Assessment of Corneal Epithelial Thickness in Chronic Contact Lens Users Using Anterior Segment Optical Coherence Tomography

Thesis

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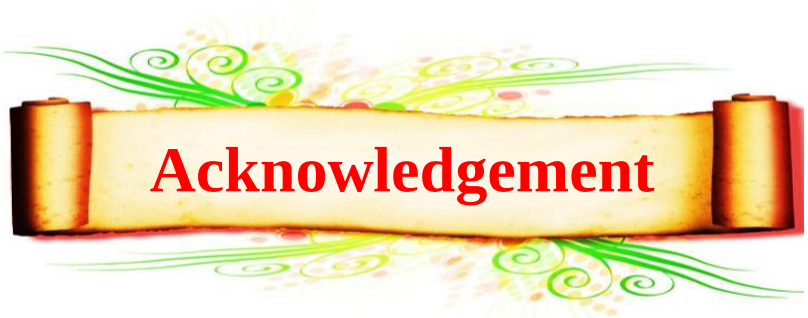

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Contents

List of Abbreviations

SCL	: Soft contact lens
AS-OCT	: Anterior segment optical coherence tomography
TransPRK	: Transepithelial photorefractive keratectomy
PTK	: Phototherapeutic keratectomy
VHF	: Very high-frequency
MUC	: Mucin
DALK	: Deep anterior lamellar keratoplasty
MMPs	: Matrix metalloproteinase
HMEA	: Hydroxyethylmethacrylate
MMA	: Methyl methacrylate
DK	Oxygen Permeability D: Diffusion coefficient, K :solubility coeffient
DK/T	Oygen transmissability : D: Diffusion coefficient, K :solubility coeffient , T :lens thickness
DSAEK	: Descemet stripping automated endothelial keratoplasty
LSCD	: Limbal stem cell deficiency
POV	Pallicade of vogt

List of Table

List of Figures

Abstract

Introduction: The corneal epithelium is stratified epithelium that is continuously renewed and provides the frontline of defence against invading ocular pathogens and a smooth refractive surface essential for vision. In the absence of a contact lens, pre-existing ocular trauma or disease, the epithelium maintains an inaccessible defence against attacks from pathogenic microorganisms, affording a high level of resistance against microbial invasion. **Aim:** The aim of this study was to determine the effect of chronic use of contact lens on corneal epithelium thickness using anterior segment optical coherence tomography as a non- invasive diagnostic accurate measure. **Patients and Methods:** 30 eyes of control subjects who don't wear contact lens along their life aged between 15-45 years ,where compared with similar age group of 30 eyes of chronic contact lens users; who wear contact lens every day not less than 8 hours per day for along time interval between 6 months up to 5 years. **Results:** The average corneal epithelial thickness in the central, paracentral and midperipheral zones was 47.767 ± 5.550 µm , 46.267 ± 5.644 µm, 44.300 ± 4.858 µm, respectively , in chronic soft contact lens users; and 49.800 ± 3.316 µm , 49.200 ± 3.367 µm , 45.733 ± 2.333 µm ,in control group who had never worn contact lens. There were insignificant thinning of corneal epithelium of soft contact group compared to control group regarding the average corneal epithelial thickness in those 3 zones. In all the 8 sectors of corneal epithelium of paracentral zone and midperipheral zones there is insignificant thinning between the two groups except for the inferior temporal sector in the paracentral zone and mid peripheral zone, which shows significant thinning in soft contact lens group compared to control group . The corneal epithelial thickness in the inferior temporal sector of paracentral and mid peripheral zones was 46.333 ± 5.677 µm , 44.933 ± 4.813 µm, respectively, in chronic soft contact lens users compared to 48.767 ± 3.266 µm , 46.900 ± 2.510 µm in control group (p=0.046, p=0.052, respectively). **Conclusion**: Anterior Segment Optical Coherence Tomography (AS-OCT) helps us to evaluate the thickness of corneal epithelium of choric contact lens users, which could be very useful in corneal refractive surgeries in patients depending on contact lens in their lives as a comfortable refractive aid, It is necessary to do AS-OCT hand on hand with pentacam in patients underwhelming refractive surgery to give a proper assessment to their corneal epithelium before determining which type of refractive surgery suits them, Our study confirms that long-term wear of SCL results in insignificant epithelial thinning in most of the corneal epithelial regions except for the inferior temporal region in the paracentral and midperiphral regions which showed significant thinning in the corneal epithelium of the soft contact lens group.

Keywords: anterior segment optical coherence tomography, corneal epithelial thickness, contact lens users

INTRODUCTION

The corneal epithelium is stratified epithelium that is continuously renewed and provides the frontline of defence against invading ocular pathogens and a smooth refractive surface essential for vision. In the absence of a contact lens, pre-existing ocular trauma or disease, the epithelium maintains an inaccessible defence against attacks from pathogenic microorganisms, affording a high level of resistance against microbial invasion.[1]

Not only does the corneal epithelium play a very important role in protecting eyes as it is the outermost layer, but also maintains a high optical quality as well. The corneal epithelium contributes to the refractive power of the cornea, as it is responsible for 0.85 diopter of the total corneal refractive power at the 3.6mm diameter zone of the cornea. Furthermore, the corneal epithelial thickness is not of homogeneous depth and tends to alter its thickness profile to compensate for the irregular corneal stromal surface to get a regular surface.[2]

The normal corneal epithelium is replaced continuously every 4 to 7 days, involving three processes: (1) differentiation of the basal cells toward the surface; pathologic example: epidermalization and keratinization in vitamin A deficiency; (2) centripetal movement of limbal and peripheral cells ;pathologic example: chemical damage of the limbal epithelium; (3) desquamation of epithelial

cells from the surface; pathologic example: extended wear soft contact lenses interfering with normal desquamation.

Soft contact lenses (SCLs) are the most popular contact lens form for the correction and enhancement of visual acuity. Worldwide, 125-140 million people wear contact lenses, Long-term SCL wear can reduce oxygen uptake, induce cell death, and result in central and peripheral corneal epithelium thinning. Therefore, investigating and analysing corneal epithelial thicknesses and shapes of SCL wearers could facilitate the detection of abnormal epithelium in its early stages.[3]

There a significant correlation between soft contact lens wear and epithelial thinning, and it was found that contact lens wear is most common aetiology of limbal stem cell deficiency, followed by pterygium, dry eye, Steven Johnson syndrome, and chemical injury as other causes of limbal stem cell deficiency.[4]

Since the corneal epithelium contributes a lot in corneal refraction and it helps in the design of Some corneal surgery and corneal refractive surgery with excimer laser ablation were done directly on corneal epithelium, such as transepithelial photorefractive keratectomy (TransPRK) and phototherapeutic keratectomy (PTK). It is very important to get a better knowledge of the characteristics of corneal epithelial thickness distribution.[2]

Slit lamp biomicroscope is used for *in vivo* visualisation of the gross appearance of the cornea, Previously, a few instruments have been invented and applied to corneal epithelium thickness measurement in vivo, including very high-frequency (VHF) digital ultrasound, and confocal microscopy which has better magnification for *in vivo* visualisation of corneal cells. A few studies on corneal epithelial thickness mapping have been done using very high-frequency (VHF) digital ultrasound and confocal microscopy. However, these two techniques have some limitations. They both are invasive devices and need anaesthetic. This may increase the risk of corneal infection and decrease the accuracy because of the possible contact related corneal compression. [5]

For *ex vivo* evaluation of the corneal surface epithelium Impression cytology can be used however, these techniques limit the capacity to take cross-sectional thickness measurements of corneal layers ;Anterior segment optical coherence tomography (AS-OCT) is becoming more widely used in clinical studies, for example to investigate the thickness changes of the total cornea and epithelium after corneal refractive therapy, rigid contact lens wear, and to evaluate the influence of soft contact lens design on epithelial indentation.[5-8]

Many techniques are used to measure central corneal thickness The most commonly used techniques are ultrasound and optical pachametry. Anterior segment

Optical coherence tomography (AS-OCT), a relatively new in vivo and non-invasive optical imaging technique that has been most commonly used for posterior retinal imaging, has also been recently found to be a reliable instrument for measuring corneal and epithelial thickness and for monitoring alterations within these structures. AS-OCT has advantages over ultrasound because it is noncontact and has nominally higher spatial resolution and over both optical pachametry and ultrasound techniques because it can easily be used to measure corneal epithelium thickness. [9-13]

Anterior Segment Optical coherence tomography provides optical corneal sections and simultaneously pachymetric data through interpolation of successive radially oriented B-scans. The most advanced AS-OCTs currently provide significantly higher speed and better resolution.The additional feature of an AS-OCT system is the 3D imaging of the corneal epithelium. This provides a practical clinical tool for mapping corneal epithelium in vivo, with the advantage of intact, rapid data acquisition.[14]

In this study we compared the mean central corneal epithelial thickness and the peripheral corneal epithelial regions of chronic soft contact lens users with the mean central corneal epithelial thickness and the peripheral corneal epithelial regions of the control group who had never worn contact lens by using AS-OCT as a non-touch, non-traumatic, easy to use, without any stain and with the ability to compare images easily.

AIM OF THE WORK

The aim of this study is to determine the effect of chronic use of contact lens on corneal epithelium thickness using anterior segment optical coherence topography as a non- invasive diagnostic accurate measure.