Reduced Brain Potentials to Novelty in Depression: Characterization of Neural Sources by Principal Components Analysis (PCA) of Current Source Density (CSD) Waveforms

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Background: We recently reported reductions in the frontocentral P3 potential to novelty in depression (20 unmedicated patients, 20 healthy controls; 31-channel EEG). This replication and extension was recorded from a high-density montage (67-channels) in a larger, independent sample (49 patients; 49 controls). PCA-CSD methods were used for improved identification and quantification of reference-free components, having sharper topographies that more closely reflect underlying neuronal generators.

Methods: A novelty oddball task (Friedman et al., 1993) included two 300-ms tones (nontargets: 350 Hz, p=.76; targets: 500 Hz, p=.12) and novel sounds (e.g., dog bark, human cough: 100-400 ms, p=.12) in pseudorandom order with 1000 ms ISI using eight 50-trial blocks. Participants responded as quickly as possible to target tones only, with response hand counterbalanced across blocks. Spherical spline CSDs were derived from ERPs, and quantified using unrestricted PCA.

Results: The CSD-PCA solution was consistent with binaural (Kayser and Tenke, 2006) and dichotic (Tenke et al., 2007) oddball tasks. However, the P3 source factor (343 ms peak latency), which efficiently summarized medial-parietal target P3b, also included a secondary, midline frontocentral source for novel and target stimuli. Moreover, a preceding factor (241 ms) identified earlier source activity at midcentral sites (Cz maximum) that was specific to novels. This novelty P3 source was preferentially reduced in patients, and confirmed by hemispatial PCA. Conclusions: Depressed patients show a reduced response to novel distractors, consistent with a deficit in an early attentional response to novelty, and localizable to frontocentral regions within and along the longitudinal fissure.

References

