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Heart Rate Variability Biofeedback and Mindfulness: A Functional Neuroimaging Study

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Mindfulness has become an integral component in many treatments for a wide variety of psychologic and stress-related disorders. Unfortunately, most treatments involve multiple interventions and procedures ranging from individual therapy, group therapy, exercise, meditation, yoga, and health and wellness strategies. In an effort to isolate the components that increase levels of mindfulness in these treatments, we utilized heart rate variability (HRV) biofeedback training to increase an individual's awareness of heart rate and decreased respirations. HRV biofeedback isolates the slow breathing and relaxation components utilized in the aforementioned traditions and interventions. Altering the autonomic nervous system through slow respirations, we contend that HRV biofeedback could increase subjective levels of mindfulness and decrease physiologic stress after the presentation of stimulus from the International Affective Picture Set.

In addition to measuring HRV and subjective measures of mindfulness, we utilized functional magnetic resonance imaging (fMRI) to establish neural correlates of HRV training. Previous functional imaging research across disciplines typically indicates increased levels of activation in the anterior cingulate cortex (ACC) and decreased activation in the limbic system when in a mindful or relaxed state. In this pilot study, we utilized fMRI pre- and post-HRV biofeedback training to identify differential activations pre- and posttraining, inquiring whether these activations parallel previous meditation, mindfulness, and biofeedback imaging studies.

In our two subjects, we found increased activation in the amygdala and the anterior cingulate cortex following HRV biofeedback training. The participants increased levels of mindfulness following training, but these results were not statistically significant. The participants reported increased levels of emotional arousal in reaction to disturbing images following the training.