



**Institute of HeartMath - RP - Improving Cognition in Recently Returned Combat Veterans with Post Traumatic Stress Disorder**

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## Improving Cognition in Recently Returned Combat Veterans with Posttraumatic Stress Disorder by Heart Rate Variability Coherence Biofeedback

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### Abstract

**Background:** Reduced heart rate variability has been reported in a variety of clinical anxiety conditions, including combat-related Posttraumatic Stress Disorder. Growing evidence suggests that deficits in attention and immediate memory are also associated with Post traumatic Stress Disorder in combat veterans. However, the unique contribution that reduced heart rate variability makes to attention and immediate memory deficits in Posttraumatic Stress Disorder in combat veterans has not been well-studied. This research takes the beginning steps in understanding the role reduced heart rate variability plays in the attention and immediate memory problems associated with Posttraumatic Stress Disorder in combat veterans. The design further tests the association by assessing the effect of improving heart rate variability coherence through training in heart rhythm biofeedback on objective performance measures of attention and immediate memory in combat veterans with Posttraumatic Stress Disorder.

**Hypothesis:** Heart rate variability is uniquely related to attention and immediate memory, and heart rate variability coherence biofeedback will increase heart rate variability coherence and reduce objective attention and immediate memory deficits in Posttraumatic Stress Disorder in recently returned combat veterans.

**Method:** Five combat veterans with Posttraumatic Stress Disorder (aged 25 – 39) were enrolled in a pilot study. Four non-veteran (VA professional employees) control subjects were included in the heart rate variability coherence biofeedback training, but attention and immediate memory variables were not measured in the control subjects. Baseline heart rate variability was measured using the emWave heart rate variability coherence training system. Baseline levels of heart rate variability were measured during a 10 minute period before the first heart rate variability coherence training session with no visual feedback on heart rate variability. Subjects then received weekly instruction on a self-regulation technique (Quick Coherence) known to increase heart rhythm coherence and coherence biofeedback training from a coach over a four week period. Pre- and Post-Training attention and immediate memory were assessed with the Conners Performance Test (sustained attention), Digit Span subtest of the Wechsler Adult Intelligence Scale, and the Rey Auditory-Verbal Learning Test. Artifacts were eliminated from the heart rate variability data before computing outcome variables.

**Results:** Heart rate variability coherence training resulted in increased total power in the heart rate variability power spectrum density (Pre-Training total power of 851.3 ms<sup>2</sup>/Hz vs. Post-Training power of 962.1 ms<sup>2</sup>/Hz). Power in the LF band increased from 253.1 to 833.6 ms<sup>2</sup>/Hz, and the peak frequency of the post-training for all subjects (veterans and controls) shifted into the Low Frequency range (0.09–.014 Hz). Improvements in attention and immediate memory were indicated by a decrease in commissions (i.e. fewer false positive responses) during the sustained attention task, and improvements in immediate memory were seen in the Digit Span Backwards task with a corresponding increase in the Digit Span Scaled Score, and in auditory verbal learning total score.

**Conclusions:** Preliminary data provide evidence that improvements in attention and immediate memory co-occur with increases in heart rate variability coherence after learning the self regulation technique and exposure to heart rate variability coherence training in recently returned combat veterans with Posttraumatic Stress Disorder. Heart rate variability coherence feedback is a promising method for improving deployment-related problems in attention and immediate memory in combat veterans with Posttraumatic Stress Disorder.

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