

## **Functional MRI and Diffusion Tensor Imaging for Concussion**

To begin, an fMRI/DTI [Requisition](#) completed and signed by patient's physician is required.

Bookings: within 10-15 days.

Reports: within 10-15 days following examination.

What's included –

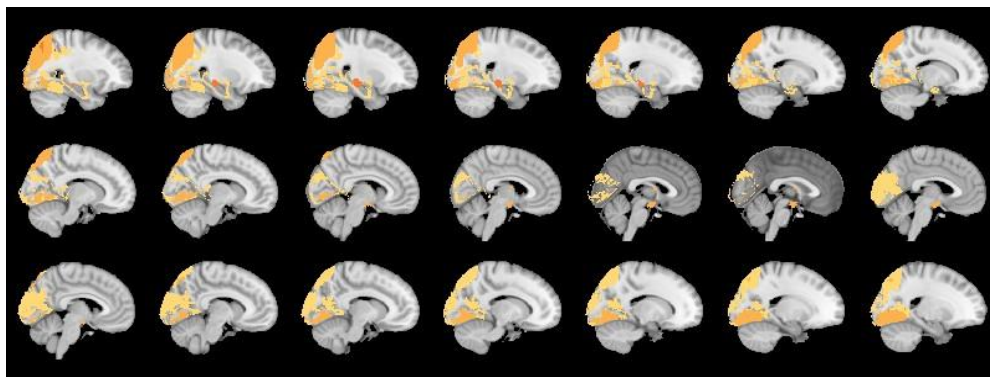
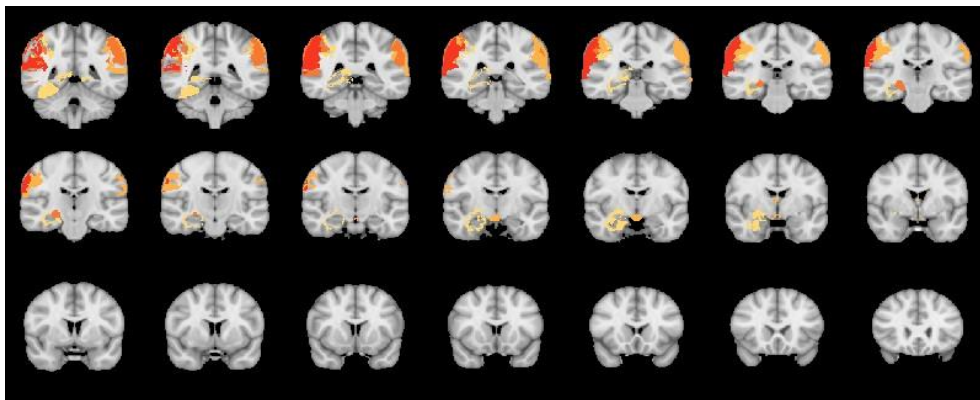
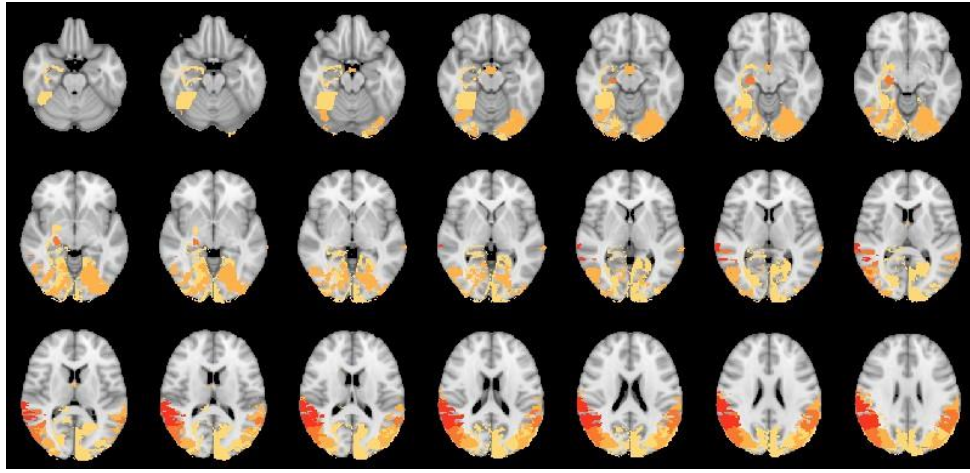
- Resting state functional MRI (grey matter function)
- Diffusion Tensor Imaging (white matter tract integrity)
- Trauma Brain MRI Protocol scan (lesions, structural anomalies, bleeds)

Overall scan time: 45-60 minutes.

### **Functional Analysis: Resting State fMRI**

Resting state fMRI (rsfMRI) identifies brain function using the blood oxygen level dependent (BOLD) principle. The tissues of the brain, including its neurons situated within the grey matter, use energy when they are functioning. BOLD measures the amount of oxygen being utilized within a certain region of the brain at that moment in time. When a brain is at rest it exhibits a specific type of functional behaviour, this requires blood to flow to those regions which use oxygen for their metabolic processes. BOLD is able to measure the increases in activation for specific regions of the brain's grey matter. The rsfMRI scan therefore reveals important functional changes in the brain following an mTBI. Functional activation as measured by BOLD to classify the functional activation is the Fractal Dimension (FD). The FD detects subtle critical changes following concussion and provides evidence for the presence of reduced neuronal function in key brain regions. Using the results of BOLD obtained in the patient we make a comparison with age/sex adjusted normal values. This is also performed using an outlier detection method very much like Z-scoring.

FUNCTIONAL MRI REPORT: Image Series (SAMPLE ONLY)



### Structural Analysis: Diffusion-Tensor Imaging (DTI)

A DTI scan is performed to yield structural information on the brain. Specifically, it is a Magnetic Resonance Imaging (MRI) scan that looks at white matter integrity in the brain. White matter is located deep in the brain, beneath the Grey Matter, and consists of densely arranged nerve fibres. These fibres function as the information highways in the brain, rapidly transmitting signals between different parts of the brain. Injury to white matter can manifest as difficulties in cognition or motor function, among others.

A DTI scan, compared to a standard MRI, takes a much closer look at white matter. It works by examining the diffusion of water molecules in white matter structures within the brain. This is the standard method used to assess the structural integrity of brain pathways. White matter brain tracts are one of the key structures of interest in mTBI. The scan provides information about the density of the tissue and the directionality of diffusion. This provides information about the structural integrity of the tracts. Poor diffusivity indicates injury. The following parameters are used to classify the density, directionality and white matter tract integrity.

- Fractional Anisotropy (FA) – a measure of how well water diffuses across white matter fibres.
- Mean Diffusivity (MD) – average overall diffusion of water.
- Axial Diffusivity (AD) – a measure of diffusion parallel to white matter fibres.
- Radial Diffusivity (RD) – a measure of diffusion across (perpendicular) to white matter fibres.

Following the determination of FA, MD, AD and RD values, we make a comparison with age/sex adjusted normal values. This is performed using an outlier approach, much like the Z-scoring method. The injuries to the patient's white matter are then defined after comparing against thousands of healthy datasets.

DTI Report – Image Series (SAMPLE ONLY)

