Background

Head trauma introduces affective, behavioral, and cognitive complications across the lifespan with approximately 37 million hospitalizations annually.

Mild Head Injury (MHI) producing an altered state of consciousness may be sufficient to produce neuropsychological dysfunction.1-3

MHI reports in university students are associated with limits in neuropsychological performance.4-5

The orbitofrontal cortex (OFC) is highly susceptible to impact injury and mediates cause-effect associative learning in decision-making, and controlling social behaviors.6-7

Decision outcomes/consequences produce (physiological/somatic) reactions which, in turn, bias future decisions/choices (learning).

OFC injury interferes with this learning in terms of anticipated activation of somatic markers (“gut feeling”) when anticipating potential consequences, self-control, and regulation.

Purpose:

To investigate the relationship between neuropsychological performance, physiological arousal, and decision-making in university students with and without a history of MHI.

Hypotheses:

1) There will be no difference in general cognitive performance between the MHI and non-MHI groups.

2) The MHI group will self-report a higher frequency of disinhibited and antisocial behaviors.

3) Decision-making performance will be significantly worse for those reporting a history of MHI.

4) Both groups are expected to physiologically respond to feedback decision outcomes, but the MHI group is expected to present with significantly lower physiological arousal when anticipating future consequences.

Methods

Participants

Brock University students (N=35; 18 Male & 17 Female; 43% reporting MHI)

Measures

Neuropsychological/Behavioral:

- Iowa Gambling Task
- Reward Ignorance Scale
- Self-Report Psychopathy Scale
- MHI (Demographic Questionnaire)

Electrophysiological:

- Electrodermal Response (EDR)

Procedures:

- 90 minute, 1-on-1 testing session
- Paper-and-pencil tasks: computer task (IGT) while EDR recorded

Results

Hypothesis 1: Cognitive Performance

- Design Fluency: Error Accuracy Score

Hypothesis 2: Disinhibition and Antisocial Behaviours

- Self-Report Disinhibition Score
- Self-Report Antisocial Behaviour Score

Hypothesis 3: Decision-Making

- IGT Final Percentile Rank

Hypothesis 4: Physiological Arousal

- Average EDR Amplitude To Choice Feedback
- Average EDR Amplitude Prior To Choice Selection

Exploratory Analyses: Maintenance of Learning

- IGT Learning By Block

Response Times

- IRT Final Percentile Rank

Discussion & Implications

- History of MHI did not differentially disrupt general cognitive performance, self-perceived behavioral tendencies, or overall decision-making.

- MHI group was capable of physiologically responding to the testing feedback environment, but only in a reactive way.

- MHI group is significantly less aroused when anticipating consequences3 indicating differential physiological input when making decisions.

- Exploratory analyses demonstrate potential differences in stability of emotional markers in maintenance of associative learning.

- MHI group is faster to commit to a decision and do not discriminate differentially on the basis of punishment magnitudes when risk is more probable.

- Prior decision making could result from lack of anticipatory emotional markers, low ability learning patterns and faster response times in uncertain risky situations.

- Lack of anticipation could produce exaggerated reactivity to outcomes (i.e. unexpected), and with limited self-control, behaviour may be deemed socially incompatible.

- These results obtained in a university sample encourage accepting MHI on a continuum of brain injury severity given this neuropsychological profile resembles features of more traumatic cases.

References