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Short Communication

Electrocochleography: a new technique

S. A. Hickey F.R.C.S., D. B. Mitchell F.R.C.S., J. G. Buckley F.R.C.S., A. F. Fitzgerald O'Connor F.R.C.S., J. L. Wunderlich B.Sc. (London)

Abstract
The near field monitoring of an auditory evoked response from the cochlear (electrocochleography) is a tried and trusted clinical tool. Conventional techniques for performing electrocochleography are cumbersome to use and frequently uncomfortable for the patient. We present a simple, modified technique which provides more flexibility with regard to where and when electrocochleography may be performed and also improves patient comfort during the test.

Method

After placement of earth and reference electrodes in the usual manner, an assembly comprising of a traditional Teflon insulated electrocochleography needle and an expandable foam ear plug is placed in the external meatus. The ear plug contains a central plastic tube which may be connected to a remote earphone, by a further plastic tube, thus forming an insert earphone assembly (manufactured by EAR Auditory Systems, Indianapolis). The foam of the ear plug is compressible, returning to its original dimensions after a minute or two (Fig. 1). It is this property which allows the foam to be compressed such that it forms a compact sleeve around the central tubing and the needle, which is passed through the foam plug, parallel to the central tubing, to form the recording assembly (Fig. 2).

With the foam thus compressed, and with the meatus splinted open with a Lempert's bivalve aural speculum, it is possible to obtain an adequate view of the tympanic membrane, thus enabling accurate placement of the needle on the promontory. The foam may then be manipulated into its final position in the meatus and held in position until it expands to fit the meatus exactly (Fig. 3). With the needle thus held securely in position, all that is required is for the needle assembly to be connected to the active terminal of the electrocochleograph and for the plug to be attached to the insert earphone. The ear may then be stimulated and the electrocochleogram recorded in the usual manner.

Discussion

This system has several advantages over more traditional systems: The insert earphone system is much smaller, lighter and more comfortable for the patient than the traditional headphone and does not require to be secured on the head with cumbersome clamps or held in place by the tester. It is simply and rapidly applied and produces a very stable support for the needle electrode, quite free of the tendencies seen with the traditional multi-component systems for spontaneous dislodgement with the slightest movement by the patient. With this system it is quite possible for the assembly to be inserted in one room and then for the patient to walk into a sound proofed booth with the assembly *in situ*.

Its comparative lack of bulk means that it is easy to isolate

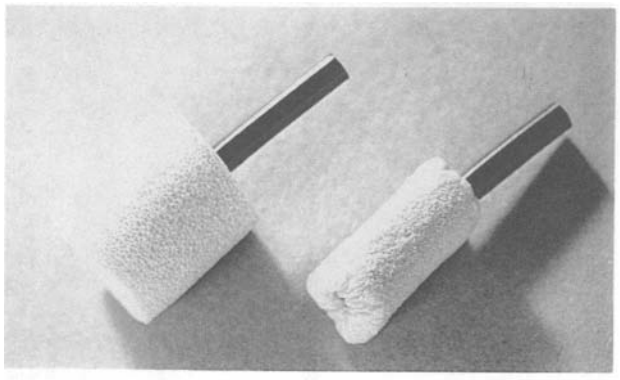


Fig. 1
Foam insert ear plug shown in its compressed and fully expanded states.

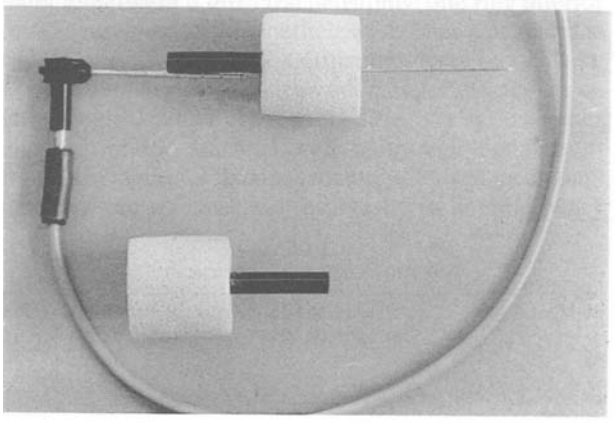


Fig. 2
Recording assembly ready for placement in the external meatus.

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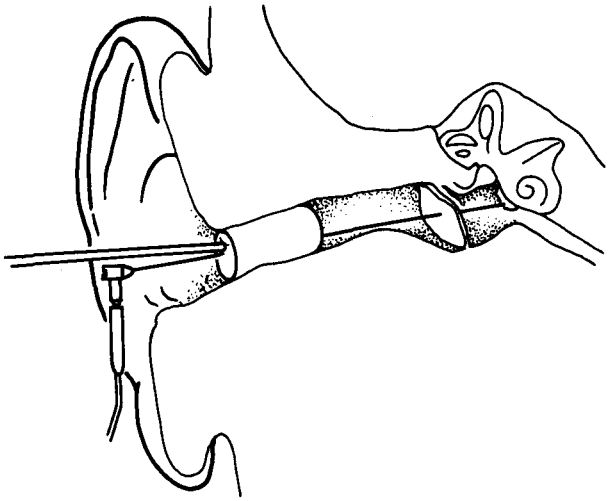


FIG. 3
Diagram to show recording assembly in position in the external meatus.

the post auricular area from the recording assembly. This makes it possible to use the assembly to monitor the electrocochleogram continuously during labyrinthine and posterior fossa surgery without the need to turn a tympanomeatal flap in order to place a round window electrode accurately or to stimulate using a free field system, with its associated risks of contamination of the sterile operative field.

The acoustic characteristics of the assembly are comparable with the T.D.H. 30 headphone (Clemis *et al.*, 1986). The fact that the earphone transducer is removed from the patients head as opposed to being secured in close proximity to the ear, as in the traditional assembly, means that there is acoustic delay of 1 msec inherent in the designed length of the sound delivery tubing. The result is that the response latencies are delayed by 0.8 msec using the insert earphone assembly compared to responses obtained using T.D.H. 30 headphones (which has an acoustic delay of 0.2 msec). There is no change in the morphology of the evoked response (Fig. 4). A useful byproduct of the acoustic delay is the removal of the stimulus artefact from the evoked response.

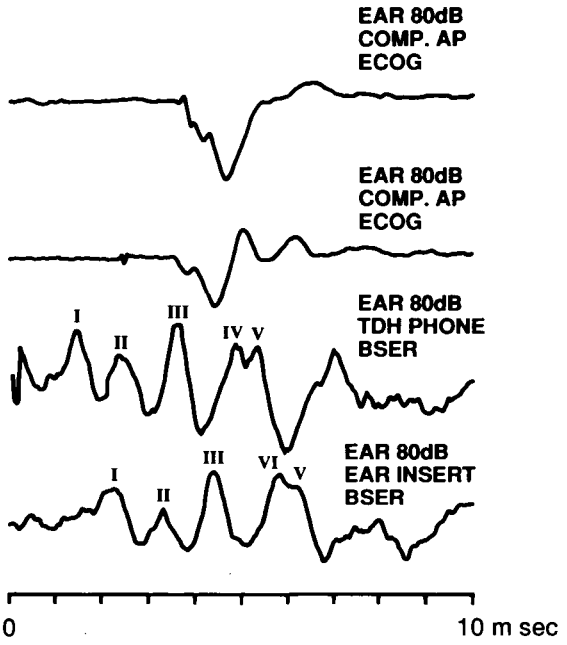


FIG. 4
Examples of evoked responses obtained using EAR insert earphone assembly.
(a) + (b) Electrocochleograms showing compound action potentials in two patients.
(c) Brainstem evoked response obtained using TDH 30 headphones.
(d) Brainstem evoked response obtained in same patient as (c) using the EAR insert earphone assembly. Note latency shift (scale relates to (c) and (d)).

References

Clemis, J. D., Ballad, W. J., Killion, M. C. (1986) 'Clinical use of an insert earphone'. *Annals of Otology, Rhinology and Laryngology* **95:** 520–524.

Address for correspondence:
Mr S. A. Hickey
Department of E.N.T. Surgery
St Thomas' Hospital
Lambeth Palace Road
London SE1 7EH
ENGLAND

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