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KERATOKYPHOSIS

F. HOFFMANN AND K. JESSEN

ALEMANIA

SUMMARY

A reports is presented on a new microkeratome with the following technical alterations: 1. Two suction rings fix the eye at the cornea and at the limbus, 2. The blade, which is made of sapphire, lies in the plane of section and glides through between the two suction rings, 3. The applanation surface does not move during the cutting procedure.

The stationary applanation surface renders possible any desired shaping of the cornea; changes can thus be made in the power of refraction without applying the cryolathe. The sapphire blade improves the quality of incisions.

Here in Bogota, it is surely not necessary for me to explain the advantages of keratomileusis and keratophakia. They are obvious. The two main disadvantages of these operations are: firstly, the freezing process, which had up to now been necessary to change the geometrical shape of the corneal surface but was at the same time responsible for some tissue alteration (e.g., keratocyte destruction) as well as for the long post-operative irritation condition; and, secondly, the formation of a scar in the corneal interface.

With the technique of keratokyphosis, we try to eliminate the freezing process and reduce the scar formation. When we remove a corneal disc with the microkeratome, the section is parallel to the outer corneal surface. When we have a lens placed on the cornea while using the microkeratome, the section runs parallel to the plane surface of the plane convex lens but results in a protrusion of the corneal interface. This is the simple principle of keratokyphosis for aphakia.

Instead of using a cryolathe in keratokyphosis, the protrusion of the corneal interface will be created with the microkeratome. Since the lens on the corneal

surface is not flexible (Fig. 1), a new microkeratome had to be developed where the lens is integrated into the applanation surface. Also integrated into the applanation surface surrounding the lens is a narrow circular recess, which is connected to a suction pump. This suction ring guarantees a tight connection between the cornea and the applanation surface during cutting. In contrast to the Barraquer microkeratome, the applanation surface remains in the same place during cutting. After attachment of the first suction ring at the cornea, a second suction ring is fixed at the limbus area, its shape being very similar to that of Barraquer's suction ring. The second suction ring is integrated into the footplate of the microkeratome. The blade surface lies in the cut surface, and the blade moves between the two suction rings parallel to and at a defined distance from the applanation surface.

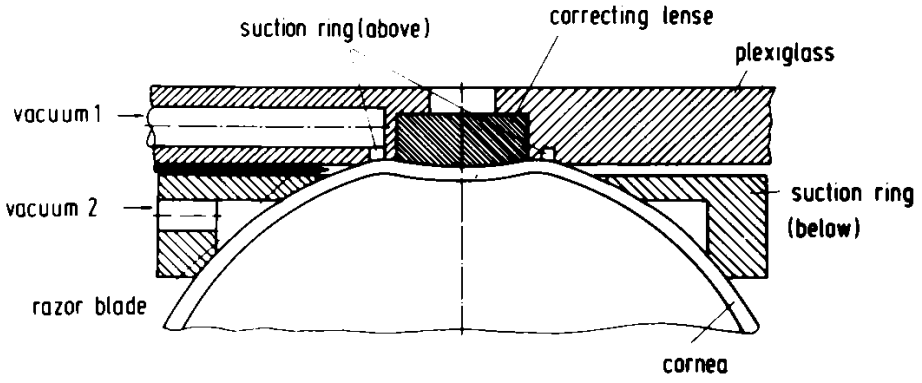

FIGURE 1

Principle of the new microkeratome: fixation is accomplished by 2 suction rings, and the blade lies in the plane of section.

Cutting experiments in pig eyes have shown:

1. Reproducibly circular corneal discs can be removed with the aid of the microkeratome.

2. A lens-shaped protrusion of the interface results.

3. The strongest protrusion of the interface corresponds with the center of the lens in the microkeratome, and the thinnest part of the cornea corresponds which the suction ring.

The microkeratome can be used in the same way in human eyes and leads to the same results (Fig. 2). However, we do not yet know whether the corneal

protrusion is exactly symmetrical. Therefore further experiments will be done in human eyes to measure the symmetry of the layer-thickness distribution in order to compare the actual and the calculated protrusion. One example with 65 radial measurment points shows a slight asymmetry of 70 ìm in the border area of the lens.

Let me close with a few remarks about scar formation in the corneal interface: in keratophakia, 2 scar lines result on the corneal stroma that are basically different. In the anterior interface, in contrast to the posterior interface, the corneal lamellae of both tissue layers are not situated parallel to each other. In the lathe, the corneal fibrils are cut obliquely. The question therefore remained to be answered whether an oblique section through the tissue with the microkeratome is of better quality than the surface formed in the cryolathe.

Oblique sections obtained in pig eyes with the microkeratome are, in fact, of better quality than those produced in the lathe. It must, however, be said that the round cutting tool produced for keratomileusis probably yields better results than the pointed cutting tool developed for keratophakia. But the microkeratome can also be improved by using a sapphire blade instead of the steel blade applied so far. The sapphire blade is much smoother and sharper after having been use 50 times than a new steel blade.

Summing up, it may be said that the new microkeratome improves the quality of incisions and makes possible lens shaped corneal protrusions without using the cryolathe. It still remains to be tested, however, whether scar formation is thus reduced and whether the calculated protrusion also corresponds to the actual one.

FIGURE 2

Saggital section of human cornea in the feed direction of the microkeratome.