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SECUNDUM FORUM OPHTHALMOLOGICUM

SEGUNDA PARTE

TECHNICAL ADVANCES IN CORNEAL SURGERY

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A long while ago use of the microscope was adopted for suturing in corneal surgery. There is no doubt that our surgical technique was improved a great deal by better optical control. In corneal graft the incision is the most delicate procedure, most important for the later result of the operation. Nevertheless so long the microscope was not used for this difficult and dangerous phase of the operation. So long there was not appropriate technical solution to allow optical control of the trephination. The usual manual trephine could not be used under the microscope. Due to its shape there was no good optical control of the cornea or the anterior chamber while the incision was performed. Even when observing in an oblique direction less than half of the blade or of the diameter of the incision is visible (Fig. 1).

Fig. 1: Manual trephine, oblique observation, only partial optical control.

Therefore our intention was to construct a new instrument which could be used under the microscope with perfect optical control. (Fig. 2).

Fig. 2: Rotor trephine, cross section.

A very low tube with a very thin wall of only 0,8 mm. thickness allows to overlook more than 90% of the cornea through the microscope while the incision is performed. Also illumination is no problem. To keep the hands off the surgical field remote control and electric drive were indispensable. The whole instrument is handsome and compact. (Fig. 3).

Fig. 3: Rotor trephine with handle.

Trephine, handle and even the cable can be sterilized. (Fig. 4).

Fig. 4: Rotor trephine, handle, motor, gear and trephine.

The blade easily can be exchanged for sharpening. All sizes from 1 to 11 mm. diameter are available (Fig. 5).

Fig. 5: Rotor trephine, blade disconnected.

By means of a flexible cable the instrument is connected to the swivel arm of the microsurgical unit. (Fig. 6).

Fig. 6: Cable connection to microsurgical unit.

The speed easily can be controlled from the panel of the unit like all other electrical functions. (Fig. 7).

Fig. 7: Electrical control for RPM.

By use of different gears the torque can be adapted to different demands. The gear ratio can be changed from 1:11, 1:41 or even to 1:141.

Remote control by foot pedal helps to avoid vibration. (Fig. 8).

Fig. 8: Foot control.

The surgeons hand is relieved from cutting. It only has to guide the instrument under permanent optical control. (Fig. 9).

Fig. 9: Rotor trephine, cutting under the microscope.

Fig. 10: Rotor trephine, cutting recipient's eye cornea.

Small holes in the lateral wall of the trephine centrifuge the aqueous from the corneal surface after having entered the anterior chamber, (fig. 11).

Fig. 11: Rotor trephine, drainage holes.

So that the incision in may cases can be completed without stopping the blade around the whole circumference (fig 12).

Fig. 12: Vertical wound edges.

This leads to a perfect shape of the wound edges which are straight and vertical. Due to the same shape in donor and recipient coaptation is no longer a problem, which means better woundhealing, better optical results. (Fig. 13).

Fig. 13: Vertical wound edges.

Trephines with different diameters easily can be exchanged and used with the same handle. (Fig. 14).

Fig. 14: Rotor trephine, different diameters.

Also a little rotor keratome, connected to the same handle, is available for small incisions. (Fig. 15).

Fig. 15: Rotor Keratome, perplacing incision for later air injection.

This keratome also cuts almost without any pressue transmitted to the tissue which especially is helpful in very soft eyes for instance in perforating injuries to prepare an incision for a later air injection to reform the anterior chamber.

So long even more difficult as for perforating graft was the use of the microscope for lamellar graft. Most of the instruments used for a lamellar keratectomy were not suitable for use under the microscope.

It is the merit of José Ignacio Barraquer to have developed a most precise automatic lamellar keratome for use with his keratomileusis and keratophakia operations. This instrument is most ingenuous and perfect. But only a few places can afford to use such a perfect but as well expensive instrument. However for simple use with the microscope we constructed a small handsome instrument, which can be applied with the same type of rotor handle as the keratome for perforating graft (Fig. 16).

Fig. 16: Lamellar Microkeratome, total view.

The blade is cutting horizontally with high speed, also transmitting almost no pressure to the tissue, which, is even more important in lamellar incision. (Fig. 17).

Fig. 17: Lamellar Microkeratome, front part.

A vacuum ring, which is connected to the high vacuum pump of the microsurgical unit fixes the instrument to the globe. Two micrometers control the diameter and the thickness of the lamellar graft, which can be taken with the same instrument as well from the recipient's as from the donor's eye. (Fig. 18).

Fig. 18: Lamellar Microkeratome, vacuum ring, guide and rotary blade.

This little instrument is especially useful as it can be applied under the microscope for better optical control of this difficult phase in lamellar grafting. Automatically equal and smooth grafts of any desired thickness can be obtained. (Fig. 19).

Fig. 19: Lamellar keratome, donor graft.

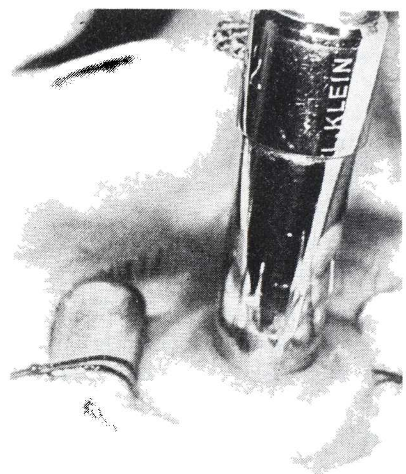

FIGURE 1

Manual trephine, oblique observation, only partial optical control.

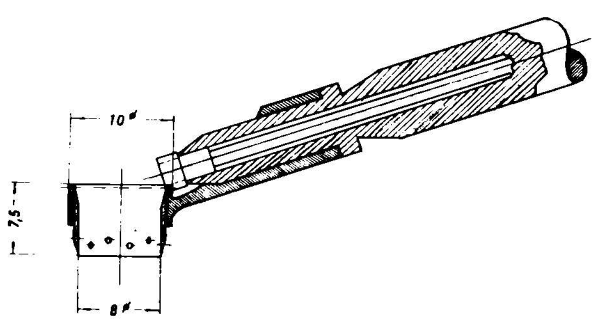

FIGURE 2

Rotor trephine, cross section.

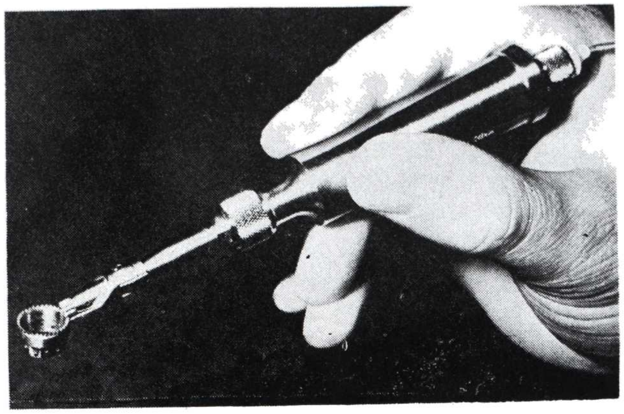

FIGURE 3

Rotor trephine with handle.

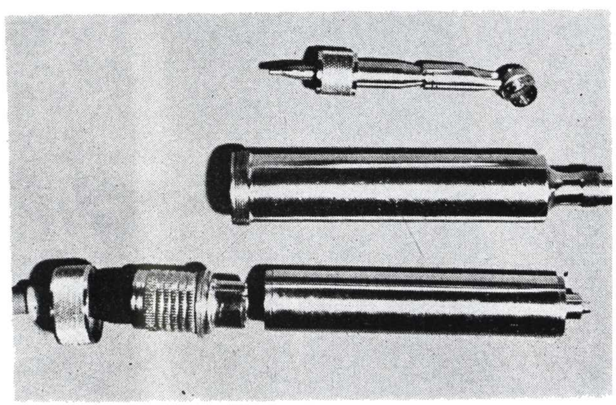

FIGURE 4

Rotor trephine, handle, motor, gear and trephine.

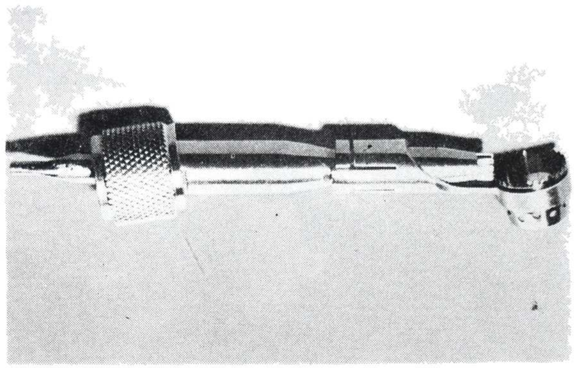

FIGURE 5
Rotor trephine, blade disconnected.

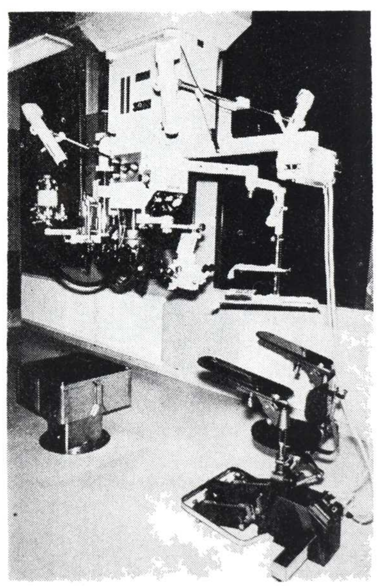

FIGURE 6
Cable connection to microsurgical unit.

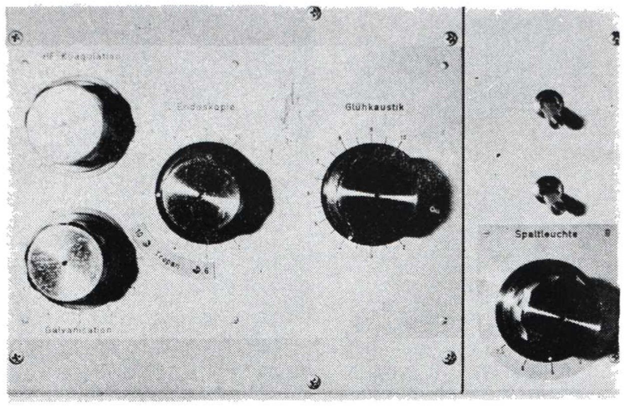

FIGURE 7

Electrical control for RPM.

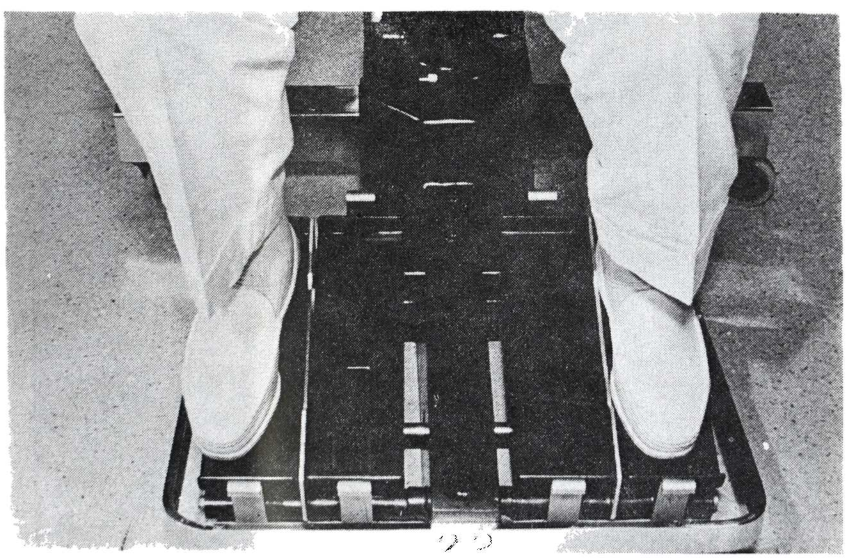

FIGURE 8

Foot control.

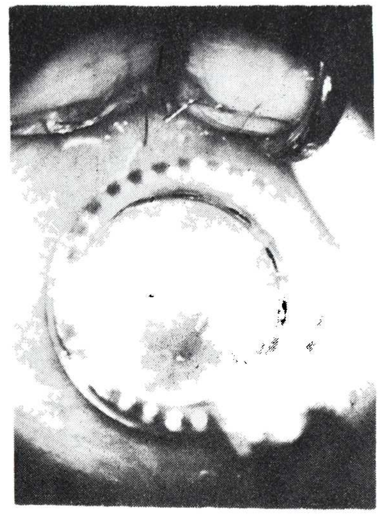

FIGURE 9

Rotor trephine, cutting under the microscope.

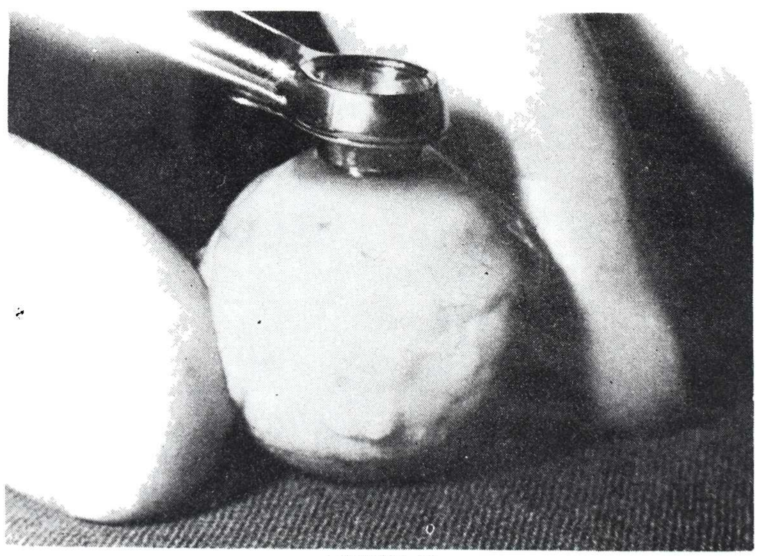

FIGURE 10

Rotor trephine, cutting recipient eye cornea.

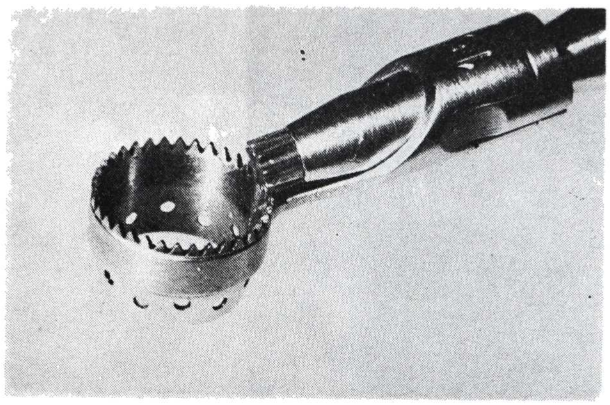

FIGURE 11

Rotor trephine, drainage holes.

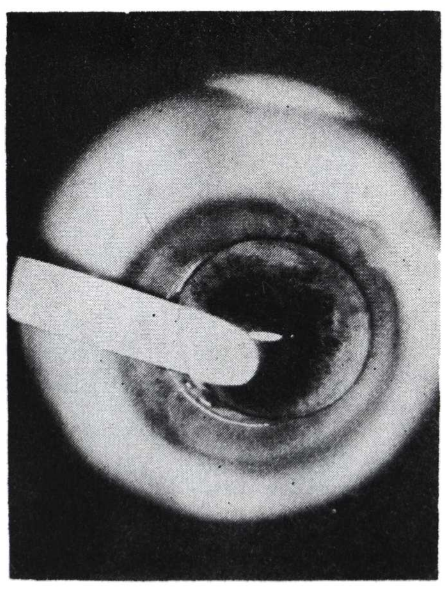

FIGURE 12

Vertical wound edges.

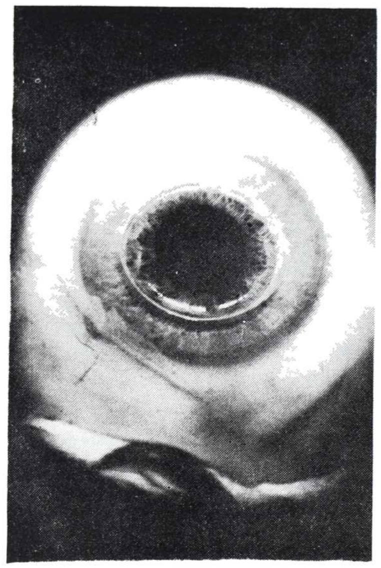

FIGURE 13
Vertical wound edges.

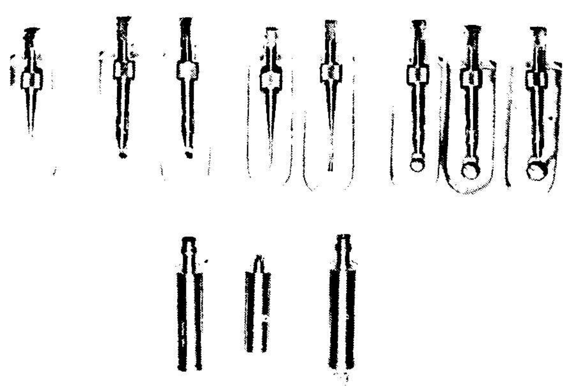

FIGURE 14
Rotor trephine, different diameters.

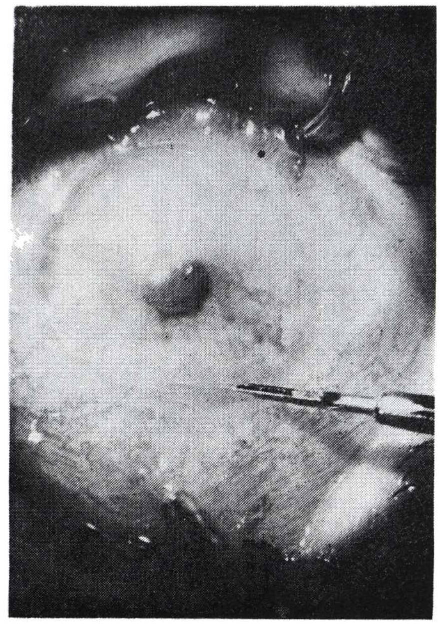

FIGURE 15

Rotor keratome, preplacing incision for later air injection.

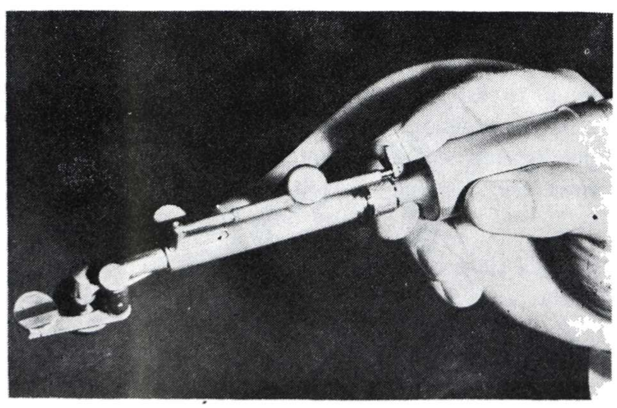

FIGURE 16

Lamellar keratome, total view.

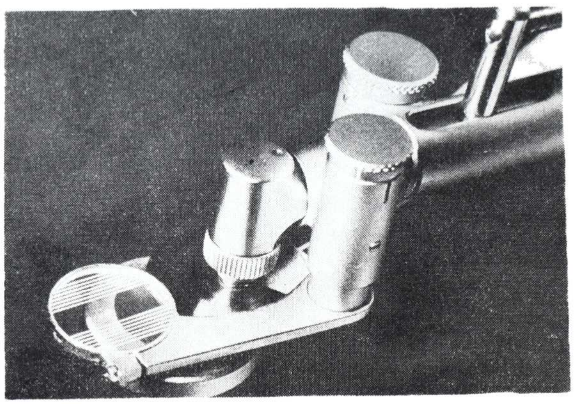

FIGURE 17
Lamellar keratome, front part.

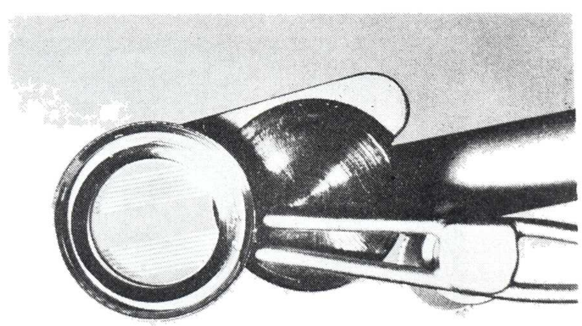

FIGURE 18
Lamellar keratome, vacuum ring, guide and rotary blade.

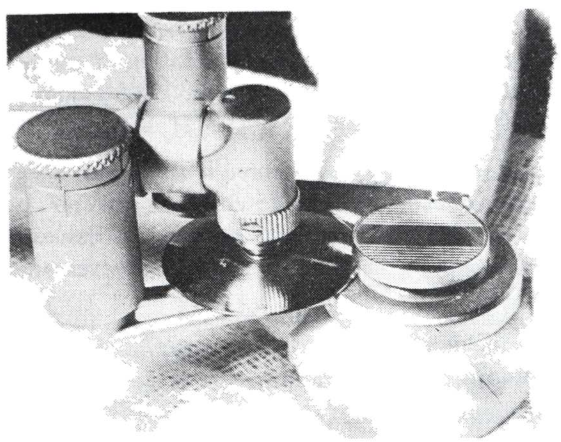

FIGURE 19
Lamellar keratome, donor graft.

SUMMARY

In this paper, the advantages and functioning of a new rotating trephine developed by the author, are presented. This trephine allows the surgeon to perform a corneal trephination under optical control during the course of keratoplasties. Up to the present this had been impossible using common trephines, due to their shape.

One of these trephines is designed for penetrating keratoplasties and consists basically of a very low and thin (8 mm.) tube, where the blade is mounted, permiting an optical control of 90% of the field through the microscope while the corneal incision is performed. The unit consists of 3 parts.

The first is a rotating trephine, copled to the handle and to a small motor in an upward and slanted way; this al˙ows the surgeon to keep his

hands off the operating field. The motor is actioned by a foot pedal and its revolutions may be controlled. The trephine has holes to centrifuge the ocuous humor during the trephination, making possible to perform a perfect and complete cut of well defined edges, both in the donor and in the host eye, helping to attain an excellent coaptation of the edges, resulting in optimal results in the postoperative period. Trephines of different diameters may be coupled to this unit.

A small rotating keratome may be adapted to this motor also, to perform small incisions used to reform the anterior chamber with air, since, due to its high speed, this keratome does not press over the tissues, facilitating thus the procedure, especially in cases of hypotonous eyes and eyes with penetrating wounds.

The whole unit, including its cable, may be sterilized and connected to the arm of the microsurgical unit.

Another instrument is designed for lamellar keratoplasties. Dr. José I. Barraquer developed an automatic microkeratome for his keratophakia and keratomileusis operations, but this ingenous and perfect instrument is at the reach of only a few surgeons. The author has adapted his lamellar instrument (to be used under microscope) to be coupled to the same unit for penetrating keratoplasties. A pneumatic ring, connected to the vacuum pump of the microsurgical unit, helps to fix the keratome to the ocular globe, and two micrometers control the diameter and depth of cut. A. high speed blade which allows a horizontal cut, permits obtaining very clean grafts of the same size and thickness for better results in lamellar keratoplasties.

P. N. G.