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SELECTIVE TRABECULECTOMY. A REPORT OF A NEW SURGICAL METHOD FOR OPEN ANGLE GLAUCOMA

BY

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A new instrument, the trabeculectome, and an new surgical method for treating open angle glaucoma is described. The double-edged instrument makes 2 cuts through the trabecular meshwork while being pulled through Schlemm's canal, thus cutting free a strip of the trabecular meshwork and the inner wall of Schlemm's canal. The results of the 21 first operations are presented. The observation time is 9–19 months. The characteristic post-operative pressure pattern is an immediate fall to 10–20 mmHg followed by a period of higher pressures which then converge to the range of 8–16 mmHg with most eyes in the 10–14 mmHg range. Four patients need timolol treatment to obtain this, the remaining 17 have no medication. The therapeutic results and additional observations are discussed with special interest to possible physiological mechanisms.

Key words: open angle glaucoma – trabecular meshwork – selective trabeculectomy – aqueous humour outflow.

The treatment of the chronic glaucomas has improved during the later decades as new pharmacological agents have enriched our therapeutic armament.

There seems, however, to be a rising activity in the field of surgical treatment. This may be the result of a rising understanding of the problem of patient compliance and of the danger of being satisfied with an 'acceptable' pressure level

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Fig. 1.
Histologic section of the anterior chamber angle where trabeculotomy has been performed. Note the very narrow slit through the trabecular lamellae. One can easily imagine that such a slit may close by tissue contact and scarring (haematoxylin and eosin, × 80).

in the advanced glaucoma. It may also be a compensatory activity as it may have been hoped that the new glaucoma agents would solve the problem.

Most advances in the surgical treatment of glaucoma have been improvements in making fistulas by stabbing the eyeball in more and more sophisticated ways, as in the different modifications of the so-called trabeculectomy, originally developed by Cairns (1968). But still these methods are mostly fistulizing in effect, as shown by Benedikt (1976) using a fluorescein technique investigating the aqueous outflow in normal eyes and in operated and non-operated glaucoma eyes.

The various methods of trabeculotomy represent attempts to re-establish the normal drainage of the aqueous humour. Some years ago I performed trabeculotomy in post-mortem eyes, removed a large corneal button and examined the chamber angle structures directly under the microscope. In some cases the trabeculotome created a flap hinged along the scleral spur. When the instrument was withdrawn, the flap fell back to its original position. This happened as a result of the elasticity of the trabecular tissue because there was no pressure gradient working on the flap. Even after trabeculotomy through the trabecular meshwork, tissue strands from the 2 sides of the slit may be brought in contact by the tissue elasticity and the intraocular pressure (Fig. 1). Fibrous bridges may form to close the slit totally or partially (personal investigation, not published).

I have assumed that the reason why many trabeculotomies do not result in a desired or expected pressure level, is such a partial or total closure of the trabecular slit created.

This paper presents a new instrument and a new surgical technique for the selective removal of the trabecular meshwork including the inner wall of Schlemm's

canal through about 1/4 of its circle in order to obtain a free access for the aqueous humour into the collector canals. The method is built on the nylon filament probing technique of Smith (1962).

Material and Methods

The instrument

The trabeculectome (patent pend.), a disposable instrument, is composed of a ring-like sharply edged cutting device attached to a flexible probe (Fig. 2). The edges emerging from the probe form an angle to fit to the scleral groove. The instrument has been under continuous development with different designs of the cutting parts used. All prototypes used in the first series of operations to be presented here, have had cutting edges made of steel attached to a 5–0 nylon monofilament.

The working principle

The free, blunt end of the probe is put through the canal of Schlemm over a sector of about 90°. The cutting part is put into the anterior chamber and pulled by the

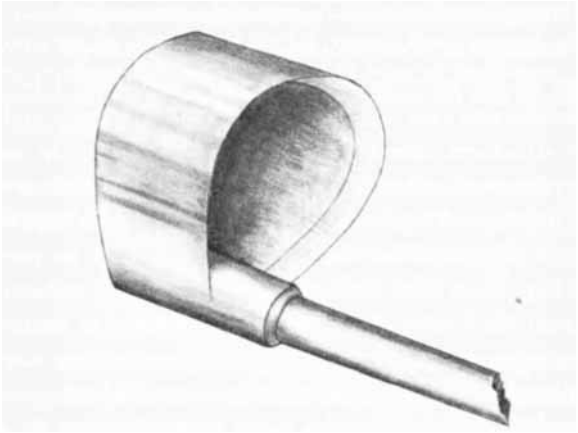

Fig. 2.
The trabeculectome. The cutting device is attached to a 0.15 mm thick flexible probe. The V-shaped cutting profile has in principle been the construction of the different prototype modifications used.

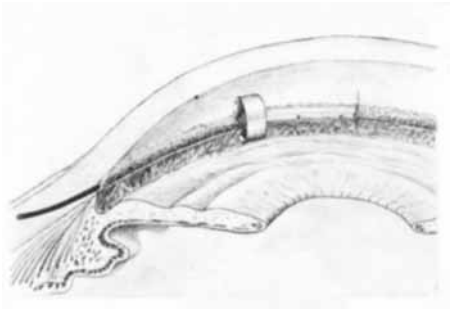

Fig. 3.
Composite cross section and gonioscopic view showing the trabeculectome cutting free and collecting a strip of the trabecular meshwork. It leaves an opened Schlemm's canal.

probe part with the edges protruding into the anterior chamber (Fig. 3). The edges in this way make 2 cuts through the trabecular meshwork, one along the scleral spur, and the other along the line of Schwalbe. The trabeculectome thus cuts free a strip of the trabecular meshwork including the inner wall of Schlemm's canal, an it may remove the strip like a biopsy, leaving the outer wall and the openings of the draining canals.

This technique has been worked out in post-mortem eyes, and the eyes have been examined microscopically. Fig. 4 shows cuts through the chamber angle of a

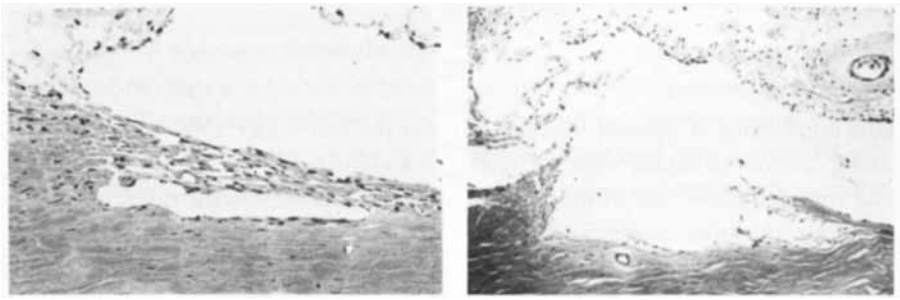

Fig. 4.
Histologic sections of the anterior chamber angle in a post-mortem eye, a) through a normal, unoperated sector and b) through a sector where selective trabeculectomy has been performed. The trabecular meshwork which has been cut free, but in this case not removed from the eye, is seen in the chamber angle. (haematoxylin and eosin, × 80).

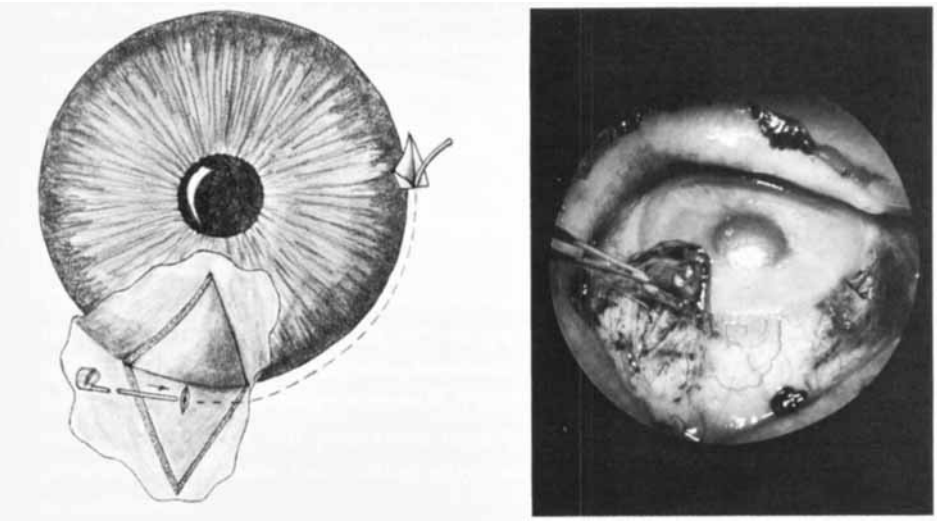

Fig. 5.
a) A radial incision through the deep scleral layers and the outer wall of Schlemm's canal is made under a thick scleral flap. The inserted probe part of the trabeculectome is picked up through an angulated limbal incision about 10 mm from the first. b) Photograph shows the probe running through Schlemm's canal between the two incisions.

post-mortem eye, both through a not operated sector and through a sector where selective trabeculectomy has been performed. In these examinations no damage to any other intraocular structure than the trabecular meshwork and Schlemm's canal was detected.

The surgical procedure

Schlemm's canal is opened through a radial incision under a thick scleral flap, taking care not to cut through the inner wall and the trabecular meshwork (Fig. 5). The rounded probe end of the trabeculectome is inserted into the canal, clockwise or counterclockwise, and picked up through a new incision about 10 mm from the first. This second incision is angulated to make the opening big enough to let through the cutting part of the trabeculectome after the cut has been completed. The cutting part is brought into position under the scleral flap either by pushing or by pulling the probe through Schlemm's canal.

A triangular microflap is then performed at the insertion site under the scleral flap, making an opening big enough to allow the cutting part to be rotated and

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