Journal of Chemical Health Risks

www.jchr.org

JCHR (2024) 14(3), 911-916 | ISSN:2251-6727

Association of Central Corneal Thickness in Myopes - A Hospital Based Study

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(Received: 04 February 2024 Revised: 11 March 2024 Accepted: 08 April 2024)

KEYWORDS

Central corneal thickness, Myopes, Hospital based study

ABSTRACT:

Background: The prevalence of myopia has been increasing steadily, and studies on the relationship between myopia and central corneal thickness (CCT) have shown conflicting results. The purpose of this study was to investigate the relationship between myopia and CCT in a hospital based population from kancheepuram.

Materials & Methods: This study was conducted at a tertiary care facility in Kanchipuram between January and December 2023. A total of 100 patients aged 11 to 40 years with myopic refractive error (spherical equivalent [SE] greater than -0.5 D) as determined by cycloplegic refraction were included in the study. The collected data was entered in Microsoft Excel. Coding of the variables was done. Analysis was done using SPSS software (Version 27, IBM).

Results: This study included 200 eyes of 100 individuals with varying grades of myopia. 60% (n = 60) of the study participants were females. The mean age of the study participants was 27.68 ± 7.25 years (range: 12–40 years). The mean SE was − 2.61 ± 1.34 D (range: -0.5 to -6.0 D). The mean CCT was 541.53 ± 57.18 µm (range: 441–664 µm).

Conclusion: We analyzed the CCT measurements using non-contact specular microscopy in individuals with mild to moderate myopia. The average CCT values did not show a correlation with the myopic SE. Further research with a larger sample size and various degrees of myopia is necessary to better understand the relationship between myopia and CCT.

Introduction

Refractive error is the most common eye condition that is seen in eye clinics. It is an eye problem that occurs when the light that enters the eye is not properly focused on the retina, causing blurred vision and other potential negative consequences if left untreated. The importance of refractive error in ophthalmology is significant and diverse[1].As compared to all other causes of vision

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impairment, myopia is the most prevalent.[2] Myopia is also one of the most common vision problems globally, affecting approximately 25% of the European population and a staggering 80% of the Asian population.[3] Given the prevalence of myopia as the most common refractive error globally[4], extensive research has been conducted on the connection between myopia and the axial length of the eye[5]. According to research, there is a positive relationship between the values of myopia and the anteroposterior diameter. Approximately 1.5 billion people, or 22% of the world's population, are estimated to have myopia.[6] As the incidence of myopia has grown, the number of Eximer laser and Femto Lasik procedures for correcting nearsightedness has skyrocketed.[7] When considering various refractive surgeries for myopic eyes, the corneal thickness (CCT) is a crucial factor to take into account. This is because if the cornea is too thin, there is a likelihood of postoperative thinning, which could pose a risk.[8] The prevalence of myopia is on the rise, but the relationship between it and central corneal thickness (CCT) has been inconclusive in previous research studies. The aim of this study was to investigate the connection between myopia and CCT in a sample of hospital patients from Kanchipuram.

Materials & Methods

This study was a hospital-based, cross-sectional investigation that took place at a tertiary care facility in Kanchipuram from January 2023 to December 2023. Total Sample size of the study is 100 patients. Participants aged between 11 and 40 years with visual impairment and myopic refractive error (spherical equivalent [SE] greater than -0.5 D) as determined by cycloplegic refraction were eligible for inclusion in the study. Those who had myopia greater than -6 D, had undergone prior refractive or ocular surgery, wore contact lenses, had a history of ocular trauma or corneal disease, cataracts, glaucoma, or ocular hypertension, as well as pregnant or lactating females and individuals with systemic conditions such as diabetes mellitus or collagen vascular disease were excluded from the study. All participants provided informed consent.

All individuals in the research underwent a comprehensive eye exam, which encompassed slit-lamp biomicroscopy and fundus assessment using a +90 D lens and indirect ophthalmoscopy. In order to perform cycloplegia, three topical doses of 1% cyclopentolate were administered, each with a 15-minute gap in between. The spherical equivalent (SE), which consists of the sphere and half-cylindrical components, was determined 30-60 minutes after the first dose of medication, following cycloplegic refraction.

An experienced ophthalmologist utilized the Tomey EM3000 NCSM instrument (Tomey Corporation, Nagoya, Japan) to evaluate the Central Corneal Thickness (CCT) of participants. They were instructed to concentrate on the central target while maintaining proper chin and forehead positioning. To ensure a smooth tear film on the corneal surface, participants were asked to blink completely before measurements were taken. The autoalignment and capture mode were used to minimize observer bias. Three consecutive measurements that were deemed valid were taken, and their average was calculated for analysis. Valid CCT values were determined when the endothelial cells were plainly visible and the bright corneal reflections were centered on the monitor. All measurements were performed between 12 and 4 PM to eliminate diurnal variation.

The collected data was entered in Microsoft Excel. Coding of the variables was done. Analysis was done using SPSS software (Version 27, IBM). Descriptive statistics was used. Association between categorical tests. The outcomes of the treatment groups were compared using a test to reach the hypothesis, a P value less than 0.5 was considered significant.

Results:

This study included 200 eyes of 100 individuals with varying grades of myopia. 60% (n = 60) of the study participants were females. The mean age of the study participants was 27.68 ± 7.25 years (range: 12–40 years). The mean SE was − 2.61 ± 1.34 D (range: -0.5 to -6.0 D). The mean CCT was 541.53 ± 57.18 µm (range: 441–664 µm).

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Table 1: shows the Age distribution among the study participants

Age	Frequency	Percentage
11 – 20	24	24%
21 – 30	47	47%
31 - 40	29	29%
Total	100	100%

With a total sample size of 100. The age groups are categorized as follows: 11-20, 21-30, and 31-40. Among these groups, the largest proportion of individuals falls within the 21-30 age bracket, comprising 47% of the total sample. This suggests that a significant portion of the population surveyed falls within the young adult demographic. Following closely behind, 29% of the sample belongs to the 31-40 age range, indicating a sizable representation of individuals in their thirties. Notably, the 11-20 age group constitutes 24% of the sample, indicating a significant presence of teenagers and young adults.

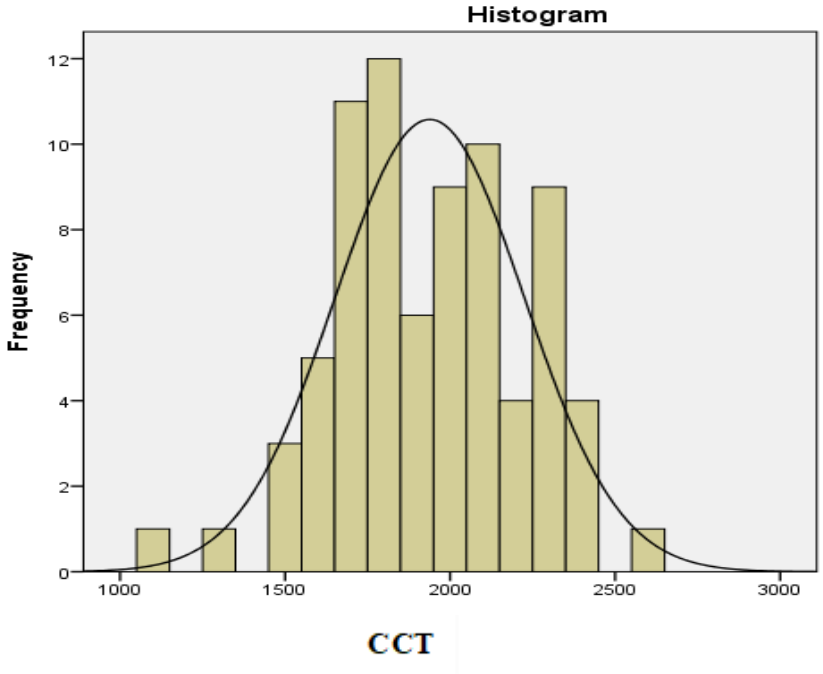
Table 2: shows the gender distribution among the study participants

Gender	Frequency	Percentage
Female	60	60%
Male	40	40%
Total	100	100%

With a total sample size of 100 individuals. It reveals that the majority, constituting 60%, identify as female, while the remaining 40% identify as male. This indicates a slight imbalance in gender representation, with females comprising a larger proportion of the sample compared to males.

The measurements were found to be nonnormally distributed.

Figure 1 shows the distribution of CCT readings among the study participants.



Journal of Chemical Health Risks
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Table 3: Association between the age of study participants and central corneal thickness

Age	Frequency	CCT (µm), mean±SD	P value
11 – 20	24 (24%)	538.35±48.10	**0.000***
21 – 30	47 (47%)	540.35±44.22	
31 - 40	29 (29%)	543.43±50.23	

Within these groups, the mean CCT measurements display a gradual increase with age. Specifically, individuals aged 31-40 exhibit the highest mean CCT of 543.43 micrometers (µm), followed closely by the 21-30 age group with a mean CCT of 540.35 µm, while those aged 11-20 have the lowest mean CCT of 538.35 µm. This trend suggests a potential correlation between age and CCT, with older individuals tending to have slightly thicker corneal compared to younger counterparts. This is statistically significant p value < 0.05.

Table 4: Association between the gender of study participants and central corneal thickness

Gender	Frequency	CCT (µm), mean±SD	P value
Female	24 (24%)	536.98±57.43	0.001*
Male	47 (47%)	539.53±46.21	

In terms of CCT measurements, males exhibit a slightly higher mean value of 539.53 micrometers (µm) with a standard deviation of 46.21, compared to females who have a mean CCT of 536.98 µm and a standard deviation of 57.43. This suggests a marginal difference in CCT between genders, with males showing a slightly thicker corneal on average compared to females.

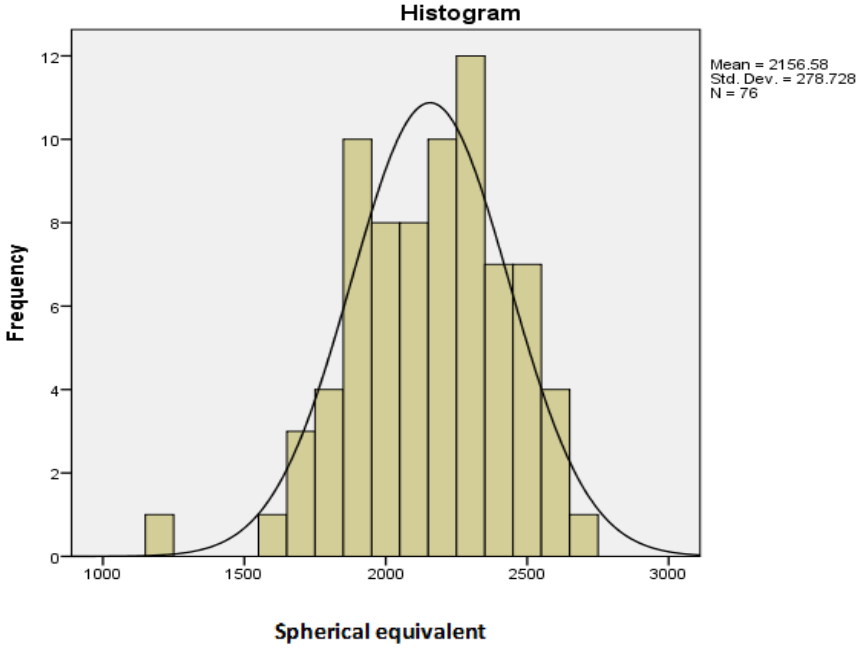

Table 5: The mean central corneal thickness values among spherical equivalent groups

Spherical equivalent	No.of.Eyes	CCT (µm), mean±SD	P value
Group 1	100(100%)	547.09±53.19	0.000*
Group 2	100(100%)	550.11±55.33	

the relationship between spherical equivalent (SE) and retinal central choroidal thickness (CCT) within two distinct groups, denoted as Group 1 and Group 2. Each group consists of 100 eyes, making up 100% of the

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JCHR (2024) 14(3), 911-916 | ISSN:2251-6727

sample for both. The mean CCT measurements for Group 1 and Group 2 are 547.09 micrometers (µm) with a standard deviation of 53.19 and 550.11 µm with a standard deviation of 55.33, respectively. This indicates that Group 2, characterized by a slightly higher mean CCT compared to Group 1, exhibits a marginally thicker corneal on average.

Discussion:

This study was a hospital-based, cross-sectional investigation that took place at a tertiary care facility in Kanchipuram from January 2023 to December 2023. Total Sample size of the study is 100 patients.

Studies conducted in India using ultrasound pachymetry (UP) have found that individuals from India have significantly thinner corneas than individuals from Africa (530 µm), Nepal (539 µm), Caucasians (540 µm), and China (542 µm) (Population-based studies from India using UP for CCT measurements have reported significantly thinner corneas among Indians compared to Africans (530 µm), Nepalese (539 µm), Caucasians (540 µm), and Chinese (542 µm). Nangia et al.[9] evaluated the distribution of CCT among adults aged 30+ from rural Central India using UP. Mean CCT among 9370 eyes studied was 514 ± 33 µm (range: 290–696 µm). CCT was associated significantly with younger age, male gender, and lower corneal refractive power($P < 0.001$). However, no statistically significant association was found between CCT and refractive error ($P = 0.54$). Vijaya et al.[9] evaluated 6754 adults aged 40+ from South India using UP and found the mean CCT to be 511.4 ± 33.5 µm.).

Our results contradict those of Muthukrishnan et al.,[11] who reported thicker corneas in high myopia. Similarly, when comparing the average central corneal thickness of myopes in this study to that of studies including Spanish Caucasian myopic people aged 20–40 (550.12 m), 3 Saudi Arabians (543.80 m), and a Caucasian population in the United States (550.40 m), our findings were consistent.12 It's possible that the older participants in this study led to a reduction in central corneal thickness compared to earlier experiments. Additionally, the previously noted lower corneal thickness in blacks compared to Caucasians might contribute to the observed difference. In a previous study, we assessed the corneal thickness of 209 healthy eyes' center and periphery, finding an average central thickness of 523 ± 39 microns (standard deviation). The average thickness of the cornea's periphery was 660 microns, with a standard deviation of 76 microns. There was no significant difference in thickness between male and female corneas, as well as between right and left eyes. Additionally, there was no correlation between central corneal thickness and refractive error, as indicated by our investigation's results. The average central corneal thickness in the control group was 522.30 microns, with a standard deviation of 29.563 microns, while in the myopic group, it was 515.18 microns with a standard deviation of 28.972 microns which contradicts previous studies that have shown a strong positive correlation between different degrees of myopia.

The study conducted by Kunert[12] and colleagues involved 615 myopic patients of Indian origin aged 18 or older. The researchers measured the central corneal thickness (CCT) using ultrasound and Orbscan scanningslit topography/pachymetry before undergoing laser in situ keratomileusis. The mean CCT reported was 519.92 ± 33.36 µm (ranging from 420 to 640 µm) using the ultrasound method and 518.23 ± 31.03 µm (ranging from 428 to 607 µm) using Orbscan. No significant differences were observed between the two methods of measurement. Additionally, the study found that individuals with myopia ranging from -0.5 to -4.9 D had lower CCT readings compared to those with myopia ranging from -5 to -9.9 D.

The research conducted by Chen et al[13]. involved 528 Taiwanese adults who were enrolled for myopic laser refractive surgery. The study analyzed the correlation between CCT measurements and the degree of myopia. The authors found no statistically significant association between CCT and refractive error ($P = 0.49$). Additionally, the researchers examined the relationship between CCT and myopia through intraindividual comparison in myopic anisometropia. The mean myopic anisometropia was 3.09 ± 1.06 D in their series, and the CCT in the more myopic eye was not significantly different from the other, less myopic eye. The authors concluded that the cornea does not thin in the same way as the sclera in myopic eyes.

Similarly, Fam et al.[14] evaluated 714 consecutive Chinese patients with a mean SE of -5.3 D (range: -17.5 to -0.625). No correlation was found between CCT and the degree of myopia ($r = -0.13$, $P = 0.719$). Ortiz et al.[15] investigated the relationship between CCT and midperipheral corneal thickness (PCT) in 175 myopic

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JCHR (2024) 14(3), 911-916 | ISSN:2251-6727

participants using Orbscan II. The participants were divided into three groups based on the degree of myopia (<0.5 D, 0.5–3.0 D, >3.0 D).

A recent study done by Pekel G et al[16] that examined the thickness of preocular tear film, corneal layers (including the epithelium, Bowman layer, stroma, and Descemet's membrane-endothelium complex in the central cornea), and anterior sclera using anterior segment spectral-domain optical coherence tomography recently discovered that there were no statistically significant disparities between emmetropia and individuals with moderate to high myopia. The results showed a P value greater than 0.05.

Conclusion:

We assessed CCT measurements through non-contact specular microscopy in young individuals with mild to moderate myopia. The average CCT values did not prove to be correlated with the myopic SE. Additional research with a larger sample size and various degrees of myopia would be necessary to gain a deeper understanding of the relationship between myopia and CCT.

Acknowledgment: We are thankful to the entire study participants for their participation and full cooperation. We acknowledge the Department of ophthalmology faculties for encouraging and supporting us.

Financial support and sponsorship: Nil

Conflicts of interest: Nil

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