STUDIES IN NEUROSURGICAL ELECTROENCEPHALOGRAPHY

1. STANDARD ELECTRODE PLACEMENT

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Practically every electroencephalographic worker has developed his own system of orientating electrodes on the heads of his patients. Providing certain fundamental technical requirements† are fulfilled, most of the systems thus evolved seem adequate for everyday requirements, and minor differences in electrode type and topography are probably of little significance.

However, this applies only in centres where the principal emphasis is on the recognition of paroxysmal dysrhythmias. When an attempt has to be made to correlate the spatial distribution of abnormal electrical activity with regional cerebral anatomy, as is the case in centres dealing largely with neurosurgical material, the actual method of electrode placement becomes of major significance. But as there is no precisely reliable method available for the accurate correlation of skull topography with regional brain anatomy, no universal standard can be prescribed.

Nevertheless, experimental results in this field depend greatly upon methods of electrode placement; so the present communication describes the method of orientating electrodes and the technique of recording employed in the studies made in the Nuffield Department of Surgery. It is to be understood that in ensuing reports the technique described in this paper has been followed, unless otherwise stated, and no further detailed description will be given. The method has been regularly employed in this Department for the last 18 months, during which time 2,200 records have been made from all types of clinical material at all ages.

No reference is made to the many other methods of electrode orientation employed elsewhere, as these have been discussed by the individual workers concerned.

TYPE OF ELECTRODE

The electrode employed is the so-called “saline pad” contact electrode, although solder disc electrodes affixed to the scalp with collodion have been used on some occasions. The former electrode consists of a silver bell-ended

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† See Walter, Williams and Gibbs, Gibbs and Gibbs, Cohn, Hill and Parr, and the recommendations of the American EEG Society.
tube mounted in a moulded polythene holder,* and covered with a convex saline pad (Fig. 1) which is kept moist in saline solution. From time to time the electrodes are rechlorided by electrolysis in saline solution; and in the intervals between use they are stored with the pads immersed in salt solution.

These electrodes are applied to the scalp, after parting the hair and cleaning the skin with ether-alcohol or methylated spirit, with or without preliminary anointing of the area with some form of contact paste ("Bentonite" or "Cambridge Electrode Jelly" is usually used in this unit). They are held in place by a cap made of rubber strands tied under the chin ("Buty-wave" type†) or, in small children, by rubber bands traversing the scalp transversely and tied to another band encircling the whole head.

With this method the electrodes sit firmly and with little discomfort to the patient, they are independent of any change of position of the head, and more electrodes can be added or their positions changed quickly. Interelectrode resistances of the order of 2,000 to 5,000 are regularly obtained, and there is no difficulty in securing satisfactory records with a minimal admixture of artifacts, under most experimental conditions. Sometimes electrodes are knocked off during a violent seizure or if the patient rolls over while asleep, but this can be avoided by controlling the position of the head; and in any case the displaced electrodes are easily restored.

This technique is entirely suitable for routine work in any centre, and is especially applicable when records have to be made from patients with recent scalp wounds, either operative or traumatic, as the electrodes can be placed around the wound more readily and more cleanly than with most other methods.

The only difficulty that may be experienced is a marked increase in electrode resistance due to rapid drying of the saline pads on hot dry days. The climate in England is such as to minimise this trouble, but in other countries it may be necessary to moisten the pads from time to time during recording; and this is easily done by dropping saline solution on them with an eye dropper, taking care to wet only the saline pad.

**SITING OF ELECTRODES**

In order to determine the electrode pattern that would give optimal coverage of the whole brain, radiographic studies of the skulls of patients

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† Manufactured by Biometica Ltd., Rampayne St., London S.W. 1.