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Correlation between Central Corneal Thickness and Degree of Myopia

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ABSTRACT

Aim of the work: this study aimed to determine the relationship between central corneal thickness (CCT) and myopia.

Methods: one hundred and eight (108) Egyptian subjects were included in this study. They were not presenting with any eye disease and had never undergone eye surgery. The total number of subjects meeting the inclusion criteria was 108 (216 eyes) 87 were myopes and 21 were emmetrope. They were categorized into two main groups: myopic group (**Group I)** and the control group **(Group II**). The CCT was measured with the pentacam.

Results: the present study comprised 59 males (54.6 %) and 49 females (45.4%). Their age ranged between 19 and 58 years. The mean CCT was 538.2 right eye and 536.3 left eye in **group Ia**, 522.3 right eye and 523.7 left eye in **group Ib**, 542.0 right eye and 550.3 left eye in **group Ic,** and 529.0 right eye and 526.8 left eye in the control group **(Group II).**

Conclusion: this clinical study showed that there was no difference in CCT between emmetropic and myopic eyes. CCT did not correlate with the degree of myopia.

Keywords: central corneal thickness , myopia pachymetry.

INTRODUCTION

The cornea is a transparent, a vascular tissue that measures 11–12 mm horizontally and 10–11 mm vertically. The cornea along with sclera forms the outermost coat of the eyeball, it is a complex structure has a protective role; it is responsible for about three quarters of the optical power of the eye [(1)]. It contributes 74% or 43.25 diopters (D) of the total 58.60 dioptric power of a normal human eye. Its refractive index is 1.376. The normal cornea is free of blood vessels. For its nutrition, the cornea depends on glucose diffusing from the aqueous humor and oxygen diffusing through the tear film. In addition, the peripheral cornea is supplied with oxygen from the limbal circulation. The cornea has one of the body's highest densities of nerve endings and the sensitivity of the cornea is 100 times that of the conjunctiva. The cornea is composed of six layers; which are epithelium, Bowman's layer, stroma, Dua's layer, Descemet's membrane and endothelium [(2)].

The normal thickness of the cornea varies from central to peripheral limbus and it is ranging from 0.7 to 0.9 mm at the limbus and from 0.49 mm to 0.6 mm at the centre. Central corneal thickness (CCT) is an important indicator of corneal health status. As an estimate of the corneal barrier and endothelial function, CCT is an essential tool in the assessment and management of corneal disease [(3)].

Moreover, CCT is a measure of corneal rigidity and consequently has an impact on the accuracy of intraocular pressure measurement by applanation tonometry. A study had demonstrated that thicker corneas with greater rigidity may offer a greater resistance when subjected to applanation, resulting in artificially higher intraocular pressure readings [(4)]. In addition, with the development of corneal refractive surgery procedures, CCT values are of enormous importance during the preoperative evaluation of the patients as they influence the decision whether or not to perform surgery, the type of recommended procedure and rate of postoperative complications [(5)]. Corneal pachymetry is the process of measuring the thickness of the cornea. It can be done by using contact methods such as ultrasound and confocal microscopy or non-contact methods such as optical biometry with a single Scheimpflug camera (such as the Oculus Pentacam or Sirius), Dual Scheimpflug (eg, Galilei), coherence tomography (Visante, ivue, or others), or optical coherence pachymetry (with orbscan) [(3)].

Myopia is a common refractive error especially in Asian countries undergoing rapid development. Myopia prevalence could be as high as 95% in medical school students. Myopic changes of the eyes included elongated axial length, deeper

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anterior chamber, thinner retina with lattice changes and higher prevalence of retinal detachment, decreased choroid circulation, as well as decreased scleral thickness and elasticity [6]. **Kobayashi *et al.*** [7] found large variation in axial length in highly myopic children. This variation might imply that the cause of high myopia might not only be axial elongation, but also some other congenital problems which could affect other optical component, such as the cornea.

PATIENTS AND METHODS

One hundred and eight (108) Egyptian subjects were included in this study. They were not presenting with any eye disease and had never undergone eye surgery.

The total number of subjects meeting the inclusion criteria was 108 (216 eyes) 87 were myopes and 21 were emmetrope. They were divided into two main groups: Myopic group (**Group I)** and the control group (**Group II).**

The myopic group (group I) was subdivided according to the degree of myopia into 3 subgroups:

- **Group Ia**: 52 subjects with myopia less than – 5.00 D.
- **Group Ib:** 20 subjects with myopia from – 5.00 D to less than – 10.00 D.
- **Group Ic:** 15 subjects with myopia from – 10.00 to – 15.00 D.

Participants underwent a complete ophthalmologic examination including visual acuity, slit-lamp examination, fundoscopy, IOP and cycloplegic refraction.

The CCT was measured with the pentacam.

All examinations and investigations were done at Al Hussein University Hospital and Nour Al Hyaa Eye Hospital, Cairo.

The study was done after approval of ethical board of Al-Azhar university.

Statistical analysis

Data were collected, tabulated, statistically analyzed using an IBM personal computer with Statistical Package of Social Science (SPSS) version 20 where the following statistics were applied.

a- **Descriptive statistics**: in which quantitative data were presented in the form of mean ($\bar{X}$), standard deviation (SD), range, and qualitative data were presented in the form numbers and percentages.

b- **Analytical statistics:** used to find out the possible association between studied factors and the targeted disease.

RESULTS

The total number of subjects meeting the inclusion criteria was 108 (216 eyes). Eighty-seven subjects were myopes and 21 subjects were emmetropes. They were categorized into 2 main groups: myopic group (**Group I**) and emmetropic group (**Group II).**

The myopic group (**Group I)** was further subdivided according to the degree of myopia into 3 subgroups:

- **Group Ia:** 52 subjects with myopia less than – 5.00 D.
- **Group Ib**: 20 subjects with myopia from – 5.00 D to less than – 10.00 D.
- **Group Ic:** 15 subjects with myopia from – 10.00 to – 15.00 D.

The study comprised 59 males (54.6 %) and 49 females (45.4 %) (**Table 1 and figure 1).**

Their age ranged from 19 to 58 years with a mean of 30.7±9.46. (**Table 2 and figure 2**).

Table 1: sex distribution among the studied groups (n=108)

Studied variables	Cases (N=87)						Control group (N=21)		Total (N=108)		Chi square P value
	Group Ia (N=52)		Group Ib (N=20)		Group Ic (N=15)						
	No.	%	No.	%	No.	%	No.	%	No.	%	
Gender											
- Male	29	55.8	9	45.0	7	46.7	14	66.7	59	54.6	2.38
- Female	23	44.2	11	55.0	8	53.3	7	33.3	49	45.4	0.496

This table showed that there was no significant difference between the studied groups regarding their sex (P value >0.05).

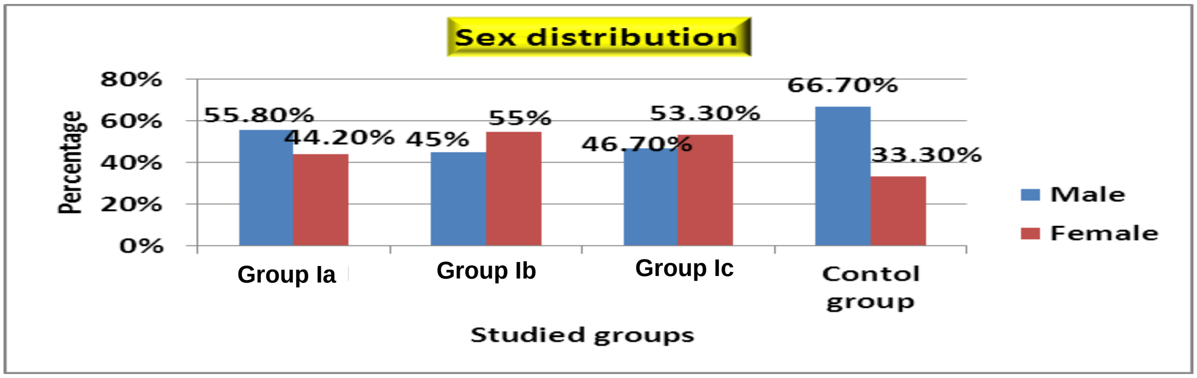

Figure 1: sex distribution among the studied groups

Table 2: mean age of the studied groups (N=108)

Studied variables	Cases (N=87)			Control group (N=21)	Kruskal Wallis test	P value
	Group Ia (N=52)	Group Ib (N=20)	Group Ic (N=15)			
	$\bar{X}$ ±SD	$\bar{X}$ ±SD	$\bar{X}$ ±SD	$\bar{X}$ ±SD		
Age / years	31.2±12.1	31.1±8.36	29.6±0.81	29.8±5.92	0.304	0.959

This table showed that there was no significant difference between studied groups regarding their age (P value >0.05)

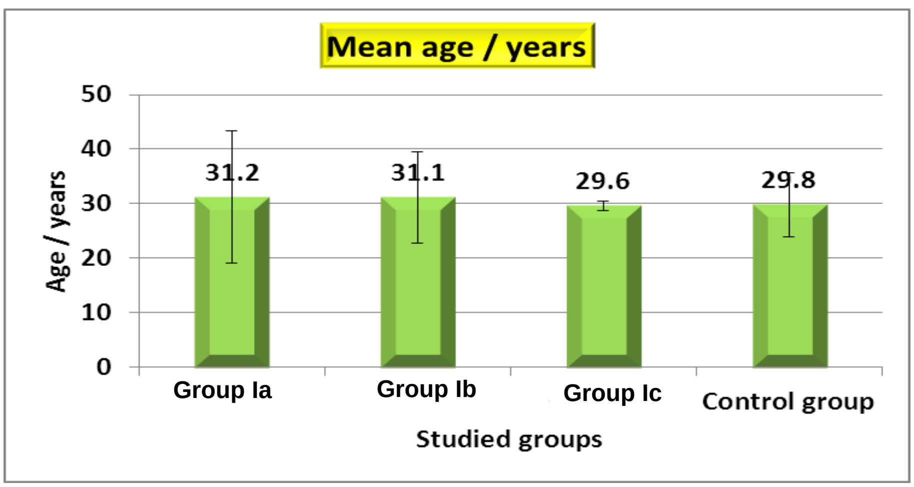

Figure 2: **mean age of the studied groups**

The mean refraction among the studied groups is shown in **table 3**

Table 3: mean refraction among the studied groups (N=108):

Refraction	Cases (N=87)			Control group (N=21)	Kruskal Wallis test	P value
	Group Ia (N=52)	Group Ib (N=20)	Group Ic (N=15)			
	$\bar{X}$ ±SD	$\bar{X}$ ±SD	$\bar{X}$ ±SD	$\bar{X}$ ±SD		
Right eye	-2.91±1.48	-5.98±3.34	-12.6±1.84	-0.52.6±0.38	82.9	**0.001****
Left eye	-3.06±1.47	-6.36±3.02	-11.6±1.28	-0.48.6±0.31	80.9	**0.001****

**highly significant

This table showed that there was highly significant difference between studied groups regarding their errors of refractions in both eyes (**Table 3)** (P value < 0.001).

The mean CCT is shown in **table 4** and **figure 3**

Table (4): mean CCT among the studied groups (n=108)

CCT	Cases (N=87)			Control group (N=21)	ANOVA	P value
	Group Ia (N=52)	Group Ib (N=20)	Group Ic (N=15)			
	$\bar{X}$ ±SD	$\bar{X}$ ±SD	$\bar{X}$ ±SD	$\bar{X}$ ±SD		
Right eye	538.2±38.2	522.3±34.4	542.0±24.5	529.0±31.7	1.42	0.240
Left eye	536.3±38.4	523.7±32.6	550.3±32.4	526.8±29.4	2.02	0.115

This table showed that there was no significant difference between the studied groups regarding their CCT in both eyes (**Table 4) (**P value >0.05).

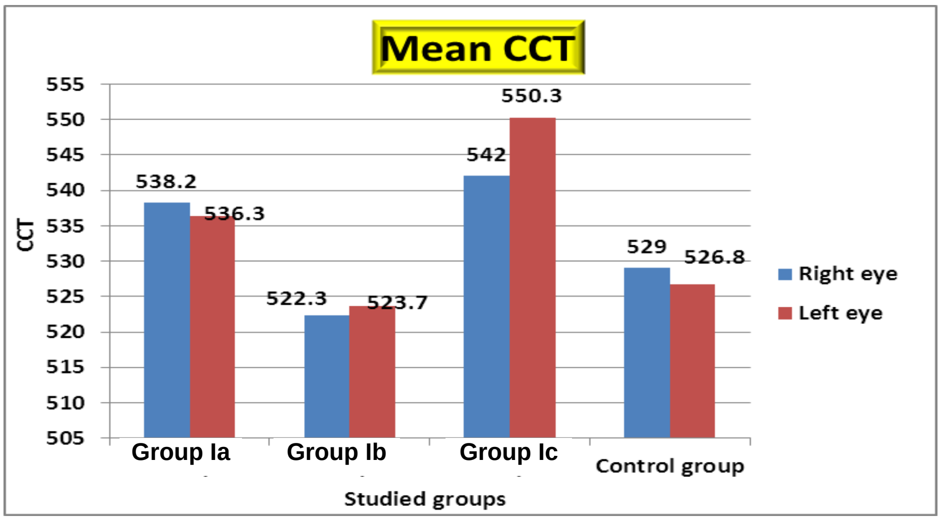

Figure 3: mean CCT among the studied groups

The correlation between error of refraction and CCT in myopic subjects was shown in **table 5.**

Table 5: **correlation between error of refraction and CCT in myopic patient (n=87)**

Studied variables	Refraction			
	Right		Left	
	r	P value	r	P value
CCT	0.048	0.661	0.005	0.961

This table showed that there was no correlation between error of refraction in both eyes and CCT in myopic patient (**Table 5**).

The correlation between error of refraction and age in myopic subjects is shown in **table 6.**

Table 6: correlation between error of refraction and age in myopic patient (n=87)

Studied variables	Refraction			
	Right		Left	
	r	P value	r	P value
Age	0.028	0.797	0.018	0.868

This table showed that**:** there was no correlation between error of refraction in both eyes and age of myopic patient (**Table 6).**

The correlation between CCT and age in myopic subjects is shown in **table 7.**

Table 7: correlation between CCT and age in myopic patient (n=87)

Studied variables	CCT			
	Right		Left	
	r	P value	r	P value
Age	-0.166	0.125	0.146	0.177

This table shows that there was no correlation between CCT in both eyes and age of myopic patient **(Table 7).**

DISCUSSION

The present study comprised 59 males (54.6 %) and 49 females (45.4%). Their age ranged between 19 and 58 years. The mean CCT was 538.2 right eye and 536.3 left eye in group Ia, 522.3 right eye and 523.7 left eye in group Ib, 542.0 right eye and 550.3 left eye in group Ic and 529.0 right eye and 526.8 left eye in the control group (**Group II).**

The results of the present study revealed no statistical difference between CCT of myopes and emmetropes. Also, no statistical difference was found between CCT of the three myopic subgroups. Results of the current study agree with those of **Liu and Pflugfelder** [(7)], they concluded that central corneal pachymetry was correlated with the mean manual keratometric measurement, but no correlation was noticed between CCT and myopia in contact lens wearers. Neither did the CCT correlate with the axial length, age, sex, horizontal corneal diameter or refraction in **Price's series** [(8)]. In addition, **Cho and Lam** [(9)] found that CCT decreased with increasing age, but not with refractive error or corneal curvature. In the present study there was no statistically significant difference related to the age.

The effect of refractive status on CCT had been reported by many investigators. However, the results of these reports were conflicting. Some found that myopic subjects have a thicker CCT, others reported thinner CCT, while yet others found no correlation between CCT and myopia. Therefore, the relationship between the degree of myopia and CCT was inconclusive in a previous study [(10)]. The different results in a previous study might be explained by any of the following: different criteria for inclusion and exclusion, influence of genetic and racial differences, influence of contact lens wearing, and different devices and methods used for assessment of the CCT and might be un-experienced observers. Also, different sample sizes in the study may affect the results. The eyeball elongates during axial myopia progression. This progression not only makes the globe longer but also makes the sclera thinner, involving the posterior segment more significantly. Also, there are dimensional changes in the anterior segment during myopia progression, but they are less documented [(6)]**.**

CONCLUSION

In the present study, the CCT showed no significant change with myopes and no statistically significant difference in CCT between myopes and emmetropes. Therefore, the growth alteration in ocular tunics of myopic eyes does not involve the corneal thickness which is of benefit for most of corneal refractive surgeries.

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