

# Comparison of Corneal Thickness of Young People with Middle and High Myopia between Shantou and Zhengzhou

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## Abstract

**Purpose:** To compare the corneal thickness of young subjects (aged 18 to 30 years) with moderate and high myopia living in Shantou and Zhengzhou.

**Methods:** One hundred and forty myopic subjects from Shantou (Guangdong, southern China) and 101 from Zhengzhou (Henan, central China) were selected and divided into 2 groups (moderate-myopic group and high-myopic group). The participants were sex- and age-matched. The central corneal thickness (CCT) and thinnest corneal thickness (TCT) were measured by Orbscan and compared between the two groups.

**Results:** In the high-myopic group, CCT ( $515.47 \pm 40.39 \mu\text{m}$ ) and TCT ( $510.22 \pm 40.95 \mu\text{m}$ ) of the Shantou subjects (mean spherical equivalent [SE]  $-7.56 \pm 1.35$ ), were thinner than those of their Zhengzhou counterparts (mean SE  $-7.47 \pm 0.88$ ). In the moderate-myopic group (Shantou mean SE  $-4.52 \pm 0.83$ ; Zhengzhou  $-4.67 \pm 0.77$ ), CCT and TCT did not differ between the two cities.

**Conclusion:** The corneal thickness of high-myopic eyes may differ between Shantou and Zhengzhou. (*Eye Science* 2012; 27: 41–43)

**Keywords:** myopia; topography; central corneal thickness

Cornea is the platform of excimer laser refractive surgery, and its thickness is the most important factor affecting the surgical design. In a clinical setting, it is found that there is a difference in the corneal thickness between southern and middle Chinese populations. Hence, the patients from Zhengzhou located in central China and Shantou in southern China were used to compare the thickness of cornea.

## Methods

### Study subjects

In this retrospective study, the myopic patients admitted to the Refractive Surgery Department in the Eye Center and Ophthalmology Department of Henan Armed Forces Police Hospital from July 2005 to December 2006 were chosen in the study. The right eyes of the myopic patients coming from Zhengzhou ( $n=101$ ) and Shantou ( $n=140$ ) were sex- and age-matched. Patients were divided into middle myopia (spherical equivalent  $-3.25\text{D}$  to  $-6\text{D}$ ) and high myopia (spherical equivalent  $-6.25\text{D}$  to  $-10\text{D}$ ) groups. Inclusion criteria: individuals aged from 18 to 30 years, without contact lens use in the past three months, and astigmatism  $> -1\text{D}$ . Exclusion criteria: those subjects who had a history of eye surgery. The research adhered to the tenets of the Declaration of Helsinki and was approved by the review board of Joint Shantou International Eye Center.

### Study methods

Corneal thickness was measured with an Orbscan II system (Orbtek, Salt Lake City, UT, USA) with an acoustic equivalent correction factor of 0.92 in Shantou and Zhengzhou. The index was measured in three seconds after patients blinked. Refraction was measured by a CV3000 phoropter (Topcon Corporation, Tokyo, Japan) and KR8800 Auto-kerato-Refractometer (Topcon Corporation, Tokyo, Japan). Intra-ocular pressure (IOP) was measured using a CT80 noncontact tonometer (Topcon Corporation, Tokyo, Japan).

### Statistical analysis

All data analysis was statistically processed by

SPSS 13.0 software (SPSS Inc., Chicago, IL). Group comparison was analyzed using independent-samples t-test.  $P < 0.05$  was considered as statistically significant. CCT and other factors were analyzed by correlative analysis.

## Results

### Demographic information

A total of 241 eyes (140 eyes from Shantou and

101 eyes from Zhengzhou) were enrolled in this investigation. The participants' demographic data are stated in Table 1. No statistical significance was noted between two groups in terms of sex, age, and refraction.

### Comparison of CCT and TCT between two groups

In the high myopic group, CCT and TCT of the patients from Shantou were significantly smaller than those from Zhengzhou ( $P < 0.05$ ), as shown in Table 2.

**Table 1** Demographic information of the subjects between the two groups

Group	City	Number of all subjects	Sex (male/female)	Age (y)	Refraction (D)
Middle myopia	Shantou	91	46/45	23.39±3.49	-4.52 ±0.83
	Zhengzhou	53	26/27	23.49±3.28	-4.67±0.77
High myopia	Shantou	49	24/25	23.24±3.21	-7.56±1.35
	Zhengzhou	48	24/24	21.00±2.81	-7.47±0.88

**Table 2** Comparison of CCT and TCT between two groups

Group	City	CCT ( $\mu\text{m}$ )	Thinnest corneal thickness ( $\mu\text{m}$ )
Middle myopia	Shantou	531.38±44.64	525.29±45.66
	Zhengzhou	536.68±39.35	528.48±39.85
High myopia	Shantou	515.47±40.39*	510.22±40.95*
	Zhengzhou	539.55±29.95*	532.34±29.54*

\* indicates  $P < 0.05$

**Table 3** Correlation analysis of CCT and other factors in middle and high myopic eyes

City	IOP	Refraction	Age
Shantou	0.4**	0.18**	-0.10
Zhengzhou	0.33**	-0.50	-0.07

\*\* represents  $P < 0.01$

### Correlation analysis between CCT and other factors

CCT was correlated with other factors (IOP, refraction, and age) in middle- and high-myopic eyes (Table 3). For the patients from Shantou, CCT presented a positive correlation with IOP and refraction and had higher myopia degree and smaller CCT. Regarding the subjects from Zhengzhou, CCT was positively correlated with IOP.

## Discussion

The Orbscan II system is utilized to measure CCT, which scans the eyes using light slit that are projected at a 45-degree angle. It acquires data points of ev-

ery surface of anterior segment, builds the three-dimensional configuration of anterior segment, and calculates the elevation and curvature on both the anterior and posterior corneal surfaces and full corneal pachymetry. Ultrasound pachymetry is the golden standard to measure CCT, but different examiners in two cities are likely to induce great bias. Thus, the present study compared CCT measured by Orbscan II. The results indicated that in the high myopic group, CCT and TCT from Shantou were thinner than those from Zhengzhou.

Certain factors affect CTC, such as IOP, age, gender, and corneal curvature<sup>1,2</sup>. The present results found that CCT in two groups was positively correlated with IOP, partially due to thicker cornea and higher IOP. For Shantou patients, spherical equivalent was positively correlated with CCT, absolute value of spherical equivalent was higher and CCT was thinner. No correlation was observed between CCT and age for all patients, possibly due to the narrow range of age (18~30 years). Uçakhan<sup>5</sup> found that eyes with high myopia had significantly lower mean corneal thickness than eyes with middle and low myopia. The present study found the higher the myopia, the thinner the CCT and the higher the discrete degree of corneal thickness. Thus, this study noted that eyes with high myopia differed in corneal thickness, while middle-myopia eyes had similar corneal thicknesses.

Environmental and genetic factors exert a primary influence on CCT in this study. The two cities significantly vary in geographical conditions, such as temperature, ultraviolet radiation, and humidity<sup>3</sup>. Genetic factors play a vital role in the determination of CCT. CCT greatly varies in different races. The African population has significantly thinner CCT than Caucasians and Asians<sup>4</sup>. Toh's results found that CCT measurements were more highly correlated in monozygotic twins than in dizygotic twins, with intraclass correlation coefficients of 0.95 and 0.52, respectively<sup>5</sup>.

Zheng assessed the heritability of CCT in Chinese children in a classic twin study; additive genetic effects appear to be the major contributor to the variation of CCT in Chinese population. Heritability of CCT in girls was slightly greater than that in boys. Heritability estimates for CCT were 0.88 (95% confidence interval [CI]: 0.84–0.91) in boys and 0.91 (95% CI: 0.89–0.93) in girls. Environmental influence alone explained only 0.12 (95% CI: 0.09–0.16) and 0.09 (95% CI: 0.07–0.11) of the CCT variance in boys and girls, respectively<sup>6</sup>.

The present authors speculate that there is a discrepancy in genetic background between Shantou and Zhengzhou. Hu Sheng-ping et al. first tried to pursue inhabitant's origin in Chaoshan<sup>7</sup>, and the results revealed that the inhabitants in Shantou and in Zhongyuan (including Zhengzhou) were closely related. Although much research have suggested that the inhabitants in Shantou originated from Zhongyuan, there was no affirmative evidence in genetic difference in inhabitants in the two places (with the factors gene mutation, gene flow and genetic drift) because of migration. For example, GSTM1 gene deletion' frequency of esophageal cancer was much higher than those in Lin county in Henan and in Japan<sup>8</sup>.

Tear film affected the corneal thickness<sup>9,10</sup>, and we controlled this factor by measuring corneal thickness in three seconds after patients blinked. Because the present study was retrospective, it provided guidance for a possible population-based study. It is possible that there is a difference in corneal thickness of middle- and high-myopic eyes between southern and

central China.

Preoperative evaluation of corneal thickness is related to surgical safety and predictability. High myopic patients' CCT is probably thin, so the present authors created the thinnest corneal flap or adopted surface ablation surgery to maintain enough corneal stromal bed thickness.

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