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ADULT MYOPES;

RELATIONSHIP OF CENTRAL CORNEAL THICKNESSES (CCT), KERATOMETRY MEAN (KM) AND AXIAL LENGTH (AL) AMONG SUDANESE ADULT MYOPES

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ABSTRACT... Objectives: This study aimed to explore the correlation of central corneal thicknesses (CCT), mean keratometry (KM) and axial length (AL) to myopia degree in spherical equivalent (SE) among Sudanese adults. **Study Design:** Cross sectional study. **Setting:** University Eye complex clinic and Makka Eye complex Omdurman. **Period:** April to October 2015. **Methods:** Central Corneal Thickness (CCT), k-reading (KM), axial length and the degree of refraction (SE) 0f 200 myopic eyes and 60 emmetropic eyes as a control group were measured. **Results:** Adult Sudanese females (57%) were found greater than males (43%) population; ($\chi^2 = 109.5$, $p = 0.000$), most of the participants' age was less than 25 years ($\chi^2 = 109.5$, $p = 0.000$), and the mean myopic spherical equivalent (SE) was – 4.79 ± 2.55 D, ranging from -1.00 to -11.00 D. The mean CCT of the myopic group was 542.8 ±11.9 μm, while for the emmetropic group was 538.7 ±12.4 μm. The cornea were steeper in eyes with longer axial length (r = 0.24, p =0.001). Eyes with higher myopic spherical equivalent had longer axial length (r =0.30, p <0.001). Mean keratometrys were steeper with increasing age (r= 0.24, p= 0.001). This study has shown that CCT has no correlation with degree of myopia (p= 0.46), gender (p= 0.99), and age (p= 0.07). The CCT, KM, and AL means for myopic participants were found significantly greater than emmetropic participants (p=0.000, 0.000, and 0.044 respectively. **Conclusion:** The females participants of myopia were higher rate than males, early adults' age group were of higher rate myopic incident; there was no correlation between CCT and the degree of myopia, gender, and age. CCT, KM, and AL means for myopic were found higher than emmetropic participant. Eyes with more myopic spherical equivalent had longer axial length; corneal curvature mean becomes steeper with increasing age.

Key words: Central Corneal Thickness (CCT); Axial Length (AL); Mean Corneal Curvature (KM) Myopia; Emmetrope.

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INTRODUCTION

The most common type of refractive error is Myopia, involving both genetic and environmental factors and has become a global issue in public eye health leading to visual impairment, economic cost effective and complications.[1,2,3,4,5,6,7] The cornea is very special ocular structure involved in visual function interpret the visual information. The cornea is the most important refractive surface and small changes in its structure can have significant effects on vision can be significantly affected by minor changes in the cornea. So the measurements of different corneal parameters are vital for the proper management and diagnosis of eye diseases such as keratonus and glaucoma[8], and in different corneal surgeries.[9] Measurement of cornea is critical for the corneal health. Small changes in the corneal thickness may be the beginning of different ocular diseases[8,9], so in clinical practice it is of a great importance to get the corneal thickness by the most reliable pachymetry method for each patient. The exact measurement of corneal thickness is also very important for the measurement and interpretation

of of intraocular pressure (IOP), planning for corneal refractive surgery to take the decision for surgery and specific procedure and other critical issues for the follow up and possible associated postoperative complications.[10,11]

The axial length (AL) is the distance between the central corneal surface and interference peak corresponding to the retinal pigment epithelium/ Bruch's membrane. Different studies have proven that axial length (AL) is strongly related to the degree of refractive error.[12,13]

Many studies have been done to show the relationship between the CCT and AL. Few of these studies have concluded that if the degree of myopia is more then the axial length is also increased but the CCT is decreased[14]; but in another study conducted in korea in myopic korean population showed that the CCT has a positive correlation with the degree of myopia and the AL.[15]

Much research has been conducted on the corneal radius of curvature (CR) and some of these studies have concluded that there is no correlation between refractive errors and CR in different studied groups.[16] on the other hand some studies have found hat myopes have a smaller CR than emmetropes.[17] The magnitude of an effect of refractive error on corneal thickness is still under investigations; however, the results of these studies can be argued. Majority of those studies found no correlation between CCT and myopia.[1819] H-B Fam et al[20] among Chinese found that the mean CCT was 534.5± 38.1 µm and it did not show any relationship with the degree of myopia. Yi-Chun Chen et al[21] also reported in his study among Taiwanese adults about correlation between central corneal thickness (CCT) and the degree of myopia and reported that the central corneal thickness was 560 ± 35 µm and he did not find any relationship between CCT and the degree of myopia among adults. A study conducted in Taiwan, Sangkyu Lee et al[15] and Aghaian et al[17] noted the following CCT differences in different races with no correlation of degree in myopia, CCT in Chinese population was found to be (555.6 μm), in Caucasian it was (550.4 μm), in Filipino it was (550.6 μm), in Hispanic it was (548.1 μm), in Japanese it was (513.7 μm), in African-American it was (521.0 μm and in Korean patients it was (536.66 μm). A study conducted by Al-Mezaine[22] et al. in Saudi Arabia also reported that there is no no relationship between CCT and myopia and they did not find any difference in CCT in myopic and emmetropic population and the CCT value of the myopic group was 543.8 ± 35.40 µm and for the emmetropic group the CCT value was 545.7 ± 27.6 µm. Whereas the author R. E. Manny[23] et al. in Myopic young adults showed small but significant differences in CCT by ethnicity but not by age, gender or magnitude of myopia. While Archna[24] et al. reported in their study, the relationship of age and refraction to central corneal thickness which was conducted in much higher number of population in the eyes which has undergone refractive surgery: mean CCT was 544± 34 µm. On the other hand Trupti S.[25] et al. has concluded that the CCT did not have any relationship with age or refraction. But the CCT was strongly associated with corneal curvature and axial length and did not find association between CCT and age or sex.

In myopic population Tahra[26] et al. reported that KM correlated inversely with SE and CCT and no correlation with CCT was detected. In our study no correlation was detected between CCT and the degree of myopia, gender and age but the central corneal thickness (CCT), mean keratometry (KM) and axial length (AL) means for myopes were found higher than emmetropes.

METHODS

In this prospective observational study, one group of 100 participants (200 eyes) of consecutive myopic and 30 participants (60 eyes) as a control emmetropic were recruited from University Eye Hospital clinic and Makka eye complex Omdurman. The participants were free from ocular and systemic diseases and had bilateral myopia. The CCT value was determined in both eyes using Ultrasound pachymeter (Niedek, US-4000 SCHOACAN), refraction in equivalent sphere and corneal curvature was measured using Auto-keratorefracto-meter (Topcon KR.880, version 1.25). The p-value of 0.05 was chosen to

show statistical significance. Means of different variables were tested by Student's t test. A Pearson coefficient of correlation was used to find out the correlation between parameters. A two tailed probability of 0.05 was considered statistically significant.

RESULTS

Myopic adults were found in females (57%) greater than males (43%) ($\chi^2 = 3.92$, $p = 0.04$), most of participants' age was less than 25 years ($\chi^2 = 109.5$, $p = 0.000$) as demonstrated in Table-I. In myopic group the mean refractive error for was -4.79± 2.55 diopters (range, -1.00 diopters to -11.00 diopters); mean CCT was 542.3±11.9µm; 538.7 ±12.4 μm(range 500 to 568;500 to 555μm), mean axial length found 23.9±2.6; 22.4±0.5 mm (range, 21.1-26.2;22-23.5mm), corneal mean keratometry (KM) found 44.7±2.2 D; 42.4± 44D (range, 33.4- 61.6 D; 42-43.4 D)for myopic and emmetropic participants respectively as shown in Table-II, and III. In Table-IV axial length (AL), corneal curvature (KM), refraction (SE) were found considerably higher in participants with age group 25 years and above as compared to less than 25, and no statistically significant difference was found regarding corneal thickness (CCT) for the two age groups. While Table-V revealed insignificant statistical differences between males and females in axial length (AL), corneal thickness (CCT), corneal curvature (KM) (approaches to be a little bit significant) but the equivalent sphere degree mean was found higher in males. Axial length (AL), corneal curvature (KM), corneal thickness (CCT) in the Table-VI were significantly found higher in myopic than emmetropic subjects. Furthermore, a strong positive relationship was detected between axial length and myopic SE, weak positive correlations b/w age and KM, SE and AL, KM and SE.On the other hand very weak positive correlation b/w CCT and SE and no correlation were found b/w age and CCT, CCT and AL, KM and AL as shown in Table-VII.

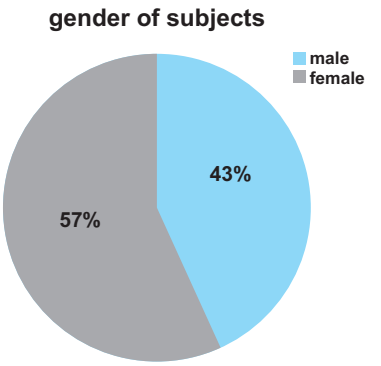

Figure-1. Showing gender distribution of myopic participants

Gender	%	χ^2	P	Age	%	χ^2	P
Females	57	3.92	0.04	Less than 25	87	109.5	0.000
Males	43			25 and above	13		

Table-I. Distribution of myopic subjects according to gender and age

	N	Minimum	Maximum	Mean	Std. Dev.
axial length in mm	200	21.5	26.2	23.7	2.6
age in year	200	16.0	35.0	22.4	3.6
KM in diopter	200	33.4	61.6	44.7	2.2
CCT in nm	200	500.0	568.0	542.3	11.9
refraction diopters SE	200	1.0	11.0	4.8	2.6

Table-II. Descriptive Statistics for myopic subjects

	N	Minimum	Maximum	Mean	Std. Devi.
axial length in mm	60	22.0	23.5	22.4	.54
age in year	60	17.0	33.0	21.1	2.84
KM in diopter	60	42.0	43.4	42.4	.44
CCT in μm	60	500	555	538.7	12.41

Table-III. Descriptive Statistics for emmetropic subjects

Type	Less Than 25	25 and Above	T	p- value
A L mm	23.6	24.2	-3.03	0.003
K M D	44.5	45.8	-2.83	0.005
CCTμm	542.2	543.1	-3.80	0.70
Refr. SE D	1.83	2.62	-4.92	0.000

Table-IV. Distribution of myopic subjects mean according to age

Type	Males	Females	T	P-Value
A L mm	23.7	23.7	0.22	0.83
K M D	45.o	44.5	1.721	0.087
CCTμm	542.3	542.3	-0.006	0.99
Refr. SE D	2.09	1.81	2.520	0.013

Table-V. Distribution of myopic subjects mean according to gender

Type	Myopic Mean	Emmetropic Mean	T	P-Value
AL mm	23.8	22.4	6.4	0.000
KM D	44.69	42.38	8.27	0.000
CCT μm	542.3	538.7	2.02	0.044

Table-VI. Comparison measurement means in myopic and emmetropic subjects

Types	R	P-Value
Age and mean corneal curvature KM	0.24	0.001
Age and central corneal thickness CCT	-0.13	0.07
Age and refraction	0.27	0.00
Age and axial length AL	0.18	0.01
Mean corneal curvature KM and CCT	0.15	0.03
Mean corneal curvature KM and refraction	0.37	0.00
CCT and refraction	0.05	0.46
CCT and AL	-0.008	0.91
KM and AL	-0.07	0.36
AL and refraction SE	0.57	0.00

Table-VII. Pearson correlations between measurements of myopic subjects

DISCUSSION

In our Study as shown in Table-I and Figure-1, emphasizes that the most of myopic adults in Sudan were females ($x^2=3.92$, $p=0.04$), but Francisco G et al[16] pointed that the proportion of myopia was more common in males. Furthermore, our results showed ages of less than 25 were more subjected to myopia than 25 years and above ($\chi^2 = 109.5$, $p = 0.000$). Similar results were pointed by P J Foster[27,28] and Y Jiang detected that myopia is less common in older adults than in younger adults and it is possibly due to near-work activities, like reading, writing, computer use, and playing video games. So it is that near work activities are possibly responsible for high prevalence of myopia among early adults group.

This study as shown in Table-VII demonstrates that CCT shows no correlation with the degree of myopia in adult Sudanese population (r=- 0.135, p= 0.057), our findings were similar with earlier studies, which investigated CCT association with myopia. H-B Fam[20] et al.; Yi-Chun Chen[21] et al.; Al-Mezaine[22] et al.; R. E. Manny[23] et al.; Archna[24] et al. who pointed out that the mean CCT and degree of myopia have no corelation. The mean CCT of myopic participants in the present study (542.8 ±11.9 μm) was significantly different compared to that found (p= 0.04- 0.000) in other races like Caucasian (550.4 μm), Chinese (555.6 μm), Hispanic (548.1 μm), Filipino (550.6 μm), Japanese (513.7 μm), African-American (521.0 μm), Saudian (544.7 μm), and Korean (536.66 μm) as it is mentioned earlier in this study, on the other hand for the emmetropic group it was 538.7 ±12.4 μm and there was no statistically significant difference between myopic and emmetropic groups (r= -.021; p= 0.87).These results are

similar to that reported by Al-Mezaine[22] et al 2009 in the Kingdom of Saudi Arabia who declared that is no association between CCT and myopia in Saudi adults, and no statistically significant difference was found in CCT between emmetropic and myopic groups. No statistically significant difference was found (P= 0.995) between gender in our study as shown in Table-V, and similar results were found by Eghosaserelyamua, EbiOsuobeni[29] who concluded that CCT was not significantly influenced by gender. Our Observations as shown in Table-VII point out that if the spherical equivalent decreases, then the mean KM values also decreases (r=0.37; p= 0.000), our findings were similar with previous studies where cornea is found to be steeper with increasing myopia.[21,30,31,32] KM in myopic group was also found steeper than emmetropic as shown in Table-VI (t=8.27; p= 0.000), other studies also noted a correlation between keratometry and refractive error where corneas are found to be steeper in myopic than emmetropic eyes.[33] In addition there was no statistically significant difference between KM and gender (t= 1.7; p= 0.087), whereas a statistically significant difference in KM was found between age groups (t=-2.83; p= 0.005) where 25 year and above had steeper corneas than age of less than 25. Independent t-test revealed statistically significant difference (t=7.4; p= 0.000) between myopic and emmetropic axial lengths, myopic mean AL was found longer, on the other hand no statistically significant differences between males and females in axial length AL (t= 0.22; p= 0.83), these findings disagree with studies indicating that women tend to have a shorter AL.[34,35] Positive correlation was found between CCT and KM in myopes (t= o.153; p= 0.031), present study findings disagreed with that found by Eghosaserelyamua, EbiOsuobeni[29] who concluded that CCT was not significantly affected by corneal curvature, gender and corneal diameter. Independent t-test as shown in Table-VI, revealed a very significant difference (t= 14.254; p‹ 0.001) between myopic (44.6925± 2.15331 D) and emmetropic (42.3755± 0.44079 D) in corneal mean keratometry KM, where in myopic eyes mean corneal curvature (KM) was steeper, these findings agreed with Goh and Lam et al[36] who pointed out that the average radius of curvature was not affected by refractive status; and it was concluded that myopes usually have steeper corneas, followed by the emmetropes and the hyperopes tend to have less steeper corneas.

CONCLUSION

In the present research, the female myopic participants were found in higher rate than males. In early adults' age group, the incident rate was found higher in myopia and no correlation was detected between CCT and the degree of myopia, gender, and age.

The mean values of different corneal parameters like Central Corneal Thickness (CCT), Corneal Curvature (KM) and Axial Length (AL) among Sudanese myopic participants were found higher than emmetropes. Eyes with more myopic spherical equivalent had longer axial length; and the corneal curvature means were found to be steeper with increasing age.

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Life isn't about finding yourself,
It's about creating yourself.

– Unknown –

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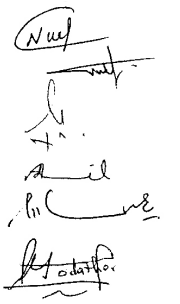
1	NuhaMohamed Fath Elrahman	Main concept.	
2	AbdElaziz Mohamed Elmadina	Data analysis and results.	
3	Manzoor Ahmad Qureshi	Introduction and discussion.	
4	Adil Mousa Younis	Data analysis.	
5	Muhammad Ijaz Ahmad	Review of literature.	
6	Madathir Musa Mohamed Zain	Data collection.	