Saccadic spike potentials in gamma-band EEG: Characterization, detection and suppression

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Abstract:
Analysis of high-frequency (gamma-band) neural activity by means of non-invasive EEG is gaining increasing interest. However, we have recently shown that a saccade-related spike potential (SP) seriously Confounds the analysis of EEG induced gamma-band responses (iGBR). as the SP eludes traditional EEG artifact rejection methods Here we provide a comprehensive profile of the SP and evaluate methods for its detection. and suppression, aiming to unveil true cerebral gamma-band activity The SP appears consistently as a sharp biphasic deflection of about 22 ms starting at the saccade onset, with a frequency band of similar to 20-90 Hz. Oil the average, larger saccades elicit higher SP amplitudes. The SP amplitude gradually Changes from the extra-ocular channels towards posterior sites with the steepest gradients around the eyes, indicating its ocular source Although the amplitude and the sign of the SP depend on the choice of reference channel, the potential gradients remain the same and non-zero for all references The scalp topography is modulated almost exclusively by the direction of saccades, with steeper gradients ipsilateral to the saccade target. We discuss how the above characteristics impede attempts to remove these SPs from the EEG by common temporal filtering, choice of different references, of rejection of contaminated trials We examine the extent to which SPs can be reliably detected without an eye tracker, assess the degree to which Scalp Current density derivation attenuates the effect of the SP, and propose a tailored ICA procedure for minimizing the effect of the SP. (C) 2009 Elsevier Inc. All rights reserved.

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