Psychological Effects of Traumatic Brain Injury Measured after Objective, Diagnostic Assessment of Physiologic Disruption at Multiple Time Points

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Introduction

- A CDC report from 2016 indicated that 1.5 million people in America sustained a traumatic brain injury (TBI).
- TBIs are associated with several negative outcomes: Cognitive deficits, vision deficits, mood disorders, and risk for increased substance use
- Purpose: Investigate the utility of an eye tracking device in predicting long term psychological outcomes.

Methods

- Subjects were recruited from a Level 1 Trauma Center
- Once consent was obtained, psychiatric history and substance use were measured with the Medical, Socioeconomic, and Lifestyle Questionnaire (MSL)
- Mood (SSS) and cognitive dysfunction (SAC) were assessed with the Sports Concussion Assessment Tool- 3 (SCAT-3)
- 4 eye tracking metrics were utilized: Box Score, Conjugate Box Score, Right Area Median, and Left Area Median
- Eye movements of subjects were tracked while they watched a 220 second video

Conclusion

- The physiology and psychology of the brain are affected after one sustains a trauma
- Differences can be seen in controls and TBI subjects at time of injury
- Subjects seem to recover at the six month time point, with regards to cognition, vision, and mood, but not substance use.
- Eye tracking metrics predict impaired cognition at 6 months.
- Limitations: Small number of subjects participating in long term follow up & missing data impacting analysis

Results

- 14 TBI subjects (50.71 ± 18.07 years old; 57% male) and 58 healthy controls (34.76 ± 13.47 years old; 59% female) were used for analysis
- 38.4% of TBI subjects vs. 23% of Controls had a previous psychiatric history
- Alcohol and drug use increased in the TBI group from 23% to 31% and 0% to 8%, respectively from the initial to the six month time points
- Controls reported drinking more alcohol and engaging in drug use (87%;17%) compared to TBI cohort (23%;0%)
- While cognitive and visual deficits resolved at the six month time point, mood dysfunction persisted long term in TBI subjects compared to controls (p=.003291)
- Initial eye tracking metrics did not predict long term symptoms of mood, but significantly predicted long term deficits in cognitive dysfunction (p=.00806)
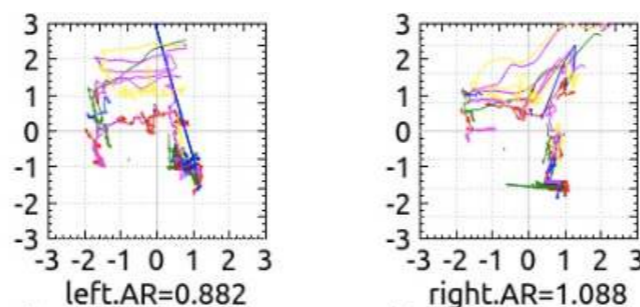

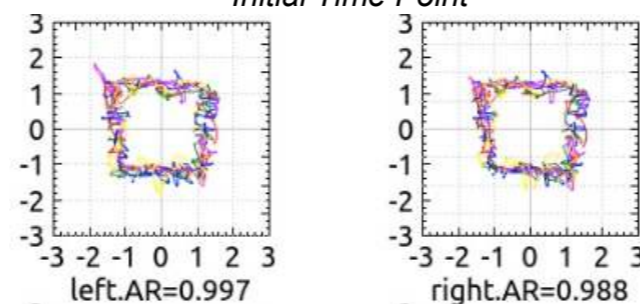Figure 1: Box Trajectory of a TBI Subject at the Initial Time Point
left.AR=0.882   right.AR=1.088

Figure 2: Box Trajectory of a TBI Subject at the Six Month Time Point
left.AR=0.997   right.AR=0.988
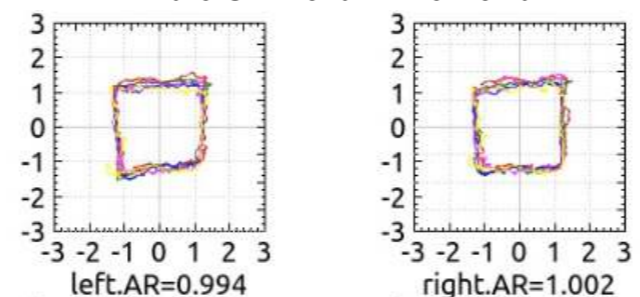
Figure 3: Box Trajectory of a Control
left.AR=0.994   right.AR=1.002

Variable	Initial Time Point	Six Month Time Point
SSS	P= <.001*	P=003291*
SAC	P = .005*	P=0.443
Box Score	P= 0.05*	P=0.994
Conjugate Box Score	P=0.00368*	P=0.5687
Right Area Median	P=.915	P=0.9037
Left Area Median	P=0.0633	P= 0.8588

Table 1: TBI Subjects vs. Controls on Multiple Measures at the Initial and Six Month Time Points

Eye Tracking Metrics	SSS (Mood)	SAC (Cognition)
Box Score	P = 0.542	P=0.191
Conjugate Box Score	P=0.899	P=0.944
Right Area Median	P=0.146	P=0.00806*
Left Area Median	P=0.497	P=0.894

Table 2: Eye Tracking Metrics at the Initial Time Point as a Predictor for SCAT-3 Scores at the Six Month Time Point

References

1.Traumatic Brain Injury & Concussion. (2016, January 22). Retrieved from https://www.cdc.gov/traumaticbraininjury/pubs/tbi_report_to_congress.html
2.Ponsford, J. (2013) Factors contributing to outcome following traumatic brain injury. NeuroRehabilitation 32, 803–815

Acknowledgements