

Neurovascular Coupling: A Unifying Theory for Post-Concussion Syndrome Treatment and Functional Neuroimaging

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Post-concussion syndrome (PCS) occurs in a significant percentage of concussion patients and is defined as having a history of traumatic brain injury with persistence of three or more symptoms. Standard structural clinical neuroimaging studies show no abnormal findings for the majority of PCS patients as opposed to functional MRI, which often reveals irregularities in the blood-oxygen level dependent (BOLD) signal. This suggests that dysregulation of neurovascular coupling (NVC), which causes abnormal BOLD signals, plays a significant role in PCS pathology. Compared to the pathophysiologic mechanisms occurring in acute concussion, the underlying neuropathophysiology of chronic concussive sequelaeor PCS is less understood, though becoming clearer with emerging research. We present a treatment approach grounded in the physiological theory presented here called Enhanced Performance in Cognition (EPIC), which has shown strong clinical success. Dysregulation of neurovascular coupling (NVC), along with disruptions in cerebrovascular reactivity (CVR) and autonomic nervous system (ANS) dysregulation are the targets of EPIC treatment. Success of the approach tentatively supports the hypothesis that these features figure prominently in the neuropathophysiology of PCS. The aim is to provide a theory of the underlying mechanisms of PCS pathology and its treatment that is in accord with the current corpus of research and explains the recent therapeutic success seen in PCS patient using the EPIC treatment. We propose a theory by which NVC dysregulation is normalized through focused, intense and repetitive neurocognitive challenges during post-exercise cognitive boost and the avoidance of intracerebral steal in the setting of restored and re-regulated CVR and ANS.

Biography

Alina K. Fong received her PhD in Clinical Neuropsychology with an emphasis in neuroimaging from Brigham Young University. She received the national American Psychological Association Clinical Neuropsychology Division 40 Graduate Student Research Award in 2004. Her research focuses on clinical applications of fMRI. She has published numerous articles combining neuropsychology and neuroimaging, along with deriving normative data for brain injury. Dr. Fong is currently the Director of Cognitive FX, a concussion treatment center that utilizes functional NeuroCognitive Imaging technology. She is a Clinical Neuropsychologist at Intermountain HealthCare, and has helped build the Sports Medicine and Concussion Clinic practices in Utah.

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