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Original Article

Effect of Age Under 20-60 years on Central Corneal Thickness

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ABSTRACT

The measurement of central corneal thickness is an important measure for the diagnosis of corneal pathologies. 510–520 microns is the standard central corneal thickness. Optical or ultrasound techniques are used for the measurement of thickness CCT. **Objectives:** To evaluate the effect of age on central corneal thickness in normal population visiting The University of Lahore Teaching Hospital, Raiwind road Lahore. **Methods:** Descriptive study design was used. Data was obtained from The University of Lahore Teaching Hospital, Raiwind road Lahore. The sample size of patients was 147 with ages ranging from 20 to 60 years. All genders were included in the data collection. Data were collected through convenient sampling technique by using researcher administrative performa and study was finalized in three months after the approval of synopsis. Data entry and analysis were done using computer software SPSS version 25.0. CCT was measured by non-contact Pachymeter (Canon TX-20P) and values were represented in the form of frequency tables and bar charts. **Results:** CCT drops over time, resulting in thinner corneas in older people. The dependence of CCT on age is greater in men. Mean CCT in male individuals were 538.66 µm and in females mean CCT was 540.37µm. In this study mean central corneal thickness values of right and left eyes were also compared. In males right mean CCT value was 537.94 µm and left mean CCT was 539.39µm. In females the mean CCT value of right was540.28µm and left mean CCT value was 540.47µm. **Conclusions:** The Central Corneal Thickness decreases with age. Men have thinner corneas than females in every age group.

INTRODUCTION

Front part of the eye is covered by a dome shaped transparent membrane known as cornea [1]. It allows the light to pass through the eye and is present in front of the iris and pupil [2]. Average diameter of the cornea horizontally and vertically is 11.7mm and 10.6mm respectively [3]. The cornea is made up of protein and cells. It is an avascular structure and is dissimilar from most of the tissues containing blood vessels in the human body. Due to blood vessels cornea may get cloudy, which may adversely affect vision and prevent it from refracting light rays properly. Nutrients are supplied to the cornea from tear and the aqueous humor, a watery fluid in the anterior chamber due to absence of blood vessels. It contributes around 2/3 66% of refraction process in eye. Its condition is probably identified with the nature of visual perception [4]. The outer layer of the eyeball is formed by the cornea along with sclera, white part of eye. Corneal refractive power in humans is approximately 43 diopters, 74% of total power of the normal eye of humans 58.60 D. Corneal refractive index is 1.376 [5]. LASIK is a surgical procedure used to reshape the surface of cornea [6]. The cornea is consisted on 5 layers: first Epithelium, second Bowman's membrane, third stroma, fourth Descemet's membrane and fifth endothelium [7]. The outermost layer, epithelium, is the arrangement of cells that covers the cornea. Nutrients and oxygen is absorbed from the tears by epithelial membrane

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and supply it to the rest of corneal layers. Corneal epithelium is highly sensitive structure because it contains free nerve endings. This also prevents foreign bodies to enter the cornea [8]. Irregular shape or corneal edema disrupts the smoothness of epithelium, and most often causes a sensation of something being on the eye and is accompanied by intense pain, tearing and light sensitivity. The corneal epithelium tends to repair itself in most situations [9]. New layer of the cornea is Dua's layer. Before Descemet's membrane and after stroma it is tough, acellular, and well established. Identification of this layer give great knowledge about corneal surgery of posterior part, biomechanics of cornea, and pathologies of posterior cornea such as Descematocele, pre-Descemet's membrane degenerative disorders and acute hydrops. It is pre-supposed 0.59 miles 15 micrometers thick, the 4th caudal layer, and situated between the Descemet's membrane and stroma of cornea [10]. Descemet's membrane is remarkably tough basement layer, which is special in the body with respect to both of its proportion and formation. It is formed by the cells of leveled squamous epithelium that lines the cornea's posterior surface cornea and is appointed as endothelium of cornea. Thickness is 5–10 microns, the layer of Descemet, like other underground layers, comprised of two different layers, a posterior layer close to the endothelium which is generated by the endothelial cells, collagen lamellae and proteoglycans made up the anterior membrane of cornea [11, 12]. Central corneal thickness CCT plays a significant role for the status of the health of cornea and is an important factor in assessing and managing the corneal diseases. It also helps to evaluate the corneal obstruction and functioning of endothelial pump [13]. Central corneal thickness of the normal eye is about 540 µm and usually consists of stroma has central thickness of 450 µm. Corneal physiological and pathological changes associated with the ocular diseases can be assessed by the measurements of central corneal thickness. In previous studies, different methods to measure the values of central corneal thickness have been used, included Optical Pachymetry, Optical Coherence Topography OCT, Orbscan, Ultrasound Pachymetry, Ultrasound Biomicrocscopy and Laser Interferometry [14]. Corneal Pachymetry is used to measure the central thickness of cornea and can be done by contact methods such as ultrasound and microscopy and non-contact methods [15]. It can be used to detect corneal endothelial cells and corneal hydration act in a dual role as a barrier to aqueous humor and act as a metabolic pump. During normal functioning, to maintain the amount of water content of corneal stroma at 78%, as the central corneal thickness is 540 micrometers that is considered normal, so the endothelial pump balances the leakage rate. Corneal Pachymetry is necessary for other surgeries of cornea such as Limbal Relaxing Incisions LRI that places a pair of incisions of a particular depth and arc length at a steep axis of corneal astigmatism, to decrease the astigmatism of corneal. The surgeon will overcome the risks of eye perforation and improve outcomes of surgery by the use of corneal Pachymeter procedure. Advanced creations of Pachymeter will give more advantage to the surgeons by arranging graphical plans of surgery to remove astigmatism [16].

METHODS

It was a descriptive cross sectional study. Data were collected from patients visiting The University of Lahore Teaching Hospital for visual assessment. Study was completed in 4 months from February 2021 to May 2021. Using convenient sampling technique sample of 147 patients having central corneal thickness measurement was selected. The study included patients of age group from 20 to 60 years presented for routine eye examination. The patients were divided into four age groups (with 10 years interval): 20-29, 30-39, 40- 49 and 50-60. After getting well-informed written consent, complete eye evaluation was done. Patients eyes were screened by slit lamp examination to exclude anterior segment pathologies, pathologies of cornea such as edema, scarring or corneal dystrophy, corneal ectasia (such as Keratoconus), and different infections, patients presented with history of refractive surgery, history of ocular trauma, glaucomatous eyes, Patients with systemic disease (such as diabetes or rheumatoid arthritis) and patients below 20 years of age were also excluded from research. Inclusion criteria were as follows, at least 20 years of age up to 60 years and all genders were included. All patients experienced Non-contact Pachymeter (Canon TX-20P Fully Automatic, Non-Contact Tonometer with Pachymeter) for measuring the value of central corneal thickness. During this inspection every patient followed the same protocol. They positioned their chin on the chin rest and, simultaneously, their forehead was rested against the provided forehead strap. The patient was requested to look straight in the machine, while the examiner adjusted the focus and alignment of the machine. The machine marked the pupil at three points: the pupil edge, center, and corneal apex and the value of CCT were noted. All data was entering in SPSS version 24.0. All descriptive statistics was calculated through this software which was represented in the form of mean ± S.D.

RESULTS

Out of 147 patients 62 (42.17%) were males and 85 (57.82%) was females (Table 1).

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Gender	Frequency	Percent
Male	62	42.2
Female	85	57.8
Total	147	100.0

Table 1: Gender wise frequency distribution of male and female

Central corneal thickness decreases with the progression of age in male on both eye sides. Mean ± SD at age 20-29 years on right side was 544.10 ± 38.56 and Mean ± SD at age 20-29 years on left side was 545.90 ± 38.03, Mean ± SD at age 30-39 years on right side was 540.43 ± 22.45 and Mean ± SD at age 30-39 years on left side was 540.29 ± 23.44, Mean ± SD at age 40-49 years on right side was 538.90 ± 21.53 and Mean ± SD at age 40-49 years on left side was 537.10 ± 20.40, Mean ± SD at age 50-60 years on right side was 528.33 ± 30.58 and Mean ± SD at age 50-60 years on left side was 534.28 ± 28.60 (Table 2).

Age (years)	N	Male (Right Eye)		
		Mean ± SD	Minimum	Maximum
20-29	20	544.10 ± 38.56	480	612
30-39	14	540.43 ± 22.45	506	580
40-49	10	538.90 ± 21.53	500	570
50-60	18	528.33 ± 30.58	460	580
Male (Left Eye)				
Mean ± SD		Minimum		Maximum
545.90 ± 38.03		490		610
540.29 ± 23.44		505		580
537.10 ± 20.40		514		574
534.28 ± 28.60		470		590

Table 2: Mean CCT (µm) value of males in each age group

Central corneal thickness decreases with the progression of age in female on both eye sides. Mean ± SD at age 20-29 years on right side was 547.37 ± 34.60 and Mean ± SD at age 20-29 years on left side was 548.15 ± 32.63, Mean ± SD at age 30-39 years on right side was 541.67 ± 28.76 and Mean ± SD at age 30-39 years on left side was 542.00 ± 29.92, Mean ± SD at age 40-49 years on right side was 540.93 ± 18.59 and Mean ± SD at age 40-49 years on left side was 541.07 ± 17.54, Mean ± SD at age 50-60 years on right side was 531.16 ± 29.45 and Mean ± SD at age 50-60 years on left side was 530.68 ± 28.66 (Table 3).

Age (years)	N	Female (Right Eye)		
		Mean ± SD	Minimum	Maximum
20-29	27	547.37 ± 34.60	485	625
30-39	24	541.67 ± 28.76	495	600
40-49	15	540.93 ± 18.59	510	570
50-60	19	531.16 ± 29.45	465	590
Female (Left Eye)				
Mean ± SD		Minimum		Maximum
548.15 ± 32.63		490		620
542.00 ± 29.92		490		600
541.07 ± 17.54		500		565
530.68 ± 28.66		450		580

Table 3: Mean CCT (µm) value of females in each age group

DISCUSSION

A study was performed to calculate the mean central corneal thickness (CCT) in the healthy population of Iraq. Kadhim YJ, Farhood QK, and his colleagues performed a cross-sectional study at a Teaching Eye Hospital known as Ibn Al-Haitham. Two hundred and nine healthy individuals with the age ranges from 20 to 75 years were examined and their CCT values were correlated with gender, age, refraction, and corneal curvature. The CCT was measured using an ultrasound Pachymeter. To evaluate the average corneal curvature, an auto-refracto-keratometry was used to test the average corneal curvature. Central corneal thickness with a range of 422 µm to 636 µm, the average central corneal thickness was 543.95 ± 32.58 µm. Gender had no impact on CCT [15, 16]. CCT was found to have a negative relationship with age. The spherical equivalent was significantly associated with CCT. CCT decreased dramatically with age in the Iraqi population. The corneas of myopic people were noticeably thinner. CCT and corneal curvature had a small but important negative correlation. For the diagnosis of many ocular diseases central corneal thickness played a very significant role [17]. In the present research all the patients were examined on non-contact Pachymeter (Canon TX-20P) for measuring the CCT. The main purpose of this study was to find the effect of age on central corneal thickness in patients between 20-60 years. Its dependence on age was greater in men. Mean CCT was 539.51 ± 27.72 µm [18]. At the Hashmanis Hospital in Karachi, Pakistan, a study was performed on five thousand one hundred and seventy one normal eyes of two thousands five hundred and ninety eight patients. Patients with age between 6 to 70 years were included in the study. An auto-refractometer was used to determine refractive error, and Oculus Pentacam was used to determine CCT. The central corneal thickness readings in males were thinner as compared to females. The interquartile range (IQR) was 44.0 µm, while the mean CCT value was 541.0 µm, and age had a poor negative association with CCT. Three variables had a major impact on CCT in the Pakistani population: gender, age, and cylinder. There was no correlation between CCT of the left or right eye [19]. Similarly, in the present study males had thinner CCT values than females. In the present research mean CCT in male individuals were 538.665µm and in females mean CCT was 540.37µm. In the study the central corneal thickness (CCT) values of both eyes were also compared [20]. From January 1, 2014, to July 1, 2015, a cross-sectional research was performed on 166 patients between the ages of 30 and 70 who had come in for a regular eye exam. An interview schedule was used to record patient parameters, as well as a full ocular examination, which included visual acuity and IOPs. Pac Scan plus A- Scan/Pachymeter was used to

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determine CCT. Vivek Oommen Varghese investigated the relationship between CCT and metabolic factors like gender, age, race, smoking, obesity, metabolic syndrome, hypertension, diabetes mellitus, corneal curvature and axial length at the Ophthalmology Department, Medical Sciences Academy, Pariyaram Kannur, and Kerala, India. In the study 28.3% were females, while 71.7% of the one hundred and sixty six participants were males. The average age of the participants was 47.8 years. Central corneal thickness was found to be reduced with age. There was a strong negative correlation found between central corneal thickness and age [21]. In Contrast to this, in the present study there was a slight statistical variation in the mean central corneal thickness measurements of men and women. Similarly, mentioned in the above study that CCT was drops over time, resulting in thinner corneas in older people. In the present research similar results were found in which CCT drops with the passage of time [22, 23]. In another research which was conducted in 2016, they predominantly evaluate the black population, and explained the results of central corneal thickness and its relationship with intraocular pressure (IOP). There were 1142 participants with pachymetry measurements, in which 58 % were females, while the mean age was 64.3 years. The mean central corneal thickness was 529.8 µm in black participants, 545.2 µm in white participants and 537.8 µm in mixed participants (black and white). The corneas of black participants were thinner. CCT values that increased with age were significantly linked to younger age among black participants. In the above results CCT values increased with age in younger patients that were positively correlated with the present research and the CCT values decreased with increasing age were also positively correlated with present study [24, 25].

CONCLUSION

In the present research central corneal thickness (CCT) was affected by age. As the age increases the central corneal thickness values decreases and it was more noticeable among the age group of 50-60 years in both males and females. It was due to degenerative changes with the increasing age, in the corneal layers specifically epithelium and endothelium. So, it showed that older people had thinner corneas as compared to younger people. Mean CCT in male individuals were 538.66 µm and in females mean CCT was 540.37 µm. Males had comparatively less central corneal thickness (CCT) values than females also the mean central corneal thickness values of right and left eyes of males and females were different.

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