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Effect of varying skin surface electrode position on electroretinogram responses recorded using a handheld stimulating and recording system

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Abstract

Purpose : The RETeval system (LKC Technologies, Inc., Gaithersburg, MD, USA) is a hand-held device for recording electroretinogram (ERG) responses with skin electrodes, placed over the lower eyelid, close to the lid margin. Some subjects find this uncomfortable due to proximity to eyelashes. We explored the effect of changing electrode position in healthy subjects.

Methods : Photopic flicker ERGs were recorded in 120 healthy twins as part of a wider study. For 48 subjects (Group 1), recording electrodes were placed in “comfortable” positions, even if this was 1-2 cm below the lid margin. For 72 subjects (Group 2), the lid margin position was used as recommended by the manufacturer. Photopic flicker and flash ERGs were recorded for an additional 5 healthy subjects in two consecutive recording sessions: in the test eye, the electrode was placed just below the lid margin in the first session, and 1.5 cm below in the second; in the fellow eye (control eye), the electrode was just below the lid margin throughout. Amplitudes and implicit times (test eye normalised to control eye) were compared for the two sessions. Pupils were undilated; stimuli were designed to deliver the same retinal illuminance as international standard stimuli.

Results : For Group 1, mean (SD) flicker ERG amplitudes were 22.9 (13.1) and 22.4 (13.3) μV for right and left eye respectively. Implicit times were 25.8 (2.1) and 25.9 (1.1) ms. For subjects with consistent positioning at the lid margin, amplitudes were 35.3 (10.1) and 37.6 (17.3) μV; implicit times were 25.3 (1.1) and 26.1 (2.4) ms. Mean amplitudes

were significantly lower for the first group ($p<0.0001$), but implicit times did not differ ($p>0.2$).
For the subjects in whom electrode position was changed between recording sessions, flash and flicker amplitudes were significantly smaller when positioned 1.5 cm from the lid margin ($p<0.05$), but implicit times were similar ($p>0.6$).

Conclusions : Moving RETeval electrodes further from the lid margin significantly reduces response amplitudes, but does not significantly affect implicit times. The study highlights the importance of consistent electrode positioning. However, in research studies in which participants may find standard electrode positions uncomfortable, it may be feasible to alter the position if analysis is restricted to implicit time parameters.

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