

OPERATIVE IMPLANTATION OF ELECTRODES INTO THE ANTERIOR CHAMBER OF THE EYE FOR POLAROGRAPHIC EXPERIMENTS

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Polarographic methods of investigation are being used on an ever increasing scale in physiology and medicine [1, 2, 5, 6]. A few polarographic investigations of the aqueous humor of the eye have been published [7, etc.]. However, these experiments were carried out either in acute conditions on anesthetized animals or in vitro. In chronic experimental conditions the polarographic method has been used mainly to investigate the degree of oxygenation of the animal brain [3, 4].

To study the oxygenation of the eye in chronic experimental conditions a method of implanting electrodes into the anterior chamber of the eye has been developed and data for the oxygen tension in the tissues of this region have been obtained and plotted graphically. In this paper an account is given of the technique of implanting electrodes into the anterior chamber of the eye as tested on 25 rabbits. The operation was performed in aseptic conditions under ether anesthesia. The scalp was shaved in the parietal region over an area of 3.5×3.5 cm. It is convenient to begin the operation by implanting a plug to which the outer ends of the electrodes are to be secured. The skin in the center of the depilated area was grasped with forceps and cut around its base with scissors. In this way an area 18-20 mm in diameter, denuded of skin, was formed. The soft tissues and periosteum were removed. A hole was made in the bone with a drill 4.7 mm in diameter. With a screw tap measuring 6×1 mm the hole was threaded and an abonite plug was screwed into it. The plug (Fig. 1A and B) is cylindrical in shape, 12-13 mm in diameter and 10-11 mm in height. The threaded part of the plug corresponds to the threaded channel in the cranial bones, and the number of pins to the number of implanted electrodes. Near each pin is the opening of a tunnel starting on the lateral surface of the plug, a little above its base. The plug with pins ensures reliable fixation of the outer ends of the electrodes, good contact, and convenience in work.

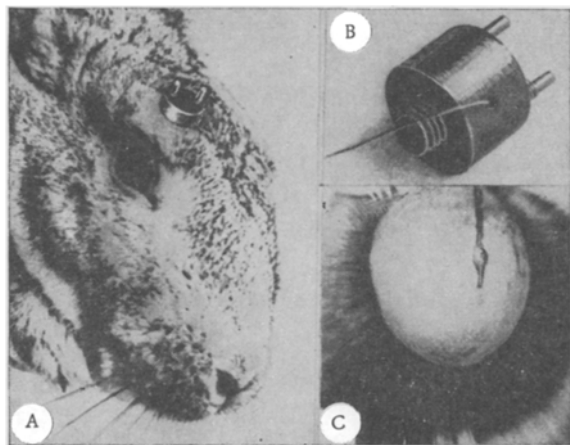


Fig. 1. Implantation of an electrode for polarographic investigations in the anterior chamber of a rabbit's eye. A) Rabbit with electrodes implanted into anterior chamber of both eyes; B) general view of plug for securing outer ends of electrodes (magnified $1\frac{1}{2}$ times); C) eye with an electrode implanted into anterior chamber (2 months after operation; magnified 3 times).

The electrodes may be fixed in the eyes in two ways. In the first method a lid retractor is introduced under the lids. An incision, 5-6 mm in length, is made in the conjunctiva at a distance of 4-5 mm from the superior limbus and the conjunctiva is reflected as far as the limbus, and the blade brought out into the anterior chamber. A platinum electrode 0.2 mm thick is inserted into the anterior chamber in a radial direction or tangentially roughly to the center, without touching the anterior capsule of the lens. To fix the electrode in a desired position the superior rectus muscle is used, a wire being passed around it with a needle (Fig. 2A). This method provides reliable fixation of the electrode in the anterior chamber, but at the same time it creates undesirable kinks in the wire. The second method is without these disadvantages. The

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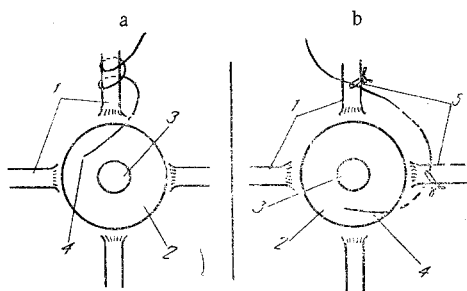


Fig. 2. Diagram of the two methods of fixation of electrodes in the anterior chamber of the eye. 1) Ocular muscles; 2) iris; 3) pupil; 4) electrode; 5) interrupted sutures. Remainder of explanation in text.

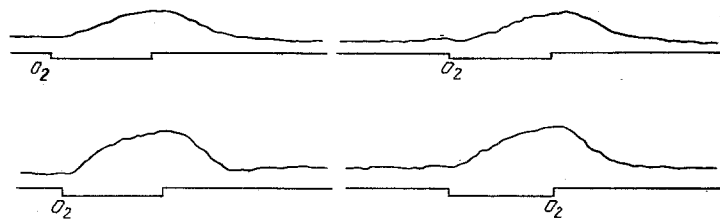


Fig. 3. Changes in oxygen tension in the tissue of the anterior chamber of the eye of two rabbits inhaling oxygen. Top lines—polarographic curves, bottom curves—marker of period of inhalation of oxygen (= 1 min).

wire passes without sharp kinks under the ocular muscles and is attached to them with silk sutures. This method should be used when implanting an electrode into the lower part of the anterior chamber, as shown in Fig. 2B. The beginning of the operation and its final stages are the same in the first and second methods.

After fixation of the electrodes, the wires were taken by means of a large, curved needle beneath the skin to the base of the plug, and then along the tunnels in the plug to the pins, to which they were soldered. Neither the incision in the conjunctiva nor the skin wound of the scalp were sutured. For 5-6 days after the operation 2 drops of 30% albucid solution and 2 drops of 1% atropine sulfate solution were instilled daily into the conjunctival sac. After 10-12 days the animals were ready for the polarographic investigations.

Polarographic curves reflecting changes in oxygen tension in the aqueous humor of the anterior chamber of two rabbits during oxygen inhalation are given in Fig. 3.

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