APPLIANCES

NEW ELECTRODE TRANSILLUMINATOR*

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THE classical operation for retinal detachment, although giving an 80–85 per cent. success rate in skilled hands, appears to have one uncertain feature, namely, the ability of the surgeon to place the diathermy electrode exactly on the point of the sclera corresponding to the hole in the retina.

To achieve this, one has been taught to think in terms of meridians and optic disc diameters, and then, by making a tentative “shot” with the diathermy, to look and see if the answer to the calculations is anything like right (Gonin’s method). Textbooks make this sound easy, and so indeed it may be, provided the diathermy has made a mark on the retina which is easily recognizable. But so often it has not, either because the current at the electrode was not sufficiently great, or because there was too much intervening fluid for the retina to show coagulation.

It would be helpful to have a really positive method of marking on the outside of the sclera the exact position of a retinal hole or tear within, and to this end I have reviewed the methods used by surgeons in Britain and elsewhere. The earlier ones, summarized by Duke-Elder (1934), all depend fundamentally upon the estimation of meridian and latitude. They include the perimetric methods of Lindner (1929) and Klein (1933), the tangential projection method of Cowan and McAndrews (1931), the “thread” method of Imre (1930), and that of Weve (1931), which depended upon the projection of the retinal hole upon an artificial eye. To these must be added the “stud” method of Foster Moore (1931), and that advocated by Vogt (1936), which depended on the production of hydrogen bubbles round a perforating electrode.

None appears to offer a completely satisfactory solution to the problem; some because they require elaborate apparatus and others because they depend upon perforating the globe, which not only causes additional trauma, but also makes subsequent diathermy on a collapsed eye much more difficult.

The new method of Weve (1940) and Arruga (1936) is a very different matter. The hole is located by indirect ophthalmoscopy, using an extremely powerful light, and the sclera is marked with Chinese ink at the point where the light is seen by translucence. It seems that this is certainly the best method in use to-day, as it provides a way of marking the sclera which is quick and accurate in skilled hands.

*Received for publication May 10, 1954.

But many of us, either because we have not been brought up in the continental tradition, or because we are too lazy to learn, find it difficult to use indirect ophthalmoscopy with the facility of the direct method. We are not happy because the image is much smaller and the picture inverted, there are more disturbing light reflexes, and it is much more difficult to keep everything still when working at arm's length; the search for a small hole or slit in the folds of a detached retina can become an exceedingly difficult procedure, and one's frustrated emotions alternate between admiration for the brilliance of one's fellow men and a deep conviction of personal incompetence.

A search was made for yet another method, and an idea germinated during an operation for the removal of an intra-ocular foreign body by the posterior route. The foreign body—a small piece of steel—was seen to be lying on the retina near the 7 o'clock meridian just behind the equator, but to study it more closely I introduced a transilluminator behind the eye and watched the result with an ophthalmoscope. The transilluminator was a powerful 12-volt model and produced a light which was rather too bright for comfort, but I was surprised at the ease with which one could steer the shining patch behind the foreign body, which stood out in stark silhouette against the network of the choroidal vascular bed.

It was then apparent that the tip of the transilluminator was exactly on that part of the sclera which would have to be incised if the foreign body were to be removed with a minimum of vitreous disturbance, and the great desirability of having some reliable means of marking it became evident. The marking could not be done with ink as the tip of the transilluminator was out of sight and some way back between Tenon's capsule and the sclera, and there was nothing for it but to draw the eye upwards and take the transilluminator with it, hoping that there had been no relative shift in the meantime.

It will be realized at once that this was a difficult and unsatisfactory thing to do, as the sclera was slippery and the transilluminator heavy, and it was not possible to be sure that movement had not taken place.

Various ideas were considered, and the answer seemed perhaps to lie in diathermy. Would it be possible to combine a transilluminator with a diathermy electrode in such a way that they could both exert their influence at the same point? It seemed that if one were in the form of a small ring round the other, the effect would be practically the same, and no less efficient. Moreover, such an instrument could be used in cases of retinal detachment, thus opening for it a much larger sphere of usefulness.

It seemed at first that it would be best to have a central electrode surrounded by a small but intensely powerful ring of light, but for technical reasons this proved impossible to arrange. A prototype model has now been constructed* with the alternative arrangement of a central light surrounded by a ring electrode, the whole measuring not more than 3 mm. in diameter.

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I found, however, that I was not the first in the field with these ideas, as Summers (1945) had devised an instrument working on the same principle for dealing with holes at or near the macula. This had been adapted from the Clegg transilluminator, but the hole through which the light emerged was surrounded by a small ring electrode. The hooded light itself was passed round behind the eye, and the resultant luminous patch was viewed with an ophthalmoscope. The Summers instrument was found very difficult to use,

however, chiefly on account of the diffusion of the light from such a small source, and it therefore seemed imperative to find a way of increasing the intensity of the light and if possible to give it focal qualities, so that it could penetrate the sclera and sub-retinal fluid with minimal dispersion. Such a light would be too large to be passed behind the eye, and once again the transilluminator cone seemed to provide the answer.

Description of the Instrument

The handle, containing the 12-volt light, iris diaphragm, and condensing lens, is the same as that supplied for the Keeler "Continental" ophthalmoscope. It carries a series of cooling fins which are particularly valuable, since the instrument must be held in the hand for some time at operation, and if covered with a sterile cloth is apt to become uncomfortably hot.

The new part of the instrument is the transilluminator cone (Figure). This has a superficial resemblance to a normal standard transilluminator cone with the end bent over at an angle, but it is different in that it is covered first by metal and then by a plastic material. The metal encases the entire cone of trans-

FIGURE.—Transilluminator electrode.
(Inset)—Magnified view of tip, showing ring electrode.

parent plastic except for the tip, where it forms the ring electrode round the light, and there is a circular fenestration at the base through which the light passes into the cone from the handle. The cone is detachable for sterilization, by a quick-run metallic screw thread, and the diathermy current is passed through this connection to the ring electrode at the tip.

The plastic outer covering of the cone is of opaque cream-coloured material, and completely envelops the metallic layer, apart from the ring electrode and the screw thread at the other end, thus providing an effective insulation between the metallic covering and the ocular tissues.

In the neck of the handle is an insulated brass collar, threaded internally to take the base of the cone, and the main diathermy lead is directly attached to it.

The function of the iris diaphragm is twofold. It has been suggested that, although it is easy to see the position of the transilluminated light when the retina is flat, the case is different when it is detached and there is a layer of sub-retinal fluid to break up and scatter the rays; that, in fact, all one would be able to see would be a diffused glare without obvious boundaries and certainly with no discernible centre. This may be true in very large detachments, and especially in those associated with haemorrhage but in detachments of "normal" size—which are more probable if the patient is rested in bed for some days before operation—this is certainly not the case. However, it is a fact that by cutting down the intensity of the light in the transilluminator the central point of light can sometimes be seen with even greater distinctness, and it is on this account that the iris diaphragm has been included in the instrument. In practice, an assistant would normally dim the light by the rheostat on the transformer box or control panel of the diathermy apparatus, but in cases where the transilluminator is run directly from a 12-volt accumulator or other supply, the iris diaphragm would be indispensable.

The second reason why dimming is desirable is shown below.

Technique of Use

The description given here applies to a case of retinal detachment in the right eye where the hole is in the upper quadrant of the retina. The essential technique is the same for either eye and for a hole in any position, and it is a simple matter to adapt it accordingly.

The preliminaries of the operation are identical with routine procedure. These include a meticulous examination of the fundus, a drawing to show the salient features of the detachment and the position of the hole(s), rest in bed for some days with the eyes covered to aid absorption of subretinal fluid, and the greatest possible mydriasis and retrobulbar anaesthesia at operation.

If it is thought necessary to divide the superior rectus, a suture is passed through its insertion to control the movement of the eye, and the sclera over the area of the hole is carefully and completely cleaned. Absolute haemostasis and a dry sclera are even more important than in the normal operation, as any dampness will seriously interfere with the proper action of the diathermy. Points of recalcitrant bleeding are stopped by a touch of a heated probe.

The electrode transilluminator is held upside down in the left hand with the light off, and the tip is placed on that part of the sclera beneath which the retinal hole is thought to lie; the eye is then rolled upwards by the assistant drawing on the traction suture, and the transilluminator is taken with it until the eye is in a suitable position for ophthalmoscopy. The theatre is darkened and the hole located by the ophthalmoscope, held in the right hand, in the usual way.

The hole, of course, appears red against the surrounding greyness of the detachment, but with the transilluminator it appears greyish yellow against a light pink

background, and it is sometimes difficult to "pick up" a hole with the transilluminator after viewing it with the ophthalmoscope. It is therefore important that the ophthalmoscope light should be gradually dimmed while that of the transilluminator is slowly brought up, so that the light is handed over, as it were, from one to the other. In this way there is less risk of losing the hole, and it is then a simple matter gently to move the transilluminator until the brightest part of the light coincides with the hole, and so to press the foot switch.

The diathermy exposure required to produce an easily recognizable mark will be found to be greater than usual. Even with a perfectly dry sclera, some 10–12 seconds at 100 ma. will be necessary. This is because the ring electrode, being of greater surface area than normal, spreads the current and makes it less effective. However, this hardly matters; the essential purpose of the ring electrode is to act as a marker, and the mark, once made, can be extended radially with a normal electrode until a sufficiently large "coagulation bed" is thought to have been prepared. If the hole is large, two or more marks can be made with the ring electrode to map out the boundaries, and the accuracy with which this can be done after a little practice is most satisfying.

The operation is completed in the usual way by drainage of the sub-retinal fluid, injection into the vitreous (as is my practice) of 1 ml. sterile air, reapposition of any divided muscle, and closure of the conjunctiva.

Discussion

It may be suggested that, owing to obliquity of the rays and the refractive effect of the sub-retinal fluid, the point marked on the sclera will not correspond with the position the hole will occupy when the retina is replaced, and this argument is valid where large balloon detachments have not subsided with pre-operative rest; but with lesser detachments the error is, I think, negligible. The mark will lie inevitably on the exact meridian of the hole, and if the diathermy reaction is extended towards the limbus, any slight error in that direction will be allowed for.

It is interesting to reflect, also, that if this criticism is valid, it is equally so when the hole is located by indirect ophthalmoscopy and the sclera marked with ink, since the passage of the light rays is identical, although reversed in direction. As Weve (1940) admits, when discussing balloon detachments:

Should the surgeon deal with the tear, he has to remember that with superficial coagulation the attached tear moves one or even several millimetres more peripherally from the position shown by transillumination.

It is believed that this instrument, if used as described above, will furnish a ready means of marking the position of holes in retinal detachments. It is not difficult to use, and I am satisfied that the position of the hole makes little difference to the technique. When Majewski and Comberg (1930) suggested localization by a transilluminator, it was thought that since the eye must be turned in opposite directions to apply the transilluminator and to view the hole with an ophthalmoscope, such a method would be impossible, but this is not so; provided the sclera has been cleaned and dried beforehand, the tip

of the electrode transilluminator can be passed backwards between the globe and Tenon's capsule, and the eye can then be placed in the best position for ophthalmoscopy.

Summary

An account is given of the difficulty of localizing on the sclera the position of an intra-ocular foreign body, or of a tear or hole in retinal detachment.

A comparison is made of the accepted ways of dealing with this and the conclusion drawn that none is really satisfactory.

A new type of combined transilluminator and diathermy electrode is described, and the technique of its use explained.

I should like to thank my colleagues at the Sussex Eye Hospital, Brighton, for their interest in the production of this instrument and for several valuable suggestions, to Mr. Charles Keeler for his unfailing courtesy, and to Mr. Jackson of the Royal Sussex County Hospital for the photographs.

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