New disposable ERG electrode made of anomalous polyvinyl alcohol gel

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Abstract. We developed a disposable electrode for the electroretinogram made of anomalous polyvinyl alcohol gel. This new hydrogel is a rubber-like elastic with water content 80–90 wt%, but insoluble in water. The elastic electrode plate is approximately 0.3–1.0 mm thick, sterile, flexible, and easily cut to the desired shape. Its low cost permits it to be discarded after use.

Introduction

The selection of an appropriate active electrode is an important factor in recording stable electroretinograms (ERG) of high amplitude from the human eye. Until now, hard contact lens electrodes have most frequently been used. Yanashima and associates (1983) developed a soft lens electrode made of Breath-0 (Toray Co. Ltd). Soft lens electrodes have eliminated foreign-body sensation and allowed comfortable recording over a long period (Dawson, Zimmerman and Houde, 1974). The drawbacks of these electrodes are that they are expensive and easily broken, and their sterilization is complicated.

We developed a disposable ERG electrode made of anomalous polyvinyl alcohol (PVA) gel.

Material and methods

The details concerning the gel-forming process from PVA solution and the physiologic properties of the new PVA hydrogel have been published previously (Watase, Nishinari and Nambu, 1983; Nagura, Nagura and Ishikawa, 1984). Briefly, pre-frozen PVA solution is immersed in distilled water at room temperature, yielding a stable gel. The PVA hydrogel has the following properties: a rubber-like elasticity, hardness of 19 (Shore Durometer type A), a smooth surface, nonabsorptiveness, 80–90 wt% water content, insolubility in water, and molecular-size pores. The elastic electrode plate is 0.3–1.0 mm in thickness. It is chemically sterilized and stored in a bottle containing physiologic saline solution, which is opened immediately before use. Carbon fibers are embedded in the plate with their other end
Figure 1. A new disposable electrode made of anomalous polyvinyl alcohol gel (left). Soft contact lens electrode of Toray Co. Ltd. for reference (right).

Figure 2. An example of a recording from a normal subject with the new PVA hydrogel electrode. The upper trace was obtained by repeated stimuli of 2 joules and the lower trace by a simple stimulus of 20 joules.

connected to the recording system. The polyvinyl gel is flexible and easily cut by scissors to the desired shape (Figure 1). Usually we cut it as an ocusert and insert it in the fornix or plate it on the corneal limbus. The plate is semilucent; therefore when it is put on the cornea, its center is cut out