A METHOD OF RECORDING THE LOCAL ELECTRORETINOGRAM

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Most authors (Boyton, Riggs and others) maintain that it is impossible to obtain a local electroretinogram (ERG) because when any light beam is focused on the retina the response involves the whole retina. Vanisek maintains that a local ERG can be maintained but does not describe how it was recorded.

Acquantance with published reports reveals that the investigator did not exhaust all possibilities. In obtaining a local ERG the principal difficulties encountered are methodological. Until now no record has been available for recording the ERG of different parts of the human retina in the living eye. The method most commonly employed clinically is to record the ERG by means of an electrode mounted on a contact lens; here measurement of the ERG of specific parts of the retina is impossible, because under these circumstances light directed into the eye causes the development of potentials by all parts of the retina (on account of the scatter of light in the media) quite independently of where it is focused. Such an ERG represents a record of the total response of the whole retina.

We have attempted to obtain a local ERG by making use of the so-called local connection to the retina. A silver tube is mounted for convenience on a spectacle frame and through it is introduced a cotton-wool wick moistened in physiological saline (Fig. 1). A special device enables the electrode to be moved in any direction. The area of contact of the electrode with the cornea is about 2 mm. The indifferent electrode consists of a clip fixed to the lobe of the ear. The ERG was recorded on an 8-string oscillograph. The brightness of the light directed into the eye was 3 stilbs. The subject was placed in a screened sound-proof room. Initial light adaptation lasted 5-7 minutes. This method enables the local electrode to be placed on various parts of the cornea.

In healthy subjects the potentials recorded under these conditions are consistent in shape and amplitude. This is especially true of the b wave to which attention is principally directed in the modern clinical electroretinography.

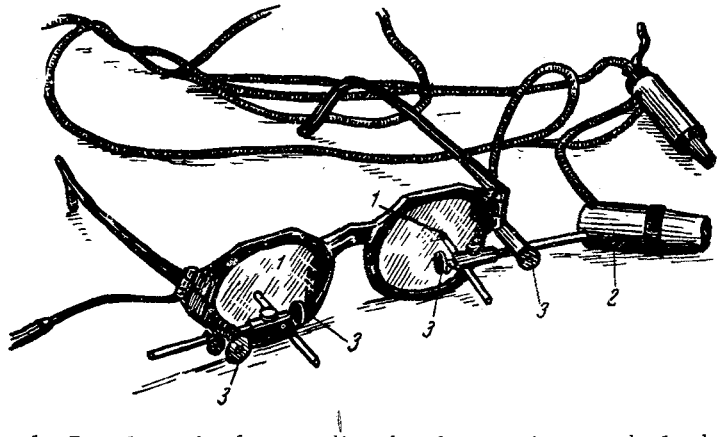

Fig. 1. Eye electrodes for recording the electroretinogram by leading off potentials locally from the retina. 1) Corneal electrodes; 2) indifferent electrode (fixed on to the lobe of the ear); 3) device for recording position of the electrode on the cornea.

Amplitude of the B-Wave (in μV) in an ERG Recorded on Patients with Retinal Detachment; Electrode Placed at Various Positions on the Cornea

Patient	Age (in years)	Diagnosis	Eye	Number of ERGS recorded	Position on cornea					Number of ERGS recorded	Healthy eye (lead from each position)
					1st	2nd	3rd	4th	5th		
S.	28	OD – Ablatio retinae cum ruptura (detachment of the retina with tear in the right eye; left eye healthy)	OD	41	50	80	60	30	120	39	180-200
K.	18	OS – Ablatio retinae traum. post. cont.; rupt. ret. (traumatic detachment of the retina in the left eye; right eye healthy)	OS	24	20-30	50		70	50	19	180-220
G.	19	OD – Ablatio retinae cum rupt. retinae (detachment of the retina with tear in the right eye; left eye healthy)	OD	14	60	50	60-70		90-100	20	250-270

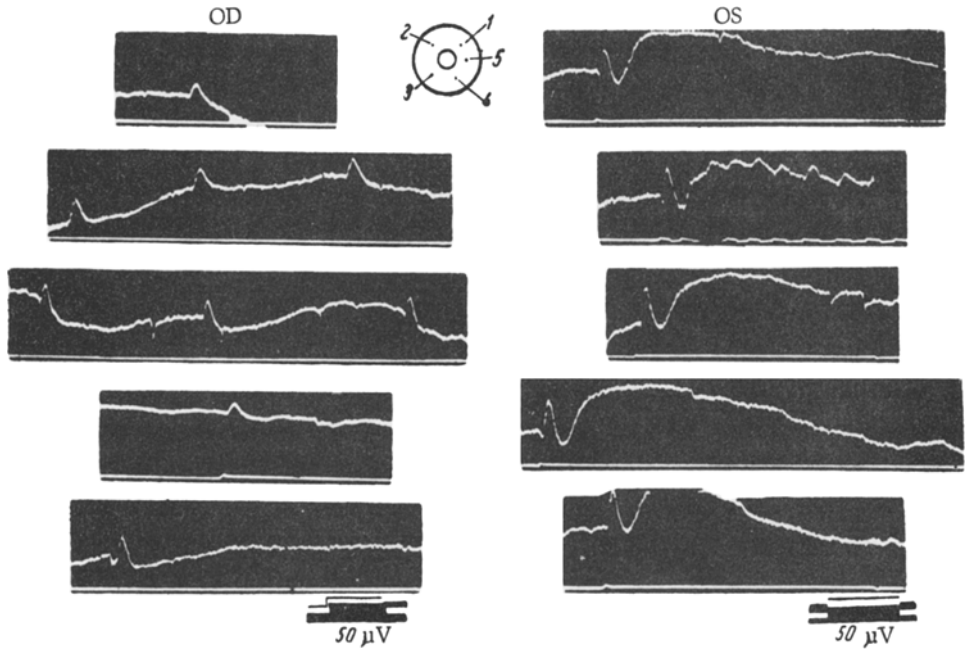

Fig. 2. Electroretinograms of the right and the left eye of patient S. Diagnosis: Detachment of retina with tear in right eye; left eye – normal. The figures on the ERG represent the numbers shown in the sketch in the upper right-hand part of the figure. They indicate the position of the electrode on the cornea during the recording of the ERG.

In detachment of the retina, if the ERG is recorded by means of a contact lens it is reduced. However, under these conditions it is not known which portion of the retina is responsible for the b wave, because in such a case the ERG represents the summed response of the whole retina.

We have recorded the ERG by a local electrode from three patients with detachment of the retina. The record was made as a rule from both eyes, and the active electrode was placed on five different regions of the pupil, such positions corresponding to times of 1, 3, 5, 7 and 10 hours on the clock-face.

In our experiments the ERGs varied in their amplitude and shape according to the position of the electrode on the cornea. The amplitude of the b wave also varied according to the patient, showing amplitudes of from 20 to 120 μV. As can be seen from the table, the ERG in eyes with detachment of the retina was reduced in all cases, and in two patients, with the lead in certain positions, it was absent altogether.

Thus, in patient S., the ERG of the right (affected) eye was pathological for all positions of the lead except the one recorded with the electrode on the cornea in the three o'clock position, where the amplitude of the b wave was approximately normal and had an amplitude of 120 μV. In patients K and G the ERG of the eyes with retinal detachment was also reduced or absent.

There was found to be not retinal response when the local active electrode on the cornea was in the seven o'clock position (patient K) or in the five o'clock position (patient G). It should, however, be noted that the absence of an ERG from these patients was not strictly related to the position of the retinal detachment. In all the patients investigated the remaining healthy eye was normal both in the shape and amplitude of the b wave, whose value varied between 180 and 270 μV.

Let us consider the results of patient S.

Diagnosis: Detachment of the retina with a tear on the right side, left eye healthy. The retina had been detached for 1½ months.

Condition of the right eye: Quiet, cornea clear; anterior chamber of moderate depth, no discoloration of the iris, pupil round, responds to light, media clear, visual acuity 0.6-0.7 uncorrected; a shallow detachment of the retina was visible in the superior temporal segment; there was a tear at eleven o'clock.

Left eye normal, visual acuity 1.0.

The ERG was recorded from both eyes by placing the electrode in various positions on the cornea.

As can be seen from Fig. 2, the ERG shows pathological changes, which however are marked to different extents according to the position of the electrode on the cornea. Thus, in position one o'clock (first position) the amplitude of the b wave was 50 uV, at ten o'clock (second position) it was 80 uV, at seven o'clock (third position) it was 60 uV and the c wave was strongly negative. When the electrode was moved to five o'clock (fourth position) the ERG showed a'b' wave of 30 uV. The greatest value of the 'b' wave occurred when the electrode was at three o'clock (fifth position) when it showed an amplitude of 120 uV. The amplitude of the healthy left eye for all positions of the electrode on the cornea corresponding to those used for the right eye was well-marked and normal in shape and amplitude of the 'b' wave. The b-wave amplitude lay between 120 and 200 uV. Unlike the right eye, that of the left showed a marked c wave.

Until now no clear relationship has been found between the position of the detachment and the shape of the ERG. However, we must point out that the amplitude of the b wave in the ERG of the right eye was greater in proportion to the distance between the electrode and the site of detachment (position five). We were unable to establish any correlation between the nature of the ERG and the position of the detachment.

SUMMARY

A method of recording the ERG from so-called local leads (placing the electrode on different parts of the cornea) was used. It was found that the amplitude of the ERG as recorded from different electrode positions was related to the site of the detachment. This effect cannot be obtained when the ERG is recorded by use of a contact lens.