Diabetology

Extended Abstract

Evaluation of Corneal Transparency in Diabetic Patients Aged 60 Years and Over - Luling Yang - Peking University Third Hospital, Beijing, China

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Abstract

Purpose

The aim of the study was to retrospectively evaluate the changes of corneal transparency in diabetic patients across 3 different age groups.

Healthy cornea ideally does not absorb visible light and the light that it scatters is minimal [8,9]. Loss of the transmission of light through the cornea give rise to the increasement of cornea backward light scattering. Past researches have verified that corneal densitometry, which describes the level of corneal transparency, could be used as a tool to evaluate corneal health and detect subclinical keratoconus [10,11]. Corneal densitometry also provides objective and quantitative information about corneal backscatter after corneal collagen crosslinking, refractive surgery, cataract surgery, keratoplasty, etc. [12-16], which is helpful for doctors to study the effects on the post-operating recovery of patients.

The Pentacam HR (Oculus, Wetzlar, Germany) employs a rotating Scheimpflug camera to image the anterior segment of the ocular tissues noninvasively and sequentially. The procedure of densitometry analysis measures corneal transparency by backscattered light and applies grayscale units as outputs. The system also provides precise data to describe the degree of corneal clarity at specific zones, allowing us to know the change in value.

The purpose of our study was to evaluate the changes of corneal transparency in diabetic patients aged 60 years and over. We also investigate the differences of corneal densitometry between people with diabetic of different age groups.

Materials and methods

We enrolled 135 diabetes mellitus (DM) patients and 154 control subjects in this retrospective and nonrandomized study. Corneal backward light scattering information was collected from different corneal layers and annuli by using Scheimpflug tomography (Pentacam HR).

We retrospectively reviewed the preoperative data of cataract patients who had undergone cataract surgery between august 2019 and November 2019 at Peking University Third Hospital. Only patients who were aged more than 60 years and had no history of ocular surgery were enrolled in our research. Eyes with any ocular diseases such as corneal infections, corneal dystrophies, uveitis and nystagmus, etc. were excluded. Patients who were not able to fully cooperative for Scheimpflug system examinations were also excluded. Both eyes had undergone routine ophthalmic examinations. As a result, 135 patients with DM and 154 patients without DM met the inclusion criteria. 578 eyes were categorized into 3 age groups (60-69, 70-79, 80-89 age groups).

In order to obtain corneal densitometry data, patients were instructed to take examinations following a series of standardized procedures as recommended in the instruction manual. All measurements were performed in dimness and automatically completed with 25 cross-sectional images in 2 seconds. The densitometry images comprises of 4 concentric radial zones around the corneal apex (the central 0-2, 2-6, 6-10, and 10-12 mm zones) and 3 layers (the anterior 120 µm, the posterior 60 µm and the central corneal layer). The scanning output is expressed in grayscale units (GSU). The GSU level is ranged from 0 (maximum transparency) to 100 (completely opacity), according to the degree of backward light scattering from the cornea.

Results

The corneal densitometry analysis results varied between different age groups. In the 60 to 69 age group, the anterior layer at zone 0 to 2 mm had better corneal clarity in controls than in DM patients. Corneal densitometry values were markedly higher in diabetic eyes compared with control eyes in 70 to 79 age group when considered by central zones of total cornea at the 2 to 6 mm. The corneal transparency increased in 80 to 89 years DM patients in the majority of corneal zones. Besides, a weak correlation was found between the occurrence of DM and corneal densitometry at 0 to 2 mm and 2 to 6 mm concentric radial zones in anterior, posterior and total corneal depth.

The mean corneal densitometry results are summarized in Table 2. The corneal densitometry analysis results varied

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between different age groups. In the 60 to 69 age group, the anterior layer at zone 0 to 2 mm has better corneal clarity in controls than in DM patients while corneal densitometry in other zones shows no significant difference. In corneal central zones of 2 to 6 mm, corneal densitometry values were markedly higher in diabetic eyes compared with control eyes in 70 to 79 age group in full depth. The corneal transparency increased in 80 to 89 years DM patients in specific corneal zones including the anterior layer at 0 to 2 mm and 2 to 6 mm, the central layer at 0 to 2 mm, 2 to 6 mm, 10 to 12 mm and 0 to 12 mm and the posterior layer at 0 to 2 mm and 10 to 12 mm regions. Moreover, the total light backscatter at total corneal thickness was higher at 0 to 2 mm, 2 to 6 mm, 10 to 12 mm and 0 to 12 mm concentric radial zones. A weak correlation was found between the occurrence of DM and corneal densitometry at 0 to 2 mm and 2 to 6 mm corneal zones in anterior, posterior and total corneal depth.

Conclusion

Diabetic patients showed higher values of corneal densitometry especially in central annuli in anterior layer than controls aged 60 years and over. Corneal transparency decreases differently in DM eyes across 3 age groups. In the present study, corneal backscattering of different layers in many zones in diabetic eyes was markedly higher than in controls' eyes aged 70 and over. Previous studies revealed that diabetic patients seemed to have thicker corneas, less cell density and hexagonality, and more irregular cell size of the corneal endothelium cells than those of the controls [4-6]. Abnormal morphology of the corneal endothelial cells combined with increased central corneal thickness is an indicator of alterations of endothelial pump function, which decrease corneal transparency [5]. Moreover, Anbar, et al. [21] and Islam, et al. [22] found a significant correlation between the duration of diabetes and polymegathism and polymorphism of corneal endothelium cells, supporting the idea that the longer the disease evolution, the higher endothelial loss. As these changes in corneal endothelial cells are age-related, corneal densitometry in the posterior layer also increases with age in all concentric radial zones [23,24].

The results additionally revealed that corneal backscatter increased to various extents in DM eyes in the 0 to 2 mm circular zone in different age groups and the evolution of DM could possibly increase the corneal densitometry at 0 to 2 mm and 2 to 6 mm in anterior, central and total corneal depth. The visual effect of increased corneal densitometry at pupillary zone is not clear. Prior researches showed intraocular scattering increased in the diabetic eyes compared with controls and the level of intraocular straylight had a tendency to increase as the severity of diabetic retinopathy increased [20,21]. Besides, optical quality of the diabetic eyes was reduced simultaneously in comparison with the control group [21]. There is not a precise relation between the level of backward light scattering and the level of forward light scattering in the cornea [9]. More investigations should be focused on the level of corneal backscatter and its effect on visual quality in clear cornea of diabetic patients.

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