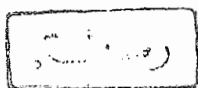


Postkeratoplasty Astigmatism

Thesis

Submitted for the partial fulfilment of
The Master Degree in Ophthalmology



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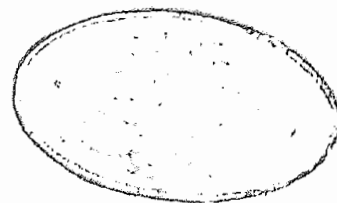
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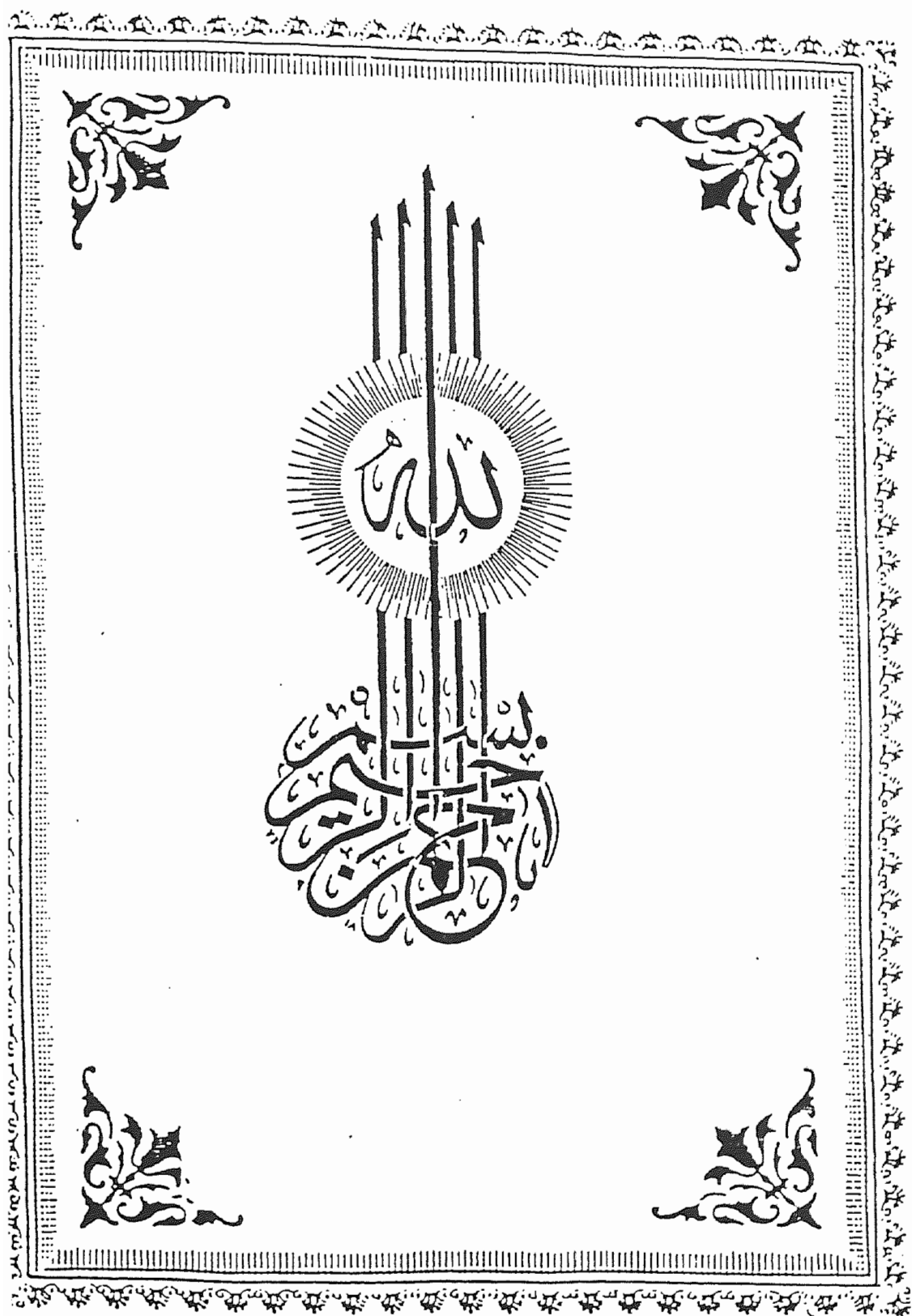
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Introduction

Astigmatism following keratoplasty surgery is not uncommon.

According to Frangieh et al. (1991), the incidence of annoying astigmatism varies between 10% and 27% .

In one study an average amount of astigmatism was 4.00 - 5.00 - diopters (D) (Hannush et al., 1989). In another study, it has a range from 3 to 18 diopters (Kirkness et al., 1991).

In most of the cases (about 90%), astigmatism can be corrected using glasses or contact lenses, but sometimes complete visual rehabilitation can not be achieved which may require surgical intervention (Kelly , 1988).

In the present study, the factors that may lead to the occurrence of astigmatism will be discussed. Also, methods of detection of the amount and the axis of astigmatism will be reviewed and finally the different ways to reduce such astigmatism will be discussed.

Causes

Causes Of Postkeratoplasty Astigmatism

The prevention of postkeratoplasty astigmatism is a major goal in achieving a satisfactory results. The two major causes of postkeratoplasty astigmatism are improper trephination and improper suturing techniques.

1- Trephination :

The surgeon's goal is to create an incision as radially symmetrical as possible for both donor and recipient bed. On assumption that more uniform tissue around the entire circumference will create more uniform healing and less astigmatism (*Perlman, 1981*).

Proper trephination to reduce the postkeratoplasty astigmatism entails the surgeon should cut a perfect circular host opening with smooth edges and should place in that hole a perfect circular button which also has smooth edges. When an oval donor button is sutured in a round recipient bed, the shorter meridian of the button flattens and the longer meridian steepens. The astigmatism induced is mixed; the steeper meridian being myopic, the flatter meridian being hypermetropic (*Troutman, 1977*). Fig. (1).

When a round cut donor button is sutured into an oval-shaped recipient opening, the longer dimension of the recipient is compressed centrally, steepening that meridian and the shorter dimension of the recipient opening is expanded, i.e., flattening that meridian (*Paton, 1980*). Fig. (2).

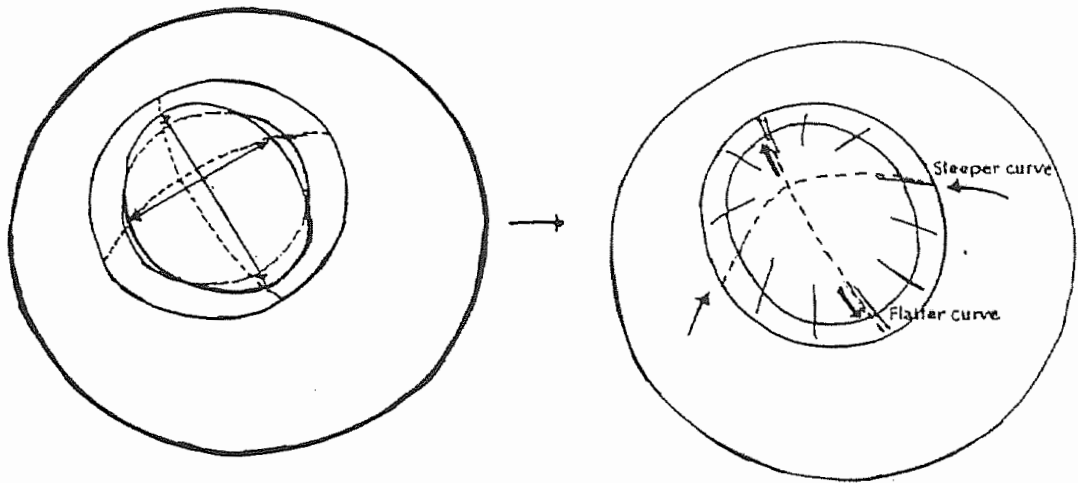


Fig. (1) : Oval button over round recipient bed (Troutman, 1977).

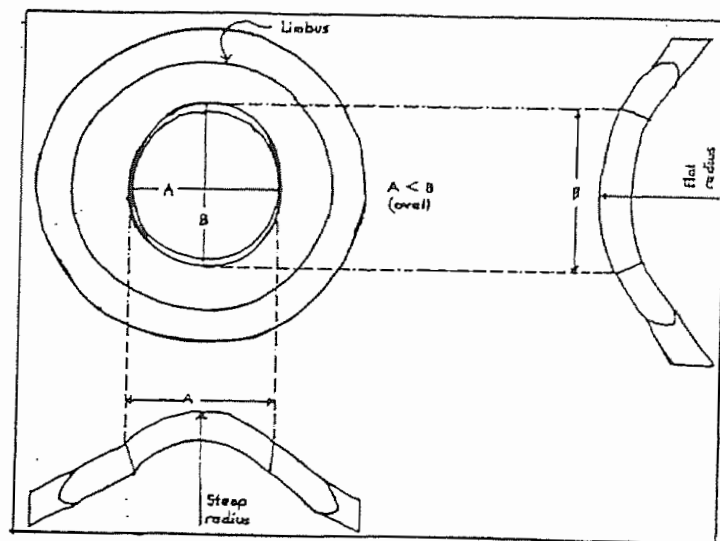


Fig. (2) : Round button in oval recipient bed (Paton, 1980).

An oval donor button can be produced by irregular cuttings such as lipping or chipping. Fig. (3). They may be due to slipping of donor button, irregularity of backing block surface or using blunt blade (Troutman, 1977).

Punching buttons from endothelial surface of a corneoscleral rim is preferred because it generally yields a high quality reproducible circular button although it needs the use of a trephine 0.2mm larger in size than that used for recipient bed to get same size donor and recipient opening. On the other hand, anteriorly trephined buttons are cut from the epithelial surface of the whole globe and buttons tend to be of variable size and shape (*Perlman, 1981*).

Hanna and Waring (1989), described a suction punch which ensures proper centration and uniform round perpendicular cut of donor tissue. Hanna donor suction punch has a teflon back block with a single radius of curvature with central fenestrations. These fenestrations allow suction to be applied and thus the donor cornea is held firmly without slip during trephination. The cylindrical blade is guided by a perpendicular cylindrical guide, which ensures that the blade is centered perpendicularly over the wall, Fig. (4).

An oval recipient bed is a commoner problem than an oval button and is considered a key factor for postoperative astigmatism (*Schwab, 1987*). It may be produced by superior and inferior rectus sutures used

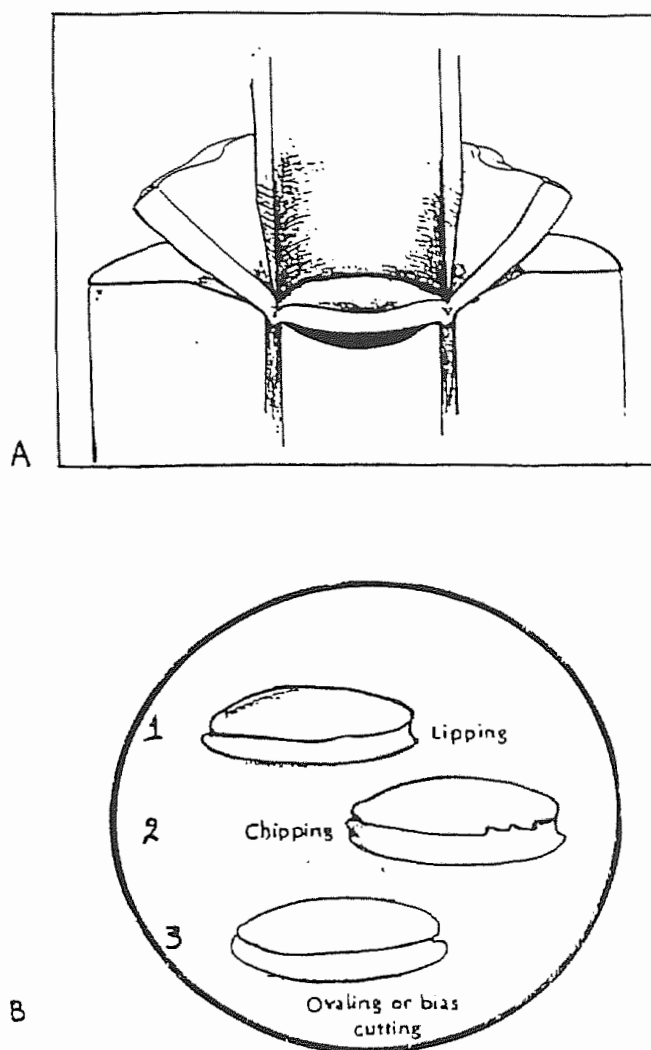


Fig. (3) : Irregular cuttings (Troutman, 1977)
A. Corneal tissue distorted by trephine as it is being cut

- B.
- 1- Lipping
 - 2- Chipping
 - 3- Ovaling

for fixation of the globe during trephination. These sutures can cause asymmetry of the bed rendering it oval with vertical long axis (*Nordan et al., 1991*).

Also, the scleral support ring used in aphakics during trephination can distort the globe and lead to irregular cut. Sutures used to fix the ring to the sclera, when tied with different tension, can create significant recipient bed asymmetry. Villacriz et al. (1986), observed that if the two tight scleral ring sutures were in the vertical meridian, the recipient bed would be oval with long axis horizontal.

Another surgical variable that can induce an oval recipient bed is the surgeon's unequal pressure on the trephine. When pressure is applied during trephination, corneal tissue balloons inside the trephine. If pressure is applied unequally, this causes more corneal tissue to be ballooned into the trephine in one side than the other, resulting in an oval bed (*Schwab, 1987*).

Tilting of the hand-held trephine can lead to an oval wound. This is due to compression of the cornea ahead of the trephine edge when rotation of the trephine to each side of a fulcrum occurs, and is helped by the intraocular pressure that forces the greatest amount of corneal tissue inside the trephine along the meridian of maximum corneal compression which is likely to be perpendicular to the direction of trephine tilt (*Cohen et al., 1986*). Fig. (5).

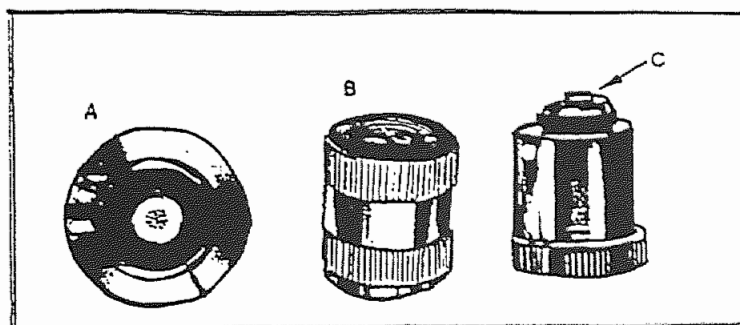


Fig. (4) : Hanna donor suction punch consists of 3 components :
 A. Supporting base attached to polythene tube syringe.
 B. Alignment cylinder assures central vertical position of the blade.
 C. Disposable razor blade (arrow) trephine is mounted on end of cylindrical handle that fits inside alignment cylinder. (Hanna and Waring, 1989).

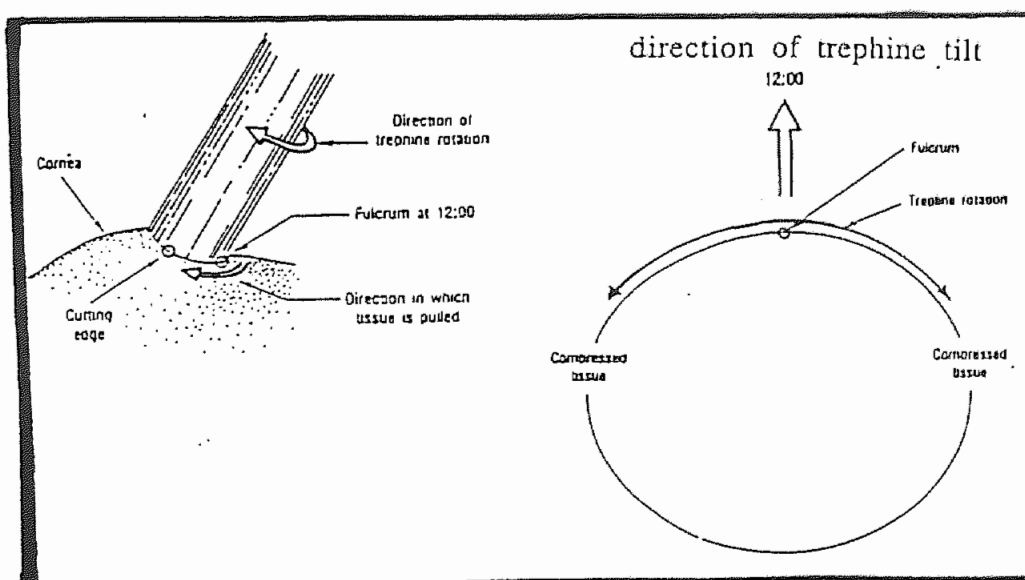


Fig. (5) : The effect of trephine tilt (Cohen et al., 1986).

Ovality of the recipient bed may also occur from scissors used to excise the button of tissue. This results in a step-like margin or shelving of the deep corneal lamellae (*Paton, 1980*) Fig.(6). Some surgeons intend to create a shelf because they think it can support the graft and prevent the collapse of anterior chamber. But, it is virtually impossible to get a uniform radially symmetric posterior shelf (*Waring, 1992*).

Eccentric cut is another factor that may lead to astigmatism. It may occur if the surgeon does not pay good attention to center the trephine cut, and also poor fixation of the globe during trephination aids to this problem. Decentered graft results in non-correspondence of the visual axis of both the donor and the recipient (*Schwab, 1987*). Fig.(7). Proper centration can be achieved by visually detecting the center of the pupil especially when constricted by pilocarpine. Another method is to use a calibre and measure equidistances from limbus to center of cornea. Opening the calibre to 6 mm, four measurements are taken at 3, 6, 9, and 12 o'clock. The corneal center corresponds to the point of coincidence of these four marks, otherwise a new mark is placed in center of the four marks. (*Pande et al., 1993*).

As the greatest ovality was found to be more common in hand-held trephines because of the need for scissors to complete the cut, suction trephines were developed. Suction trephines have the ability to perform deep or penetrating 360 degrees trephination with minimal detected ovality (*Pflugfelder et al., 1992*). Hessberg-Barron vacuum trephine is an example of suction trephines. It consists of a body and a blade

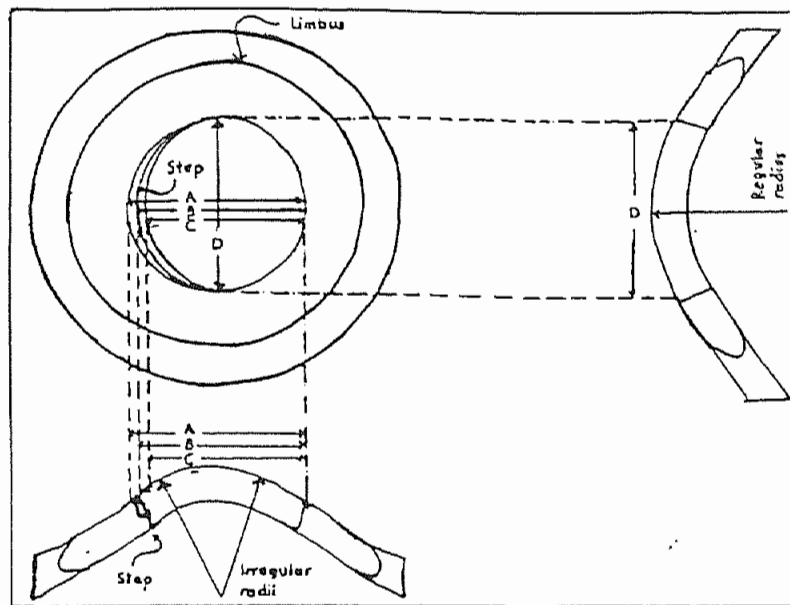


Fig. (6) : Step-like margin of recipient bed. (Paton, 1980).

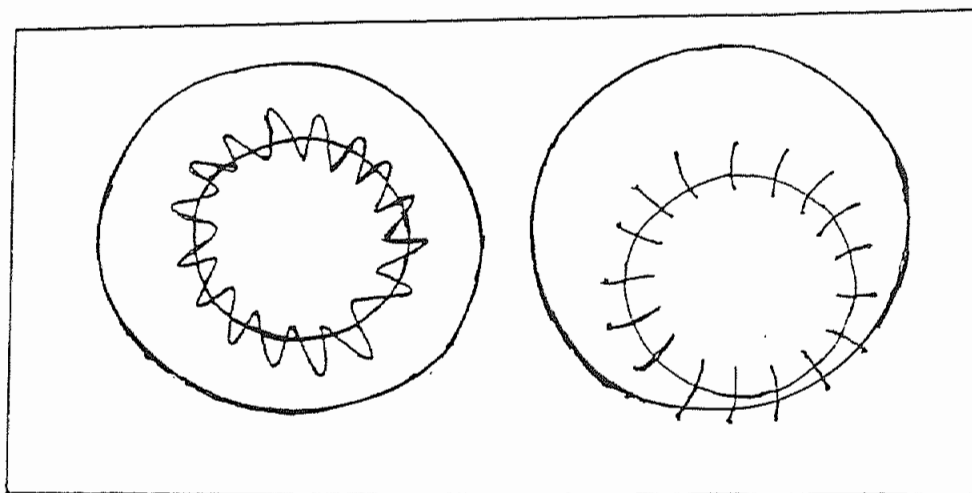


Fig. (7) : Centered and eccentric graft.