

ESTIMATION OF MEAN CENTRAL CORNEAL THICKNESS USING SIRIUS SCHEIMPFLUG–PLACIDO TOPOGRAPHER IN BASRAH

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Abstract

This study aimed to assess the mean of central corneal thickness (CCT) in a sample of normal Iraqi population (Basrah and its surrounds as a sample).

Pachymetry was done by Sirius Scheimpflug–Placido Topographer for 1774 eyes of 887 healthy participants 10–68 years old. The parameters studied included central corneal thickness and the results were compared with other studies.

This study included 414 healthy male and 473 healthy females and it revealed mean CCT equals to $531.49 \pm 34.92 \mu\text{m}$ with range from 426.5–632. The mean CCT in those who are 10-19 years old ($543.7 \pm 32.3 \mu\text{m}$) was significantly higher than the other age groups (p value < 0.01) there was a significant difference between right and left eyes of the studied participants. There were no correlations of age and sex with CCT (p value > 0.1).

In conclusion, normative data regarding central corneal thickness were reported in Iraqi population. Means of central corneal thickness was generally lower than those reported in Turkey and Iran.

Introduction

Establishment of normal range of Central Corneal Thickness (CCT) is very important as it is considered an integral part of a thorough ophthalmic examination and provides specialists with an essential biometric parameter in various fields of ophthalmology and optometry¹.

Pachymetry, or the measurement of the corneal thickness, to plan for refractive procedure, is useful for deciding whether a patient should be considered before surgery and which technique would be most adequate^{2,3}. particularly when performing laser in situ keratomileusis because the amount of correction is limited by the corneal thickness⁴

In refractive surgery, the inaccurate way of measurements can cause additional tissue removal in the stromal bed that could cause iatrogenic ectasia^{5,6}.

In corneal pathology, corneal thickness

have a role in many conditions such as contact lenses related complications⁷, dry eye⁸, and diabetes mellitus⁹, also the CCT value is necessary for diagnosing and following up corneal ectasia such as Pellucid marginal degeneration or keratoglobus² and is a crucial parameter in the risk assessment for glaucoma progression in patients with ocular hypertension and glaucoma¹⁰.

Central Corneal thickness is used to correct intraocular pressure (IOP) values, thin cornea leads to underestimation while a thick cornea results in overestimation of the actual IOP^{1,11}. It showed that approximately 10% change in CCT can lead to approximately 3.4 mm Hg change in IOP¹².

Moreover, there is evidence suggesting that CCT is an independent risk for the development and progression of glaucoma¹³.

Several studies showed that normal range of CCT is affected by several factors including race and ethnicity^{11, 14-16}, there was no previous study to estimate the normal range of CCT in healthy Iraqi population, that why this study was designed as a trial to establish normal values in this field although the sample is geographically more reflective for Basra and surrounding population than other Iraqi areas. In the past there is deferent methods used to measure CCT. These Include: Optical Pachymetry, Ultrasound Pachymetry, Orbscan, Optical Coherence Tomography, Laser Interferometry, and Ultrasound Biomicroscopy.

Sirius (Costruzione Strumenti Oftalmici Inc. Firenze, Italy) utilizes the combination of a single rotating Scheimpflug camera (pentacam) and a Placido-disk corneal topographer and it approve high degree of precision and accuracy without the drawbacks of invasiveness^{17,18}. Also the precision of the rotating Scheimpflug camera and Placido-disk analyzer system was determined based on the definitions adopted by the British Standards Institution, as recommended by Bland and Altman¹⁹.

Patient and methods

This is an outpatient based cross sectional combined prospective and retrospective study performed in Al-Basrah outpatient clinic (prospective part started during the period from March 2014 until January 2015).

The overall study was conducted on 887 healthy individuals (1774 eyes) with an age of 10 to 68 years. The participants were chosen from clinic attendant's whether patients or relatives for patients. All the studied individuals were informed verbally about the aim of the study and the way of examination prior to being enrolled with their verbal consent insured.

Inclusion criteria: All participants have clear cornea, clear lens, normal IOP and no suggestive history of ocular trauma or surgery or glaucoma or ocular

medications no history of contact lens wear.

Exclusion criteria: Patients who have abnormal ocular surface examination and or corneal ectasia, individuals with IOP more than 21 mm Hg or less than 11 mmHg, individuals with previous ocular surgery and or refractive surgery, patients with systemic diseases, individual whose one of his/her eyes did not fulfilled the inclusion criteria, and individuals who wear contact lens.

Data collection: The identifying data were the age and gender while the examination data were visual acuity and refraction (automated refractometer) and intraocular pressure (air puff).

Central corneal thickness was measured in both eyes by Scheimpflug-Placido topographers which is a topography device that combining monochromatic Scheimpflug camera with Placido disc to perform analysis for anterior segment by getting 25 radial section for cornea and anterior chamber. The Pachymetry map was produced using method of point-by-point for anterior and posterior corneal surface. Three consecutive readings was taken for each participant and the mean value was depend on the measures. The Sirius system measure formed when the tool come to focus, and the patient's eye become parallel along the visual axis by centrally located fixation light. Then the participant informed to sit back after each individual reading, and the tool was realigned before the next measurement. The participants are instructed to blink before each measurement. A three measurements for each one is done and the mean value was calculated for each. All measurements were done at the same time of the day, between 10:00 am and 2:00 pm, at least 3 h after awakening with a 5 min interval between each test.

Patients were divided into five age groups to explore the effect of age in different age groups. The results were expressed in form of mean± standard deviation. The difference between the

means of any parameter in study in different groups was assessed by the use of independent sample *t test*; (Paired *t test* was done for paired data). Pearson coefficient was used to estimate correlations. Statistical analysis were performed by SPSS Windows software (version 20.0, SPSS, Inc.) $P < 0.05$ was considered the lowest limit of significance.

Results

This study involved a total of 887 patients (Total of 1774 eyes) with ages ranged from 10–68 years with mean of 30.3 ± 10.9 years. The gender and age group distribution is exposed in Table I which shows that most patient are 20 to 40 years old (65.5%) with slight female predominance.

Table 1: Age and Sex Distribution

Age group (years)	Frequency	percent
10-19	120	13.5%
20-29	357	40.2%
30-39	224	25.3%
40-49	126	14.2%
50 and above	60	6.8%
Total	887	100%
Gender	Frequency	percent
Male	414	46.7%
Female	473	53.3%
Total	887	100%

Estimation of central corneal thickness revealed mean CCT equals to $531.49 \pm 34.92 \mu\text{m}$ with range from 426.5–632 μm . The mean corneal thickness in each age group are shown in Table II it

reveals that the youngest age group (10-19) has a significantly higher CCT in comparison to other age groups ($p \text{ value} < 0.01$) with slight difference among the remaining age groups in CCT.

Table II: Mean Central Corneal Thickness in Different Age Groups

	Age group (years)	Number of eyes	CCT (μm) Mean \pm SD	95% confidence interval	P Value*
1	10-19	240	543 ± 32.3	539.5-547.8	1
2	20-29	714	528 ± 36	525.5-530.9	<0.01
3	30-39	448	527.5 ± 32.6	524.4-530.6	<0.01
4	40-49	252	535.4 ± 33.3	531.2-539.6	<0.01
5	50 and above	120	533.3 ± 39	526-540.4	<0.01
	total	1774	531.5 ± 34.9	529-533.2	

* In comparison with 1st age group

There were no significant correlation of age and sex with CCT (P value 0.568). There was no significant difference between mean CCT between males and females ($530.1 \pm 36.4 \mu\text{m}$ vs 532.7 ± 33.6

μm ; $p \text{ value} = 0.11$); but paired sample *t test* showed a significant difference between both eyes in CCT ($p \text{ value} < 0.001$).

Discussion

Establishment of normal national range of different ophthalmological parameters is very important due to effect of race and environment on these parameters. Since there was no previous study to estimate mean CCT in healthy Basra population; such study is needed to allow us take scientifically-based decision in our daily clinical practice.

This study revealed mean CCT equals to $531.49 \pm 34.92 \mu\text{m}$ with range from 426.5–632 μm in healthy Basrah population.

The obtained CCT values, in comparison to the population of our environment, is consistent with that of Doughty et al¹², who carried out a meta-analysis for obtaining the mean CCT on the basis of publications between 1968 and 1999, obtaining a mean CCT value in Caucasian population of 535 μm , than that of the study of the Turkish population (531 vs 552 μm)²⁰ but slightly lower and also lower than those of a study in Tehran (555.6)²¹. All the previous studies used ultrasonic Pachymetry. Sedaghat et al²², by using Rotating Scheimpflug Camera, obtained a mean CCT of 537.1 μm which is much similar to our results, while Hashimi et al²³ found the mean CCT of men above 40 equals to 529.5 μm which is lower than our results (534.7 μm) One theory to explain this is that Iranian population tends to have higher CCT in young age groups but with prominent inverse relationship with age as some studies has suggested^{21,23}.

Comparing the mean CCT with other races throughout the world, we found that it is higher than the values obtained in

Australian aborigine population (514 μm)²⁴, and one population of northern Africa (531 vs 519 μm)²⁵.

This study shows no statistically significant correlation between CCT and age, in contrast with the findings of other studies^{20,26,27}, and clinically the low level of difference in corneal thickness, do not have much importance.

The Association between CCT and sex has been analyzed in several studies in most of which, as in ours, statistically significant differences were not found^{25,27,28}. In contrast, some studies discovered a statistical association between both factors^{20,26,29}.

Some of the strengths of our study is the large sample size (1774 eyes) in a homogeneously distributed population with wide age range (10-68 years) without extreme refractive defects and normal ophthalmic exploration. In addition, it is the first study to obtain normative data of CCT in Iraq.

Even though this study was not based on population but on patients or patient relatives of attending Al-Basra general hospital; but this has a minor effect since a large panel of exclusion criteria have been applied and participants were from different residence inside and outside Basrah.

In conclusion, the normal CCT value in the Iraqi population was $531.49 \pm 34.92 \mu\text{m}$ with normal range from (461.69-601.29 μm) with a significant_high CCT in youngest age group, but age appeared not to be correlated with CCT in this study.

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