USES OF EXCIMER LASER IN REFRACTIVE SURGERY

ESSAY

Submitted For Partial Fulfilment

of Master Degree In Ophthalmology

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DEDICATED TO

MY PARENTS

FOR HELPING ME A LOT THROUGHOUT

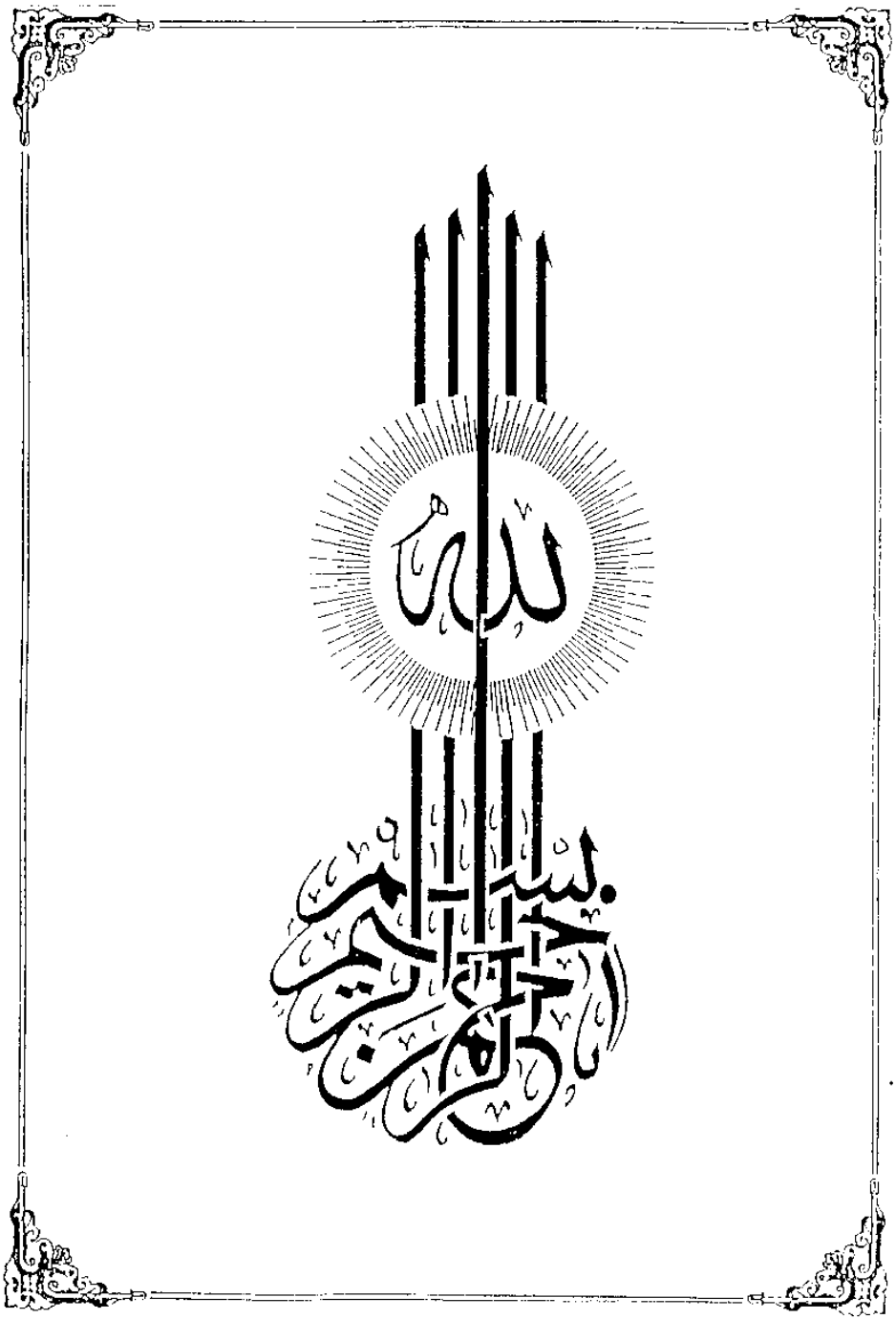
MY LIFE AND FOR THEIR ENCOURAGEMENT

AND SUPPORT TO BECOME WHAT I AM TODAY

IT IS ALSO

DEDICATED TO

THOSE WHOM I LOVE



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CONENTS

PAGE

LIST OF FIGURES

INTRODUCTION

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Many Keratorefractive approaches have been made as an alternative to the use of spectacles and contact lenses, recently Excimer Lasers were discovered.

Excimer Lasers are high-power sources of pulsed ultra violet radiation.

They constitute of a group of rare gases like (Krypton, Xenon and Argon) which by electric discharge react with a halogen (Fluoride or Chloride) to build Excimers. Most important of all is Argon Fluoride Excimer Laser, which has shown very significant potential in the treatment of a variety of clinical conditions in ophthalmology.

The surface of various tissues absorbs the pulses of ultraviolet light which are controlled to change corneal refractive errors, they can remove superficial opacities, smoothen and decrease corneal irregularities, performing penetrating keratoplasty and also controlled removal of central corneal tissue to reduce myopia, and to perform excisional linear cuts into the cornea to reduce astigmatism.

Some unsatisfactory results and ocular complications have been discovered after the procedure, but attempts to overcome them are being tried and searched for.

ANATOMY and PHYSIOLOGY OF THE CORNEA

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The cornea is the transparent window through which the rays of light gain admittance into the eye ball. The cornea is an avascular, transparent structure forming the anterior 1/6 of the outer coat of the eye.

It is elliptical (or oval) being 12 mm in the horizontal meridian and 11 mm in the vertical. It is circular from behind having a diameter of 11.5 mm. The curvature of the cornea is some what greater than the rest of the globe. (Wolff, 1976).

The radius of curvature of the anterior surface is 7.5 - 8 mm and that of the posterior surface is 6 - 6.5 mm. It's central thickness is 0.52 - 0.60 mm and about 0.67 up to 1 mm at the limbus.

The cornea is formed of five layers from without inwards.

1- The epithelium.
2- The basal lamina and Bowman's membrane.
3- The stroma.
4- Descemet's membrane.
5- The endothelium.

(Klyce and Beuerman, 1988).

The anterior corneal surface is covered by the precorneal tear film.

The precorneal tear film

it covers the ocular surface. It is 6.5 - 7.5 μ thick, it's volume is 7.4 μl (unanaesthetised eye) and 2.6 μl (anaesthetised eye), decreases with age. It is not grossly visible except at the lower lid margin. It is optically clear, renewed constantly. A normal and constantly replenished precorneal film is essential to the health of cornea, particularly the epithelium. (Adler, 1959; Girard, 1981).

The precorneal film is composed of three layers: an outer, oily; a middle, watery layer; and an inner mucous layer. The surface corneal epithelium is covered by minute microvilli that may aid in holding the tear film in place. The precorneal film will disappear in areas that have been injured or show disease. . In general it has the following functions (Girard, 1981).

1- Optical: fills up irregularities in corneal epithelium.
2- Removes and flushes desquamated cells, debris or foreign bodies.
3- Lubrication of the surfaces.
4- Supplies oxygen to the cornea.
5- Antimicrobial: Lysozyme and immunoglobulins. (Adler, 1959).

The Epithelium:

It is non keratinized stratified squamous epithelium, consisting of four to six layers of cells, it is 50-100 μ thick, and represents 10 percent of the corneal thickness. (Ehlers, 1970).

The epithelium is histologically divided into three layers:

- Superficial squamous cell layer.
- Middle or wing cell layer.
- Deep basal cell layer.

1) Superficial cells:

The cells are polygonal in shape, with a distinct surface membrane, having microscopic projections (microvilli and microplicae) (klyce and Beuerman, 1988).

Ultrastructurally: they have a lucent cytoplasm containing free ribosomes, and fragments of endoplasmic reticulum. The Golgi complex, which is necessary for the export of synthesised protein, is poorly developed. The mitochondriae are small, some tonofilaments are associated with the desmosome. Micro-filaments (actin layer) are parallel beneath the cell membrane (Teng, 1961).

b) Wing cells:

These are transitional cells that form between basal cells and superficial cells. The nuclei are rounded or elongated, parallel to the surface. The cells interdigitate and joined by desmosomal junctions, which are important to prevent slippage, sliding and deformity of the cells. Matts of tonofilaments fill the cytoplasm, few microtubules and mitochondriae are present. (tonofilaments are intermediate filaments between the diameter of microfilaments and that of microtubules) (Klyce and Beuerman, 1988).

c) **Basal cells:**

The columnar basal cells, represent the germinative layer of the epithelium, and possesses more cytoplasmic organelles than the more anterior layers. The mitochondriae, are small and in moderate number around the nuclei. The Golgi complex is less prominant , and found anterior to the nucleus. Scattered ribosomes and rough endoplasmic reticulum together with mass of tonofilaments and some microtubules are present. The lateral borders of the basal cells interdigitate together by zonulae adherens. The posteior surface of the cells is flat, and rests on the basal lamina to which they are attached by hemidesmosomes (Klyce and Beuerman, 1988).

The basement membrane plays an extremely important part in the movement of fluids and nutrient substances through the cornea.

Repair:

When the epithelium suffers a discontinuity, such as after an abrasion, two factors result in restoration of the epithelium.

1- Epithelial slide, which is a horizontal migration of epithelial cells surrounding the denuded area to cover the defect.
2- Multiplication, which occurs by the divided epithelial cells by mitosis.

In the absence of recurrent injury and under normal circumstances, the process of re-epithelialization of the cornea is extremely rapid. The entire cornea can be re-epithelialized in 4 to