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## CHANGES IN CORNEAL THICKNESS IN PATIENTS WITH DIFFERENT STAGES OF PRIMARY OPEN-ANGLE GLAUCOMA

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### ABSTRACT

*Using a pachymeter (Optical Coherence Tomography HOCT-1 / 1F, Huvitz), the diagnostic informativeness of corneal thickness indicators was studied in 41 (48 eyes) patients with various stages of primary open-angle glaucoma (POAG). The pachymeter contains a special accessory that is required to be able to view the anterior segment of the eye. It allows you to measure the thickness of the cornea in high resolution. There is a change in the indices of the corneal resistance factor depending on the severity of primary open-angle glaucoma. With the progression of the glaucomatous process, a decrease in the index of the corneal resistance factor is noted.*

**KEYWORDS:** *Glaucoma, Central Corneal Thickness*

### INTRODUCTION

Despite progress in methods of treatment and diagnosis, glaucoma is still the cause of irreversible blindness and low vision, occupying one of the leading places in the list of disabling diseases of the organ of vision [1,4,5].

Among the clinical forms of the disease, primary open-angle glaucoma (POAG) is of the greatest importance, accounting for 70.0% to 92.0% of all glaucoma cases. To date, POAG affects approximately 90 million people in the world [11], and this figure has been steadily increasing over time.

Since applanation tonometry appeared, there has been interest in the relationship between corneal thickness and intraocular pressure (IOP). The identification of such a correlation is necessary for the diagnosis and determination of "target pressure" [T.G. Lobova, 2014]. A decrease in intraocular pressure in patients with glaucoma does not always lead to stabilization of

the glaucomatous process and preservation of visual functions, despite the rather low values of intraocular pressure. Increased intraocular pressure is one of the leading risk factors for the development of glaucomatous neuropathy. Thorough measurement of IOP remains the most important procedure for monitoring glaucoma patients, which prompted many researchers to analyze indicators of central corneal thickness (CCT), as it was believed that.

The central corneal thickness remains the only parameter of its biomechanical (biometric) assessment that is actually available in wide clinical practice. The average values of the central corneal thickness in POAG compared with individuals without pathology of hydrodynamics were calculated by many authors, with different results. A number of authors do not find differences in the mean values when comparing these groups; others speak of a thinner cornea with POAG [1,2,4]. According to many authors, the initial link in the pathogenesis of primary open-angle glaucoma (POAG) is the increasing disorganization and destruction of the connective tissue of both the anterior and posterior parts of the eye [6,7,9,10].

According to the literature, it was found that in patients with glaucoma with normal intraocular pressure, pachymetry data are lower, and in patients with one form or another of hypertension of the eye - higher indicators of the central thickness of the cornea [13, 14]. The average value of the central corneal thickness according to pachymetry data for normal eyes is 534  $\mu\text{m}$ , while its values are in the range from 510 to 578  $\mu\text{m}$  [15].

**The purpose of this study** is the analysis of the diagnostic information content of the corneal thickness indicators in patients with different stages of POAG.

## **MATERIALS AND METHODS**

The study involved 41 patients (48 eyes) with primary open-angle glaucoma, including 24 women and 17 men. The average age of the patients was  $60.23 \pm 4.8$  years. The patients were divided into 3 groups: group 1 - 9 patients (10 eyes) with stage I POAG, group 2 - 18 patients (21 eyes) with stage II POAG, group 3 - 14 patients (17 eyes) with stage III. The age in the compared groups was identical.

The study was conducted from 2020 to 2021 at the clinical base of the Bukhara branch of the Republican Specialized Scientific and Practical Medical Center for Eye Microsurgery (Bukhara, Uzbekistan).

Comprehensive examination included visometry, refractometry, biomicroscopy, gonioscopy, ophthalmoscopy, perimetry, tonometry, as well as pachymetry examination, which were performed on a pachymeter analyzer (Optical Coherence Tomography HOCT-1 / 1F, Huvitz, South Korea). IOP according to Goldman (Pg, mm Hg), corneal resistance factor (CRF, mm Hg), central corneal thickness (CCT,  $\mu\text{m}$ ) were determined. Corneal resistance factor is an additional parameter that is calculated using a special algorithm. Considering that, according to the literature, the average central corneal thickness is 534 microns, the corneas were divided into three conditional groups: "thin" - less than 520 microns, "medium" - from 520 to 580 microns, "thick" - more than 580 microns.

The study excluded patients with refractive errors of +2.0 diopters, immature cataract and with previous surgical treatment for glaucoma. The established stages of the disease and the state of stabilization were confirmed by the data of perimetry and ophthalmoscopy. Patients received

local instillation therapy in the form of monotherapy (prostaglandins or beta-blockers), or a combination of the above drugs, the intraocular pressure in these patients was uncompensated.

### Research results

The data of indicators of the biomechanical properties of the cornea of patients with primary open-angle glaucoma are presented in Table 1.

The analysis of the studies showed that in patients with primary open-angle glaucoma, the mean IOP according to Goldman was  $28.42 \pm 6.5$  mm. Hg. The corneal resistance factor in the studied patients was the same as in healthy individuals and was equal to  $10.69 \pm 2.2$  mm Hg, respectively and  $10.6 \pm 2.03$  mm Hg. The average value of the central corneal thickness was  $532.67 \pm 6.8$   $\mu$ m. Among the studied patients, a thin cornea was observed in 13 eyes (27.1%), a cornea of medium thickness was observed in 30 eyes (62.5%), and a thick cornea was registered in 5 eyes (10.4%). The analysis of the studies revealed that the indicators of the biomechanical properties of the cornea in patients with different stages of primary open-angle glaucoma with uncompensated pressure were different.

**TABLE 1 INDICATORS OF CORNEAL THICKNESS IN PATIENTS WITH DIFFERENT STAGES OF PRIMARY OPEN-ANGLE GLAUCOMA**

| POAG stages  | Number of eyes | Pg, mmHg.                         | CRF, mmHg.                        | CCT, $\mu$ m                       |
|--------------|----------------|-----------------------------------|-----------------------------------|------------------------------------|
| one          | 10             | $28.56 \pm 5.2$                   | $11.86 \pm 1.8$                   | $538.69 \pm 16.0$                  |
| 2            | 21             | $31.24 \pm 7.3$                   | $10.54 \pm 2.2$                   | $532.48 \pm 18.0$                  |
| 3            | 17             | $25.48 \pm 6.9$                   | $8.96 \pm 2.1$                    | $528.11 \pm 24.2$                  |
| <b>Total</b> | <b>48</b>      | <b><math>28.42 \pm 6.5</math></b> | <b><math>10.6 \pm 2.03</math></b> | <b><math>532.67 \pm 6.8</math></b> |

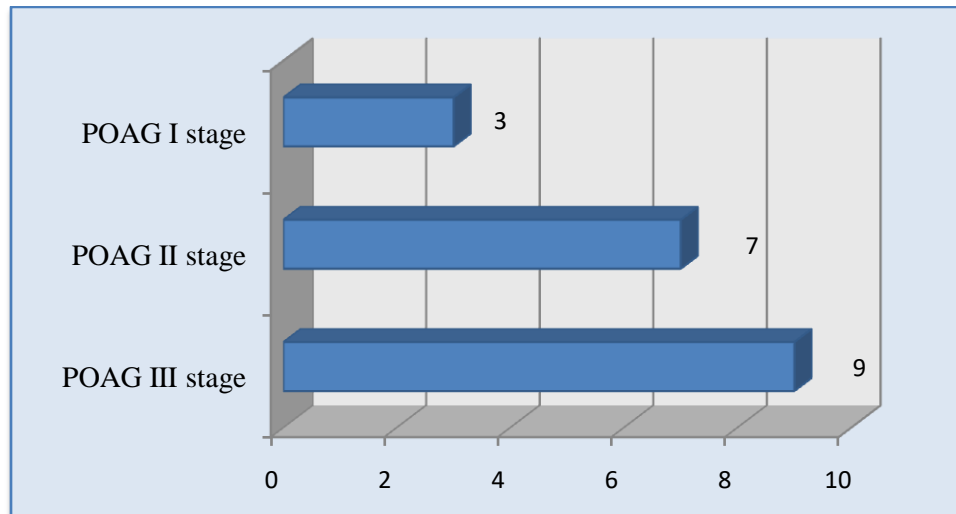
In the first group of patients, the value of intraocular pressure according to Goldman varied from 21.2 to 42.5 mm Hg., the IOP index according to Goldman (Pg) was  $28.56 \pm 5.2$  mm Hg. The resistance factor was  $11.86 \pm 1.8$  mm Hg. in the patients of this group. The average value of the central corneal thickness was  $538.69 \pm 16.0$   $\mu$ m, with the data scattering from 498 to 565  $\mu$ m. The middle cornea was in 70% of patients with the first stage of primary open-angle glaucoma, and the thin cornea was in 30%.

In the second group, the indices of the central corneal thickness were as follows: Pg -  $31.24 \pm 7.3$  mm Hg. The resistance factor in patients of this group was equal to  $10.54 \pm 2.2$  mm Hg. The average value of the central corneal thickness was  $532.48 \pm 18.0$   $\mu$ m, among which the thin corneas accounted for 33.3%, the average - 61.9%, and the thick cornea was only in 1 eye (4.8%).

In the third group, in patients with the third stage of primary open-angle glaucoma, the IOP value according to Goldman (Pg) was  $25.48 \pm 6.9$  mm Hg. CRF -  $8.96 \pm 2.1$  mm Hg. The average value of the central corneal thickness was  $528.11 \pm 24.2$ , among which the thin corneas accounted for 52.9%, the average - 41.2%, and the thick cornea was only in 1 eye (5.9%).

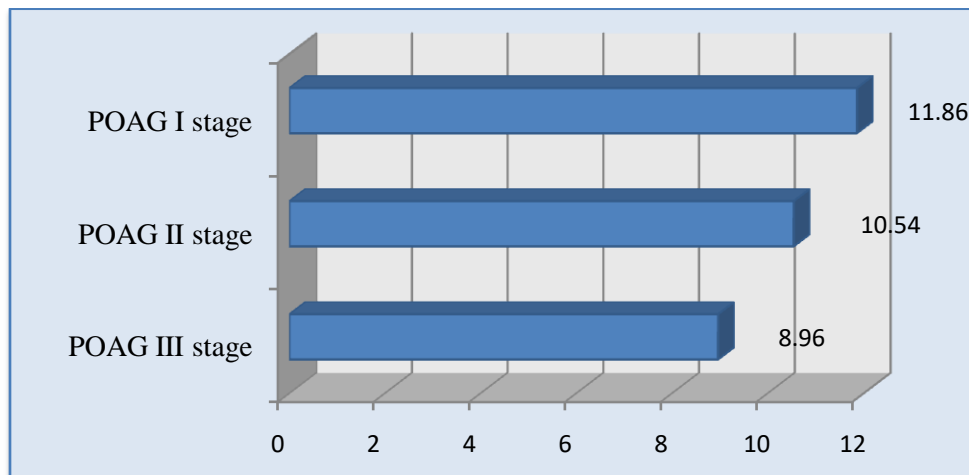
### The discussion of the results

According to the data of our study, the index of the central corneal thickness varied from 486 to 592  $\mu$ m, which is consistent with the data of other authors. The frequency of thin corneas increases with the stage of glaucoma (Fig. 1).



**Fig. 1. Frequency of thin cornea in patients with different stages of POAG**

In patients with primary open-angle glaucoma with uncompensated intraocular pressure, the corneal resistance factor (CRF, mm Hg) is significantly lower than in healthy individuals. There is a correlation between the factor of corneal resistance and the stage of the glaucomatous process. In patients with advanced and advanced stages of primary open-angle glaucoma, the index of the corneal resistance factor is lower than in patients with the initial stage (Fig. 2).



**Fig. 2. The level of the indicator factor of corneal resistance in patients with different stages of primary open-angle glaucoma**

## CONCLUSIONS

1. Research indicators of the central thickness of the cornea should be included in the complex of standard methods of examination of patients with a diagnosis of primary open-angle glaucoma.
2. The average thickness of the cornea in patients with POAG corresponds to the average values of this indicator in healthy individuals. The number of patients with POAG with a thin cornea is in direct proportion to the stage of glaucoma.

3. Indicators of the corneal resistance factor depend on the severity of primary open-angle glaucoma. With the progression of the glaucomatous process, there is a decrease in the viscoelastic properties of the cornea, there is a decrease in the index of the corneal resistance factor.

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