

Correlation Analysis of Area of Corneal Invasion of Pterygium and Measurement Deviation with Intraocular Lens Power

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Abstract

Objective: To investigate the correlation between area of corneal invasion of pterygium and measurement deviation with intraocular lens power.

Methods: Did A prospective study of 30 patients with pterygium admitted to our hospital from September 2018 to December 2020. Collected all patients' length, width and area of corneal invasion by pterygium and data of intraocular lens power from OrbscanII and IOL-Master500. Finally Analyzed the data.

Results: When the length of pterygium invasion into the cornea was: ≥ 2 mm or the width was: ≥ 4 mm, the K values of horizontal corneal curvature were the largest. When the length of pterygium invasion into the cornea was 2 mm - 5 mm and the width was 4 mm - 6 mm, the K values of horizontal corneal curvature and the values of anterior chamber depth were the smallest. When the length of pterygium invasion into the cornea is > 5 mm or the width is > 6 mm, the values of anterior chamber depth were the largest. Meanwhile, the values of anterior chamber depth measured by IOL-Master500 was 0.55 mm larger than that measured by OrbscanII and the above differences were statistically significant.

Conclusion: For cataract patients with pterygium, when the length of pterygium is less than 2 mm or the width is less than 4 mm, before cataract surgery, IOL-master500 and corneal topographic map should be performed to measure the patient's corneal curvature (pay special attention to the K value of the horizontal corneal curvature of the patient) to ensure the accuracy of the calculation of intraocular lens degree. If the length and width of pterygium develop further (length > 2 mm or width > 4 mm), pterygium excision should be performed first and the IOL power should be measured after the stabilization of corneal epithelial repair about 1 month after the operation and the IOL power should be calculated based on the IOL-Master500 measurement data.

Keywords: Cataract; Degree of Intraocular Lens; Pterygium; Length, Width and Area of Corneal Invasion; OrbscanII; IOL-Master500

Introduction

Cataract is a common disease of ophthalmology and its main pathological feature is opacity and degeneration of the lens. Protracted and untreated cataract will cause gradually blurred vision of the patients. In clinical work, surgical treatment is very effective. With the

development of medical technology, patients have higher and higher requirements for the quality of surgery. Therefore, accurate determination of preoperative refraction and improvement of postoperative visual quality are the focus of clinical research. Factors which affect measurement accuracy of IOL [1] are corneal curvature, eye axial length, anterior chamber depth, etc. and as one of the important factors, corneal curvature has many influence factors: including pterygium [2-5], LASIK [6,7], wearing orthokeratology, corneal trauma [8], keratoconus [9-12], high myopia and dry eyes [13] and so on. Pterygium is another common disease in ophthalmology. The pathological mechanism of pterygium is the proliferation of fibrous vessels from bulbous conjunctiva to cornea [14].

Purpose of the Study

The purpose of this study was to analyze the correlation between the area of pterygium invasion into the cornea and the measurement deviation of IOL power.

Methods

General data: Selected 22 patients (33 eyes) with pterygium diagnosed between September 1, 2018 and December 1, 2020, including 8 males and 14 females with average age of about 67 years. The inclusion criteria were: (1) All patients were primary pterygium, recurrent or pseudopterygium were excluded. (2) Patients with previous eye operations such as cataract surgery, corneal surgery or glaucoma surgery were excluded. (3) Patients with previous history of corneal trauma, keratitis or corneal scar were excluded. (4) Patients with previous orthokeratology wearing history were excluded. (5) Patients who could not be measured by IOL-Master500 or OrbscanII were excluded.

Methods:

1. After superficial anesthesia with bupivacaine eye drops, the length of pterygium invasion into the cornea and the width of the corneal limbus of each patient were measured with an angle gauge and then calculated the area of pterygium located on the cornea. According to the length of pterygium, the width of corneal limbus and the size of the area of pterygium, the differences between the groups were compared. And the measurement methods were: (1) length (mm): the distance from the top of the pterygium head to the limbus; (2) width measurement (mm): the distance between two endpoints on pterygium. (3) calculation of area (mm²): length * width/2.
2. All patients accepted slit lamp's examination. Vertical and horizontal K values (D) and there axial position (°) and anterior chamber depth (ACD) (mm) were measured by OrbscanII and vertical and horizontal K values (D) and there axial position (°), ACD (mm) and length of optic axis (AL) (mm) were measured by IOL-Master500.

Statistical treatment: SPSS 20.0 software was used for statistical analysis of data. The Data were expressed as (x ± s), and one-way ANOVA test (F test) was used. And Horizontal K values, vertical K values and ACD's data were compared between OrbscanII and IOL-Master by paired t test. P < 0.05 was considered statistically significant.

Result

The patients were grouped according to the length of pterygium invasion into the cornea, the width of the corneal limbus and the area of the pterygium. The patients were divided into three groups according to the length: Group 1 (S2 mm) with 12 eyes, Group 2 (2 mm - 5 mm) with 16 eyes and Group 3 (> 5 mm) with 5 eyes. And divided into three groups according to the width: Group CD (s4 mm) with 9 eyes, Group @ (4 mm: S6 mm) with 18 eyes and Group ® (> 6 mm) with 6 eyes. And also divided into four groups according to the area: Group I (S5 mm² with 5 eyes, Group II (5 mm² - 10 mm² with 6 eyes, Group III (10 - 15 mm² with 14 eyes and Group IV (> 15 mm² with 8 eyes. Verti-

cal and horizontal K values, axial position, ACD and AL of each group were shown in table 1. It showed that with the increase of the length and width of pterygium invasion into the cornea, when the length and width of pterygium invasion into the cornea were: S2 mm and S4 mm, the horizontal K values measured by IOL-Master500 were the highest. When the length of pterygium invasion into the cornea was 2 mm - 5 mm and the width was 4 mm - 6 mm, the horizontal K values measured by IOL-Master500 were the smallest. When the length was > 5 mm and the width was > 6 mm of pterygium invasion into the cornea, the values of ACD measured by IOL-Master500 were the highest. When the length of pterygium invasion into the cornea was 2 mm - 5 mm and the width was 4 mm - 6 mm, the values of ACD measured by IOL-Master500 was the smallest. The above differences were significant (P < 0.05). Besides, in this study, the corneal horizontal K values, vertical K values and ACD data measured by OrbscanII and IOL-Master500 in 33 eyes were shown in table 2. It can be seen that the values of ACD measured by IOL-Master500 was larger than that by OrbscanII, and the difference was statistically significant (P < 0.05).

	Vertical K Values (D)	Horizontal K Values (D)	Anterior Chamber Depth (mm)	AL (mm)	Vertical K Values (D)	Horizontal K Values (D)	Anterior Chamber Depth (mm)
Length							
Group 1	44.73 ± 2.39	43.53 ± 2.68	2.40 ± 0.27	23.04 ± 1.37	44.95 ± 2.15	43.85 ± 2.44	3.01 ± 0.29
Group 2	45.21 ± 1.73	43.39 ± 1.75	2.28 ± 0.35	24.03 ± 1.82	45.19 ± 1.76	43.35 ± 1.86	2.79 ± 0.40
Group 3	45.23 ± 2.10	42.90 ± 0.50	2.52 ± 0.07	22.69 ± 0.71	44.13 ± 0.88	43.47 ± 0.96	3.13 ± 0.01
Width							
Group CD	45.01 ± 2.47	44.01 ± 2.41	2.36 ± 0.22	22.74 ± 1.21	45.42 ± 2.05	44.48 ± 2.02	2.99 ± 0.26
Group @	45.08 ± 1.84	43.19 ± 2.10	2.30 ± 0.36	24.04 ± 1.81	45.00 ± 1.91	43.14 ± 2.11	2.81 ± 0.40
Group ®	44.90 ± 1.99	42.94 ± 0.46	2.56 ± 0.09	22.78 ± 0.67	44.13 ± 0.76	43.48 ± 0.83	3.17 ± 0.07
Area							
Group I	45.40 ± 2.01	44.26 ± 2.02	2.44 ± 0.26	23.21 ± 1.27	44.90 ± 1.82	43.98 ± 1.66	3.11 ± 0.26
Group II	44.47 ± 2.66	43.72 ± 2.56	2.27 ± 0.12	22.42 ± 1.07	45.45 ± 2.36	44.63 ± 2.37	2.81 ± 0.14
Group III	45.33 ± 1.81	43.16 ± 2.23	2.29 ± 0.39	24.04 ± 1.71	45.09 ± 1.97	43.20 ± 2.20	2.83 ± 0.4
Group IV	44.66 ± 1.80	42.90 ± 0.41	2.50 ± 0.15	23.32 ± 1.61	44.47 ± 0.82	43.08 ± 0.99	2.96 ± 0.27

Table 1: Comparison of data obtained by OrbscanII and IOL-Master500 after pterygium invasion by the length, width and area of cornea.

	Vertical K Values (D)	Horizontal K Values (D)	Anterior Chamber Depth (mm)
OrbscanII	45.03 ± 2.06	43.38 ± 2.07	2.35 ± 0.31
IOL-Master500	45.00 ± 1.88	42.54 ± 5.75	2.90 ± 0.36
p	> 0.05	> 0.05	<0.05

Table 2: Comparison of vertical K values, horizontal K values and anterior chamber depth values measured by OrbscanII and IOL-Master500.

Discussion and Conclusion

Nowadays phacoemulsification combined with intraocular lens implantation is the main operation method for most cataract patients. With the progress of science and technology, patients have higher and higher requirements for postoperative visual recovery and visual quality [15]. As the most time-honored ocular surface disease, pterygium has been recognized and studied since as early as 1000 BC.

When a patient suffers from cataract combined with pterygium, the growth of pterygium will change the patient's eye parameters such as corneal curvature, which will affect the preoperative measurement of IOL power, and ultimately affect the outcome of cataract surgery.

There are two theories to the mechanism of the alteration of corneal curvature caused by pterygium: 1. Compression and mechanical pulling on the cornea mainly cause the horizontal diameter of the cornea to be relatively flat [16-18]. 2. Lensing effect of partial tear film: the pterygium head infiltrates the corneal epithelium and forms a low flat area in the central area of the cornea, and the tear accumulations form a crescent tear film, which is like a crescent lens and cause the horizontal diameter of the cornea to become flatter [19-21].

In this study, it was found that with the increase of the length and width of pterygium invasion into the cornea, the horizontal K values firstly decreased and then increased. The possible reasons are: 1. When pterygium grows into the cornea of a certain length or a certain limbal width, the horizontal corneal diameter becomes relatively flat due to the compression and mechanical pulling and lens effect of partial tear film, so the horizontal K value decreases; 2. When the length and width of pterygium further increase, the pterygium may spread to the pupil and the corneal limbal width could be too large to affect the whole corneal structure, so the horizontal diameter of the cornea changes significantly, which counteracts the effect of compression and pulling and lens effect of partial tear film and therefore causes the horizontal K value to increase again.

The IOL-Master500 measures the ACD by using a slit lamp with an image analysis system to measure the "opticator" passing through the anterior chamber. The right eye is irradiated from the right side and the left eye is from the left side at an angle of about 30° with the optical axis, and then the results are obtained through the computer image analysis system.

In this study, it was found that the ACD values were firstly decreased and then increased with the increase of the length and width of pterygium invasion into the cornea. The possible reasons were: 1. When pterygium grows into a certain length of the cornea or a certain width of the corneal limbus, the cornea becomes relatively flat due to the lens effect of partial tear film and compression or pulling, resulting in a relatively smaller "opticator" of the anterior chamber; 2. When the length and width of the pterygium were further increased, the pterygium spreads to the pupil and the corneal limbal width was too large to affect the whole corneal structure, and the degenerated conjunctival tissue grows to the cornea, resulting in the relative enlargement of the "opticator" of the anterior chamber of IOL-Master500 and ultimately the ACD values were significantly increased.

In addition, this study also found that the IOL-Master500 measured ACD values were larger than that of OrbscanII. Compared with the principles of IOL-Master500, OrbscanII use the placido plate combined with fracture scanning system, using the 45° 20 optical slit laser to scan the eyes from left to right and right to left, then use slit scanning, video cameras and computer automatic processing methods to get 9600 point data of the cornea, finally reconstruct the cornea by using the 3D image data analysis. Combined with the results of this study, the ACD values measured by IOL-Master500 was 0.55mm larger than that measured by OrbscanII and the difference was statistically significant. The possible reasons were: 1. The ACD values measured by IOL-Master500 included corneal thickness, which was different due to different corneal thickness of patients. 2. OrbscanII usually uses correction coefficient, so the ACD values will be slightly shallower than the actual ACD.

Therefore, when we are faced with the patients combined with pterygium and cataract, we should realize that with the progress of the pterygium, patients' corneal curvature may change significantly, which may affect the measurement of intraocular lens power before cataract surgery. Therefore, for the patients with cataract combined with pterygium, if their pterygium length were: ≤ 2 mm or the width were: ≤ 4 mm, before cataract surgery, it is feasible to measure the patient's corneal curvature with IOL-Master and Corneal Topography (focusing on the K values of the horizontal corneal curvature), so as to calculate the intraocular lens power accurately. If the length and width of pterygium develop further (length > 2 mm or width > 4 mm), pterygium excision can be performed first, and the intraocular lens power can be measured after the stabilization of corneal epithelial repair about 1 month after surgery. And when measuring the intraocular lens power, data from IOL-Master can prevail. Besides, the data of anterior chamber depth measured by OrbscanII is only for reference.

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