Mechanical Affective Touch Therapy (MATT) for Anxiety Disorders: Effects on Resting State Functional Connectivity

Meghan A. Gonsalves, ScM1,2, Quincy Beck, ScB2, Andrew M. Fukuda, MD, PhD2,3, Eric Tirrell, BA1, Fatih Kokdere, MD2,3, Eugenia F. Kronenberg, ScB2, Nicolas D. Iadarola, MS2,4, Sean Hagberg, PhD5,6, Linda L. Carpenter, MD2,3*, Jennifer Barredo, PhD2,3,7

Background:
Mechanical Affective Touch Therapy (MATT) is a novel non-invasive mechanical nerve stimulation device targeting peripheral nerves developed by AffectNeuro for treatment of anxiety. The device delivers gentle, topical vibrations (< 20 KHz) over the mastoid processes.

Aim: We evaluated the effects of MATT treatment on resting state functional connectivity (RSFC) in pain and anxiety circuits in adults diagnosed with an Axis I anxiety disorder.

Hypotheses: 1) RSFC in pain and anxiety circuits at baseline will predict post-treatment symptom response. 2) Acute RSFC changes will be observable following initial stimulation. 3) Changes in RSFC of these circuits occurring across treatment will correlate with symptom changes.

Methods: Study Design & Participants

Design: Participants in an open-label trial self-administered MATT for at least two 20-minute sessions daily for four weeks. 3T MRI: Structural images and 10 minutes of resting-state fMRI were collected: (1) before initial MATT stimulation (baseline; T1), (2) immediately after baseline stimulation (T2), and (3) after completion of treatment (T3). Participants: All were diagnosed with at least one Axis I AD (i.e. GAD, PD, SAD). Self-report: GAD-7, DASS Total & Subscales, PSS, and BDI were collected at T1 and T3.

Methods: Seed-to-Voxel Analyses

The CONN Toolbox was used for all preprocessing and analyses. A priori Functional Regions of Interest (ROIs) were based on term maps for “pain” and “anxiety” in the Neurosynth database. Second-level ANCOVA models used for hypothesis testing controlled for baseline symptom severity. Results were corrected for multiple comparisons (voxel p-unc.<.005, cluster p-FDR<.05) and subjected to leave-one-out cross validation.

Results: Pre-treatment RSFC in pain circuits predicts subsequent post-MATT symptom improvement

Results: Acute changes in pain circuit RSFC are observable following initial MATT administration

Results: Changes in pain circuit RSFC to the default network are correlated with symptom improvement after a course of MATT

Conclusions: MATT-induced increased connectivity between pain and anxiety ROIs and posterior DMN regions involved in memory and self-reflection correlate with decreases in stress and depression post-treatment. Acutely, we observed increases in insula connectivity between mid-cingulate cortex and postcentral motor regions.

1 Neuroscience Graduate Program, Brown University, Providence, RI; 2 Butler Hospital/Neurorehabilitation Research Facility, Providence, RI; 3 Department of Psychiatry and Human Behavior, Alpert Medical School of Brown University, Providence, RI; 4 University of Arizona College of Medicine-Tucson, Tucson, AZ; 5 Affect Neuro, Brooklyn, NY; 6 University of New Mexico Department of Neurosurgery, Albuquerque, NM; 7 Center for Neurorehabilitation and Neurotechnology, Providence VA Medical Center, Providence, RI;