Abstract

P3 amplitude in schizophrenia has been reported to be more reduced over left than right hemisphere during passive listening tasks, which has been interpreted as left-hemispheric dysfunction. However, the contributions of methodological factors (stimulus properties, response mode, recording reference, affect) on the bidirectional surface potential (ERP) topographies, remain unclear. We recorded 31-channel ERPs from 23 schizophrenia patients and 23 age- and gender-matched healthy adults (all right-handed) during tonal and phonetic oddball tasks, varying response mode (left press, right press, silent count) also within subjects. Both groups performed adequately but were slower. ERP group patterns were augmented by temporal PCA (univariate Varimax from reference-free current source density (CSD); spherical spline Laplacians) waveforms used unambiguously related to known ERP components and highly comparable between groups. In the tone task, left parietal sinks and asymmetric centrotemporal P3 sources for targets (left, right), phonetic (L+R), but patients had reduced centrotemporal N2 sinks and reduced midparietal P3 sources. In both groups, left and right produced opposite, region-specific asymmetries originating from central sites, modulating the N2/P3 complex, and a larger parietal P3 source compared to silent count. Data suggest overall reduced neural generators in schizophrenia during auditory oddball tasks, with both groups showing comparable topographic effects of task and response mode.

Stimuli and Procedure

Tonal: Complex Tones

Tonal: Square waves corresponding to major notes (A4: 440 Hz, B4: 485 Hz) or complex tones (3, 5, 7 harmonics). Tonal stimuli were preceded by a central tone (500–600 ms) that matched the peak frequency of the subsequent complex tone or a blank interval of the same length. Phonetic: CV syllables (/ta/, /da/, /ta/) matched for discriminability.

ERP Recording and Data Analysis

- 31-channel scalp electrodes: Fp1, Fp2, F7, F3, Fz, F4, F8, C3, Cz, C4, P3, Pz, P4, O1, O2, AF7, AF8 (NeuroScan), or equivalent (Biosemi).
- 256 ms epochs, 200 ms before stimulus onset, baseline-averaged condition with stimulus-locked.
- Rejection-averaged artifacts (spaced EEG) by linear regressions of bilateral EOG (Biosemi).

Results

- CSDs were submitted to univariate or multivariate principal components analysis (PCA) and were submitted to multivariate statistical analysis (univariate per temporal and response mode).
- Reference-free current source density (CSD; spherical spline Laplacian; Perrin et al., 1997) for each electrode was used for calculation of ERP source densities (spherical splines surface Laplacian; Perrin et al., 1997) or CSDs submitted to multivariate statistical analysis (univariate per temporal and response mode).
- Topographical effects were evident in both groups, including reduced neural generators in schizophrenia during auditory oddball tasks, with both groups showing comparable topographic effects of task and response mode.

Summary and Conclusions

All statistical analyses showed that both SD components and topographies that were corrected by the variance in the real conditions revealed highly comparable ERP patterns observed across the two tasks. The reference CSD components were highly comparable in schizophrenia patients and controls, involving asymmetric, task-specific N2 sinks and P3 sources that were equally modulated by response mode. Temporal N2 sinks over parietal sites (including N2b and N2d) and P3 sources over parietal sites were reduced in patients, indicating overall reduced neural generators in schizophrenia during auditory oddball tasks. These reductions were not, however, a function of electrode site and response mode. In contrast, the reduced temporal P3 reductions in schizophrenia for both tasks were evident in both groups. In contrast, the reduced temporal P3 reductions in schizophrenia for both tasks were evident in both groups. Transient stimuli (male voices and women) used in prior studies may be processed differently than the longer 250 ms stimuli used in this study (Tallal et al., 1984)

References