eyes. An association between these variables with the degree of myopia was sought. A correlation between these variables and CCT was also evaluated. The CCT ranged from 430microns to 624microns with a mean CCT of 540.10microns. Pearson Correlation coefficient is 0.021 shows weak positive Correlation between Central thickness and Age. There was no significant difference between CCT between males and females. This study found no statistically significant correlation between the degree of myopia and central corneal thickness

**Keywords:** Central Corneal Thickness (CCT), Correlation, Myopia

## 1. Introduction

Myopia is a very common refractive error noted among the general population. It is also a very disabling condition as patients with myopia have difficulty in viewing distant objects. It affects about 25% of population in the west and up to over 80% in some Asian regions<sup>1</sup>.

Although the true aetiology of myopia is still unknown the cornea is responsible for approximately two-thirds of optical refraction and its role in myopia has consequently been studied intensely over the years<sup>2</sup>.

With the advent of Refractive procedures for surgical correction of refractive errors, it becomes necessary to determine inclusion and exclusion criteria for patients who can undergo keratorefractive procedures and who cannot. Pachymetry or simply said, the Central Corneal Thickness (CCT) is the main determinant in deciding if a patient can safely undergo a keratorefractive procedure.

If this study finds that such a correlation exists, the degree of myopia on its own may have a predictive value on the CCT expected in that patient and as a corollary, aid in deciding candidates for keratorefractive procedures.

## 2. Materials and Methods

This study was a hospital-based cross sectional observational study in patients with myopia. In a period of 1.5 year, 138 patients, total of 276 eyes were evaluated for the present study. The aim of the study was to find a correlation between myopia and central corneal thickness. Other variables like age of the patient, gender of the patient were also studied and compared. In addition, dioptre power of the cornea in dioptries was recorded.

Inclusion Criteria for selection was previously diagnosed myopic patients aged 20-40 year irrespective of sex. Patients with history of corneal surgical interventions

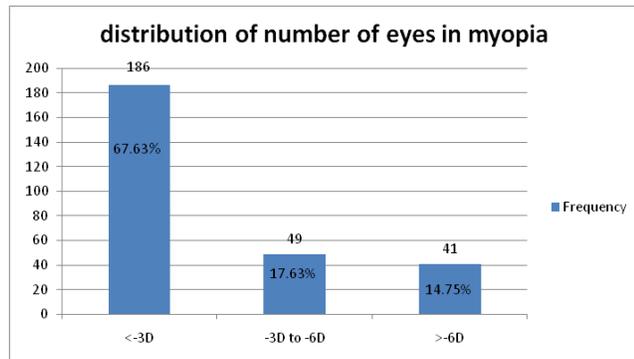
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and patients with history of corneal pathologies were excluded.

### 3. Results

**Table 1.** The range of spherical acceptance encountered in the population

Myopia (in Dioptres)	Frequency	Percentage
<-3D	186	67.63%
-3D to -6D	49	17.63%
>-6D	41	14.75%
Total	276	100.00%



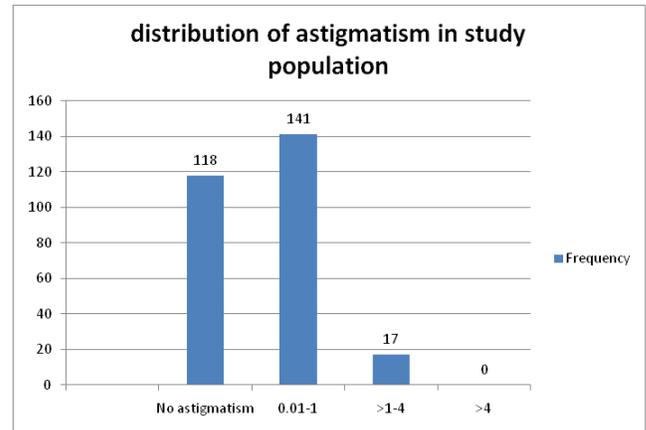
**Figure 1.** Graph showing the distribution of spherical acceptance in the study population.

The population was showing highest percentage of subjects with low degree of myopia with 67.63% (Table 1 and Figure 1).

**Table 2.** The amount of astigmatic error found in the study population

Astigmatic error (in Dioptres)	Frequency	Percentage
No astigmatism	118	42.45%
0.01-1	141	51.44%
1-4	17	6.12%
>4	0	0.00%
Total	276	100.00%

The maximum astigmatic error found was -3D and the minimum astigmatic error found was 0. Mean astigmatic error was -0.59D. Astigmatism ranging 0.01 to 1 was highest followed by subjects without astigmatism (Table 2 and Figure 2).

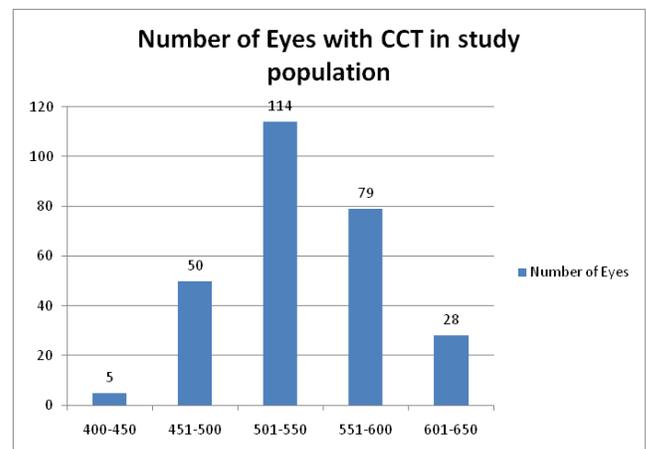


**Figure 2.** Distribution of astigmatic error among the study population.

**Table 3.** The range of CCT encountered in the myopic population

Thickness of Central Cornea in Micrometers	Number of Eyes	Percentage
400-450	5	1.80%
451-500	50	17.99%
501-550	114	41.37%
551-600	79	28.78%
601-650	28	10.07%
Total	276	100.00%

Mean of CCT of study population: 540.10

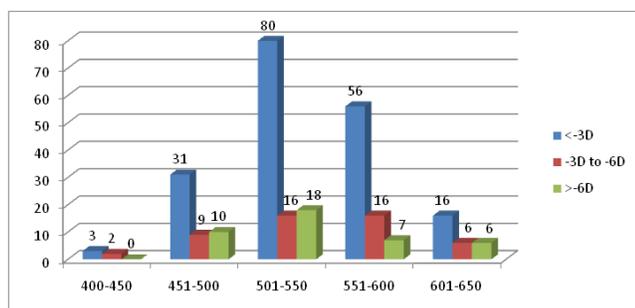


**Figure 3.** Distribution of the CCT in the study population.

The CCT reported in this study group was ranging from 430 micrometers to 624 micrometers. The mean CCT found in this study group was 540.10 microns (Table 3 and Figure 3).

**Table 4.** Comparison of the degree of myopia with the central corneal thickness

Myopia (Dioptres)	CCT (in microns)					Total
	400-450	451-500	501-550	551-600	601-650	
<-3D	3	31	80	56	16	186
-3D to -6D	2	9	16	16	6	49
>-6D	0	10	18	7	6	41
Total	5	50	114	79	28	276

**Figure 4.** The distribution of corneal thickness over a range of myopia.

In present study it was found that large numbers of subjects were having low grade myopia and CCT of range 501-550 was the most common for myopic patients in nearly all the degrees of myopia. CCT below 450 was least common amongst the study findings (Table 4 and Figure 4).

**Table 5.** Correlation between CCT and degree of myopia

		Degree of myopia
Central corneal thickness	Pearson Correlation	0.03
	Sig. (2-tailed)	0.62
	N	276

Pearson Correlation coefficient is 0.03 shows no statistically significant correlation between Central thickness and degree of myopia (Table 5).

## 4. Discussion

### 4.1 Age and Sex Distribution of the Study Group

The study targeted on healthy myopic subjects aged 20-40 years because the period between these ages is of

refractive stability. Hence the mean values for cornea can be considered stable as they are not affected by growth or aging.

In present study not a single age slab has statistically significant difference over other suggesting myopia is not restricted to certain age group in the study population. 53.24% of the study population was males and 46.76% of the group was females. It showed that the study group had marginally more males as compared to females (Table 6).

**Table 6.** Age and sex distribution of the study group

	Male	Female
Chen Y-C <i>et al.</i> , <sup>3</sup>	20.10%	79.9%
Chinawa NE <i>et al.</i> , <sup>2</sup>	52.5%	47.5%
Present study	53.24%	46.76%

### 4.2 Myopia in the Study Group

This group included population with a range of myopia from (-0.5) D to (-11) D. The mean myopia in the study group was -3.04 with a S.D. of 1.62 (Table 7).

**Table 7.** Myopia in the study group

Study	Mean degree of myopia
Medina MG <i>et al.</i> , <sup>4</sup>	-4.18D
Present study	-3.04D

67.63% of the study group had a myopic spherical equivalent of less than (-3.0). 17.63% population had myopia between (-3) to (-6) Dioptres whereas only 14.28% of the group had a myopia of more than (-6.0) Dioptres.

According to the study "Prevalence of refractive errors in a rural South Indian population"<sup>5</sup> the unadjusted prevalence of emmetropia (Spherical Equivalent (SE), -0.50 to +0.50 diopter sphere [D]), myopia (SE < -0.50 D), high myopia (SE < -5.00 D), and hyperopia (SE > 0.50 D) were 50.60%, 26.99%, 3.71%, and 18.70%. They found

that only 30.7 % of the population had myopia. But only 3.71% had a myopic spherical equivalent above (-5.0) D<sup>5</sup>.

The above study is in agreement with the present study in saying that majority of the myopias encountered in the general population have low degrees of myopia.

### 4.3 Central Corneal Thickness

The CCT reported in this study group was ranging from 430 micrometers to 624 micrometers. The mean CCT found in this study group was 540.10. The mean CCT in males was found to be 542.60 microns and in females was found to be 537.70 microns (Table 8).

**Table 8.** Mean CCT in microns

Study	Mean CCT in microns
George R <i>et.al.</i> , <sup>6</sup>	511.4±33.5
Medina MG <i>et.al.</i> , <sup>4</sup>	550.12
Chen Y-C <i>et.al.</i> , <sup>3</sup>	560±35
Present study	540.10±35.34

Carried out a study known as “The CCT in adult South Indians: the Chennai Glaucoma Study”<sup>6</sup> found the mean CCT for the population was 511.4 ±33.5 microns. The present study showed that the mean CCT was higher as compared to the population taken in the Chennai Glaucoma Study.

In Chennai glaucoma study CCT in males (515.6±33.8 microns) was significantly (P = 0.0001) greater than females (508.0±32.8 microns)<sup>6</sup>. The present study found coinciding results showing males to have a higher CCT than females (Table 9).

**Table 9.** CCT in adult microns

Study	Mean CCT in Male	Mean CCT in Female
George R <i>et.al.</i> , <sup>6</sup>	515.6±33.8	508±32.8
Chen Y-C <i>et.al.</i> , <sup>3</sup>	567±33	558±35
Present study	542.6	537.7

### 4.4 Correlation Between Age of the Patient and Central Corneal Thickness

Age had a statistically significant and weak negative correlation with the median CCT reading ( $P < 0.001$ ,  $r = -0.058$ )<sup>7</sup>. Contradicts with our finding and found a decrease of 0.12  $\mu\text{m}$  in CCT per year<sup>8</sup>. Other studies around

the globe had mixed results. For example, a research in Tehran concluded that volunteers younger than 20 years had thicker corneas when compared to those who were older<sup>9</sup>. The sub-Saharan study also showed that CCT values decreased significantly with older age ( $P = 0.002$ )<sup>10</sup>. However, not all studies agree, with one study in a large population in the USA showing no association of CCT with age<sup>11</sup>.

Conducted in the rural Thai community seem to disagree with the present study findings<sup>12</sup>. They concluded that thinner cornea was correlated with older age group.

As regards to the correlation of age and central corneal thickness, though the present study did not find a significant correlation, an association definitely exists with thicker central cornea found in younger age groups than the found in older age groups. Differences in results might be due to different ethnicities, geographical distributions, hydration level of cornea and measuring techniques.

### 4.5 Correlation of the CCT with Gender of the Patient

In present study showed no significant difference between gender proportions of groups regarding Central corneal thickness.

A study carried out in Karachi<sup>13</sup> did not find a significant relationship of CCT with variables like age, sex, or presence of co-morbidity. Conversely, in Japanese, African, and Chinese studies, it was found that men had thicker CCTs<sup>14-16</sup>. CCT has been said to have a diurnal variation in thickness<sup>17</sup>. Additionally, CCT in females has been linked to additional variables such as Oral Contraceptive Pill (OCP) use<sup>18</sup> and menstrual cycle<sup>19</sup>. However, these factors can be explained on the basis of the discrepancy between our data and that of the global community, as we did not account for these.

### 4.6 Astigmatism in the Study Group

The maximum astigmatic error found was -3D and the minimum astigmatic error found was 0. Mean astigmatic error was -0.59D (Table 10).

**Table 10.** Astigmatism in the study group

Study	Average astigmatism
Pedersen L <i>et al.</i> , <sup>20</sup>	-0.81D
Present study	-0.59D

Study conducted<sup>21</sup> eyes in children with higher myopia were more likely to have a higher cylinder power.

The prevalence of myopia (18.5%) and astigmatism (33.6%) is highest in Asians<sup>22</sup>.

#### 4.7 Correlation between Myopia and CCT

This study included 138 patients (276 eyes) with a minimum spherical equivalent of (-0.5) D to a maximum of (-11) D. CCT of each of these patients was recorded. The aim of the study was to find a correlation between the degree of myopic spherical equivalent and the central corneal thickness. Chi square test of significance was applied to the data. Pearson's correlation coefficient was used to calculate the correlation between these two variables.

#### 4.8 Correlation between CCT and Degree of Myopia

**Table 11.** Correlation between CCT and degree of myopia

		Degree of myopia
Central corneal thickness	Pearson Correlation	0.03
	Sig. (2-tailed)	0.62
	N	276

Pearson Correlation coefficient is 0.03 shows no statistically significant correlation between Central thickness and degree of myopia (Table 11).

In effect the value of one variable is independent of the change in the value of the other variable. This study is in agreement with similar such studies done in various parts of the world. Carried out a study<sup>23</sup> in Chinese adults where they correlated myopia with central corneal thickness. They found no correlation between CCT and the degree of myopia ( $p = 0.719$ ) (Table 12).

**Table 12.** Country - wise patients study in degree of myopia

Study	Country	Result	p value
Fam HB <i>et al.</i> , <sup>23</sup>	China	No correlation	$p = 0.719$
Kunert KS <i>et al.</i> , <sup>26</sup>	India	No correlation	-
Liu Z <i>et al.</i> , <sup>27</sup>	China	No correlation	-
Lee S <i>et al.</i> , <sup>24</sup>	Korea	Positive correlation	$P < 0.0001$
Bao FJ <i>et al.</i> , <sup>25</sup>	China	Positive correlation	$P < 0.001$

Another study conducted in the Korean population, deferred from the above observations. Conducted a study<sup>24</sup> in myopic Korean population they found that a positive correlation exists between the degree of myopia and CCT. Conducted a study<sup>25</sup> in Chinese patients where they found a positive correlation between the degree of myopia and CCT ( $P < 0.001$ ). These studies were probably the only studies which showed any correlation whatsoever between the degree of myopia and CCT.

## 5. Conclusion

A wide range of myopia existed in the study group with a minimum of -0.5D to a maximum of -11D. Mean myopia in the population was -3.04D. Only 14.75 % had myopia of more than -6D indicating that higher degrees of myopia are less commonly found.

The CCT ranged from 430microns to 624microns with a mean CCT of 540.10microns. There was no significant difference between CCT between males and females.

Astigmatism in the myopic group was found between a minimum of 0D to a maximum value of -3D. Mean astigmatism was -0.59D. No astigmatism was found in 42.45% population.

No single age slab selected for study showed prominence in age of the patient and myopia. These findings were in agreement to other studies done.

Mean degree of myopia of right eye was -3.064D while of left eye was -3.038D. The present study found no difference between the laterality of the eye and the degree of myopia.

In present study it was found that large numbers of subjects were having low grade myopia and CCT of range 501-550 was the most common for myopic patients in nearly all the degrees of myopia.

This study found no statistically significant correlation between the degree of myopia and CCT in the study group. Multiple studies done all over the world support the present study findings that myopia has no correlation to the degree of myopia.

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