Cognitive and neural deficits associated with a history of mTBI

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Introduction

- Patients with mild traumatic brain injury (mTBI) are expected to **fully** recover.
- But chronic deficits are found when sought (Christodoulou et al., 2001, Shah-Basak et al., 2018).
- *Undergraduates* with a history of mTBI are impaired at visual WM. (Arciniega et al., 2019)
- mTBI etiology, sex, time since injury, # of injuries does not predict visual WM performance. (Arciniega et al., 2020)

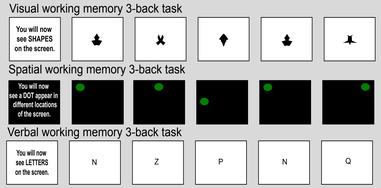
Questions:

- **Q1:** Is there a process-general WM deficit?
- **Q2:** Can neuropsychological assessments detect cognitive impairment in mTBI?
- **Q3:** Are neural networks at rest impacted by mTBI?

Methods

Exp 1: 3-Back

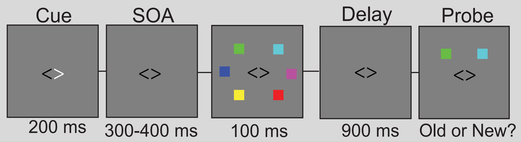
25 Controls (17 F, M: 22.2 yo)
25 History of mTBI (16 F, M: 20.88 yo, self-report)
- Mean #'s of mTBI: 1.88, mean time since last mTBI: 3.98 **yrs**



Exp 2: Visual WM, RBANS, Trails Part B

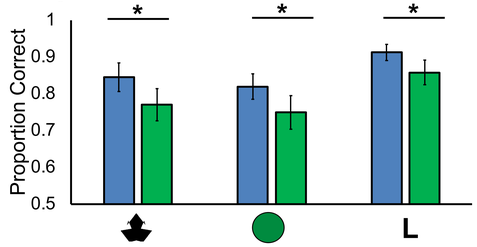
25 Controls (15 F, M: 25 yo)
25 History of mTBI (10 F, M: 22.2 yo, self-report)
- Mean #'s of mTBI: 3.5, mean time since last mTBI: 4.3 **yrs**

20 Subacute mTBI (14 F, M: 20.3 yo, self-report)
- Mean #'s of mTBI: 2.1, mean time since last mTBI: 17 **Days**

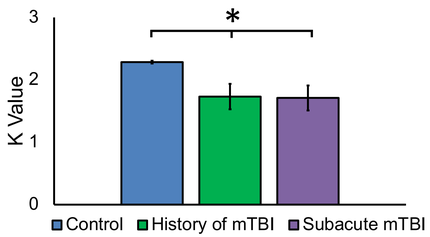


Behavioral Results

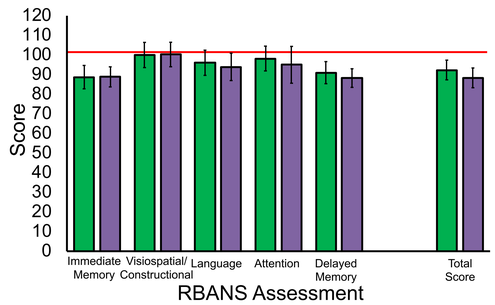
Exp 1: 3-Back



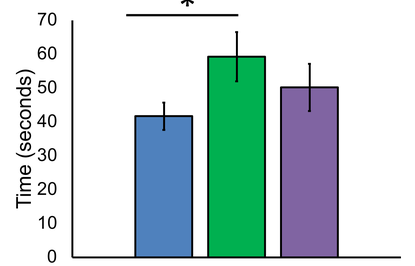
Exp 2: Visual WM



Exp 2: RBANS



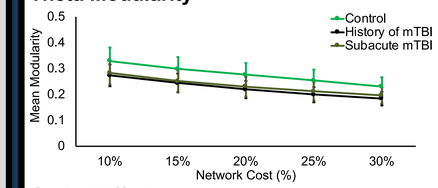
Exp 2: Trails Part B



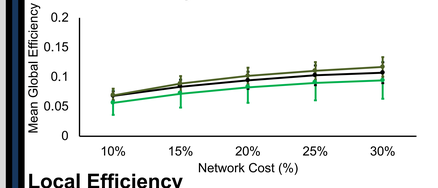
All error bars reflect 95% confidence intervals

rs-EEG & rs-fMRI Results

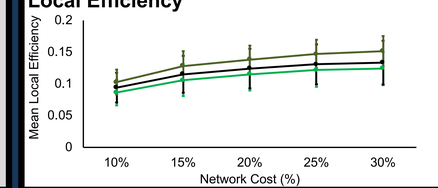
Theta Modularity



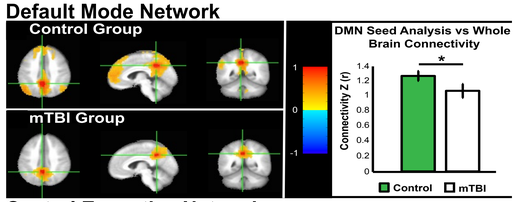
Global Efficiency



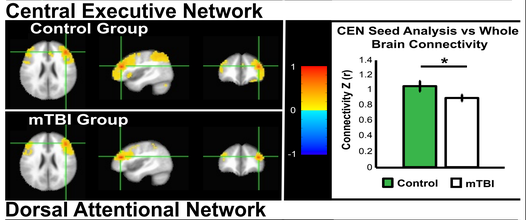
Local Efficiency



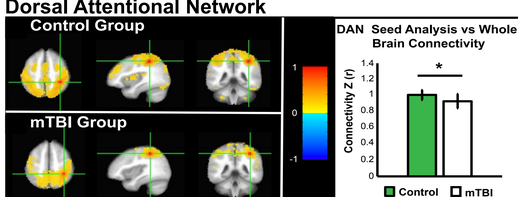
Default Mode Network



Central Executive Network



Dorsal Attentional Network



Conclusions

Q1: Is there a process-general WM deficit?
- Visual, Spatial, Verbal ⬇

General Visual WM impairment

Q2: Can neuropsychological assessments detect cognitive impairment in mTBI?
- No

Q3: Are neural networks at rest impacted by mTBI?
- No Evidence in rs-EEG
- Evidence of network dysfunction in rs-fMRI
  - DMN, CEN, DAN

Future directions

- What predicts long-term cognitive deficits?
- Can WM deficits be remediated?
- Can network abnormalities be detected in other frequencies?
- Are there white matter structural changes following mTBI?

Contact Information

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References: **(1)** Christodoulou C, DeLuca J, Ricker JH, *et al.* Functional magnetic resonance imaging of working memory impairment after traumatic brain injury *Journal of Neurology, Neurosurgery & Psychiatry* **(2)** Shah-Basak, P. P., Urbain, C., Wong, S., da Costa, L., Pang, E. W., Dunkley, B. T., & Taylor, M. J. (2018). Concussion alters the functional brain processes of visual attention and working memory. *Journal of Neurotrauma* **(3) Arciniega, H.**, Kilgore-Gomez, A., Harris, A., Peterson, D. J., McBride, J., Fox, E., & Berryhill, M. E. (2019). Visual working memory deficits in undergraduates with a history of mild traumatic brain injury. Attention, Perception, & Psychophysics. **(4) Arciniega, H.**, Kilgore-Gomez, A., McNerney, W., Lane, S., Berryhill, M.E., Loss of consciousness, but not etiology, predicts better working memory performance years after injury. Journal of Clinical Translational Research.

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