MANAGEMENT OF POSTOPERATIVE CORNEAL ASTIGMATISM

ESSAY

Submitted in partial fulfilment

of the Master Degree In Ophthalmology

BY

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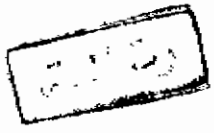

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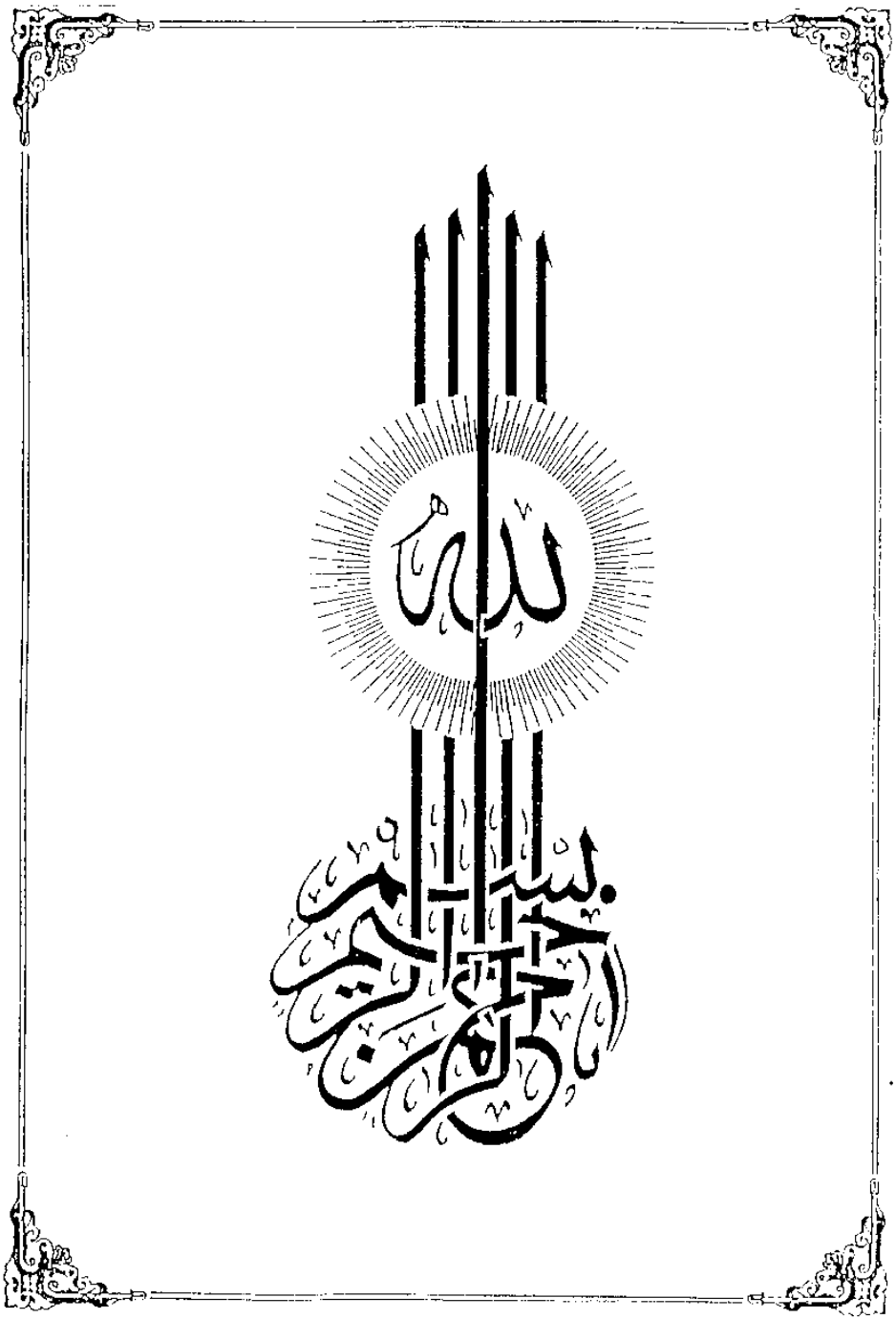

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INTRODUCTION:

The prevention and treatment of corneal astigmatism following cataract and keratoplasty have been subjects of discussion and debate for many years. The ophthalmic surgeons have concerned with postoperative corneal astigmatism because it is an integral part of the postoperative refractive error in aphakia. A high degree of astigmatism postoperatively can result in an unhappy patient who continues to complain of eye strain after prolonged use of the eye.

Thanks God, the improvement and the wide use of intraocular lenses and the ultrathin comfortable contact lenses, could correct the aphakic situation resulting after cataract surgery. Still, in doing so, astigmatism remains a prevalent and inexorable problem.

On the other hand, microsurgical instrumentation and techniques, increased availability of, and better, homograft material and improved postoperative management have all combined to make primary penetrating keratoplasty an operative procedure with predictably successful outcome.

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Residual postoperative astigmatism, in an otherwise successful, clear corneal graft, remains the major unsolved complication of microsurgery. It can be of such magnitude that the patient may see less through an optically clear corneal graft than preoperatively through the pathologic cornea. Many patients who anticipated enjoying good vision without spectacles following keratoplasty, have been forced to wear either insightly astigmatic spectacles correction or to return to contact lenses. So, one of the goals to achieve good results after corneal surgery, is to succeed to control this postoperative problem.

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AIM OF THE WORK:

In this essay, an attempt will be done to express the problem of postoperative astigmatism which commonly follows cataract and keratoplasty operations and causes a considerable degree of visual impairment. Also, we shall try to throw out a spot of light on the main causes and surgical errors that commonly lead to this problem and the most important corneal and scleral approaches suggested to overcome this problem during and after surgery.

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GROSS ANATOMY OF THE CORNEA:

It is a clear transparent tissue with a smooth and brilliant surface. It is curved in meniscus form and fits with a bevelled margin into the anterior scleral foramen(Duke Elder,1961).

Looked at from infront, the cornea is elliptical, being 12 mm in the horizontal and 11 mm in the vertical meridian. From behind it is circular, the cornea appears about 11.5 mm in diameter (Flg. 1). This difference is due to the fact that the sclera and conjunctiva overlap the cornea anteriorly more above and below than laterally (Wolf,1976).The diameter of the cornea being slightly less 0.1 mm in females (Duke Elder, 1961). The anterior surface is not uniformly curved, in the central one third or optical zone an area with a diameter of about 4 mm, it is approximatly spherical usually with a small amount of astigmatism giving it a toric form. While beyond this, the peripheral zone becomes flattened, more so on the nasal side than the temporal and more so above than below so as to approximate an elliptical form.

The posterior surface is more strongly curved, a circumstance which makes this tissue considerably thinner at the center than near the margins. In order

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that, this thick margin may accomodate itself to the bevelled edge of the sclera, the inner margin of the cornea is rounded off in a deep groove: the sulcus circularis corneae which fits into the internal scleral sulcus.

The values given for the thickness of the cornea vary depending on weather they are measured anatomically on the dead eye or optically on the living. Owing to swelling of tissues after death, anatomical measurements are in general greater than the optical measurements and of course are not so accurate. The physiological astigmatism making the radius of curvature in the horizontal direction 7.8 mm and in the vertical meridian 7.7 mm.

A sexual difference occures, the radius being greater in males than females and there is also association between it and the size of the body and head. The cornea is relatively large at birth and almost attains its adult size during the first and second years, indeed practically all the post natal growth occures in the second 6 monthes after birth, although some increase in size may be evident upto the end of the second year of life (Duke Elder, 1961).

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In general terms it may be said that while the eye ball as a whole increases a little less than 3 times in volume from birth to maturity, the corneal segment plays a relatively small part in this. The cornea of the new born is flatter than in the adult and contrary to its condition in later years, it is more curved peripherally than centrally, it finally tends to flatten again, the vertical meridian usually more than the horizontal.

THE CORNEOSCLERAL JUNCTION (THE LIMBUS):

Is the transition zone between the conjunctiva and sclera on one hand and cornea on the other (Wolf,1976). The anterior boundry of the limbus is located at the most anterior point where a limbus based flap can be reflected. Just posterior to this, there is a slightly blue area about 1 mm wide. The junction of the blue and white areas overlies the end of Descemet's membrane, or Schwalbe's line. The blue portion of the limbus overlies clear cornea, where as the white portion overlies the trabecular meshwork (Fig. 2).The anterior baseline overlies the termination of Bowman's membrane. This is the anterior border of the limbus. The posterior baseline overlies the scleral spur or root of the iris.

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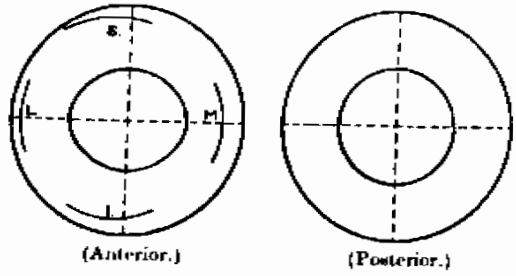
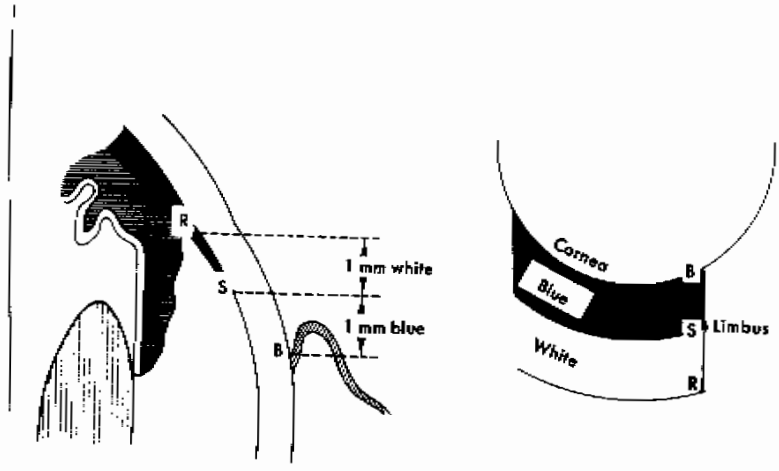


In the anterior aspect the cornea is transversely ellipsoid, whereas its posterior aspect is circular.

Figure (1)

(Wolf,1976)



Surgical anatomy of the limbus.

B: Bowman's membrane.

S: Schwalbe's line.

R: scleral spur, or iris root.

Figure (2)

(Jaffe,1984)

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This is the posterior border of the limbus. There are wide variations in the appearance of the limbus in different individuals with some caused by post inflammatory conditions such as trachoma or congenital anomalies such as scleralization (Jaffe,1984).

An understanding of wound healing is essential for rational planning of cataract surgery and for avoiding several major postoperative complications, that may result in distortion of corneal curvature. During healing excessive contraction or gaping of wound may occure, resulting in astigmatism.

CORNEAL INCISION HEALING:

A corneal incision is often performed in the extraction of a lens from an eye that has previously undergone a filtering procedure for the control of glucoma and in patients with certain types of blood dyscrasis. Some surgeons employ a corneal incision routinely (Jaffe,1984).In the cornea there is immediate swelling of the wound margins created by imbibition of aqueous. This helps to produce a more secure and water tight wound which contributes to the surprising

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stability of a corneal section in the early stages. Histologically, the anterior and posterior lamellae of the cornea appear to retract, forming anterior and posterior triangles which have to be filled. The anterior triangle becomes filled with epithelial cells within 2 days. Initially there is epithelial cell slide followed by cell replication(Gasset and Dohlman,1968). Filling of the posterior triangle of the wound is less rapid. Early investigation(Tooke,1914)reported rapid filling of this triangle with fibrin. More recent investigations (Dunnington,1955) have failed to find this plug, although a small amount of exudate at the apex of the triangle is seen, probably the result of seepage from the adjacent corneal stroma.

Within 3 to 4 days, active proliferation of keratoblasts occures within the stroma. It was noted that intrastromal injection of 5 micrograms of mesodermal growth factor induced wide spread fibroblastic activity and stromal cell division and markedly stimulated stromal healing(Rich et al.,1979). Polymorphs thought to come from the tear film, invade the stroma within 24 hours. The amount of infiltration is much greater with an absorbable suture material. Macrophage infiltration attracted by chemotaxis leads to destruction of cell debris. During this phase the

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tensile strength of the wound is law. Only when new collagen starts to be formed after the first 5 days, does the wound strength increases.

By the eleventh day, collagen is found throughout the wound length (Pierse,1975).Gradually the epithelial plug anteriorly is pushed towards the surface and corneal shape returns. It is at the posterior corneal surface where there is most delay in wound healing. After cutting, Descemet's membrane retracts and curls upon itself.

Incomplete healing of the posterior corneal surface was demonstrated in 34 out of 64 eyes examined postmortem by Heller(1971).Within 1 to 6 months all but one showed posterior gaping, but after 7 months all were healed. Within 7 to 14 days postoperatively, endothelial cells with dark flat nuclei and attenuated cytoplasm cover the stromal lamellae where Descemet's membrane is missing. Flaxel and Swan (1969) found in their 32 days specimen, relatively large areas of gaping of the inner wound edges lined by abnormal endothelial cells. Descemet's membrane as a thin band is present at 4 months postoperatively, the thickness of this increases with time to approximately one third to one half thickness of the uninvaded membrane at 22-23 years postoperatively (Heller et al.,1971).

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