Assessment of Epithelial Thickness in Keratoconic Patients Before and After Intra corneal Ring Segment Implantation Using Anterior Segment Optical Coherence Tomography

Thesis

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By

Reham Fathi Mohammed Sayed

M.B.B.cH 2014

Faculty of Medicine, Ain Shams University

Supervised by

Prof. Dr. Rafik Mohamed Elghazawy

Professor of Ophthalmology

Faculty of Medicine, Ain Shams University

Dr. Samah Mahmoud Fawzy

Lecturer of Ophthalmology

Faculty of Medicine, Ain Shams University

Dr. Tamer Abdelfatah Badran.

Lecturer of Ophtalmology

Faculty of Medicine, Ain Shams University

Faculty of Medicine

Ain Shams University

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Reham Fathi Mohammed Sayed

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List of Abbreviations

Abb.	Full term
ALL	Anterior limiting lamina.
AS-OCT	Anterior segement optical coherence tomography
DM	Descemet memembrane
ECM	Extra Cellular Matrix
FD- OCT	Fourier domain OCT
ICRS	Inracorneal ring segment implantation.
KC	Keratoconus
MMPS	Matrix metalloprotinase
OCT	Optical coherence tomography
TD-OCT	Time domain OCT

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INTRODUCTION

Keratoconus, the most common primary corneal ectasia, is a bilateral asymmetric corneal degeneration accompanied with local corneal thinning and occurs mostly in the inferior and central part of the cornea [1].

Initiating in puberty, Keratoconus (KCN) often progresses until fourth decade of life [2]. Affecting all ethnic groups equally, KCN usually causes high myopia and irregular astigmatism which results in poor quality of vision [2,3].

Based on disease severity, many treatment modalities exist including glasses and contact lenses for mild to moderate disease [2-4] while corneal graft preserved for more advanced disease [5].

High costs, need to long follow-ups, long periods for visual rehabilitation, risks of graft rejection or infection, wound dehiscence and suture-related problems make corneal grafts preserved for the last therapeutic choice by many ophthalmologists [6].

In advent of alternative treatments, intrastromal ring implantation have been introduced which improves visual acuity and optical aberrations and also corrects refractive errors and mean keratometric data [7-14].

Initially, intra corneal ring has been used to treat high myopia [15], but incision-related complication resulted in arrival of intrastromal segments to treat KCN in 2000 which achieved FDA approval in 2004 [14-18].

Different types of intrastromal segments include Intacs, Ferrara and Keraring [19]. Intacs segment consist of two semicircle PMMA-made parts with the arcuate length of 150 degrees and an axial hexagonal shape [20]. Ferrara segment shapes triangularly which helps to reduce stare and is made of PMMA and CQ acrylic [21].

Optical coherence tomography (OCT) is a non-contact optical signal acquisition and processing device that provides magnified, high resolution cross-sectional images of ocular tissues. Development of anterior segment OCT (AS-OCT) offers the benefits of fine resolution and noninvasive examination of the anterior segment anatomy to the depth of the iris plane. This imaging device has been utilized for investigating a variety of corneal and anterior segment diseases [22].

Technological advances toward three-dimensional visualization broaden the scope of AS-OCT in ophthalmologic evaluation. The AS-OCT is a valuable imaging tool whose use in research and clinical practice will continue to expand our knowledge and management of various ophthalmic conditions [22].

AIM OF THE WORK

To investigate epithelial thickness changes in keratoconic patients before and after intra corneal ring segment implantation using AS OCT.

Chapter 1

ANATOMY OF CORNEA

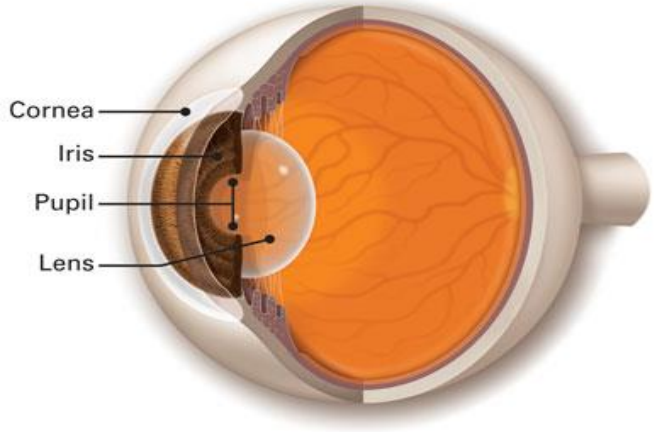

Figure (1): Anatomy of cornea [23].

The cornea is a transparent avascular tissue that acts as a structural barrier and protects the eye against infections [23].as shown in figure 1 Along with the tear film, it provides proper anterior refractive surface for the eye. Cornea contributes to two-third of the refractive power of the eye.

The cornea is horizontally oval, measuring 11–12 mm horizontally and 9–11 mm vertically [24]. Cornea is convex and aspheric. The anterior curvature is 7.8 mm and posterior curvature is about 6.5 mm. Cornea contributes to about 40–44 D of refractive power and accounts for approximately 70% of total refraction. The refractive index of cornea is 1.376. There is a gradual increase in thickness from central cornea to the periphery [25].

The cornea is made up of cellular and acellular components. The cellular components include the epithelial cells, keratocytes, and endothelial cells. The acellular component includes collagen and glycosaminoglycans. The epithelial cells are derived from epidermal ectoderm. The keratocyte and endothelial cells are derived from neural crest. The corneal layers include epithelium, Bowman's layer, stroma, Descemet's membrane, and endothelium as showen in [Fig. 2]. Recently, a layer of cornea which is well defined, acellular in pre-Descemet's cornea is getting attention with the development of lamellar surgeries [26].

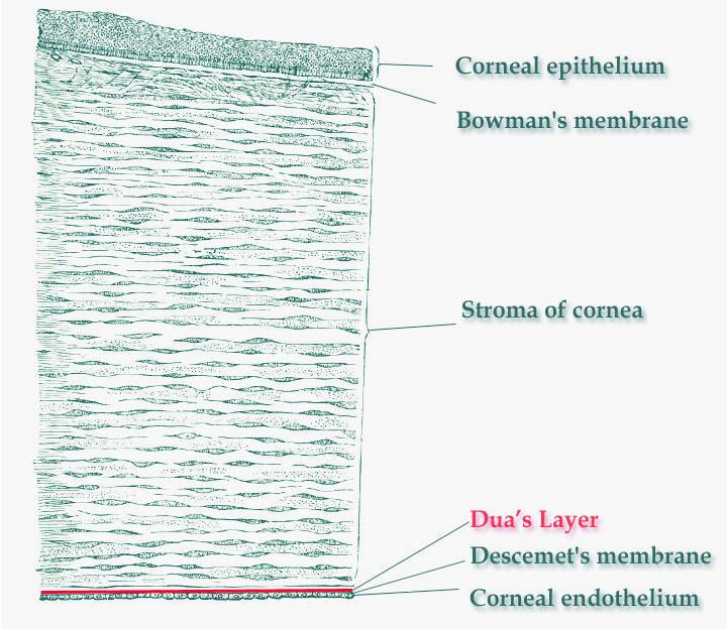

Figure (2): Layers of cornea [26].

The corneal epithelium is composed fairly uniformly of 5–7 layers of cells. It is about 50 μ in thickness. The epithelium

is uniform to provide a smooth regular surface and is made up of nonkeratinized stratified squamous epithelium.as showen in figure (3).

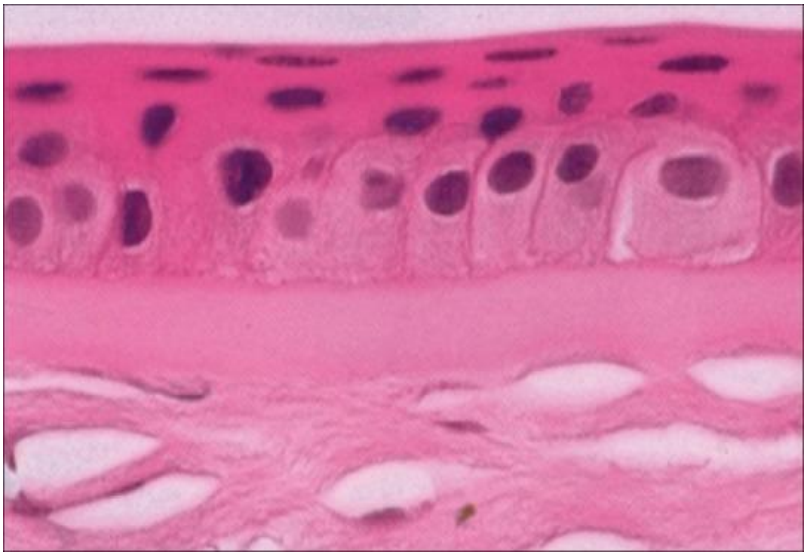

Figure (3): Histopathology of corneal epithelium and Bowman's membrane [27].

Cornea epithelial cells have a lifespan of 7 to 10 days undergoing involution, apoptosis, and desquamation. The epithelium is 5–6 layers structure with three types of cells: superficial cells, wing cells, and the basal cells. The superficial cells are 2–3 layers made up of flat polygonal cells. Desmosomes form the tight junction in between the superficial cells. Thawing cells are 2–3 layered and are named as they have wing-like shape. Basal cells are single layer of the epithelium which is cuboidal or columnar. They have abundant organelles and they are active mitotically [27].