MILD HEAD INJURY AND FRONTAL LOBE DYSFUNCTION AS PREDICTORS OF DISINHIBITION

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Background

Previous research has consistently shown that the frontal lobes, particularly the prefrontal cortex (PFC), are most susceptible to damage during a traumatic brain injury. After the injury, TBI patients exhibit difficulties with planning, memory and other executive functions. While it has been established that extensive frontal lobe damage leads to significant behavioural dyscontrol or impulsivity people with mild head injuries (MHI) show deficits similar to, but less pronounced than the more severe TBI cases. Even so, impulsivity dimensions ranging from behavioural disinhibition such as purchasing items at whim to an inability to delay gratification have not been extensively examined in the MHI population, particularly in cognitively competent individuals (e.g. university students). The purpose of this study was to investigate the relationship between executive function, impulsivity and MHI.

Hypothesis 1:

University students who have experienced a subtle MHI will present higher scores of impulsivity than their non-MHI counterparts.

Hypothesis 2:

MHI history will predict higher impulsivity levels after executive functioning has been accounted for.

Method

Participants

Brock University Students (N = 79)

- 51 % (n = 39) reported at least one MHI;
- 31 % (n = 28) reported sustaining a concussion

Methods and Procedure

Indicators of previous MHI - Self-reported experience of altered state of consciousness:

- Have you ever hit your head against a hard surface sufficient to alter your consciousness (i.e. loss of consciousness, vomiting, dizziness)?
- Did it result in a concussion?

Measures of Executive Function:

- Working memory: manipulation - Mental Control (WMS-III) and anticipation - Trails (DKEFS)
- Sustained attention: auditory attention and response set (NEPSY)
- Reasoning: pictorial analogies subtest (CTONI)

Measures of Impulsivity:

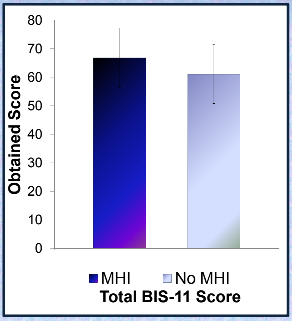
- Decision making: Delayed Discounting Task (Kirby, Petry & Bickel, 1999)
- Behavioural Disinhibition: BIS-11 (Patton, Stanford & Barratt, 1995)
- Response Inhibition: Stroop subtest (DKEFS)

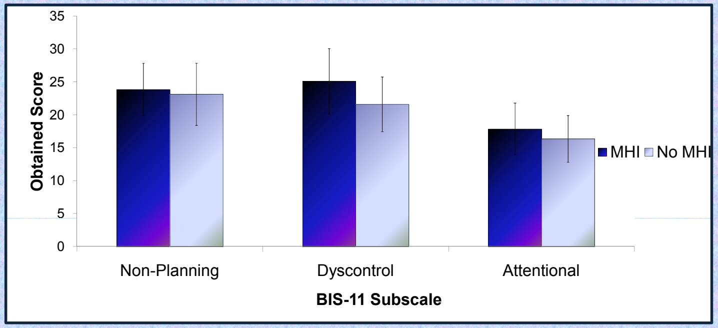
Results

Hypothesis 1:

Participants who reported sustaining at least one MHI also reported higher levels of behavioural disinhibition as measured by total BIS-11 score, F (1, 76) = 5.9, p = .02.

More specifically, participants who have sustained a MHI reported significantly higher levels of behavioural dyscontrol (p = .001) while attentional (p = .08) and non-planning (p = .47) scores did not differ significantly.





There was no significant difference between two groups on the delay discounting measure, F (1, 77) = 0.46, p = .50.

Hypothesis 2:

Once the executive functions were accounted for, MHI predicted higher behaviour dyscontrol levels, as measured by BIS-M subscale, R^2=.26, F (5,70) = 4.87, p =.001.

Predictor	β	B	SE B	sr^2	ΔR^2	df	F	p
Step 1								
Reasoning	-0.21	-0.34	0.19	0.04				
Manipulation (WM)	-0.15	-0.31	0.25	0.02	0.145	4, 71	3.004	0.02
Anticipation (WM)	-0.35	-0.20	0.07	0.10				
Sustained Attention	0.11	0.13	0.13	0.01				
Step 2								
MHI	0.34	3.31	1.01	0.1129	0.113	1, 70	10.673	0.002

Performance on executive function measures and self-reported MHI did not significantly predict the delay discounting scores, R^2=.10, F (5,70) = 1.59, p =.12.

Discussion

In summary, MHI was related to higher levels of self-reported disinhibited behaviour, but not to measures of impulsive decision making. Additionally, while behavioural dyscontrol was predicted by cognitive executive functions (i.e., reasoning ability, working memory anticipation and manipulation, as well as attentional skills), impressively, having sustained a MHI was a significant predictor of behaviour dyscontrol beyond the influence of executive competence.

The results provide support for the multidimensional nature of impulsivity, but also demonstrate that MHI is linked to only a subset of these dimensions, namely the behavioural presentation of impulsive actions, but not to decision making and choices. Although participants in the MHI group reported higher levels of impulsivity across all three subscales of BIS-11, they did not present with an impulsive personality and differed significantly only on the measure of behavioural dyscontrol.

While the ability to regulate one's behaviour is associated with the functions of orbitofrontal cortex (OFC), impulsive decision making as measured by a delay discounting task is thought to rely more on the activation of the more cognitive skills of the medial PFC.

Cognitively competent individuals (i.e. university students) who have experienced a mild, but notable, head injury present with impulsive behaviours, but not impulsive decision making, indicative of detectable, and persistent effects compatible with OFC disruption.

Conclusion

Mild injuries to the head may be subtle, but clearly are not trivial since simply acknowledging a history of a notable impact injury to the head is sufficient to produce measurable changes in self-reported impulsive behavioral actions.

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