Comparisons of Mismatch Negativity in Clinical High Risk and Schizophrenia Populations

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Introduction

People who suffer from schizophrenia consistently show deficits in auditory mismatch negativity (MMN), a pre-attentive measure of irregularities in unattended/background sounds.

However, findings in clinical high risk (prodromal/CHR) populations show conflicting reports of the efficacy of auditory MMNs as neurophysiological biomarkers[1-3].

This preliminary investigation builds on the well-established duration, intensity, and pitch deviants[4,5], as well as two novel deviant tones (stimulus onset asynchony (SOA) and frequency modulated (FM)).

We expected the schizophrenia patient group (SCZ) to show reduced MMN compared to healthy controls (HC), with the prodromal cohort (PRDM) to show variable attenuation.

Methods

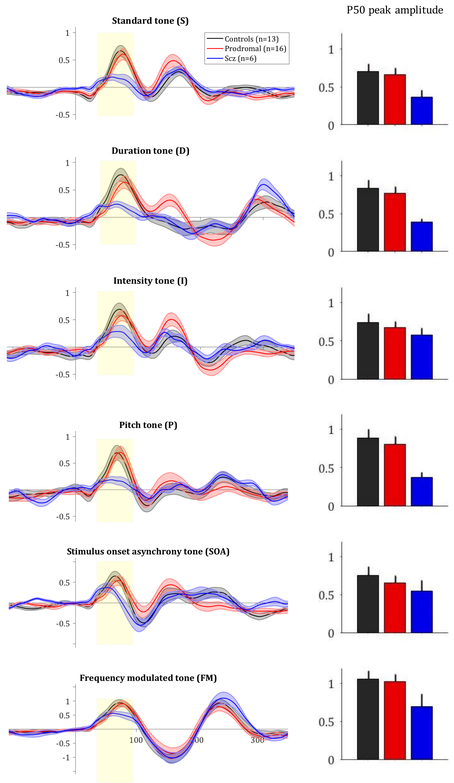
Participants: 16 prodromal (ages 14-30, 8 female), 13 healthy controls (ages 19-33, 3 female), and 6 schizophrenia patients (ages 26-40, 1 female)

Participants sit in a sound attenuated chamber with the lights off, and are asked to watch a National Geographic Classics DVD with the sound off and no subtitles.

Each block is 5 mins long with a tone played every half second at the probability of 45% for standard tones (100 ms), 10% for duration, intensity, pitch, and frequency modulated (FM) deviant tones, and 15% for location deviants (7.5% each to left and right delayed tones) for a total of 600 trials. There are 7 blocks.

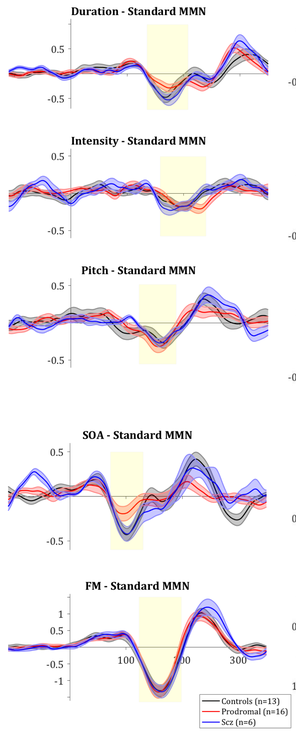
Continuous EEG acquired using 64 active electrode system (no online filter, @500 Hz). Event related potentials (ERP) epochs of -500 ms to 1000 ms with the baseline from -500 ms to 0 ms, and bandpass filtered from 0.3 ~ 80 Hz with a notch filter at 60 Hz.

ERPs of each stimulus

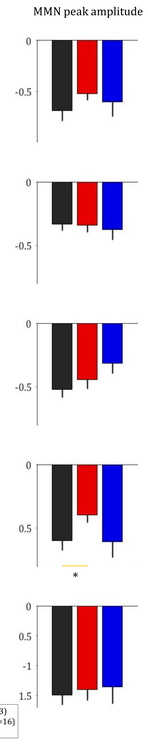


P50 peak amplitude

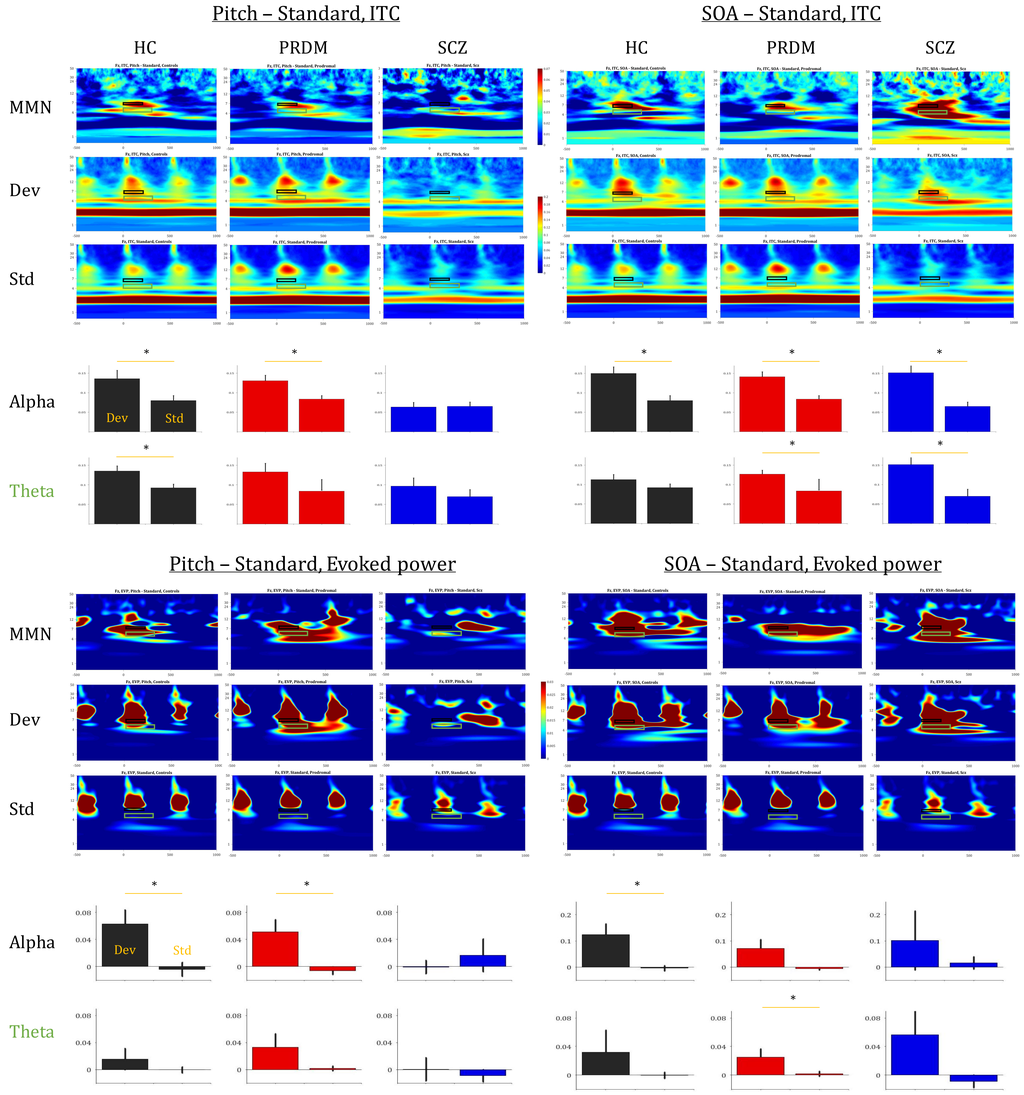
Mismatch negativity (MMN)



MMN peak amplitude



Time-frequency analysis (TFA) – ITC and Evoked power



Discussion

This novel task paradigm shows overall trend towards stepwise reduction of ERPs in prodromal and schizophrenia cohorts for all stimuli, replicating a previous paradigm[4], but also adds evidence to the variability in MMN findings in the literature.

Phase locking across trials, shown via ITC analysis, reveal differential movement in HC vs. PRDM and SCZ groups in the theta band for both pitch-standard and SOA-standard tones[6].

Alpha band activity is most robust in this task, perhaps due to the large number of stimuli (6 deviants) that point to the hierarchical organization of top-down attentional effects during task.

In evoked power analysis, during the time window of sensory information processing, alpha and theta frequencies show significant power modulation particularly for the deviant condition.

References

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