Introduction

Prior research suggests that event-related potentials (ERPs) obtained during active and passive auditory paradigms may be helpful in predicting transition to psychosis (Kayser et al. 2010). ERP abnormalities in schizophrenia patients and individuals at clinical high risk (CHR) for psychosis include:

- mismatch negativity (MMN), a pre-attentive measure of auditory deviance detection (e.g., Makeig 1993; Kayser et al. 2010; Koh et al. 2011)
- P3 amplitude (e.g., Kayser & Tenke 2003; Tenke & Kayser 2012)

Recent research also suggests abnormal neural oscillations in schizophrenia, with a focus on high-frequency (e.g., beta and gamma modulations) (e.g., Tenke & Kayser 2012; van der Stelt et al. 2005; Koh et al. 2011). Abnormal beta responses may involve distinct neuronal processes, and a major finding is that beta responses are modulated by alpha activity (e.g., Van Dijk et al. 2012). As a result, abnormal alpha and beta responses may be related to abnormal neural oscillations in schizophrenia.

Novelty Oddball Task

A novelty oddball task, which involves presenting novel-Control-ERP and reference-free condition. Participants performed well on this task, and there were no significant differences in performance between conditions in any of these performance measures (all F(1,24) < 2.54, p > 0.12).

Event-Related Spectral Perturbations (ERSP)

(1) Novelties (nontarget, target, novel). Distinct event-related synchronization (ERS) for target and novel stimuli between 100 and 400 ms is evident for both groups at anterior sites (maximum at FCz). In contrast, event-related desynchronization (ERD) is most prominent for target stimuli between 400 and 800 ms over posterior sites (maximum at Cz), and appears to be reduced for patients compared to controls. (B) Factor loadings of three alpha-related time-frequency PCA (tPCA) factors (with explained variance) extracted from CSD factor score topographies corresponding to alpha event-related desynchronization (ERD; factor 1,0-30 Hz), novelty vertex source (novel; event-related synchronization (ERS); factor 3,0-50 Hz), and nontarget ERP (factor 2,0-30 Hz) for converters (Cz, CPz, CP2) and nonconverters (Cz, CPz, CP2).

Summary and Conclusions

Despite comparable novelty oddball task performance (Fig. 1), event-related desynchronization (ERS), as obtained by a reference-free time-frequency approach (CSD-tPCA), was markedly reduced over right posterior regions for targets in CHR patients compared to healthy controls (Fig. 2). In contrast, low-frequency event-related synchronization (ERS) distinctly linked to novels (mid-frontal) and N1 sink across conditions (temporal-frontal-temporal) did not differ between groups (Fig. 3). Analogous time-domain measures (CSD-tPCA), replicating prior findings (Takanishi et al. 1998) and consisting of N1 sink, novelty mismatch negativity (MMN), novelty vertex source (novel; novelty P3, P1b, and frontal response negativity (FRN), were robust and closely comparable between groups (Fig. 4). Novelty MMN and alpha ERD were virtually absent in three CHR patients who developed threshold psychosis (Fig. 5).

The available preliminary data from three converters (Fig. 6) is extremely encouraging at this stage. Further research with larger samples is needed to confirm these findings and understand their clinical implications.