SOCIETY FOR BRAIN MAPPING AND THERAPEUTICS ABSTRACT for AUTISM

TITLE:

Noninvasive EEG-EKG guided trans-magnetic stimulation at natural resonance frequency in children with autism: randomized double-blinded pilot study

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PURPOSE:
EEG abnormalities of the neocortex exist in ASD when compared with neurotypic EEGs of the same age group (public database [1]). Particularly, cortical-to-cortical coherences inherent in normal children may be disrupted in ASD [2]. Transmagnetic stimulation (TMS) is a non-invasive modality that may be able to alter baseline EEG patterns, thereby improving cortical connectivity [3]. We hypothesize clinical improvement in patients with ASD coinciding with changes in EEG coherence.

METHODS:
28 children with moderate to severe ASD were included in a randomized, double-blinded, placebo-controlled clinical trial. In Phase 1, children were divided randomly into treatment versus sham group and treated daily for 5 weeks. In Phase 2, all children were treated openly for an additional 5 weeks. Subjects' EEG, QEEG, FFT and symptoms were scored at baseline and every 2 weeks and compared with existing normative data [1] for same age group. EEG and EKG were used to determine the treatment frequency for TMS, typically the computed dominant natural resonant frequency, $\mathbf{f_{NR}}$, for each child. One-year clinical follow-up was obtained. Phase lag coherence measures were calculated (scalp electrode grid 19x19 matrix) for each child for each EEG obtained [4 5]. P-values were obtained comparing phase lag coherence changes over time with treatment versus sham. Phase lag coherences' alterations were compared for trending towards or away from normative EEGs.

RESULTS: 10 of 14 patients who received 5 weeks of MeRT showed >5 points CARS2-ST reduction versus 0 of 14 patients who received 5 weeks of sham ($p = 0.0002$). After open label,

23 of 28 children showed CARS score reduction > 5 points (82%). In particular, improvements were noted in sensory perception as supported by CARS2-ST. Phase lag coherences were significantly altered across bands following treatment ($p <= 0.05$) when compared to sham. Phase lag coherences' changes tended to trend *towards* normative EEGs' appearance.

DISCUSSION:

Parents reported most improvements in Query II "imitation," III "emotional response," IV " body use," VI "adaptation to change" and, IX "taste, smell, and touch responses and use". This suggested EKG-EEG-guided TMS may be more effective at mitigating averse sensory misperceptions common in ASD. Majority of children who improved were of ages slightly less than 7, rather than pre-adolescents. Improvements were noted in a 'short' 10 week window and counter to natural ASD developmental trajectories [6]. There was also no significant correlation between initial CARS score and amount of CARS reduction. We were able to achieve EEG changes while maintaining output intensity at less than or equal to 80% of motor threshold. Given the low n, however, further studies will be necessarily.

CONCLUSION:

EEG-EKG guided TMS may improve clinical scores in ASD up to one year. Changes in EEG pattern (trending *towards* baseline normative EEGs) may correspond to reduction in symptom severity. No severe adverse effects were reported by 1 year. Further studies will be needed.

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