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TECHNICAL ADVANCES IN GLAUCOMA MICROSURGERY

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On principle two different approaches are available for surgical treatment of glaucoma:

First we can follow the classical advice of Elliot to form an artificial outflow pathway for subconjunctival drainage.

Secondly we can try to improve the outflow through the natural pathways, especially by surgery in the trabecular area. Both methods can be improved by use of modern microsurgical technique.

I. The most delicate phase of the operation is the trephination. The greatest risk is an accidental lesion of the conjunctival flap, the iris or even of the lens. All these accidents are due to poor optical control while performing the trephination by means of the manual trephine. To overcome this problem we have applied the same principle as used for the corneal trephine also for glaucoma surgery. (Fig. 1).

The low instrument allows a good survey of the surgical field. (Fig. 2).

If the microscope is put into an appropriate direction and coaxial illumination is used, the depth of the incision easily can be controlled. (Fig. 3).

Vertical observation through the trephine is possible, in many cases the whole circumference can be cut.

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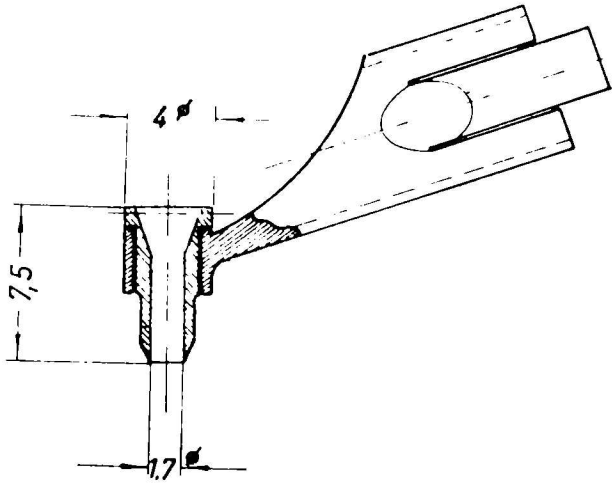

FIGURE 1

Rotor Elliot trephine, cross section.

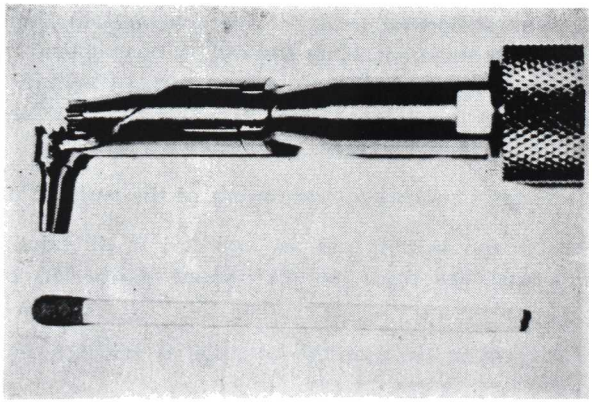

FIGURE 2

Rotor Elliot trephine, side view.

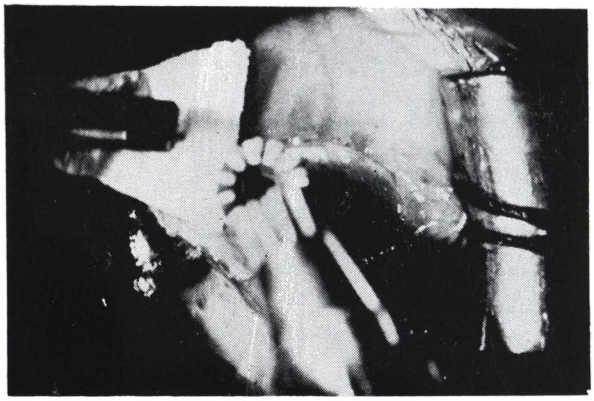

FIGURE 3
Rotor Elliot trephine, from above.

To relief the surgeon's hand from cutting manually an electronic drive is used. Remote control by foot switch allows to cut without vibration. (Fig. 4).

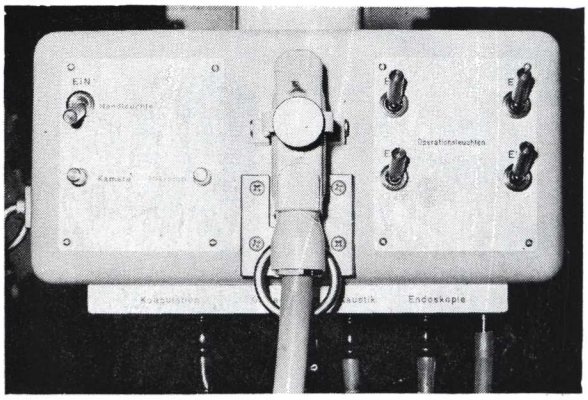

FIGURE 4
Cable connection to microsurgical unit.

A cable connects the swivel arm of the microsurgical unit and the handle of the instrument. The speed can be controlled from the panel of the microsurgical unit. (Fig. 5).

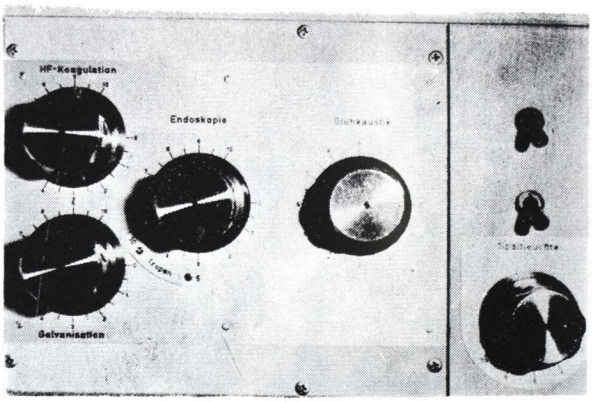

FIGURE 5
RPM control on the microsurgical unit.

Furthermore the torque can be changed by use of different gears.

The surgeon's chair provides several foot controls for all the different functions used for microsurgery. (Fig. 6).

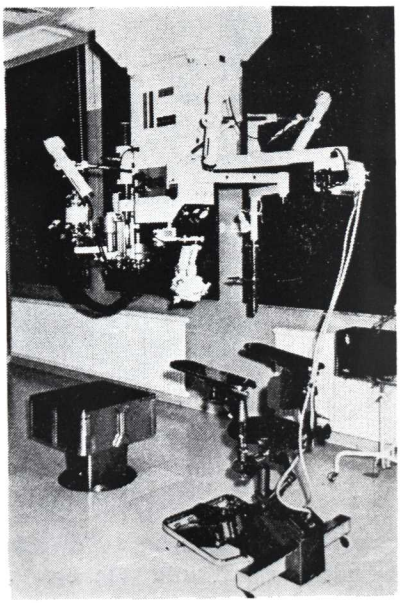

FIGURE 6
Surgeon's chair with connection from remote control.

The surgeon's hands are only guiding the instruments by optical control. Different cutting instruments can be used with the same rotor handle. The high cutting speed reduces the pressure transmitted to the tissuse to a minimum. This is also true for a rotor keratome, which we use in glaucoma surgery for preplacing an incision for air injection at the end of the operation. But also for chamber angle surgery, which has found an increasing interest during the last few years.

II. Performing a goniotomy, the microscope must be tilted, so the incision into the trabecular meshwork is possible under continuous optical control. Coaxial illumination is mandatory. The illumination system especially developed for this new microsurgical microscope can be switched from normal slit lamp to coaxial illumination. (Fig. 7).

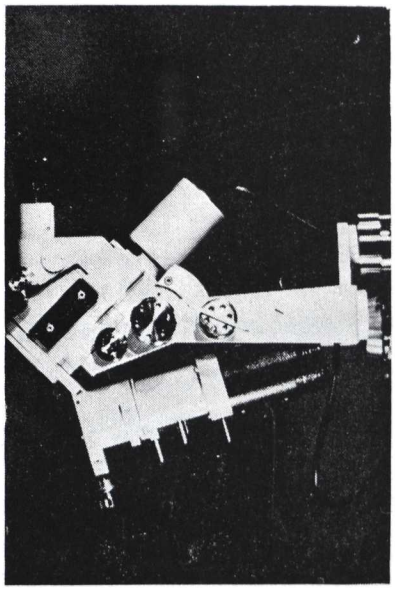

FIGURE 7

Microsurgical microscope, coaxial illumination, tilted.

Only under these optical conditions the goniotomy needle can be observed precisely while performing the incision. According to the almost horizontal movement of our rotor goniotome in front of the iris diaphragm we need a lateral movement to be in focus all the time. (Fig. 8).

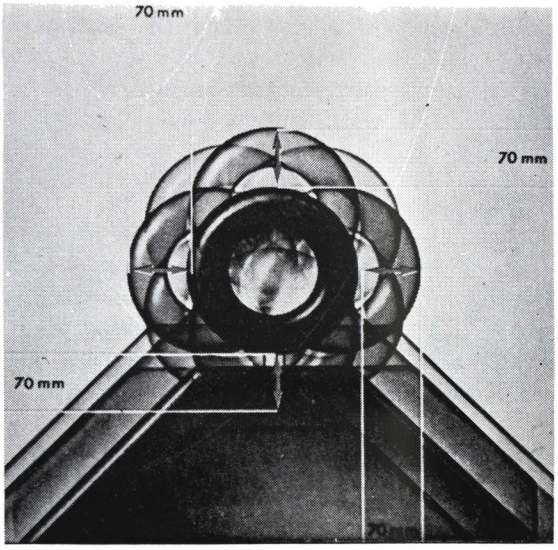

FIGURE 8
Lateral movement of microsurgical table, cross section.

As the microscope suspension only allows vertical movement of the microscope we need another mechanical aid which also must be remote controlled to leave the surgeon's hand free for the instrument. This is achieved by a new microsurgical table, the base of which contains the remote controlled system for lateral movement. (Fig. 9).

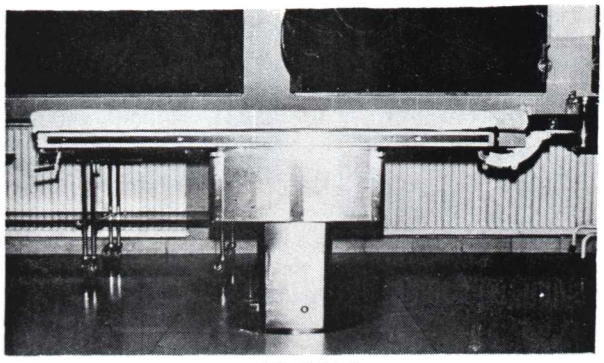

FIGURE 9
Microsurgical table, base and plate

Further more the plate can be removed from the base for quick exchange of the patient between the different operations. A special carriage picks up the plate and takes the patient back to his bed.

The lateral movement can be extented to + 70 mm. So the movement of the needle easily can be compensated by shifting the table, also remote controlled from the surgeon's chair. Exact focussing, even using large magnification is possible. Also for goniotomy the rotor system can be used. (Fig. 10).

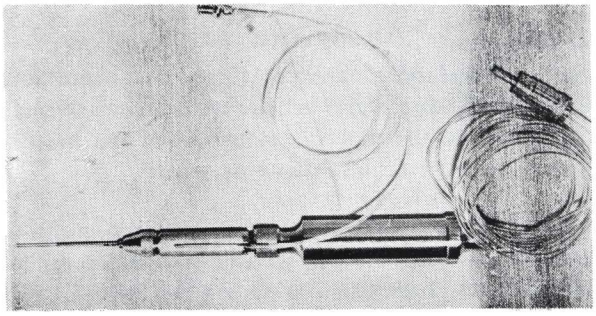

FIGURE 10

Rotary goniotome.

A microstwist drill is protected in a small tube which also provides the irrigation influx. So the delicate incision can be performed precisely without any pressure to the tissue. (Fig. 11).

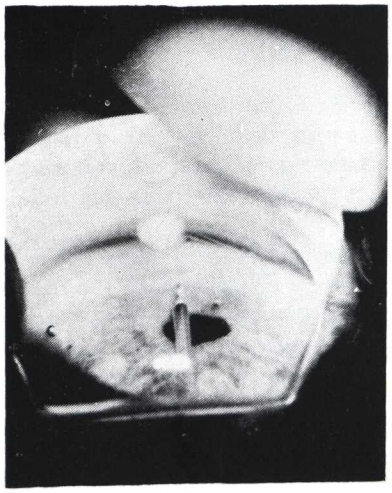

FIGURE 11

Rotary goniotome, view through Barkan leans.

Thus bleeding can be avoided which can be a complication of chamber angle surgery.

Combined use of the microsurgical unit and the rotor cutting instruments offers more facilities for delicate procedures which means facilities to avoid complications.

SUMMARY

The author presents a microsurgical unit for glaucoma operations, whether they open up artificial drainage routes or improve drainage through the natural routes. With the aid of the unit these operations can be performed more precisely, avoiding most complications as well.

To practice a goniotomy, the microscope must be in an obique position; this way it is possible to perform the incision in the trabeculum under continuous optical control. Coaxial illumination is mandatory (this microscope has a special illumination system which permits changing the slit lamp for coaxial illumination.)

Under these optical conditions, the goniotomy needle may be observed while the incision is being made. Due to the almost horizontal movement of the author's rotating goniotome, when he is in front of the iridian diaphragm he has to make a lateral movement to focus constantly.

Since the microscope may move only vertically, a microsurgical table has been designed with a remote control system placed in its base, for lateral movements of approximately 70 mm. The surgeon may control this unit automatically with his feet.

Elliot's rotating high speed trephine is also presented; with it the pressures which increase the risk of accidents are avoided. The illumination system lets the depth of the incision be controlled easily.

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