Araştırma Makalesi (Research Article)

An Evaluation of Central Corneal Epithelial Thickness and Central Corneal Thickness Determined On Optic Coherence Tomography Before and After Applanation Tonometry

Optik Koherans Tomografi ile Tespit Edilen Santral Korneal Epitelyal Kalınlık ve Santral Korneal Kalınlığın Aplanasyon Tonometrisi Öncesi ve Sonrası Değerlendirilmesi

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Özet

Amaç: Goldman aplanasyon tonometrisi ölçümlerinden sonra santral korneal epitelyal kalınlıkta ve santral korneal kalınlıkta oluşan değişimleri optik koherans tomografi kullanarak saptamak

Gereç ve Yöntemler: Çalışmamıza kliniğimize rutin oftalmlojik muayene için başvuran 25 hasta dahil edildi. Hastaların tonometri ile ölçümleri yapılmadan önce Optik Koherans Tomografi (OKT) cihazı ile santral epitel kalınlığı ve santral korneal kalınlık değerleri tespit edildi. Ardından Goldman aplanasyon tonometrisi ile göz içi basıncı ölçüldü ve hastaların OKT cihazı ile korneal ölçümleri tekrarlandı. OKT ve tonometri ile yapılan tüm ölçümler aynı kişi tarafından yapıldı.

Bulgular: Çalışamaya katılan hastaların on sekizi erkek, yedisi kadındı. Hastaların yaş ortalamaları 36.6 idi (maksimum 55, minimum 17). Hastaların aplanasyon tonometrisi ölçümü öncesi ortalama epitelyal korneal kalınlığı 52.58 mikron iken, ölçüm sonrası değerleri 52.02 mikrondu (p=0.059). Hastaların ölçüm öncesi santral korneal kalınlıkları ortalama 530.96 mikron iken ölçüm sonrası bu değer 529.88 mikrondu (p>0.05). Her iki ölçümde de istatistiksel olarak anlamlı sonuç tespit edemedik. Santral korneal epitelyal kalınlık değerleri istatistiksel olarak anlamlı çıkmasa da, korneal epitelyal kalınlıkta tonometri sonrası değişiklik olduğu görülmektedir (p=0.059).

Sonuç: Çalışmamızda santral korneal epitelyal kalınlık ve santral kornea kalınlığı ölçümlerinde istatistiksel olarak herhangi bir farklılık saptamadık. Ancak istatistiksel olarak anlamlı olmasa da sonuçlar arasında bulduğumuz kalınlık farkı hastaların epitel hücrelerinde işlem sonucu deskuamasyon olduğuna işaret etmektedir.

Anahtar Kelimeler: Santral epitelyal kalınlık, Santral korneal kalınlık, Optik koherans tomografi, Tonometri

Abstract

Objective: To determine the changes in corneal epithelial thickness and central corneal thickness using optic coherence tomography taken after Goldmann applanation tonometry measurements.

Material and Methods: The study included 25 patients who presented at our clinic for routine ophthalmological examination. Before taking Goldmann applanation tonometry measurements of the patients, epithelial corneal thickness and central corneal thickness values were determined using optic coherence tomography (OCT). The intraocular pressure (IOP) was measured with tonometry and then the corneal OCT measurements were repeated. All the OCT and tonometry measurements were taken by the same clinician.

Results: Evaluation was made of 25 patients comprising 18 males and 7 females with a mean age of 36.6 years (range, 17-55 years). The mean epithelial corneal thickness was 52.58 microns before the applanation tonometry measurement, and 52.02 microns after the tonometry (p=0.059). Central corneal thickness was measured as mean 530.96 microns before tonometry and 529.88 microns after (p>0.05). No statistically significant difference was determined in the changes of both measurements. Following tonometry, a change was seen in corneal epithelial thickness, but not of a statistically significant level (p=0.059).

Conclusion: The study results showed no statistically significant difference in the measurements of corneal epithelial thickness and central corneal thickness following applanation tonometry. Although not statistically significant, the difference seen in thickness indicates desquamation in the epithelial cells as a result of the procedure.

Key words: Central corneal epithelial thickness, Central corneal thickness, Optic coherence tomography, Tonometry

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INTRODUCTION

The cornea is a multi-layer, squamous, non-keratinized structure. It is attached to the Bowman layer with basal columnar cells through hemidesmosomes. Immediately above 2-3 rows of wing cells and 2 rows of squamous surface cells are placed over this layer. This layer is in contact with tears (1). Corneal sensory nerves originate from the ophthalmic part of the trigeminal ganglion (2). Nerve branches divide and run parallel to the superficial surface of the cornea between the basal epithelium and Bowman's layer, forming the sub basal nerve plexus (SBNP) that supplies the overlying corneal epithelium (3,4). Due to this innervation, structural changes in the corneal epithelium are important. Also corneal epithelium is responsible for the nutrition of the cornea and protecting the eye from microbial invasion or foreign bodies.

Goldmann applanation tonometry is a measurement method that operates according to the principle of propulsion force required to flatten the cornea. It is the gold standard method used in the measurement of intraocular pressure (IOP) (1). The aim of the current study was to determine with optic coherence tomography (OCT) whether or not there was any change in the central corneal epithelial thickness and pachymetry values caused by IOP measurements taken with Goldmann applanation tonometry.

MATERIALS AND METHODS

The study was performed in adherence to the tenets of the Declaration of Helsinki and was approved as a prospective study by the Ethics Committee of Firat University Faculty of Medicine (approval no: 2020/07-31).

The study included 50 eyes of 25 patients who presented at our clinic for routine ophthalmological examination. All the patients had no refraction defect, no chronic, systemic or eye disease, had not used any ophthalmological or systemic drug within the previous month and had no history of eye surgery.

Before taking the tonometry measurements of the patients, central epithelial thickness and pachymetry values were determined with an OCT device (OPTOVUE). The IOP was measured with tonometry then the corneal measurements were repeated with the OCT device. All the OCT and tonometry measurements were taken by the same clinician.

Statistical analysis

Data obtained in the study were analysed statistically using SPSS version 26.0 software (IBM, Chicago, IL, USA). In the paired comparisons the Wilcoxon t-test was used. A value of $p<0.05$ was accepted as statistically significant.

RESULTS

The 25 patients included in the study comprised 18 males and 7 females with a mean age of 36.6 years (range, 17-55 years). The mean epithelial corneal thickness was 52.58 microns before the applanation tonometry measurement, and 52.02 microns after the tonometry ($p=0.059$). Central corneal thickness was measured as mean 530.96 microns before tonometry and 529.88 microns after ($p>0.05$). No statistically significant difference was determined in the changes of both measurements. Following tonometry, a change was seen in corneal epithelial thickness, but not of a statistically significant level ($p=0.059$) **(Table 1)**.

Table 1. Central corneal epithelial thickness and central corneal thickness before and after applanation tonometry.

	Before tonometry	After tonometry	p value
Central epithelial thickness (μ)	52.58	52.02	>0.05
Central corneal thickness (μ)	530.96	529.88	>0.05

DISCUSSION

Changes occurring in the corneal structure may include; clouded vision because of surface irregularities caused primarily by microtrauma, infectious events, and potential changes in IOP measurements associated with changes in corneal thickness.

When making IOP measurements in patients, first anesthetic drops are applied to the eye then the ocular surface is stained with fluorescein, and the measurements are taken by placing the prismatic section of the tonometer in contact with the corneal surface. Previous studies have determined that these three stages create desquamation on the corneal epithelium and cause microtraumas in the corneal epithelium and punctate keratopathy (5,6). Changes of up to 15 microns have been determined in central corneal thickness following the dropping of topical anaesthetic agents (7). Changes of 20 microns in central corneal thickness have been reported to lead to differences of 1mmHg in IOP. Previous studies have compared central corneal thickness before and after tonometry but statistically significant changes affecting IOP have not been determined (8). In the current study, no change was determined at a level that could affect IOP.

In some studies in the literature that have examined the effects of fluorescein administered during tonometry measurements, statistically significant changes have been determined in IOP, while other studies have reported no change (9-11). In the studies that determined a change, the difference was attributed to many measurements taken from changes formed in the corneal curvature and differences in the level of IOP. In the current study, no change at a level to affect the IOP was determined in the corneal curvature in the results obtained with OCT.

In a study by Lim et al, epithelial debris was determined in the prismatic section of the tonometer following applanation

measurements and it was determined that because of corneal microtraumas an environment had been created appropriate for the transfer of prion diseases such as Creutzfeldt-Jakob disease (12). To prevent events such as this, cleaning of the tonometer head in particular should be performed routinely in clinics.

In conclusion, the results of this study showed no statistically significant difference in the measurements of central corneal epithelial thickness and central corneal thickness. Nevertheless, the difference found in thickness, although not statistically significant, indicates that there is desquamation in the epithelial cells as a result of the procedure. This may cause complaints such as reduced visual acuity and the feeling of burning or pricking in the eye after tonometry. If glasses are to be prescribed for patients, this should be taken into consideration and the eye examination should be made before the tonometry measurement. As no change in central thickness was determined at a level which could affect IOP, there was no importance in examining the pachymetry measurements before and after the procedure. To the best of our knowledge, there has been no previous study in literature of central corneal epithelial thickness measured before and after tonometry, and therefore the results obtained in this study are the first on this subject.

Conflict of Interest and Financial Status: Our study has not been financed by an institution and institution. In this study, there is no conflict of interest among the authors on any subject.

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Ethical Approval: The study was performed in adherence to the tenets of the Declaration of Helsinki and was approved as a prospective study by the Ethics Committee of Firat University Faculty of Medicine (approval no: 2020/07-31).

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