An Investigation of Electrovestibulography and Vestibular Field Potentials

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An emerging technique called Electrovestibulography (EVestG) shows promise for the diagnosis of various balance and mood disorders. This technique records the electrical signal from the external ear during evoked vestibular responses. In order to extract the vestibular signal from a recording which contains many other signals (muscle artifacts, cochlear responses, and environmental noise), a signal processing technique called the Neural Event Extraction Routine (NEER) is used [1].

NEER currently consists of four major operations. In the first step is an adaptive filter is applied to the signal to reduce noise and artifacts as much as possible. The second step is to separate the signal into segments corresponding to the direction of acceleration applied to the subject. The third step involves filtering the signal using a set of wavelets, each tuned to a different frequency. The final step is to use a set of heuristics on the phase and magnitude of the wavelet responses to identify possible evoked field potentials. These possible field potentials are then averaged to obtain a typical field potential, which can be used to identify disorders [2].

So far, a number of refinements have been made to the original algorithm. A rewrite for computational efficiency has allowed much faster processing of results. Also, changes to the segmentation process have been investigated. Numerous tests have been done to measure the reproducibility of EVestG data under various experimental conditions. Additionally, initial work has been done on a procedure for objectively evaluating the performance of the NEER algorithm using simulated signals. Such a procedure will allow us to compare the current algorithm with other techniques.

Future work will use the characterization of the evoked vestibular field potential from animal studies to guide improvements to the NEER algorithm. A possible alternative algorithm will be investigated which will use matched filters based on expected field potential shapes.


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