

The Mediating Effect of Sleep on the Relationship between Mild Traumatic Brain Injury and Reactive Aggression in Youth

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ABSTRACT

Within recent years, mild traumatic brain injuries (mTBIs) have been on the rise, specifically amongst children and adolescents. Previous research has associated mTBI with poorer developmental and behavioral outcomes, sleep problems, and poor sleep quality, which in turn has been linked to higher levels of reactive aggression. These findings often failed to account for pre-injury behaviors, so data is collected within at least two weeks of the initial injury. Participants will be assessed following diagnosis of an mTBI, then again six months later and compared to an orthopedic injury control group. It is predicted that youth who experience mTBI will demonstrate higher levels of reactive aggression and worse psychopathological outcomes than that of the orthopedic control group, with subjective sleep ratings posing as a mediator for this relationship.

INTRODUCTION

What is mTBI or Concussion?

Occurs as a result of non-puncturing trauma and/or rapid acceleration or deceleration resulting in at least one of the following: loss of consciousness lasting less than 30 minutes, memory dysfunction (<24 hours), headache, nausea, dizziness, diplopia, irritability, poor concentration, fatigue, confusion, disorientation, or impaired consciousness (National Center for Injury Prevention and Control, 2003).



Reactive Aggression

- Defined as defensive responses to perceived threats or frustration (Dodge et al., 1997).
- Decreased sleep quality has been shown to lead to slight increases in reactive aggression (Freitag et al., 2017)

Sleep as a Potential Mediator

- Children spend more time asleep in the first ten years of their life than they do awake (El-Sheikh & Sadeh, 2015).
- Sleep-wake disturbances have been linked to TBI-related trauma (Kempf et al., 2011).
- Lower sleep quality has been associated with poorer cognitive performance and delay in recovery for those suffering from sports-related concussion (Murduagh et al., 2018).

Hypotheses

1. Youth who experience mTBI will demonstrate higher levels of reactive aggression than that of the orthopedic control group
2. mTBI will be associated with a decrease in sleep quality
3. Poor sleep quality will be associated with an increase in reactive aggression
4. Subjective sleep ratings will pose as a mediator for this relationship, with poorer sleep ratings resulting in poorer outcomes

METHODS

Participants

- Children and adolescents ages 6 to 17 recruited
- Ended up with 60 total participants who completed time-point two
- Taking demographics such as race, SES, and parent education level into account

Measures

- Child Behavior Checklist- measures for psychopathological problems and behaviors
 - Parent Report
 - Self Report
 - Use reactive aggression subscale
- Children's Sleep Habit Questionnaire Abbreviated- measures child's sleep quality
 - Self Report- previously adapted from a parent-report form for younger children to one for adolescents
- Pittsburgh Sleep Quality Index- measures sleep quality on a global sleep score
 - Self Report

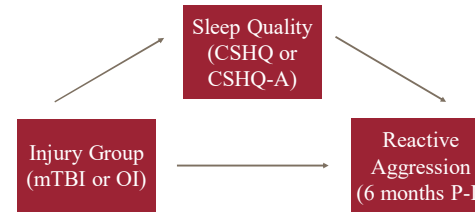
Analyses

- Regression analysis to assess differences across time points for reactive aggression in both groups
- Regression Analysis to assess differences across time points for sleep in both groups
- Correlation to assess if poor sleep quality is correlated with reactive aggression
- Mediation analysis to assess if sleep acts as a mediator in the mTBI-reactive aggression relationship

INCLUSION/EXCLUSION CRITERIA

✓	Experienced an orthopedic injury OR a closed head injury with at least one of the following symptoms: <ul style="list-style-type: none">• Loss of consciousness <30 minutes• Post-traumatic amnesia <24 hours• Headaches• Nausea/vomiting• Vision problem• Confucius or feeling as if they were in a fog• Dizziness or changes in coordination• Difficulty concentrating or answering questions• Sudden unexplained changes in mood
X	<ul style="list-style-type: none">• Not fluent in English• Required general anesthesia• Experienced hypoxia, hypotension, or shock• Have premorbid neurological disorder• Have a diagnosis of ASD or intellectual disability• Have a history of a severe psychiatric disorder which required in-patient care• If the injury is known or suspected to be the result of abuse• History of moderate or severe TBI

RESULTS



Hypothesis 1

- A regression analysis was used, with head injury status as a predictor and reactive aggression as the outcome variable to assess differences across the initial data collection timepoint and the six-month follow-up for reactive aggression in both mTBI and OI injury groups while also controlling for biological sex and subject age.
- While controlling for pre-injury symptoms, age, and sex, having a head injury predicted higher aggression levels at wave 1 ($b=.385$, $p>.05$), but the result was not significant.

Hypothesis 2

- The same method was used as the first hypothesis, but sleep was analyzed in place of reactive aggression.
- While controlling for pre-injury symptoms, age, and sex, having a head injury predicted slightly higher sleep levels at wave 1 ($b=.088$, $p>.05$) but the result was not significant.

Hypothesis 3

- A correlation analysis was used to assess if poor sleep quality is correlated with reactive aggression.
- Baseline sleep and aggression was controlled for, but results were not significant ($b=.004$, $p>.05$)

Hypothesis 4

- A mediation analysis to assess if sleep acts as a mediator in the mTBI-reactive aggression relationship. The Sobel test was used, with unstandardized regression coefficients calculated between mTBI and sleep, sleep and reactive aggression, and reactive aggression and mTBI plugged in. The product of the coefficients was then calculated.
- Four models in total were ran, two for the two separate time points in the mTBI group and two for separate time points in the OI group. Results were compared to determine if there is a positive correlation across time.
- The indirect effect of injury status on reactive aggression via sleep was not significant ($AB=.050$, $p>.05$).

CONCLUSIONS/SIGNIFICANCE

- Over two million emergency department visits each year are estimated to be related to head injury, therefore it is important that we understand the effects of these injuries that we are dedicating so much time and resources to (Taylor et al., 2017).
- Concussions are on the rise, especially in the adolescent population (Zhang et al., 2016).
- Although results are not significant, helps us understand more about mTBI and its effects (or lack thereof)
- Sleep is still a crucial factor in childhood development, and interventional measures on a case-by-case basis could still potentially be beneficial for some children/adolescents (El-Sheikh & Sadeh, 2015).
- Could help fight the publication crisis in psychology

FUTURE DIRECTIONS

- Because sleep was not found to be a mediating factor, this suggests that future studies should focus on other possible interventional measures

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