



A Study of Corneal Parameters in Myopic Patients

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Abstract

Purpose: To study the central corneal thickness, corneal curvature and axial length in patients with myopia.

Methods: 64 eyes of 32 myopic patients were included in this cross sectional study. Central corneal thickness, axial length and corneal curvature were measured using ultrasonic pachymeter, A SCAN ultrasonic instrument, auto refractometer respectively. Correlation between these three variables was analysed.

Results: The degree of myopia ranges from -0.5 to -16 D ($3.5 \pm 3.0D$). The mean CCT was $540.9 \pm 33.36 \mu m$. Mean axial length was $24.5 \pm 1.4 mm$. Mean corneal curvature was $44.08 \pm 1.35 D$. CCT showed a statistically significant positive correlation with degree of myopia ($r=0.298$, $p=0.017$), and axial length ($r=0.276$, $p=0.027$). A statistically significant negative correlation was found between axial length and corneal curvature ($r=-0.443$, $p<0.001$). A statistically significant association was found between axial length and degree of myopia ($p<0.001$). In this study, 31.3% were males and 68.7% were females. Mean age was 27.6 ± 3.8 years. Axial length showed a statistically significant association with age and sex. However, CCT didn't show any association with age and sex.

Conclusion: This study showed a statistically significant positive correlation between CCT, degree of myopia and axial length. CCT didn't show any correlation with corneal curvature. CCT didn't show any significant association with age and sex. Axial length showed a highly significant positive correlation with the degree of myopia and a statistically significant negative correlation with corneal curvature. Axial length showed a statistically significant association with age and sex.

Keywords: Central corneal thickness, axial length, corneal curvature, myopia.

Introduction

Myopia is a type of refractive error in which parallel rays of light coming from infinity are focussed in front of the retina when accommodation is at rest.

Eye ball elongates during myopia progression. It is associated with increased axial length, deepening of anterior chamber and greater vitreous depth, retinal

thinning with lattice degeneration and retinal detachment, decreased choroidal circulation, and thin sclera. Thus, parameters like corneal curvature, AL has to be evaluated in myopic individuals.

Most popular refractive surgery such as LASIK performed on thin corneas may result in corneal perforation and post-operative corneal ectasia. Pre-

operative CCT measurement is needed to prevent these complications.

Primary open angle glaucoma (POAG) is one of the common ocular associations of myopia. IOP measurement is central corneal thickness (CCT) dependent. Hence, CCT has to be evaluated in myopic individuals.

The aim of this study is to evaluate the central corneal thickness, corneal curvature and axial length in myopic individuals.

Materials and Methods

This was a cross sectional study performed between January 2016 to January 2017, and enrolled patients visiting outpatient department of our institution, after obtaining informed consent. 64 eyes of 32 patients within 22-39 years were included. Exclusion criteria were history of previous ocular surgeries, glaucoma, Diabetes Mellitus, contact lens use, any corneal pathology, astigmatism of more than 2.00D.

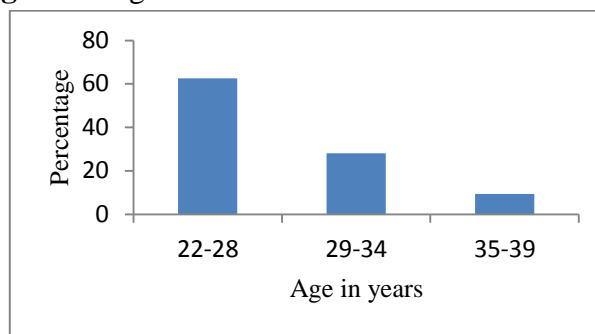
After detailed ophthalmological evaluation, central corneal thickness measured with Ultrasonic Pachymeter (Sonomed Pacscan 300P), corneal curvature measured with auto ref/keratometer (URK-700) and corneal topography (CT-1000 SHIN-NIPPON), axial length of the eye ball measured with A-scan ultrasonic instrument (MARVEL A/B-scan).

Statistical analysis was done using Statistical Package for Social Sciences version 22 (SPSS Inc.). Correlation between variables was studied with Karl Pearson’s correlation co-efficient. Relationship between two quantitative variables was found out using *t* test (*t*), relationship between more than two groups was found out using ANOVA test (*F*). A *P*-value of less than 0.05 was considered statistically significant.

Results

Among the total 32 patients, 68.7% were females and 31.3% were males.

Figure 1: Age incidence



Mean age in this study group was 27.6±3.8 years. Majority belonged to the age group of 22-28 years. (62.5%).

Table 1: Distribution of refractive error

SPHERICAL EQUIVALENT	Frequency	Percent
0.5-3.0	38	59.4
3.25-6	17	26.6
>6	9	14.1
Total	64	100

Table 2: CCT and gender

Sex	N	CCT (µm)		t	p
		Mean	SD		
Male	20	541.2	39.6	0.042	0.967
Female	44	540.8	30.6		

There was no statistically significant association was found between CCT and gender (*p* = 0.967).

Table 3: CCT and age

Age in years	N	CCT (µm)		F	p
		Mean	SD		
22-28	40	546.13	25.03	1.398	0.255
29-34	18	530.61	45.93		
35-39	6	537.33	36.76		
Total	64	540.94	33.36		

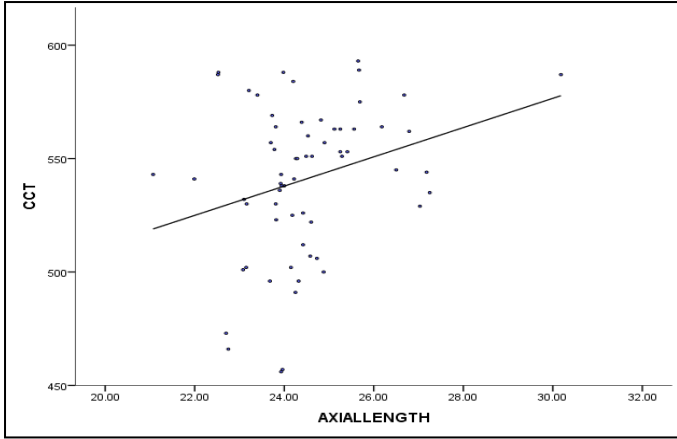
There was no statistically significant association was found between CCT and age (*p* = 0.255).

Table 4: CCT and myopia

	Pearson Correlation	
	r	p
Correlation Between CCT and degree of myopia	0.298*	0.017

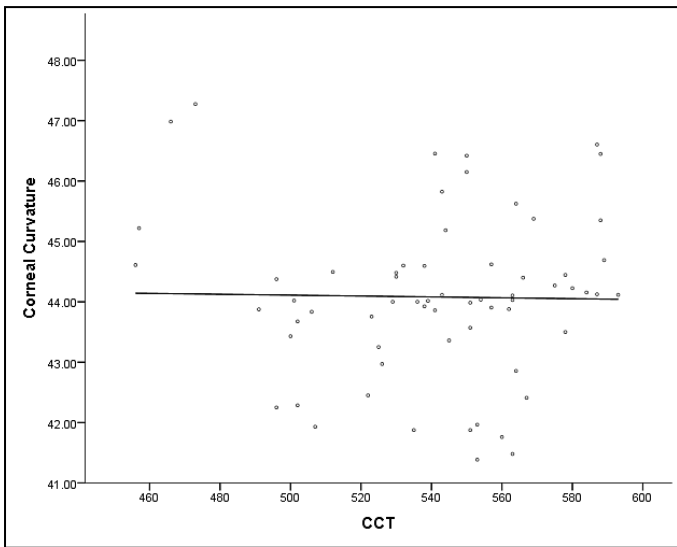
Statistically significant positive correlation was found out between CCT and degree of myopia (*p*= 0.017).

Figure 2: Scatter plot showing correlation between CCT and axial length



Statistically significant positive correlation was found out, while correlating CCT with AL ($r=0.276$, $p=0.027$).

Figure 3: Scatter plot showing correlation of CCT with corneal curvature



A negative correlation was found out between CCT and corneal curvature ($r=-0.018$), but it was statistically not significant ($p=0.887$).

Table 5: Axial length and gender

Sex	N	AXIAL LENGTH (mm)		t	p
		Mean	SD		
Male	20	25.0	1.5	2.185	0.033
Female	44	24.2	1.3		

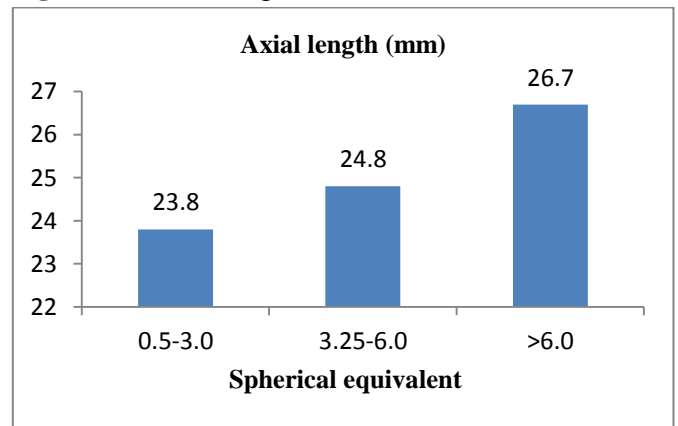
A statistically significant association was found out between axial length and gender ($p=0.033$).

Table 6: Axial length and age

Age in years	N	AXIAL LENGTH (mm)		F	p
		Mean	SD		
22-28	40	24.55	1.04	4.002	0.023
29-34	18	23.90	1.57		
35-39	6	25.68	2.44		
Total	64	24.48	1.43		

A statistically significant association found out between axial length and age ($p=0.023$).

Figure 4: Axial length and refractive error



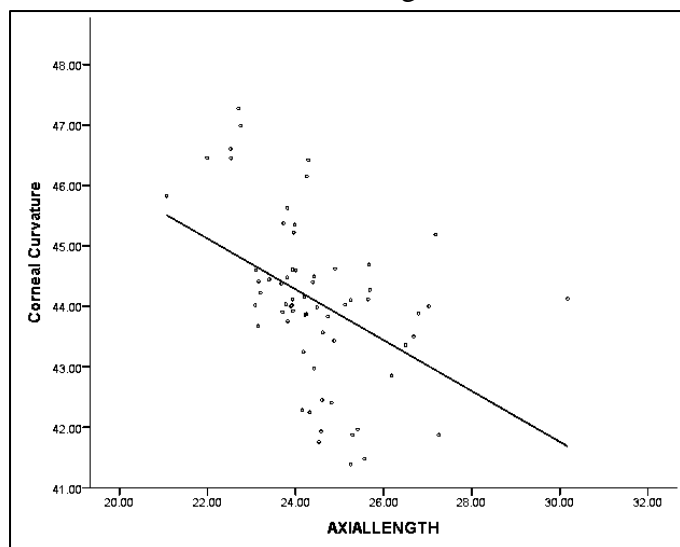
The AL seems to be increased when the degree of myopia increased. This was statistically significant ($p<0.001$).

Table 7: Axial length and corneal curvature

Axial length (mm)	N	Corneal Curvature		F	p
		Mean	SD		
≤ 24	27	44.90	1.07	11.539	<0.001
24-26	29	43.45	1.30		
>26	8	43.60	0.97		
Total	64	44.08	1.35		

When AL length increased the corneal curvature was decreased. It was statistically significant ($p=<0.001$).

Figure 5: Scatter plot showing correlation between corneal curvature and axial length



There was a negative correlation between AL and corneal curvature ($r=-0.443$), and it was statistically significant ($p<0.001$).

Discussion

This study was attempted to find out the relationship between the degree of myopia and central corneal thickness, axial length and corneal curvature.

CCT and Degree of Myopia

The degree of myopia ranges from -0.5 to -16 D. The mean refractive error in this study group was 3.5 ± 3.0 D. Myopes were divided into 3 groups and analysed. Patients with SE of 0.5 to 3 D had the CCT of $536.6\pm 33.7\mu\text{m}$, patients with SE of 3.25-6.0D had the CCT of $540.6\pm 36.8\mu\text{m}$ and patients with the SE of >6 D had $560\pm 17.6\mu\text{m}$. A statistically significant positive correlation was found out between degree of myopia and CCT ($p=0.017$).

Similar to our study a study done by Xiao gang Wang et al^[1], showed thicker CCT in the high myopes, and it was statistically significant.

In contrast, Study done by Von Bahr et al^[2] showed thinner CCT in myopic population.

CCT and Axial Length

A statistically significant positive correlation was found out, while correlating CCT with AL ($r=0.276$, $p=0.027$).

Similar to our study, Lee et al^[3] studied 1011 Korean myopic patients, to find out the relationship between refractive error and optical components and found out a positive correlation between CCT and AL.

In contrast, Oliveira et al^[4] studied 140 eyes with mean refractive error of -1.3 ± 5.0 D and found no statistically significant correlation between CCT and axial length ($P=0.4$).

CCT and Corneal Curvature

In our study, there was a negative correlation between CCT with corneal curvature ($r=-0.018$), but it was statistically not significant ($p=0.887$).

Similar to our study, a study done by Cho P et al^[5], in Hong Kong showed no correlation between CCT and corneal curvature.

In contrast, a cross sectional study done by Suzuki et al^[6], in Japanese population showed a positive correlation between corneal curvature and CCT.

Axial Length and Corneal Curvature

Patients with the axial length of >26mm had CC of 43.6D when compared with patients with the AL of ≤ 24 mm. When AL length increased the corneal curvature was decreased. A negative correlation was found out between AL and corneal curvature ($r=-0.443$), and it was statistically significant ($p<0.001$).

COMET (Correction of Myopia Evaluation Trial) study was done to find out the relationship between AL and CC over 14 years. The mean axial length at baseline was 24.14 mm, and at 14 years was 25.40 mm. At 14 years the mean axial length increased to 25.40 mm. Baseline corneal curvature was 44.11D and at 14 years the average corneal curvature was 43.98 D. Baseline refractive error was -2.38 D at 14 years -5.17 D. They found out a significant ($p < 0.0001$) flattening in corneal curvature. The results were similar to our study.

In contrast to our study, Carney et al found out patients with greater axial lengths had steeper central corneal curvatures. In this study corneal curvature was determined in 113 eyes using Topographic Modelling System.

Axial Length and Refractive Error

In this study the AL in patients with the SE of 0.5-3.0D was 23.8 ± 0.8 mm, and it was increasing up 26.7 ± 1.6 mm in patients with the SE of >6.0 D. When degree of myopia increased AL also increased. This was statistically significant ($p < 0.001$).

Similar to our study, a study done by Llorente et al^[7] showed that axial length was significantly higher in myopes than hyperopes. The spherical equivalent in myopic group ranged from -1.2 to -7.6 D (-3.8 ± 2.4 D).

CCT and Gender

The mean CCT in males was 541.2 ± 39.6 µm and in females 540.8 ± 30.6 µm. There was no statistically significant association between CCT and gender ($p = 0.967$).

Similar to our study, Hashemi et al^[8] examined 800 eyes and did not find any relationship between CCT and gender.

In contrast to our study, Xu et al^[9] examined 3,251 participants and found that the corneas were thicker in men than in women.

CCT and Age

The mean CCT in 22-28 years was 546.13 ± 25.03 µm. The mean CCT in 29-34 years was 530.61 ± 45.93 µm. The mean CCT in 35-39 years was 537.33 ± 36.76 µm. In our study, there was no statistically significant association was found between CCT and age ($p = 0.255$).

Similar to our study, Prasad et al found that there was no association between age and CCT. The mean CCT in this study was 544 µm with an SD of 34 mm and the range of age group was 17-83 years. Foster et al^[10] studied 1,242 participants aged from 10-87 years, and found out a highly significant decrease in CCT with age. (5 microns/decade in men and 6 microns /decade in women)

Axial Length and Age

In our study patients in the 35-39 year age group had the AL of 25.68 ± 2.44 mm when compared with 22-28 years who had the AL of 24.55 ± 1.04 mm. Patients in 29-34 year age group had the AL of 23.9 ± 1.57 mm. There was a statistically significant association was found between axial length and age ($p = 0.023$).

Similar to our study, Hidasi et al^[11] studied 600 myopic patients whose age range was 4-76 years, and found that the axial length was increased continuously with age and in older individuals.

In contrast to our study, Wong et al did a cross-sectional study and found that older people have shorter axial length than young participants. Age of the participants ranged from 40 to 81 years.

Axial Length and Gender

In our study, males had longer AL than females. There was a statistically significant association was found between axial length and gender ($p = 0.033$).

Similar to our study, a study done by Selovic et al^[12] studied 1,600 Croatian schoolchildren and found that boys have a significantly longer axial length than girls ($p < 0.01$).

Conclusion

This study showed a statistically significant correlation between CCT, degree of myopia and axial length. CCT didn't show any correlation with corneal curvature. Axial length showed a highly significant positive correlation with the degree of myopia and a statistically significant negative correlation with corneal curvature. CCT didn't show any significant association with age and sex. Axial length showed a statistically significant association with age and sex.

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