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# Correlation between Central Corneal Thickness, Keratometric Readings, Axial Length and Anterior Chamber Depth in Normal Egyptian Eyes

**Research Article**

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## Abstract

**Purpose:** To determine the correlation between the central corneal thickness (CCT), keratometric readings (K1 & K2), anterior chamber depth and the axial length in normal Egyptian eyes.

**Design:** Prospective observational cross-sectional study.

**Methods:** Five hundred and fifty eyes of 275 Egyptian patients aged between 20 & 70 years were recruited in this study. The central corneal thickness, keratometric readings and anterior chamber depth were measured using corneal tomography (Pentacam). The axial length was measured by partial coherence interferometry (IOL Master). Data was collected and analyzed using linear regression analysis & Pearson correlation coefficient.

Results: Mean keratometric readings were (K1) 44.1 ± 1.74D and (K2) 30.9±1.72 D, mean anterior chamber depth was 3.4831± 0.5 µm, mean central corneal thickness was 552.4± 46.28 µm and the mean axial length (AL) was 24.09 ±2.25 mm. There was no significant correlation between central corneal thickness and axial length, but a statistically significant correlation between axial length and anterior chamber depth, and inverse correlation between central corneal thickness and Keratometric reading (k2) were found.

**Conclusion:** There is no significant relationship between CCT & AL, but a significant one between CCT & ACD, and AL & ACD. Also, there is an inversely significant relationship between AL & K1 reading, and CCT & K2 reading in a sample of normal Egyptian eyes.

**Keywords:** Central corneal thickness, anterior chamber depth, axial length, Keratometric reading.

## Introduction

Corneal thickness is of great importance when measuring the intraocular pressure, or if a corneal refractive procedure is to be planned.The correlation between central corneal thickness (CCT) and intraocular pressure (IOP) has been previously demonstrated [1,2] and a continuous interest in studying correlation between central corneal thickness and other ocular parameters in different populations is ongoing since ocular biometric parameters are known to vary with ethnicity [3-10].

The Pentacam (OCULUS, Wetzlar, Germany) is a noncontact rotating Scheimpflug imaging technology used to measure the anterior and posterior corneal surfaces, as well as other anterior segment parameters with excellent repeatability [11].

Also, the IOL Master (Carl Zeiss Meditec, Germany), is a partial coherence interferometer used for anterior segment measurements. It has the benefits of non- contact procedures along with greater accuracy in measuring axial length (AL) and

other parameters such as keratometric readings (K1 & K2), central corneal thickness and anterior chamber depth (ACD). The validity and repeatability of these measurements have been widely accepted [12,13].

The aim of this study was to investigate the variation of central corneal thickness with Keratometric readings (K1 and K2), anterior chamber depth and the axial length in a sample of normal Egyptian eyes.

## Patients and methods

This observational prospective cross-sectional study was conducted at Kasr El Aini Hospital, Ophthalmology department, Cairo University, from the period of January 2017 to March 2018. It included 550 eyes of 275 normal Egyptianpatients

(175 males, 100 females) aged between 20 and 70 years. The study was approved by the ethical committee of Kasr El Aini Hospital and adhered to the tents of the declaration of Helsinki. An informed written consent was obtained from all participants. Exclusion criteria included previous ocular trauma or surgery, glaucomatous eyes, dry eyes, corneal dystrophies, ocular pathologies affecting corneal curvature such as keratoconus or pellucid marginal degeneration.

A complete history was taken from all subjects, regarding their medical and surgical history. All patients were subjected to complete ophthalmological examination in the form of autorefraction assessment, anterior segment Slitlamp examination, IOP measurement by goldmann applanation tonometry and fundus examination using +20 D lens (indirect ophthalmoscopy) and +90 D lens (Slitlamp biomicroscopy) after pupillary dilatation with tropicamide 1% eye drops. In all

subjects, corneal topography by Pentacam (OCULUS, Wetzlar, Germany) was done for assessment of central corneal thickness, keratometric readings and anterior chamber depth. Optical biometry (IOL Master) was done for assessment of axial length.

Data was collected and analyzed using the statistical package SPSS (Statistical Package for the Social Science; SPSS Inc., Chicago, IL, USA) version 23. Data was summarized using mean & standard deviation in quantitative data and using frequency (count) and relative frequency (percentage) for categorical data. The relationship between variables was assessed using Pearson Correlation. $r > \pm 0.65$ and $p < 0.05$ indicates a high-level correlation; $\pm 0.2 \le r \le \pm 0.65$ and $p < 0.05$ indicates a

moderate-level correlation; and $< \pm 0.2$ and $p < 0.05$ indicates a low-level correlation [14].

All tests were two tailed and considered significant at $p < 0.05$ and highly significant at $p < 0.001$.

## Results

The patients' ages ranged from 20 to 70 years old with a mean value of 50.25 ± 9.317 years old. The study included 550 eyes of 275 normal Egyptian patients (175 males, 100 females). The mean keratometric reading (K1) was 44.1 ± 1.74 D and (K2)

45.309±1.72 D and the mean anterior chamber depth was 3.4831± 0.5 mm. The mean central corneal thickness was 552.41± 46.289 µm, the mean axial length was 24.093

**Table 1:** showing K1, K2, ACD, CCT, AXL in all Patients

| | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|
| **Age** (years) | 30 | 70 | 50.25 | 9.371 |
| **CCT** (µm) | 460 | 610 | 552.41 | 46.289 |
| **AL** (mm) | 21.23 | 33.25 | 24.0973 | 2.25224 |
| **K1-readings** (Diopters) | 40.10 | 48.49 | 44.0904 | 1.74089 |
| **K2-readings** (Diopters) | 40.98 | 50.80 | 45.3094 | 1.72056 |
| **ACD** (mm) | 2.42 | 5.41 | 3.4831 | 0.50986 |

(K: Keratometric values, CCT: central corneal thickness, ACD: anterior chamber depth, AL: axial length, µm: microns, mm: millimeters)

±2.2522 mm (Table 1). The mean IOP was 16.260 ±3.8579 mmHg using Goldmann applanation tonometer.

The regression analysis performed on different ocular parameters showed that there was no statistically significant correlation between CCT and axial length (r=0.106,p value=0.186) (Figure 1). The regression analysis performed on AL and ($K_1$) showed

inverse association that is statistically significant (r= -0.181, p = 0.023) (Figure 2). There was a positive correlation that is statistically significant between AL and ACD (r=0.297, p <0.05) (Figure 3), as well as between CCT and ACD where (r=0.199, p<0.05) (figure 4). An inverse correlation between central corneal thickness (CCT) and keratometric reading ($K_2$) (Figure 5) that is statistically significant (r=-0.199, p= 0.013) was detected.

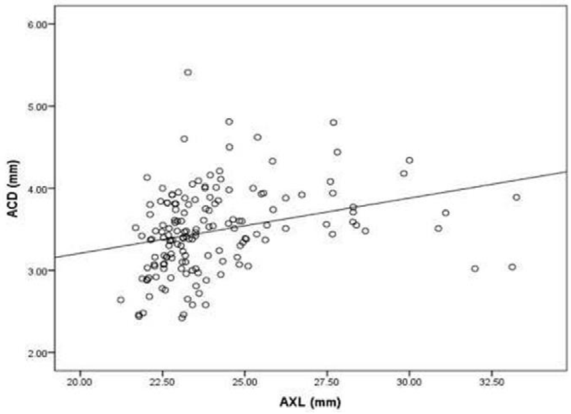


**Figure 3:** Correlation between axial length AL and anterior chamber depth ACD.

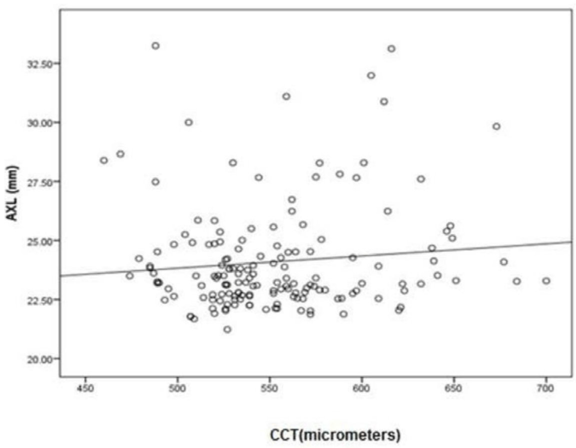


**Figure 1:** Correlation between central corneal thickness CCT and axial length AL

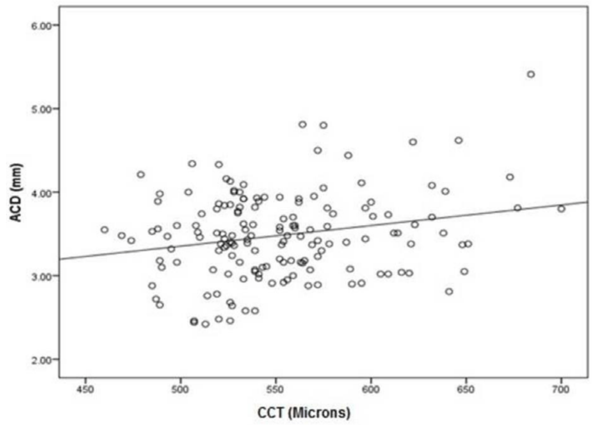


**Figure 4:** Correlation between central corneal thickness CCT and anterior chamber depth ACD.

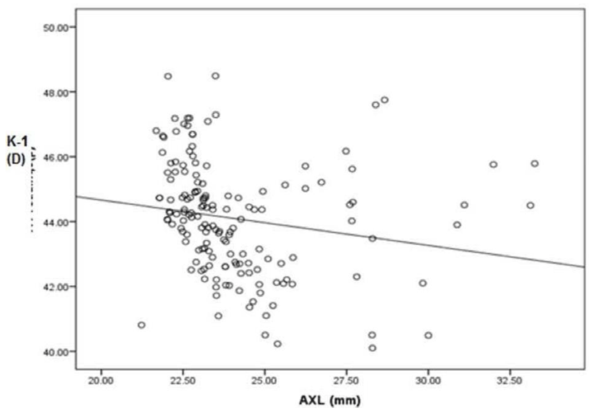


**Figure 2:** Correlation between axial length AL and $K_1$-readings.

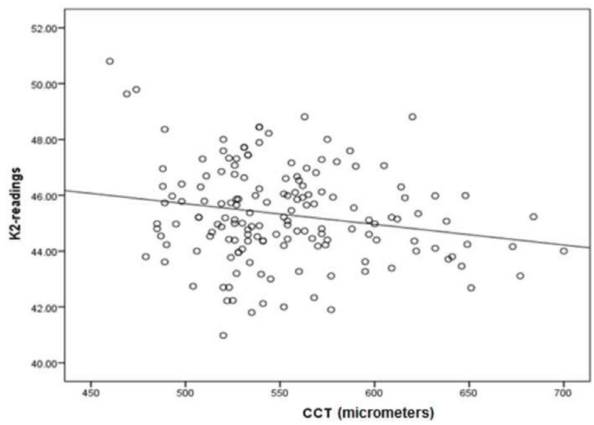


**Figure 5:** Correlation between central corneal thickness CCT and $K_2$ readings.

## Discussion

According to the recent studies, different races have different ocular parameters profiles among both children and adults.[4,5,6,15].

This study demonstrated the corneal profile among a sample of the Egyptian population and its relationship to other corneal parameters.

In this study, we found no statistical significant correlation between the central corneal thickness (CCT) and axial length ($p < 0.05$), which agrees with the results of Mei-Jun Chen et al, in which 500 Taiwanese Chinese patients with a wide range of ametropia were included. Their study correlated between refractive error, central corneal thickness, corneal curvature, anterior chamber depth and axial length. CCT was obtained using a DGH-550 ultrasonic pachymeter. Keratometry was determined using an auto kerato refractometer, anterior chamber depth and axial length were measured using A-Scan ultrasonography. The central corneal thickness was not associated with refractive error, axial length, anterior chamber depth and corneal curvature indicating that central corneal thickness is an independent factor unrelated to other ocular parameters [16].

Our results also agree with a study done by Shimmyo et al, which correlated between the central corneal thickness and the axial length in a retrospective study that included 1084 eyes, where the central corneal thickness was measured by DGH 550 ultrasonic pachymeter and axial length was measured by Carl Zeiss IOL Master. It showed that central corneal thickness and axial length are independent occurrences. Thin corneas are not associated with longer eyes [17].

Another study was done by Oliveira and colleagues included 140 eyes of 140 patients with no history of previous intraocular surgery, where axial length and central corneal thickness were measured ultrasonically. It showed that central corneal thickness does not correlate with axial length [18].

Iyamu et al studied the correlation between central corneal thickness and axial length in adult Nigerian population where a total of 95 subjects were included where axial length was measured by A-Scan ultrasonography using I-2100 A-Scan biometer and central corneal thickness was measured by ultrasound pachymeter using SW-1000

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