·Clinical Research·

Corneal topography and hyperopia

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Abstract

• AIM: To evaluate Orbscan II corneal topography in hyperopic cases.

• METHODS: A retrospective, observational, consecutive, clinical case series in 295 eyes of hyperopic patients who undergo a LASIK evaluation. The information that was reviewed included age, sex of the patients and the Orbscan II corneal topographic maps. Refractive powers and the following test indices produced by Orbscan II were analyzed: keratometry, corneal diameter, pupil diameter and anterior chamber depth.

• RESULTS: The total mean corneal thickness was 546.3± 35.5μm. It was found; 547.3± 38.4μm in 17-29 years old, 553.4± 38.3μm in 30-44 years old and 546.2± 29.3μm in older than 45 years old. The mean corneal thickness was found 551.5 ± 35.9μm in female, and 542.6 ± 34.7μm in male. The total mean depth of anterior chamber was 2.57± 0.40mm and in 17-29 years old patients was 2.82± 0.39mm. In 30- 44 years old patients was 2.49± 0.39mm and in patients older than 45 years old was 2.37± 0.40mm. The mean depth of anterior chamber was 2.53± 0.40mm in female and 2.60± 0.40mm in male. A reverse significant relation between corneal thickness and keratometry were found. Refractive error severity had a reverse correlation with depth of anterior chamber and a correlation with keratometry (P=0.061, r= 0.108).Corneal thickness had a reverse correlation with keratometry (P=0.005, r=0.160), and correlation with pupil diameter (P=0.013, r=0.144).

• CONCLUSION: We provides a description and analysis of Orbscan II findings in hyperopic patients. These show mean corneal thickness 546.3± 35.5μm and anterior chamber depth 2.57± 0.40mm in hyperopic patients.

• KEYWORDS: Orbscan II; corneal topography; hyperopia

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INTRODUCTION

Evaluation of corneal shape is an important aspect in the preoperative assessment of refractive surgery candidates. The Orbscan II system combines scanning slit with placido disc technology and has the capacity to provide detailed information regarding curvature and elevation of both anterior and posterior corneal surfaces, global thickness of the cornea [1], and anterior chamber depth [2]. With multiple measurement functions, the Orbscan system is a valuable screening tool to detect abnormal corneal shapes, such as keratoconus and contact lens-induced corneal thinning [3-5]. To detect early abnormal changes in corneal morphologic features, a database of topography in normal human eyes is required to establish baseline indices. The purpose of this study was to analyze the corneal morphologic features of persons with hyperopia using the Orbscan II corneal topography.

MATERIALS AND METHODS

The Orbscan II corneal topographic maps of 295 eyes in consecutive subjects with hyperopia who enrolled preoperative assessment for LASIK were reviewed retrospectively. Subjects having any type of ocular pathologic features or surgery or a family history of keratoconus were not included in this study. All patients wearing contact lenses before LASIK assessment stopped contact lens wear for at least 2 weeks before examination. In our study, The Orbscan II (Bausch & Lomb, Claremont, CA) topographies were performed by one experienced examiner. Then all data, including demographic information, refraction, and quantitative data from each Orbscan II videokeratography, were entered into a database. One Orbscan II topography measurement from each eye was evaluated. All results were analyzed statistically using SPSS statistics software version 11.5 (SPSS Inc., Chicago, IL). Descriptive analyses including mean values and standard deviation (SD), One-way ANOVA, Pearson correlation coefficient and confidence interval of 95% were performed. A P value of less than 0.05 was considered to be statistically significant.

RESULTS

In this study, 295 eyes (OS=147, OD=148) with hyperopia

Table 1 Corneal thickness according to age

Corneal thickness(μm)	Frequency	Median	SD	Minimum	Maximum	Interval
Age group						
17-29	99	574.3	38.4	539.7	555.0	95%
30-44	93	553.4	38.3	545.6	561.3	95%
>45	103	546.2	29.3	533.1	544.5	95%
Total	295	546.4	35.5	431.0	648.0	95%

Table 2 The corneal thickness according to sex

Corneal thickness(μm)	Frequency	Median	SD	Minimum	Maximum	Interval
Male	175	542.6	34.7	537.4	547.8	95%
Female	120	551.5	35.9	545.2	557.9	95%
Total	295	546.3	35.5	542.3	550.4	95%

Table 3 Anterior chamber depth according to age

Anterior chamber depth (mm)	Frequency	Median	SD	Minimum	Maximum
Age group					
12-29	99	2.82	0.39	2.74	2.90
30- 44	93	2.49	0.39	2.41	2.57
>45	103	2.37	0.40	2.51	2.61
Total	295	2.57	0.40	1.34	1.00

were analyzed. They were divided into three age groups; 17-29 years old (n=99, 33.6%) 30-44 years old (n=93, 31.5%) and >45years old (n=103, 34.9%). The total mean corneal thickness was 546.4±35.5μm. It was found 547.3±38.4μm in 17-29 years old, 553.4±38.3μm in 30-44 years old and 546.2±29.3μm in older than 45 years old (Table 1). That differs significantly between age group of 17-29 years old and other age groups. The mean corneal thickness was found in female 551.5±35.9μm, and in male 542.6±34.7μm (Table 2).The mean depth of anterior chamber in 17-29 years old patients was 2.82±0.39mm, in 30-44 years old patients was 2.49 ± 0.39mm and in patients more than 45 years old was 2.37±0.40mm (Table 3), the mean depth of anterior chamber was 2.5±0.40mm in female and 2.6±0.40mm in male. The depth of anterior chamber had only a mild difference between age groups of 30-44 and patients more than 45 years old.

The total mean keratometry was 43.91±1.90D. The mean keratometry was 43.61±1.70D in 17-29 years old patients, 43.45±1.80D in age group of 30-44 years old and 44.68±1.90D in group more than 45 years old. Mean keratometry results of patients was 43.69 to 44.13 and its comparison between two age groups of 17-29 and 30-44 years old showed significant F=0.554, P=0.01.This significance wasn't been found between other age groups.

The mean refractive error detected 4.60±1.90D, in male patients were 4.70 ±1.90D and 4.59 ±1.90D in female patients. We have found a correlation between corneal thickness and refractive error severity (P=0.000, r=0.28), a reverse significant relation between corneal thickness and keratometry (P=0.005, r=0.16), a positive relation between corneal thickness and pupil diameter (P=0.013, r=0.144), a reverse correlation between refraction error severity and depth of anterior chamber (P=0.132, r=- 0.87) and a significance relation between refraction error severity and keratometry (P=0.061, r=- 0.108).

DISCUSSION

Corneal topography is widely used to interpret corneal morphologic patterns and the Orbscan II seems to be a predictable and useful device for measuring corneal topography [6,7]. Hyperopia has been less studied because of its lower prevalence in developed countries, relative stability, and difficulties in measuring its magnitude accurately in young subjects[8].

In our study, the mean corneal thickness differs significantly between age group of 17-29 years old and other age groups. It also appears the corneal thickness in female differs to male. These indicate that the young hyperopes in our study have a good balance of corneal and internal spherical aberration in comparison of older hyperopes. Ocular aberrations have been reported to increase with age [9-12] and Artal *et al* [9,13] showed that aging disrupts the balance between corneal and internal optics found in young eyes.

Cho *et al* [14] reported that central corneal thickness decreased with increasing age but appeared to be due to female subjects only. In a study by Cosar *et al* [15] on 1341 eyes of 688 consecutive patients who had a LASIK evaluation; age was correlated with corneal thickness, spherical equivalent, and inversely correlated with corneal diameter, anterior chamber depth and pupil size: males had larger corneas and deeper anterior chambers than females. These underline the influence of age, sex, and refractive state of the eyes on dimensions of anterior structures of the human eye.

Reverse correlation between refractive error severity and depth of anterior chamber and a mild difference of the depth of anterior chamber in female and age group of 45-67 years old in our study detected; Dacosta *et al* [16] also reported

mean central anterior chamber depth (ACD) decreased with age and was shallower in females than in males. It was highest in myopes and lowest in hypermetropes this relationship between a shallow anterior chamber and a thick cornea may be explained by the fact that a thick cornea takes away some space from the anterior chamber so that the chamber depth becomes shallower [17]. In a study by Hosny *et al*[18], the ACD was found to correlate significantly with both the average corneal diameter and the axial length of the globe and was also found to correlate through an inverse relation with both age and spherical equivalent refraction. Corneal thickness and keratometric power did not correlate with the anterior chamber depth. This relation between age, gender and depth of anterior chamber also has been suggested in an Population-based study on Chinese adults by Xu *et al* [17]. Rabsilber *et al* [19] also reported significantly lower ACD values in the hyperopia group than in emmetropia and myopia groups when they assess the reliability of repeated anterior chamber depth measurements using the Orbscan II Topography System.

A significance relation between refraction error severity and keratometry (P=0.061, r =- 0.108)in our findings can be explained the findings of Rabsilber *et al* [19] in a corneal topography measurement using the Orbscan II topography system referring to different refractive conditions; for keratometry in particular, patients with hyperopia had significant differences (P <0.01) and patients with astigmatism and especially hyperopia showed significantly higher SD values in peripheral zones for anterior elevation and keratometry, indicating a lower reliability, compared with the emmetropic cohort.

In conclusion, we provides a description and analysis of Orbscan II corneal topography of a normal population with hyperopia in this study. The findings suggest some normal values of Orbscan II corneal topography in hyperopic patients that will aid in preoperative assessment in refractive surgery.

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