Central corneal thickness and Axial length in myopia of various grades

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Introduction : Myopia is one of the most commonly observed refractive error. Myopia, also known as 'short sightedness' is that dioptric condition of the eye in which, with the accommodation at rest, incident parallel rays come to a focus anterior to the light sensitive layer of retina, resulting in a defocussed image on the retina. As a result a person is unable to see a distant object clear [1]. Although the etiology of myopia is still unknown, approximately two-thirds of optical refraction is due to the cornea and its relation with myopia has been studied since a long time. Most of the changes are studied in the posterior segment namely, posterior staphyloma, choroidal atrophy, retinal thinning and detachment. Changes in the anterior segment associated with myopia are still under debate. The myopic eye is known to be longer than the normal emmetropic eye. If this is the result of general growth, one might expect the cornea to have grown thicker than normal. If instead, the myopic eye is larger due to mechanism similar to that of a balloon being inflated, one would expect the cornea to be thinner. The major structural cause of myopia is an excessive axial elongation of the eye; on average, each diopter (D) of myopia in young adults is associated with an axial length (AL) increase of approximately 0.3 to 0.5 mm. Corneal thickness in the centre is 500 -600 µm and in the periphery is 1200 µm. Over the past 15 years, the world has witnessed an explosion of cases of myopia. A quarter of the world's population, or 1.6 billion people, now suffer from some form of myopia. It ranges from 30% to 65% in different countries of Southeast Asia [2]. It has been observed in the previous studies conducted among school going children having various types of refractive errors, 50 % to 60% had myopia [3]. So with the increasing number of myopic patients, they may have to undergo certain kerato-refractive surgeries which are not affordable and accessible to the general population. For that Central corneal thickness (CCT) is an important parameter to be measured in such patients undergoing refractive surgeries to prevent the cornea from becoming too thin after treatment. Studies that have attempted to investigate the effect of refractive errors on CCT and Axial length have reported conflicting results. Some of them found the cornea to be thinner in more myopic eyes. The purpose of our study was to determine correlation between CCT and Axial length in all grades of myopia.

Materials and Methods:

In this prospective cross sectional study of 100 patients, all grades of myopic patients visiting Ophthalmology opd were included after undergoing refraction. They were in the age group of 18-40 years. Subjects with Corneal disorders like degenerations, dystrophies, infections, opacities, raised IOP or a known case of glaucoma, cataract, previous ocular surgeries were excluded. Astigmatism less than 2 diopters was not taken into account. All patients underwent a cycloplegic refraction and complete ophthalmic evaluation with slit lamp biomicroscope. CCT was measured with an ultrasonic pachymeter and Axial length was measured using an A- Scan biometer. Informed written consent about the pachymetry and A Scan biometry procedures was taken. Study protocol was approved by Institutional Ethics Committee. Statistical analysis was done using SPSS V.11 and Microsoft Excel. Correlation between CCT and Axial length among all grades of myopes was studied. A probability of 0.05 was considered statistically significant.

Results:

Among 100 myopic patients studied, 64 (64%) were low myopes, 26 (26%) were moderate myopes and 10 (10%) belonged to high myopia. There were 38 (38%) female participants and 62 (62%) male participants. Participants in the age group 18-40 years were included in the study. Table 1 shows distribution of participants according to degree of myopia. Table 2 shows mean of all measured variables of all grades of myopia.

Correlation between CCT and axial length in all grades of myopia studied using Karl Pearson's cofficient and difference in CCT and Axial length between all grades of myopia was studied using z test. This study showed that there was a statistically significant difference between CCT among moderate ($z=2.25>1.96$, $P<0.05$) and high ($z=3.18>1.96$, $P<0.05$) grades of myopia. However the difference between CCT and low grade of myopia was not statistical significant ($z=1.425<1.96$, $P>0.05$). Changes in axial length were statistically significant in myopes. Correlation between CCT and Axial length in this study was statistically significant (r=

-0.217, P < 0.0001)

(Table 1) Distribution of participants according to degree of myopia

Degree of Myopia (diopters)	Cases of various grades of myopia (n=100)			
	Number of cases	Male	Female	Percentage (%)
Low	64	39	25	64
Moderate	26	16	10	26
High	10	7	3	10

(Table 2) Mean of measured variables of various grades of myopia

Degree of Myopia (diopters)	Total participants (n=100)		
	Number of participants (%)		Mean AL±SD
<4	64		23.81±0.85
4-8	26	530.56 ±38.28	25.11±1.05
>8	10	494.4 ±45.79	25.16±1.10

Discussion : The study attempted to determine the relation between CCT and axial length in all grades of myopia. The mean (SD) CCT of low, moderate and high grades of myopia were 541.58 ± 25.47 µ, 530.56 ±38.28 µ and 494.4 ± 45.79 µ respectively. Fam et al. in a study on 714 Chinese patients had a mean of 534.5 µ.[4]Chang's series had 533 µ, whereas Vijaya et al. reported it in the rural South Indian population as 505.9 µ.[5] Trupti et al. reported a mean CCT of 587.80 ±28.6 µ[6]and Anna Elias et al reported a mean of 543.11 µ.[7]

This study showed that there was a statistically significant difference between CCT in moderate (z=2.25>1.96, P<0.05) and high (z=3.18>1.96, P<0.05) grades of myopia. This result is in agreement with few of previous studies (Table 3). Von Bahr [8] first generated interest in the correlation between myopia and CCT in 1956, when he reported thinner corneas in myopia less than –4D.

There was a thinner cornea in patients having a more axial length in our study. Chang et al. , Bueno- Gimeno et al.[9] and Trupti et al. found similar results, whereas Bhat et al. and Chen et al.[10] found no correlation between them (Table 4). Myopia is increasing in prevalence and may be a growing problem in the future. Consequently, there is a higher rate of refractive surgeries to correct it. With LASIK, there is a general concern that one should ablate the cornea further than a given amount. It is, therefore, necessary to measure CCT before surgery. A thin central cornea is a risk factor for the development of glaucoma in patients with ocular hypertension. In the ocular hypertension treatment study, a multivariate model that included intraocular pressure, CCT was an important component of the predictive model. CCT is the most heritable aspect of ocular structure (more than refraction, axial length or optic disc size), suggesting it is under exquisite genetic control.

(Table 3) CCT and degree of refractive error

Sr. No	Authors	Years	Country	Results CCT and myopia
1.	**Pedersen et al.**	2005	Denmark	No correlation
2.	**Kunert et al.**	2003	India	Thicker CCT in high myopic
3.	**Touzeau et al.**	2003	France	Thinner CCT when myopic
4.	**Shrivannaboon et al.**	2002	Thailand	Thinner CCT when myopic
5.	**Chang et al.**	2001	Taiwan	No correlation
6.	**Liu and Pflugfelder et al.**	2000	China	No correlation
7.	**Cho and Lam et al.**	1999	China	No correlation
8.	**Price et al.**	1999	USA	No correlation
9.	**Tanaka et al.**	1996	Brazil	No correlation
10.	**Alsbirk et al.**	1978	Greenland	Thinner CCT when myopic
11.	**Ehlers and Hansen et al.**	1976	Denmark	No correlation
12.	**Hansen et al.**	1971	Denmark	No correlation
13.	**Martola and Baum et al.**	1968	USA(Boston)	No correlation
14.	**Von Bahr et al.**	1956	Sweden	Thinner CCT when myopic
15.	**Blix et al.**	1880	Sweden	No correlation
16.	**Trupti and Pathik et al.**	2013	India	No correlation

(Table 4) Comparison of correlation between Axial length and CCT

Authors	Axial length and CCT
Lee et al.	
Chang et al.	Thinner CCT with ↑ AL
Chen et al.	No correlation
Bueno-Gimenol et al.	Thinner CCT with ↑ AL
Bhat et al.	No correlation
Trupti and Pathik et al.	Thinner CCT with ↑ AL

Conclusion :

This study has shown that there was a significant difference between CCT among moderate and high grades of myopia. There was a significant difference between AL and all grades of myopia.

There was a significant correlation between CCT and Axial length in all grades of myopia.

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