



Biometry and corneal astigmatism in cataract surgery candidates from Southern China

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PURPOSE: To analyze biometry data and corneal astigmatism in cataract candidates from Southern China.

SETTING: Guangdong Eye Institute, Guangdong General Hospital, Guangzhou, China.

DESIGN: Cross-sectional hospital-based study.

METHODS: The axial length (AL), anterior chamber depth (ACD), horizontal corneal diameter (white to white [WTW]), and corneal power (keratometry [K], flat K, steep K) were measured using the IOLMaster system. Ocular biometric data were collected and analyzed between 2007 and 2011.

RESULTS: The study comprised 6750 eyes of 4561 consecutive cataract candidates with a mean age of 70.4 years \pm 10.5 (SD). The mean AL, ACD, and WTW were 24.07 \pm 2.14 mm, 3.01 \pm 0.57 mm, and 11.68 \pm 0.45 mm, respectively. All values were statistically significantly greater in men than in women ($P < .001$) and had a significant trend toward a decrease as age increased ($P < .001$). The mean K value was 44.13 \pm 1.63 D. The median corneal astigmatism was 0.90 D (interquartile range, 0.54-1.43). Corneal astigmatism of 1.00 D or greater was found in 2963 eyes (43.9%), and 3590 eyes (53.2%) had against-the-rule (ATR) astigmatism. The axis of corneal astigmatism turned in the ATR direction with age.

CONCLUSIONS: This study provides reference data for cataract patients from Southern China. The profiles of ocular biometric data and corneal astigmatism can help improve surgical procedures and intraocular lens design for the Chinese population.

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Phacoemulsification is now widely used in China in an attempt to provide optimum visual quality. In cataract and refractive surgery, accurate assessment of axial length (AL), corneal power, and anterior chamber depth (ACD) is crucial to achieve satisfactory postoperative refractive results and reduce spectacle dependence. Corneal astigmatism is also a major factor affecting postoperative visual quality. However, most previous studies of ocular biometry and the prevalence of corneal astigmatism focused on ethnically European populations,¹⁻⁶ while few studies of Asian populations have been performed.⁷⁻⁹ The purpose of the present study was to evaluate the distribution of biometric parameters, determine the prevalence of corneal astigmatism, and characterize their

correlations before phacoemulsification in patients in a Southern Chinese population.

PATIENTS AND METHODS

This study comprised consecutive cataract candidates scheduled for phacoemulsification and foldable intraocular lens (IOL) implantation between July 2007 and June 2011 at Guangdong General Hospital, Guangdong, Southern China. The study was approved by the Guangdong Academy of Medical Sciences Human Research Ethics Committee and adhered to the tenets of the Declaration of Helsinki. All patients signed an informed consent form at the preoperative examination.

The major criteria for inclusion were cataract and age 40 years or older. Exclusion criteria included corneal disease or ocular surface disorders, previous corneal or intraocular

surgery, a history of ocular inflammation or trauma, and severe systemic disease.

The patients were divided into 5 groups on the basis of age as follows: 40 to 49 years, 50 to 59 years, 60 to 69 years, 70 to 79 years, and 80 years and older. All eyes were stratified into 4 groups based on AL as follows: shorter than 22.0 mm, 22.0 mm to 24.5 mm, longer than 24.5 mm to 26.0 mm, and longer than 26.0 mm.

Preoperative Assessment

Partial coherence interferometry (PCI) with an infrared diode laser at a 780 nm wavelength (IOLMaster, Carl Zeiss Meditec AG) was used to perform ocular biometry before cataract surgery. Measurements included AL, ACD, horizontal corneal diameter (white to white [WTW]), and corneal power. The AL was measured as the distance from the tear film to the retinal pigment epithelium. The ACD was assessed as the distance from the anterior corneal surface to the anterior lens surface. Corneal power was measured in 2 meridians; that is, flat keratometry (K1) and steep K (K2). The K value was the mean of K1 and K2. The refractive index value used by PCI was 1.3375.

The SRK II formula¹⁰ was used for statistical analysis of the theoretical IOL powers, and the target refraction was 0.00 diopter. The A constant was set at 118.0.

Statistical Analysis

Data were stored in Excel spreadsheets (Microsoft Corp.), which were then converted to SPSS data files (SPSS, Inc.) for further statistical processing. All analyses were performed using SPSS software (version 19.0, International Business Machines Corp.). Distributions of normality of the ocular biometric parameters were checked with the Kolmogorov-Smirnov test and were considered significantly different

from normal when the *P* value was less than 0.10. Variables were reported as the mean \pm SD and the median after adjustment for sex and age or as the median (interquartile range [IQR]) depending on the distribution of the data. Differences between groups were compared using an unpaired *t* test or analysis of variance (ANOVA) for normally distributed variables and a Wilcoxon or Kruskal-Wallis test for non-normally distributed variables. Two-way ANOVA was used to assess differences across sex and age groups for each variable followed by a student Newman-Keuls post hoc test, when necessary. Associations between AL, K, and WTW were calculated using 3rd-order polynomial regression, and correlations between other corneal biometric variables were analyzed with the Pearson or Spearman coefficient depending on their distributions. A 2-tailed α of 0.05 to assess for significance was used for all statistical tests.

RESULTS

This study enrolled 4561 cataract candidates (6750 eyes). The mean age of the 2026 men (44.4%) and 2535 women (55.6%) was 70.4 ± 10.5 years (range 40 to 101 years).

Distribution of Ocular Biometry

The distributions of AL, ACD, WTW, and corneal power (K1, K2, and K) were normal ($P < .001$). After adjustment for age, the mean AL, ACD, and WTW were statistically significantly greater in men than in women. In contrast, the mean K value was greater in women than in men. There was no statistically significant difference in corneal astigmatism between men and women (Table 1).

The mean AL was longer in men than in women in each age group and showed a trend toward a significant reduction with increasing age (Table 2 and Figure 1). The ACD and WTW showed a similar profile for age and sex.

Table 3 shows the distribution of ocular biometry for different ALs. The AL in the majority of eyes was between 22.0 mm and 24.5 mm. The mean ACD showed a trend toward increasing as the AL increased ($P < .001$). When the AL was shorter than 26.0 mm, the WTW was greater and the corneal power (K1, K2, and K) decreased with an increase in AL. The smallest mean corneal astigmatism (0.87 D) was in eyes with an AL between 22.0 mm and 24.5 mm, and the largest (1.06 D) was in eyes with a longer AL (≥ 26.0 mm). The median of the theoretical IOL power required to achieve emmetropia was 19.60 D (IQR, 17.60-20.89), and it decreased as the AL increased ($P < .001$).

Distribution of Corneal Astigmatism

Of the eyes, 2963 (43.9%) had corneal astigmatism of 1.00 D or higher and 1555 (23.0%) had 1.50 D or more. Corneal astigmatism was 1.00 D to 1.99 D in 2176 eyes (32.2%), 2.00 to 2.99 D in 555 eyes (8.2%), and

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