

Identifying post-concussion syndrome pathology using fMRI and DTI imaging

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Background

Many people each year experience a concussion. For a significant 15% of patients, symptoms may persist for more than 3 months, leading to disability. These persistent symptoms comprise Post-Concussion Syndrome (PCS) and commonly include headache, dizziness, sleep disturbance and cognition difficulties. Both concussion and PCS have a pervasive impact on people's lives, affecting personal and work relationships, educational and employment potential and involvement in recreational activities. At present, it is not clear what causes the symptoms and why different individuals have such different outcomes. Identification of predictors could ultimately be used to create early interventions right from acute care and allow for better management of symptoms.



3.0 Tesla Siemens TRIO MR scanner

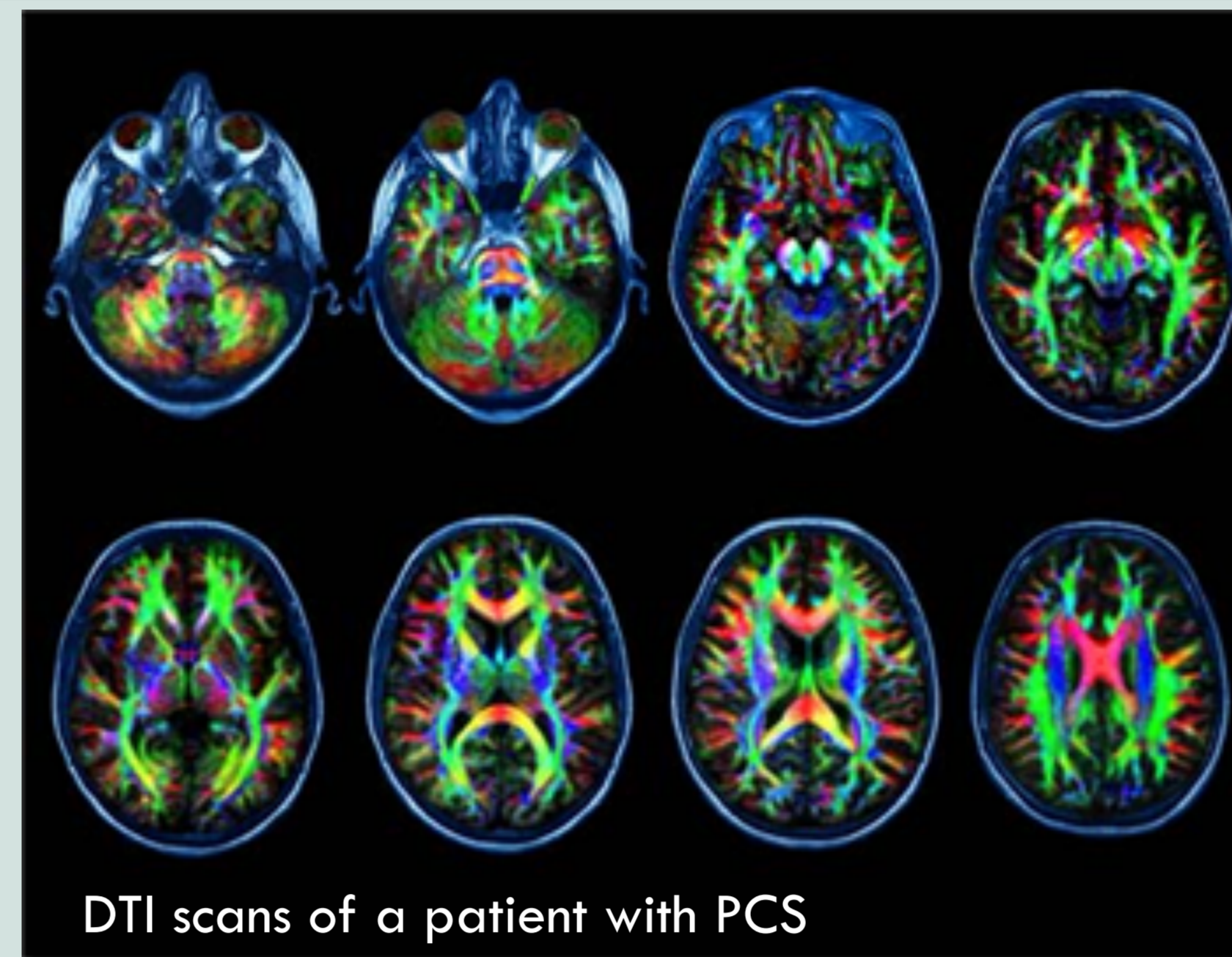
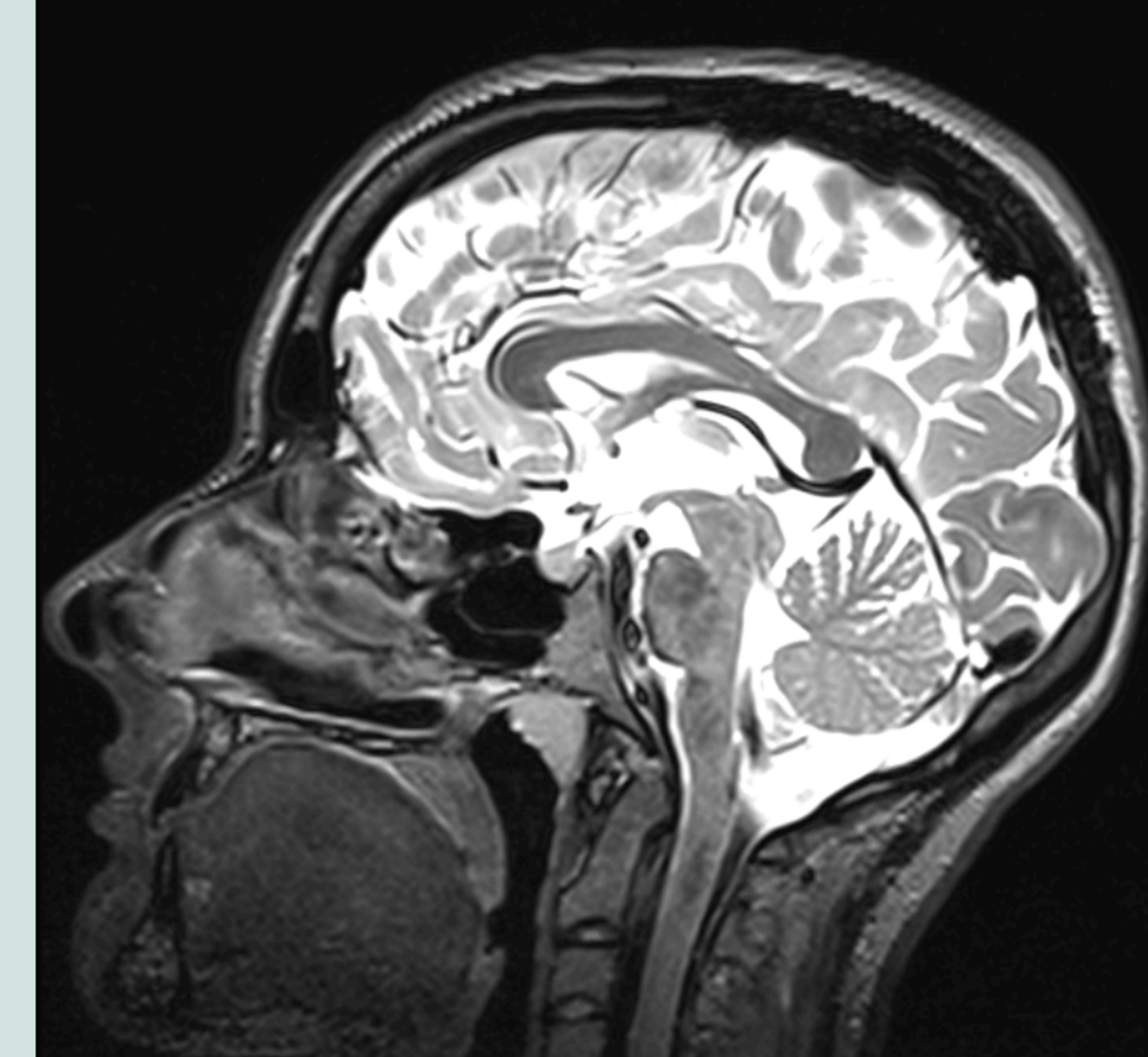
Objective

The objective of this study is to use magnetic resonance imaging (MRI) technologies, such as functional MRI (fMRI) and diffusion tensor imaging (DTI) to demonstrate the potential pathology associated with concussion and also to identify underlying neurobiological markers that may predict those persons who will go on and develop PCS. What sets this study apart is that the participants will be those who have experienced concussions that are non-sport related, so there will be an opportunity to see if there is a difference in pathology and development of PCS between those who experienced concussions due to sports, and those who experienced concussions due to other causes.

Methodology

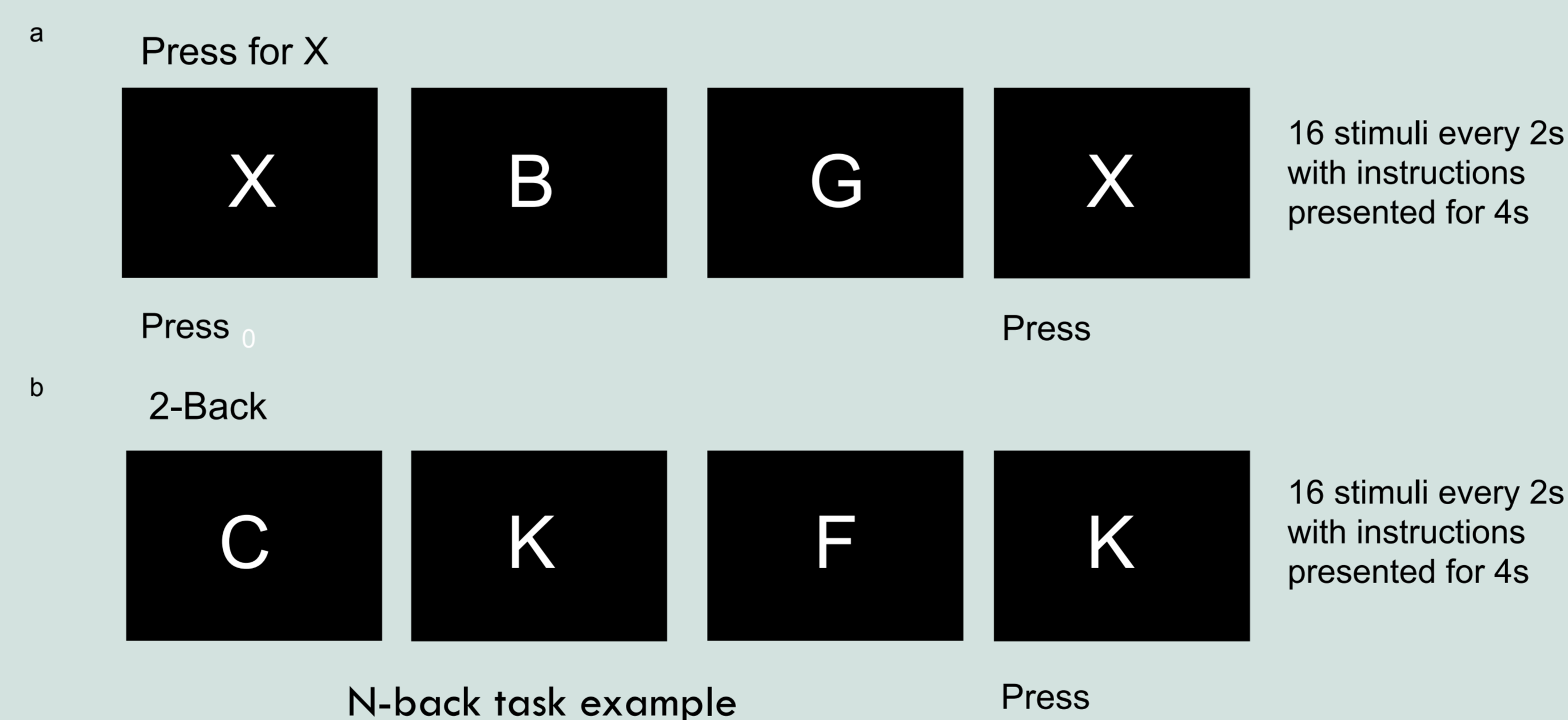
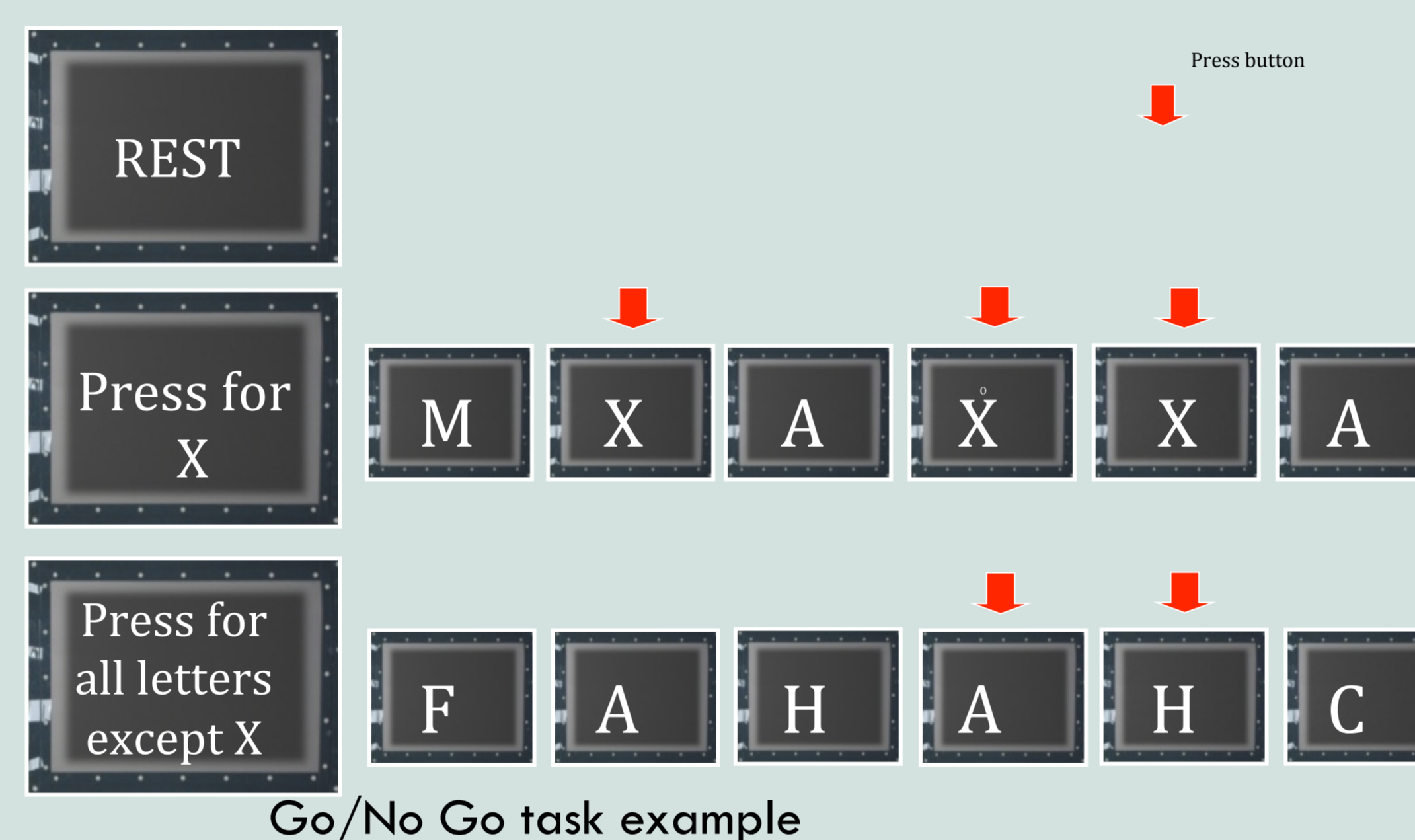
Two groups will be made: Group 1 will contain 5 people diagnosed with PCS and Group 2 will be comprised of 5 people who were symptom free past the 3 month post-injury stage. Each participant will undergo a one hour imaging session in a 3.0 Tesla Siemens TRIO MR scanner that includes fMRI and structural scans (DTI and VBM).

Anatomical scan example



DTI scans of a patient with PCS

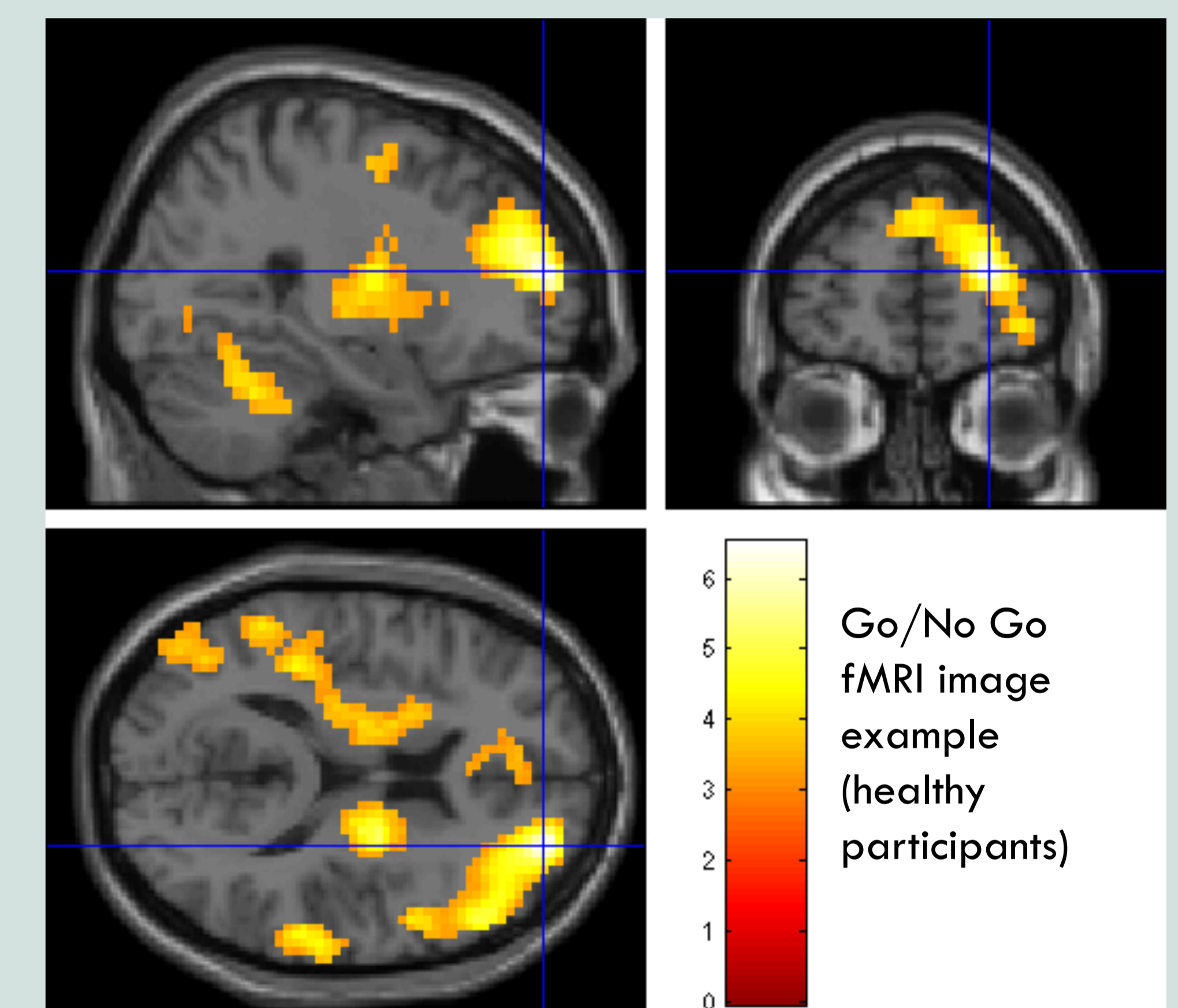
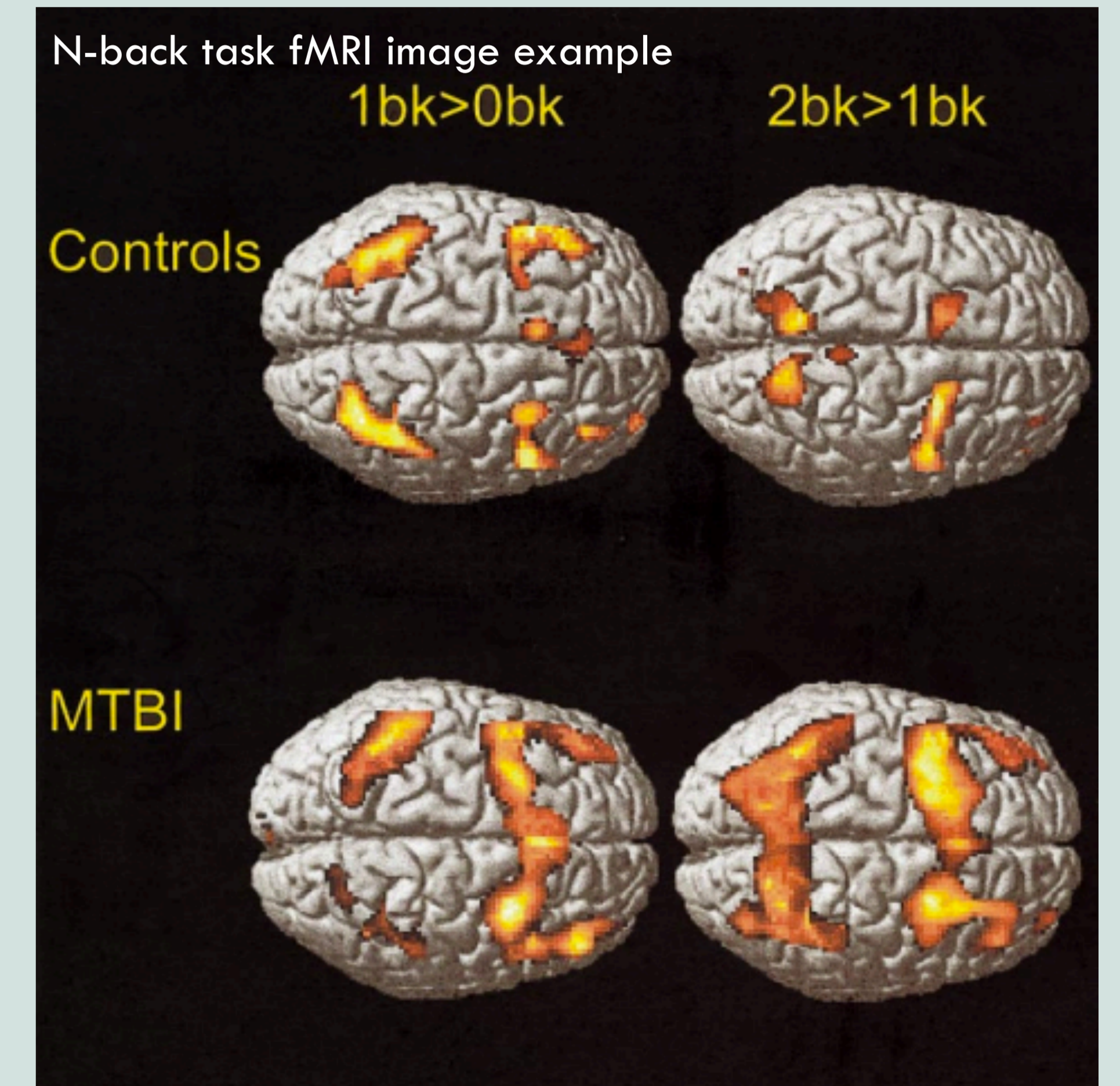
There will be two fMRI tasks which will be projected through an LCD projector from a laptop: Go/No Go and Letter N-Back tasks.



Each participant also will fill out questionnaires about their concussion, which includes information about symptoms and quality of life post-injury. Imaging data will be post-processed and analyzed using Statistical Parametric Mapping 8 (SPM8) and fMRI of the Brain's Software Library (FSL), including Tract-Based Spatial Statistics (TBSS). Connectivity and changes in percent signal during fMRI will be assessed. Comparisons between groups and the neuropsychological performance of groups will be performed using T-tests.

Discussion

The expected results are that there is a different signature in the fMRI and DTI scans between those who have PCS and those who did not develop PCS. The DTI images will potentially show irregularities in the myelin, or other aspects of axonal health. More activity is expected in the prefrontal cortex of the PCS patients during both the Go/No Go and N-back tasks, showing that they must employ more brain energy or effort to complete the tasks successfully.



Future work

Future work should be done on larger sample sizes in order to obtain generalizability. If management techniques can be derived from this study, further research should compare which techniques are most effective.

References

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