

FROM THE EDITOR

The Use of Heart Rate Variability Biofeedback and Neurofeedback for Traumatic Brain Injury

Editors: Donald Moss, PhD, BCB, BCN, and Leah Lagos, PsyD, BCB

Introduction to the Special Issue

According to the Centers for Disease Control and Prevention (CDC), there were 2.5 million emergency room visits, hospitalizations, or deaths associated with traumatic brain injury (TBI) in 2010 (CDC, 2015). The problem of TBI in children and athletes is receiving increasing attention, as it becomes clearer that participation in sport, especially football and soccer, can easily produce lifelong cognitive deficits. In 2009, over 248,000 children (age 19 or younger) visited the emergency room for sports- or recreation-based concussion or TBI (CDC, 2015).

The application of neurofeedback for postconcussion syndrome (PCS) or TBI is increasingly accepted. In an article posted by the International Brain Injury Association, Hammond (2012) reviewed the growing evidence on neurofeedback and concluded that neurofeedback has practical value for remediating symptoms of both open and closed head injuries. The current revision of the volume, *Evidence-Based Treatment in Biofeedback and Neurofeedback* (Tan & Shaffer, in press), has tentatively rated the efficacy of neurofeedback for TBI as *probably efficacious*, which indicates that there are numerous observational studies, clinical studies, wait-list controlled studies, and replication studies that demonstrate the efficacy of this treatment. When larger controlled studies are conducted, that rating is likely to improve. In addition, many clinical reports document the alleviation of serious cognitive deficits in individuals who failed to improve under conventional treatment.

This special issue focuses on both neurofeedback and a newer form of biofeedback, heart rate variability (HRV) biofeedback, as promising interventions for TBI. In 2012, Lagos, Bottiglieri, Vaschillo, and Vaschillo published an article in *Biofeedback* reviewing current knowledge about autonomic nervous dysregulation in TBI. They cited extensive medical research showing diminished activation of the parasympathetic nervous system following concussion, increased activation of the sympathetic nervous system, and reduced HRV. The authors persuasively argued that retraining HRV presents a credible intervention for

patients with PCS and TBI, based on our current knowledge of autonomic correlates of TBI. Later, Lagos, Thompson, and Vaschillo (2013) also published a case narrative of a 42-year-old competitive athlete with postconcussion symptoms, showing that HRV training significantly reduced headache, decreased mood disturbance, and reduced post-concussion symptoms.

The authors in the present special issue present a range of clinical approaches applying either HRV biofeedback, neurofeedback, or a combination of the two, in patients with TBI.

Special Issue Articles: Heart Rate Variability Biofeedback, Neurofeedback, and Traumatic Brain Injury

Leah Lagos opens this special issue with an editorial addressing the overlap in symptoms between PCS and posttraumatic stress disorder (PTSD). She describes how the physiological release of trauma during HRV biofeedback training has been found to improve physiological functioning among PTSD patients. Lagos posits that such a release may play an important function in the restoration of autonomic balance among patients who present with PTSD as well as PCS. She notes that the cognitive and physiological manifestation of trauma emerges among many of her patients with PCS symptoms between the third or fourth week of training. Guidelines for future research are outlined.

Sonya Kim and her colleagues provide a report on their recent research applying heart rate variability to individuals with severe brain injury. Kim's team conducted a study on individuals with emotional and cognitive dysregulation following severe brain injury. They measured HRV, attentiveness, problem solving, and other variables pre- and postintervention. Their study showed first that participants were able to learn the skill of increasing HRV in spite of their TBI status. The participants also demonstrated improved attention, emotional control, life-satisfaction, and self-esteem.

Michael and Lynda Thompson and Andrea Reid-Chung at the ADD Centre in Toronto provide a comprehensive overview of the process by which they assess patients with traumatic brain injury, including a 19-channel quantitative EEG, psychometric questionnaires, and an HRV baseline. Their treatment program integrates HRV biofeedback as well as neurofeedback in the treatment of TBI. The authors have utilized this treatment approach with a series of 50 patients with postconcussion symptoms. They include a case narrative to illustrate their approach.

A second article from Andrea Reid-Chung and Michael and Lynda Thompson utilizes three case narratives of adults with TBI, treated with a combination of HRV biofeedback and neurofeedback. The authors highlight the reduced HRV found in individuals after head injury, and the power of HRV biofeedback to restore HRV and remediate cognitive deficits. Each of the three individuals portrayed in the case narratives showed below normal HRV on baseline, and dramatic increases in HRV following a combination of neurofeedback and HRV training. The second individual suffered a second concussion during the course of the HRV/neurofeedback training, partially reversing the benefits of training, and then a third concussion. His unfortunate history further illustrates the predictable effects of TBI on HRV and autonomic regulation.

J. Lawrence Thomas and Mark Smith provide an overview of the application of neurofeedback to TBI. They describe the evolution of the field from single channel to multisite recording, and review basic concepts useful for neurofeedback practitioners. They also introduce the most recent approaches to emerge in neurofeedback, including the use of low resolution brain electromagnetic tomography (LORETA) to retrain deeper brain structures, Z-score training to normalize multiple brain sites and functional parameters simultaneously, hemoencephalography, the LENS approach, and infraslow fluctuation neurofeedback.

J. Lawrence Thomas provides a second article highlighting clinical concerns for practitioners dealing with brain-injured patients. Thomas describes typical patterns in patient behavior and symptoms, and pragmatic treatment strategies. He shows how neurofeedback training can mitigate many cognitive deficits. He also advocates that anyone utilizing neurofeedback for TBI also needs a broad understanding of brain function, knowledge of behavior therapy principles, and familiarity with cognitive remediation strategies applicable for such individuals.

Michael Linden provides a case study of a 17-year-old female goalie who suffered two consecutive concussions, producing headache symptoms and inattention. The athlete was treated with neurofeedback following the first concus-

sion, showed improvement in headache and attention, and in EEG activation problems, then suffered a second concussion, with an aggravation of EEG abnormalities and an exacerbation of symptoms. A second series of neurofeedback sessions again produced normalization of the EEG and renewed improvement in headaches and attention. This case narrative is particularly interesting in that a quantitative EEG was conducted prior to the first concussion, after the first concussion, at the close of the initial segment of neurofeedback, after the second concussion, and at the close of treatment.

Feature Article

Stephen Porges and Erik Peper provide a provocative article, applying Porges' polyvagal theory to the problem of date rape. Porges' polyvagal theory includes an evolutionary neurobiological understanding of the human stress response, including the immobilization fear response, when a human being faces life threat. Porges and Peper propose that this immobilization fear response may explain why rape victims often lose their ability to protest and fight the aggressor. This article presents a timely scientific perspective, at a time when the legislative climate is moving toward requiring affirmative consent from both parties for consensual sexual activity (e.g., California Senate Bill 967).

Book Review

Susan Antelis provides a review of the recent book by Sebern Fisher, *Neurofeedback in the Treatment of Developmental Trauma: Calming the Fear-Driven Brain* (2014). Fisher's book utilizes the concept of developmental trauma disorder, proposed by Bessel Vander Kolk, to understand the pervasive injury accompanying early childhood abuse and neglect, in contrast to the less pervasive emotional and neural dysregulation accompanying adult onset posttraumatic stress disorders. Fisher proposes a treatment protocol combining psychotherapy with neurofeedback to assist individuals with this disorder in affect regulation. Antelis recommends this book for any practitioners utilizing neurofeedback with patients with childhood trauma-based disorders.

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Donald Moss



Leah Lagos

Proposal and Abstracts

Authors are invited to submit articles, for upcoming special issues on Evidence-Based Interventions in Sports for Summer 2015, on Mindfulness and Compassion in Biofeedback Practice for Fall 2015, on The Impact of the Digestive System on Health for Winter 2015, on Emerging Developments in Biofeedback and Neurofeedback for Spring 2016, and on Medical Factors That Affect and Influence Successful Biofeedback Treatment for Summer 2016. Articles are also invited on general topics in biofeedback, neurofeedback, and self-regulation, as well as proposals for additional special issues.

Erratum: In the Winter 2014 issue, one author was omitted, for which we apologize. The article, “The Effect of LENS Treatment on Cognitive Functioning and Brainwave Patterns” was authored by Mary Donaldson, MEd, Stuart Donaldson, PhD, Doneen Moran, BA, and Samantha Kimball, PhD, MLT. Samantha Kimball, PhD, is affiliated with Pure North S’Energy Foundation.