STUDY OF CORNEAL THICKNESS IN EGYPTIANS

Thesis
Submitted for partial fulfillment
of M.Sc. Degree in **Ophthalmology**

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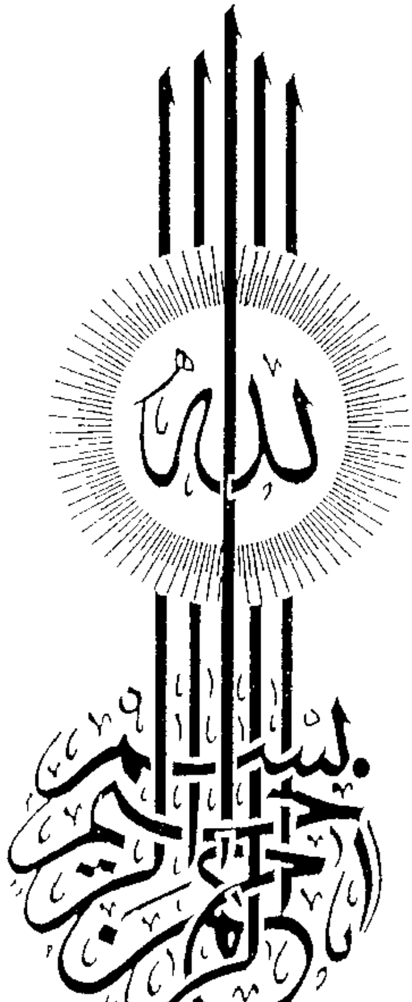
بسم الله الرحمن الرحيم

سُبحانكَ لا علمَ لنا إلا ما علّمتنا

إنك أنت العليم الحكيم

سورة البقرة .. آيه ٣٢


بسم الله الرحمن الرحيم

TO...

To My Family
Who Gave Me A Lot

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INTRODUCTION

Measurement of corneal thickness can be of value in following up patients with certain corneal diseases. It may be used to evaluate the degree of corneal oedema in various states of corneal decompensation, as in Fuch's dystrophy, or the thickness of the cornea in keratoconus or ulcerations.

Perhaps most important is the use of corneal thickness measurement in following up patients with corneal transplants to determine endothelial function and its recovery and to become alert to graft decompensation *(Sugar, 1980).*

The corneal thickness is an important measurement for both the safety and efficacy in radial keratotomy operation *(Hofmann, 1985).*

Terminology

Pachometer comes from the Greek terms pachy (thick) and metron (to measure).

The spelling pachometer was introduced into ophthalmology by David Maurice on the advice of Sir Stuart Duke-Elder. It is pointed out by Maurice that the noun form pachometer seems preferable than the adjective form pachymeter *(Waring, 1992)*.

Optical pachometry

Instrumentation for the measurement of corneal thickness by optical means was first accomplished by Blix (1879). The method used involved the observation of specular reflection from the epithelial and endothelial surfaces of the cornea by employing a microscope of high magnification. The difference in adjustment gave the apparent distance between the two surfaces. Fig. (1).

The real distance could then be calculated from the known radius of corneal curvature and the index of refraction of the cornea *(Donaldson, 1966)*. Fig. (2)

Hartinger (1921) was the first to use the slit lamp beam for measuring the corneal thickness. A similar method was used by Juillerat and Koby (1928) who also used a slit lamp beam. Measurements were made of the apparent length of the optical section by means of an eyepiece micrometer. From this reading the actual thickness could be calculated.

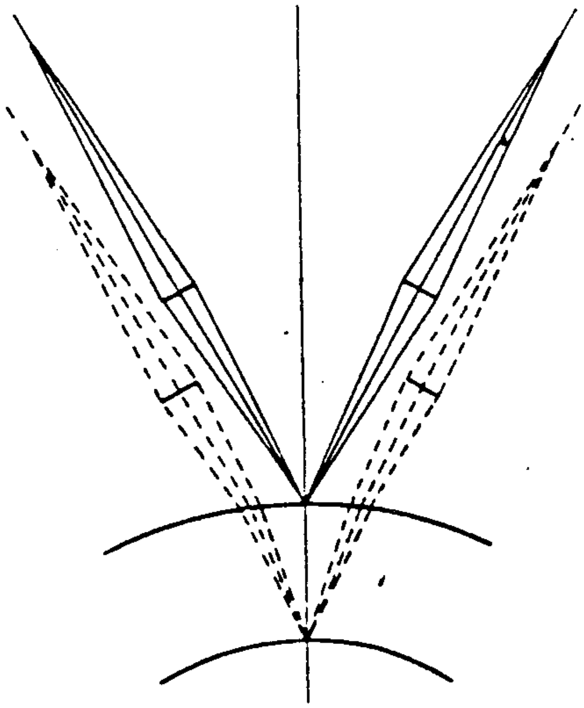

Fig. (1): Diagram of light pathways in instrument designed by Blix for optical measurement of corneal thickness. Successive measurements were taken by first observing specular reflection from epithelial surface and then endothelial surface of the cornea *(Donaldson, 1966).*

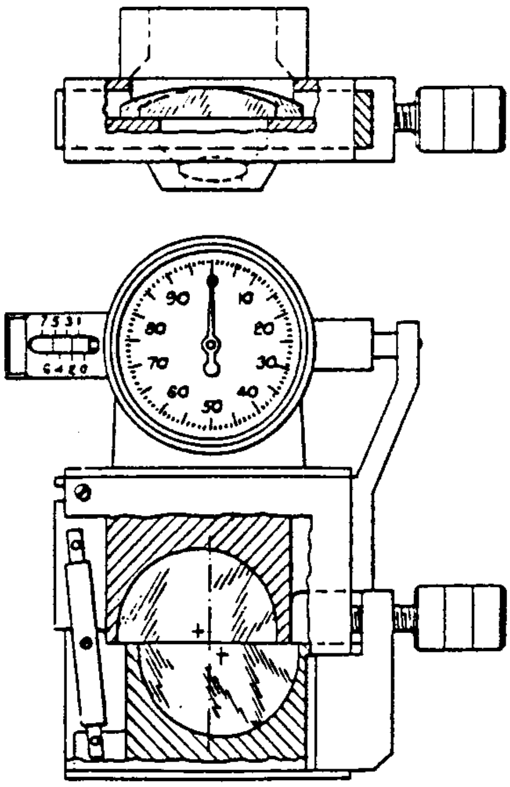

Fig. (2): Diagram of optical parts of split ocular (described by Donaldson). In cross section (above) eye lens is seen which has been left intact but field lens is split, each part being slightly greater than half a lens. Each "half" moves in opposite directions because of lever system at left side of cutaway drawing (below). Also a dial is shown which indicates precise degree of movement of split field lenses *(Donaldson, 1966).*

Goldmann (1932) was apparently the first to use a split ocular to measure the optical section of the slit lamp beam as it passed through the cornea *(Donaldson, 1966)*.

Another method was first introduced by Von Bahr (1948) then modified by Maurice and Giardini (1951) and finally modified by Mishima and Hedbys (1968).

The instrument (Haag-Streit pachometer attached to the model Haag-Streit 900 slit lamp) measures the apparent thickness of the corneal optical section, using an image splitter placed infront of the objective lens of the microscope and a special ocular lens. When the image splitter is rotated, the upper half of the optical section is displaced from the fixed lower half. When the centres of the upper endothelial and lower epithelial lines are aligned, the meter readings give the thickness values in millmeters *(Mishima, 1982)*. Fig. (3).

The corneal thickness must be measured with the optical section perpendicular to its surface. Failure to obtain this optical alignment is the most important source of error *(Ehler and Hansen, 1971)*.

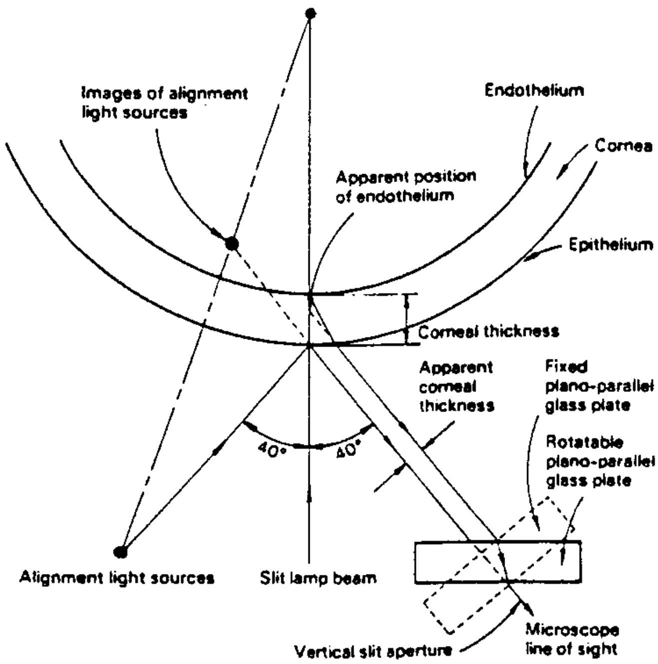

Fig. (3): When the light sources are correctly aligned, the slit lamp beam is perpendicular to the corneal surface. Corneal thickness is measured by finding the apparent thickness by rotation of the plano-parallel glass plate, then calculating actual thickness from the amount of displacement of the light path (ray trace method). *(Topcon, Instrument manual).*

This gives thickness values that are too high *(Azen et al., 1979).*

A modified Haag-Streit pachometer ensures perpendicular alignment at the time of measurement.

Two small lamps are attached so that the distance from the slit beam aperture to the lamps is the same as the distance from the aperture to the centre of the microscope.

When he image splitter is rotated, the upper half of the optical section is displaced from the fixed lower half, when the centres of the upper endothelial and the lower epithelial lines are aligned, the meter readings give the thickness values in millimeters. At this point, however, the image of the two small attached lamps must be on the epithelial line and at equal distance from the horizontal dividing line of the visual field. Fig. (4) *(Mishma and hedbys, 1968).*

The slit beam must be as narrow as possible to facilitate proper alignment of the optical section. The corneal thickness is calibrated with an assumed refractive index of 1,377 *(Mishma, 1982).*

The modification of Mishima and Hedys (1968) in which an extrafixation light mounted on the arm of the attachement,