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# Specular Microscopy in Glaucoma Patients

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## ABSTRACT

*The endothelial cells are one of the most important structures in a donor cornea. Morphology and concentration of endothelial cells must be carefully evaluated with a specular microscope before transplantation. The aim of this study is to evaluate the status of corneal endothelium in glaucoma patients. Prospective study included 50 patients suffering from glaucoma and 50 patients in control group. Patients had no corneal disease, ocular inflammation, previous trauma or ocular surgery. Patients were not contact lens wearers. They were also analyzed in groups according to type of glaucoma. Specular microscopy was performed on central corneas. This study showed that patients with glaucoma have lower central corneal endothelial cell density than those without glaucoma of the same age group. Also, patients with pseudo-exfoliative glaucoma had lower values of central endothelial cell density comparing to patients with open angle or angle closure glaucoma.*

**Key words:** corneal endothelial cells, specular microscopy, glaucoma

## Introduction

Anatomically, cornea consists of five layers: epithelium, Bowman layer, stroma, Descemet membrane and endothelium. The endothelium consists of a single layer of hexagonal cells. It plays a vital role in maintaining the deturgescence of the cornea. With age, the number of endothelial cells gradually decrease, but because they cannot regenerate, neighboring cells have to spread out to fill the space<sup>1,2</sup>. The young, normal corneal endothelium shows a nearly regular array of hexagonal cells all having nearly the same size. With aging, trauma and corneal disease this regularity is lost<sup>3,4</sup>. Human cornea has 350,000 cells approximately. At birth it is 3,000–4,000 cells per millimeter, at middle age 2,500 cells, at old age 2,000 cells. For donor corneas minimal acceptable is 2,000 cells per millimeter. Below 1,000 cells per millimeter corneal edema can be expected. The goal of endothelial specular microscopy is to enable the status of the corneal endothelium. A microscope magnifies the cells thousands of times and the image is captured with a camera. The number of cells within one square millimeter are counted and recorded. Specular reflections refer to viewing of objects that occurs when light is reflected from the interfaces of materials with different indices of refraction. Endothelial cells are different in refractive index that the aqueous and also Descemet's membrane. The more regular and numerous the cells are, the better their function is

thought to be. Tightly packed, hexagonal-shaped cells with little variation in shape and size are considered normal.

Except the number of the corneal endothelial cells per millimeter we can analyse its shape and size. Cell density is number of cells per millimeter, cell area is number of cells in one cell area-micro m<sup>2</sup>. Polimegethism is a variation of cell size and pleomorphism is a variation of cell shape such as percentage of six-sided cells.

## Patients and Methods

Fifty patients with glaucoma (a hundred eyes) were compared with fifty patients (a hundred eyes) without glaucoma at the same age group in a prospective study. They were examined at the Department of Ophthalmology, Rijeka University Hospital from June 2009 to September 2009. Exclusion criteria included history of corneal disease, ocular inflammation, trauma or surgery. None of the patients was contact lens wearer. All the patients have glaucoma diagnosed from four to eight years ago. They were from 57 to 65 years old in both groups, 27 males and 23 females in glaucoma group; 24 males and 26 females in the control group. The following data was extracted from the patient files: glaucoma type. We ana-

lyzed in separate groups also 30 patients with open angle glaucoma, 12 patients with angle closure glaucoma and 8 patients with pseudoexfoliative glaucoma. Specular microscopy was performed on central corneas. We used Tomey-EM non contact specular microscope and we measured corneal cell density.

## Results and Discussion

Corneal endothelial density was significantly lower in patients with glaucoma than in control group. In glaucoma group corneal endothelial cell counts were  $2148 \pm 317$  cells/mm<sup>2</sup>. In control group results were  $2528 \pm 306$  cells/mm<sup>2</sup> (t-test,  $p < 0.0001$ ).

In glaucoma patients group, open angle glaucoma group-corneal endothelial cells counts were  $2153 \pm 217$  cells/mm<sup>2</sup>. In group of patients with angle closure glau-

coma corneal cell density was  $2113 \pm 243$  cells/mm<sup>2</sup>, so there was no significant difference between these two groups. But, the group with pseudoexfoliative glaucoma showed significantly lower values  $2024 \pm 254$  cells/mm<sup>2</sup> (t-test,  $p < 0.0001$ ).

## Conclusion

The study suggests that patients with glaucoma have lower corneal cell density than those without glaucoma at the same age group and also those with pseudoexfoliative glaucoma comparing to open angle and angle closure glaucoma. It may be caused because of damage from intraocular pressure, congenital alteration of the endothelium in patients with glaucoma, glaucoma medication toxicity or combination of these reasons<sup>5</sup>.

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## SPEKULARNA MIKROSKOPIJA KOD GLAUKOMSKIH PACIJENATA

### SAŽETAK

Endotelne stanice su jedan od najvažnijih dijelova rožnice davatelja. Morfologija i koncentracija endotelnih stanica mora biti pažljivo proučena spekularnim mikroskopom prije transplantacije. Cilj ove studije je proučiti status rožničnog endotela u glaukomskih pacijenata. Prospektivna studija obuhvatila je 50 pacijenata koji boluju od glaukoma i 50 pacijenata u kontrolnoj skupini. Pacijenti nisu bolovali od neke rožnične bolesti, upalne bolesti, nisu imali ranije traumama oka ili očnu operaciju. Nijedan pacijent nije bio nositelj kontaktnih leća. Pacijenti su također bili analizirani po grupama ovisno o tipu glaukoma. Spekularnim mikroskopom smo proučavali centralnu rožnicu. Ispitivanje je pokazalo da pacijenti s glaukomom imaju niže vrijednosti centralne stanične gustoće endotela u odnosu na skupinu bez glaukoma iste dobi. Također, pacijenti s pseudoeksfolijativnim glaukomom imaju niže vrijednosti centralne endotelne stanične gustoće u odnosu na pacijente s glaukomom otvorenog kuta ili one s glaukomom zatvorenog kuta.