Central corneal thickness in a healthy Tunisian population

Epaisseur cornéenne centrale dans une population Tunisienne saine

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RÉSUMÉ
Introduction: L'épaisseur cornéenne centrale (ECC) est un paramètre important dans le glaucome, la chirurgie réfractive et les maladies cornéennes. Malgré son importance, l'ECC a été peu étudiée en Afrique du nord en particulier en Tunisie.
Objectif : Mesurer l'ECC dans une population Tunisienne saine et étudier la corrélation entre cette épaisseur et l'âge, le sexe, la longueur axiale et l'erreur réfractive
Méthodes: Nous avons mené une étude observationnelle portant sur 608 yeux de patients Tunisiens sains sans atteinte oculaire. Tous les patients ont bénéficié d'un examen ophtalmologique complet et d'une mesure de l'ECC (Oculus Pentacam, USA). Nous avons étudié la corrélation entre ECC et l'âge, le sexe, la longueur axiale et l'erreur réfractive.
Résultats: L'épaisseur cornéenne centrale était de 522±37.17 µm (allant de 461 à 655µm). Nous n'avons pas noté de corrélation statistiquement significative entre l'ECC et l'âge, le sexe, la longueur axiale et l'erreur réfractive.
Conclusions: La valeur normale dans la population Tunisienne était de 522±37.17 µm. C'est la première étude de l'épaisseur cornéenne centrale dans une population Tunisienne saine.
Mots clés : Epaisseur cornéenne centrale, population Tunisienne, Pachymétrie

SUMMARY
Aim: To study the central corneal thickness of a Tunisian population and determine the influence of age, gender, axial length and refractive error on central corneal thickness (CCT) values.
Methods: An observational, cross-sectional study was conducted on 608 eyes of consecutive Tunisian patients without ophthalmic disease. Corneal tomography (Oculus Pentacam, USA) and a complete eye examination were performed on all patients. The relationship between the central corneal thickness values and variables of age, refractive error, axial length and gender was assessed.
Results: The mean central corneal thickness was 522±37.17µm (range 461 to 655 µm). No statistical association was found between central corneal thickness values and variables of age, refractive error, axial length and gender.
Conclusions: The normal CCT value in the Tunisian population was of 522±37.17 µm. We have analyzed, for the first time, normal central corneal thickness values of a healthy Tunisian population.
Keywords: Central corneal thickness; Tunisian population; Pachymetry.

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INTRODUCTION

The central corneal thickness (CCT) is a highly interesting parameter in glaucoma, refractive surgery and corneal diseases. Glaucoma is the second most common cause of blindness and the leading cause of irreversible blindness [1]. Early diagnosis and initiation of treatment are important factors in minimizing the progression of disease and reducing its burden. Several studies have shown that intraocular pressure (IOP) alone is not an accurate test for detecting glaucoma [2]. CCT has been identified as an important factor to consider when measuring IOP [2]. CCT has been shown to be associated with an over or underestimation of the IOP if the cornea is thick or thin, respectively [3]. Despite its importance, CCT evaluation has received little attention in most North Africa countries, including Tunisia. Considering the above, to decide whether a cornea is thick or thin in order to adopt an adequate diagnostic and therapeutic approach, a CCT study must be carried out amongst our healthy population and should be utilized as a reference in daily practice.

We studied the central corneal thickness of a normal Tunisian population group and determined the influence of age, gender, axial length and refractive error on CCT values.

METHODS

Study Design:

This study was conducted in Hedi Rais Institute of Ophthalmology, Tunis, Tunisia over a period of two years (from October 2011 to September 2013) to determine the mean central corneal thickness. The study was approved by the hospital's ethics committee.

Exclusion criteria included cases of open angle glaucoma, patients who underwent any surgery that needs corneal incision, patients with corneal ectasia (such as keratoconus), or any other corneal disease and patients with history of ocular trauma.

One eye of each patient was analyzed, choosing the right eye when both eyes fulfilled the study inclusion criteria.

Data collection:

Patients enrolled in this study underwent a complete ophthalmic examination by the same specialist including refraction, slit-lamp biomicroscopy, intraocular pressure (IOP) measurement, contact lens slit-lamp biomicroscopy, biometrics study with axial length and CCT measurements. CCT was measured with corneal tomography (Oculus Pentacam, USA).

Statistical analysis:

All data were transferred to an access spreadsheet (Microsoft Corp., Redmond, WA, USA), and univariate analysis was performed using Statistical Package for the Social Sciences (SPSS 23, IBM Corp., Armonk, NY, USA). For qualitative variables, we calculated frequencies and percentage proportions. For quantitative variables, the mean values for CCT, age, refraction and axial length were analyzed. In addition, the CCT – axial length ratio was analyzed as well as age and refractive defects through linear regressions and Pearson's correlation coefficient. For analyzing the influence of age in the upper and lower quartiles of our population as well as sex in CCT, the non-paired, twotail t for Student test was applied. Finally, the CCT percentage distribution was analyzed. P < 0.05 was considered statistically significant.

RESULTS

A total of 608 eyes were included in the study, 242 patients (39.8%) were males and 366 patients (60.2%) were females. The mean age of the study population was 39±17.27 years with a median of 35 years (range: 5-82). The normal CCT value was 522±37.17μm (range 461 to 655 μm). The demographic characteristics of the study population are described in Table 1.

Table 1. Demographic characteristics of the study population

	Mean +/- Standard Deviation
Age (years)	39+/- 17.27
Sphere (dioptres)	-1.89 +/-2.8
Cylinder (dioptres)	-0.72 +/- 1
Central corneal thickness (μm)	522+/- 37.17
Axial length (mm)	24.12 +/- 1.9

The mean CCT value in males was of 512.4±22.4 μm, while in females of 544.2±22.4μm, without reaching statistical significance (p=0.09).

To analyze the influence of the various age groups in CCT, the population was divided in quartiles, selecting the lower quartile (≤ 30 years, CCT=529±11.4 μm) and upper quartile (≥50 years, CCT=519±21.7μm). The non-paired, double tail t for Student analysis of this data was not significant (p=0.70).

The linear regression analysis and Pearson correlation coefficient for age, axial length and refractive defect with CCT demonstrated the absence of any significant correlation, as can be seen in Table 2.

Table 2. Linear regression and Pearson correlation

	P	R	r²
Age	0.2	0.04	0.002
Axial lenght	0.2	0.05	0.004
Refrative defect	0.3	0.04	0.003

* P <0.05 value was considered to be significant

DISCUSSION:

In our study, the mean CCT of a normal Tunisian population was 522±37.17μm (range 461 to 655 μm). We did not find a statistical association between CCT and age, gender, axial length or refractive defect. To our knowledge, this is the first report on the average CCT value in Tunisian population. Analyzing the demographic features of our population, we concluded that age, gender, axial length and refractive error did not influence CCT values.

It important to know the average CCT in a particular population is required in order to predict the risk of glaucoma. The Ocular Hypertension Treatment Study recognized CCT as a strong predictor for the development of predict the onset of primary angle glaucoma (POAG) [4].

It has been shown that Goldmann applanation tonometry over/underestimates IOP by as much as 5mmHg for every 70 μm corneal thickness above or below the mean [3]. Doughty et al, showed that the IOP-CCT interrelationship was different for glaucomatous and non-glaucomatous eyes [3]. They concluded that for normal eyes, a 53 μm difference in CCT would be expected to produce a 1.1mmHg shift in the measured IOP [3].

As with our own study, most published studies that analyzed

the relationship between axial length and CCT did not find statistical association [5,6,7]. Only the Singapore Malay Study found a relationship between these two factors [8].

The CCT values in different populations are shown in Table 3. In a retrospective study comprised 1662 patients from North Africa (Tunisia included) and 221 patients from France and the prospective study, 249 and 110, respectively [22]. Corneas were thinner in North African patients than in French patients (518 mm versus 553 mm, respectively), with 29% of North African eyes having a corneal thickness of 500 mm or less compared with only 7.7% of French eyes [22]. The percentage of patients with a CCT thinner than 500 mm was statistically significantly higher in North Africa than in France (P< .0001) In this study, the CCT was similar in patients from the 3 North African countries (Algeria, Morocco, and Tunisia) [22].

Table 3. The central corneal thickness values in different populations

Author	Year	N (eyes)	Race	Mean CCT (μm)
La Rosa et al [9]	2001	82	African American	531.0-350
		83	Caucasian	558.0-557.6
			Black	529.8
Nemesure et al [10]	2003	1142	Mixed black & white	537.8
			White	545.2
Wong et al [11]	2002	74	Chinese	555.1
Suzuki et al [12]	2005	7313	Japanese	517.5
Ashwin PT et al [13]	2009	120	English	520
Oriowo OM et al [14]	2009	35	Saoudian	583
Torres RJ et al [15]	2008	33	African-American	528.5
		46	American White	551.9
Foster PJ et al [16]	1998	1129	Mongolian	504.5
Alsbirk PH et al [17]	1978	839	Eskimo	523.7
Zhang H et al [18]	2006	4439	chinese	556.2
Channa R et al [19]	2009	200	Pakistani	531.08
Kim NR et al [20]	2008	580	korean	537
Gros-Otero J et al [21]	2001	357	Spanish	548.21
Lazreg S et al [22]	2013	1662	African	518

The implications of this difference in mean CCT are significant and important for a better assessment of IOP in our population. Glaucoma patients in the Tunisian population will need to maintain a lower level of IOP.

Several factors can affect CCT such as age, gender, daytime changes, refractive error, genetic influence, and conditions like diabetes [7,8,23,24]. In our study, we did not find any significant association between age, gender and average CCT.

For our study population, we examined adult patients who had no known eye disease other than refractive error. However, it is not a population-based study and is prone to selection bias because the subjects we selected represent only those people who can afford to pay for an executive check up at this hospital. It is necessary to complete with a study to estimate the mean values of the CCT, taking into account socio-economic factors and ethnic distribution of the general population.

CONCLUSION

The normal CCT value in the Tunisian population was of 522 ± 37.17 µm. In our study we did not find a statistical association between CCT and age, gender, axial length or refractive defect.

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