Corneal D.C. recordings of slow ocular potential changes such as the ERG c-wave and the light peak in clinical work

Equipment and examples of results

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Key words: electroretinography, D.C. recordings, light stimulator, recording equipment, slow ocular potentials, standing potential, c-wave, fast oscillation, light peak

Abstract. A set-up for D.C. recordings of slow ocular potentials such as the c-wave of the electroretinogram (ERG) as well as the fast oscillation (FO), the light peak (LP) and the dark trough (DT) in both clinical and experimental work is described. It includes matched calomel half-cells connected by saline-agar bridges to a corneal contact lens on the eye and a reference chamber on the forehead, a low-drift differential-input D.C. amplifier, an A/D converter, a computer, a thermoprinter, a flexible disc memory, a plotter, and a device for light stimulation controlled by the computer.

Examples of the usefulness of the set-up in clinical work are shown in the form of D.C. c-wave ERGs of normal subjects as well as of patients with vitelliform macular degeneration, choriocapillaris atrophy, and retinitis pigmentosa. The direct corneal recording of the FO and LP is demonstrated as well. The different origins of the standing potential (SP) of the eye, the ERG c-wave, the FO and the LP are reviewed briefly.

Introduction

While several apparatuses for recording the electroretinogram (ERG) a- and b-waves are commercially available, each individual laboratory has so far had to build its own equipment for D.C. recordings of slow ocular potentials. For many years our department has been interested in these slow potentials, such as the c-wave and the h-wave (the “off c-wave”) of the ERG as well as the later and still slower light peak (LP) and dark trough (DT). The indirect method of recording the LP and DT, the EOG, is well known. We have developed a technique for D.C. recordings of the slow ERG potentials which can be used also for direct corneal recordings of the LP and DT, without eye movements. Such direct recordings of the slow potential variations are advantageous particularly in animal experiments, but may be useful also in examination of humans, as a continuation of c-wave studies. This can be done also in small children under general anaesthesia.

Our initial equipment (Nilsson and Knave, 1974) has been improved
throughout the years (Nilsson and Skoog, 1975; Nilsson, 1980; Textorius et al., 1985). The current set-up will be described in the present paper, together with examples of its usefulness.

Systems for recording and light stimulation

The recording and display system is shown in Figs 1–4. After dilating the pupils with 0.5% tropicamide and 10% phenylephrine hydrochloride and after topical tetracain anaesthesia a polymethylmethacrylate (PMMA) contact lens with a groove and a ridge, so as to hold the eyelids apart, and with an unpolished surface to better diffuse the light, is placed on the eye (Fig. 1). A PMMA chamber is attached to the forehead by means of a piece of ring-shaped, double-sided adhesive tape. The contact lens and the chamber are both filled with 2% sterile methyl cellulose, containing 0.9% saline. When preparing for recordings of long duration a few drops of tetracain are added to the methyl cellulose before inserting the lens. The contact lens and the chamber on the forehead are connected by means of saline-agar bridges

Fig. 1. A contact lens on the eye and a plastic chamber on the forehead are connected by means of saline-agar bridges to matched calomel half-cells (recording and reference electrodes), plugged into a preamplifier. To provide a well-defined suction the contact lens is equipped with a second tube, ending in a testube with saline, 20 cm below the eye. The earlobe is grounded.