

EFFECT OF AEROBIC EXERCISE ON CORTICAL ACTIVATION AND WORKING MEMORY FOLLOWING TRAUMATIC BRAIN INJURY: A PILOT STUDY

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This study maintains compliance with protection of subjects and records as required by the Veteran's Administration, University of Minnesota and the Center for Magnetic Resonance Imaging. IRB approval was obtained and monitoring is in effect for this study through all of the above agencies.

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Purpose:

The purpose of this pilot study was to investigate changes in the intensity, volume and location of brain activation and working memory in a subject with a severe TBI following participation in 6 weeks and 12 weeks of regular aerobic exercise.

Subject:

One male subject, age 28 with a severe, non-penetrating, TBI 6 yrs ago and a cohort of 10 neurologically intact subjects.

Materials/Methods:

A 3T fMRI scanner was used to collect brain activation data during a visual fixation (control) condition and the 0-back and 2-back conditions of the N-back working memory task. fMRI data was collected on 3 separate days prior to and following 6 and 12 weeks of participation in a supervised aerobic exercise program that met 3 times a week. Brain Voyager was used to Statistically analyze the location, volume, and intensity of activation during each N-back task. Pre-determined regions of interest included the rostral/caudal anterior cingulate cortex (ACC), precuneus and the dorsolateral prefrontal cortex (DLPFC).

Results:

Following 6 and 12 weeks of aerobic exercise, the rostral ACC demonstrated a decrease in intensity during the 2-back compared to the 0-back task while the caudal ACC showed an increase in voxel count and intensity during the 2-back task. The precuneus showed a decrease in voxels and intensity during the 2-back task after exercise. All findings were consistent with the activation patterns of the neurologically intact subjects.

Conclusions:

Findings indicate that aerobic exercise subject with TBI resulted in positive changes in cortical activation in the ACC and precuneus and working memory at 6 and 12 weeks.

Implications:

Aerobic exercise shows promising results towards enhancing working memory and changes in cortical activation following chronic TBI. Further research is being conducted to determine if these findings exist in a larger population.