Physiological and Affective Underarousal as a function of Mild Head Injury in University Students

Julie Baker1, Ph.D. Candidate & Dawn Good1,2, Ph.D., C. Psych.
1Department of Psychology, Brock University, St. Catharines, Ontario, Canada
2Centre for Neuroscience, Brock University, St. Catharines, Ontario, Canada

Introduction

- The prefrontal cortex (PFC), especially the ventromedial PFC (vPFC), has been implicated in the modulation of emotional and autonomic responses. This region is particularly vulnerable in head trauma2 and, therefore, emotional responses may be at risk in this population. Consistent with this research (see Tranel & Damasio, 19941), has shown that persons with moderate to severe traumatic brain injury (TBI) to the vPFC present with underarousal as evidenced by reduced electrodermal activation (EDA) responses and flattened affect. Furthermore, it has been suggested that individuals with moderate to severe neurological compromise are particularly vulnerable to the adverse effects of stress2,3.

- Until recently, little research has been conducted to examine the persistence of emotional and cognitive sequelae following mild head injury (MHI) – injuries which can be subtle and involve alterations in consciousness without extensive neural loss4. Further, the findings regarding arousal have been, at best, variable5, and, at worst, inconclusive.

- Previous research from our lab6,7 has demonstrated that persons with a history of mild head injury (MHI) reported lower arousal and performed better on memory and attention tasks with increased arousal. Despite reports of lesser self-perceived stress, students with MHI reported experiencing a greater level of life stressors compared to their no-MHI cohort8.

- Furthermore, it has been typically suggested that post-concussive symptoms (i.e., cognitive difficulties, altered affect, and physical complaints) subside after a three month period and functioning is assumed to return to previous abilities9,10. Yet, for some, 5% - 10%11,12,13, these difficulties may not be transitory14,15,16.

Purpose

- Therefore, the purpose of the current study was to:
  - investigate the affective (both self-report and physiological indices [e.g., electrodermal activation, heart rate]) status of students with self-reported MHI
  - examine possible differences in responsivity to the experimental manipulation of arousal (psychosocial stressor or relaxation) as a function of MHI history
  - investigate effects of experimentally manipulated arousal on cognitive performance in university students with and without MHI
  - explore post-concussive-like symptom reports in this high-functioning population as a function of MHI history

Method

Participants

University students (N = 91); 56% self-reported MHI history

- Neuropsychological measures (memory17,18, attention19; abstract reasoning18,19,20; and standard intelligence18; indices of arousal/anxiety21; manipulated arousal (via psychosocial stressor22 or relaxation)

- Post-concussive symptoms (Post-concussive Symptom Checklist [PCSC])16

- Indices of Anxiety
  - *physiological recordings of electrodermal activity (EDA) and heart rate27; STAI21; self-reported arousal levels; Everyday life stress.24

Results

- University students with self-reported MHI endorsed experiencing significantly more life stressors than their no-MHI cohort, r(89) = 2.51, p = .014.

- Despite reports of increased life stress, university students with history of a previous MHI self-reported significantly lower arousal, F (1, 89) = 5.60, p = .020, and produced significantly fewer EDA responses, F (1, 89) = 28.60, p < .001, as compared to their no-MHI cohort.

- Overall, university students with self-reported MHI had a diminished EDA response to the arousal manipulations as compared to their no-MHI counterparts. The no-MHI group had more extreme and larger range of EDA responses than the MHI group (p < .05).

Discussion

- As expected, prior to any arousal manipulation (i.e., baseline) students with MHI performed more poorly on tasks of working memory (WAIS-III, 1997; DKEFS, 2002) and attention (DKEFS, 2002).

- However, when arousal state was manipulated students with MHI tended to perform better on a cognitive flexibility task (WAIS-III, 1997) when stressed than when relaxed in contrast to their no-MHI counterparts who performed better when relaxed than when stressed, F (1, 87) = 3.17, p = .079.

- Overall, competent university students who acknowledge a history of MHI but have not complained of persistent effects or concerns regarding the MHI nonetheless endorsed significantly more post-concussive symptoms (e.g., headaches, concentration difficulties, irritability), r(89) = 2.29, p = .024, experienced the symptoms with greater intensity, r(89) = 2.62, p = .010, and for longer durations, r (89) = 2.24, p = .028, than their no-MHI counterparts.

References