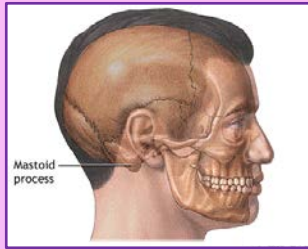


# Mechanical Affective Touch Therapy (MATT) for Anxiety Disorders: Effects on Resting State Functional Connectivity



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## 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.

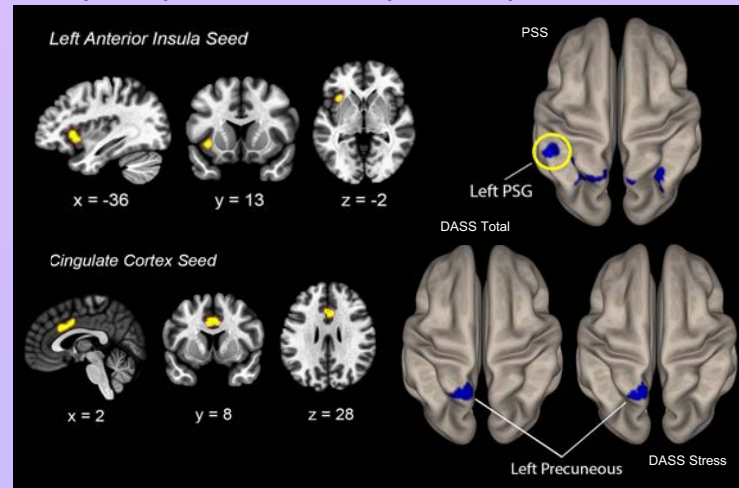
**Hypotheses:** 1) RSFC in pain and anxiety circuits at baseline will predict post-treatment symptom response. 2) Acute RSFC changes will be observable following initial stimulation. 3) Changes in RSFC of these circuits occurring across treatment will correlate with symptom changes.

## 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.

	T1	T1-T2	T1-T3
n	20	18	14
Age, mean (s.d.)	35.80 (14.72)	37.28 (14.80)	35.86 (14.46)
Females, n (%)	14 (70.00)	13 (72.20)	10 (71.40)
% MATT Compliance, mean (s.d.)	74.50 (33.00)	77.92 (30.83)	89.53 (19.86)
% MATT Treatment Completer, n (%)	15 (75.00)	14 (77.80)	14 (100.00)

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



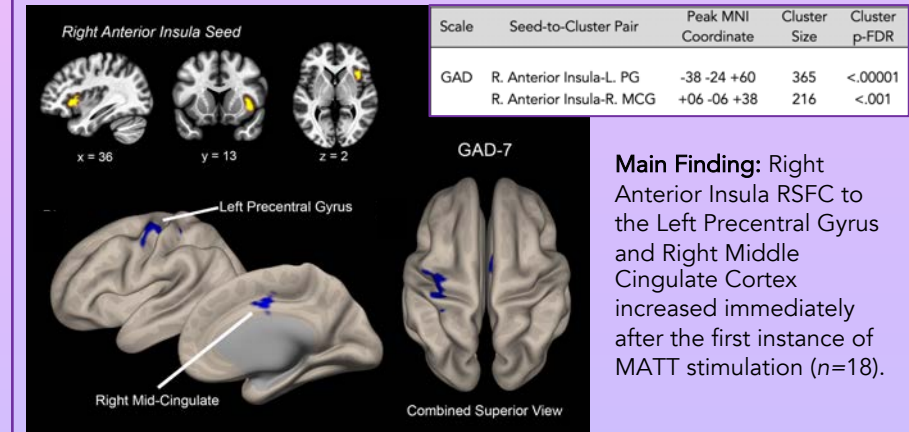
**Main Finding:** Stronger positive RSFC between insula and cingulate pain circuits & default and executive networks predicted greater reductions in stress at treatment endpoint ( $n=20$ ).

Scale	Seed-to-Cluster Pair	Peak MNI Coordinate	Cluster Size	Cluster p-FDR
PSS	L. Anterior Insula-L. PSG	-50 -42 +48	317	<.0001
DASS Total	Cingulate Cortex-L. Precuneus	-08 -58 +58	315	<.001
DASS Stress	Cingulate Cortex-L. Precuneus	-08 -58 +60	267	<.01

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

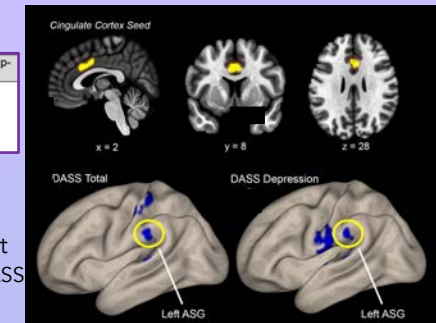


**Main Finding:** Right Anterior Insula RSFC to the Left Precentral Gyrus and Right Middle Cingulate Cortex increased immediately after the first instance of MATT stimulation ( $n=18$ ).

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

Scale	Seed-to-Cluster Pair	Peak MNI Coordinate	Cluster Size	Cluster p-FDR
DASS Total	Cingulate Cortex-L. ASG	-66 -34 +24	186	<.001
DASS Depression	Cingulate Cortex-L. ASG	-66 -34 +24	168	<.01

**Main Finding:** Increased positive RSFC between the cingulate and left anterior supramarginal gyrus at treatment endpoint were correlated with decreases in total DASS scores & DASS Depression scores ( $n=14$ ).



**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.

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