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Magnetic Resonance Imaging (MRI) has developed new techniques to better study and image parts of the body. Two techniques, functional MR imaging (fMRI) and functional connectivity MR imaging (fcMRI), will referenced in this paper, with the latter being the focus of this study. fMRI can be used to study cerebral blood flow in specific regions of the brain and map their correlation with specific tasks performed during examination. fcMRI can be used to study regions of the brain and map their synchronization with cerebral blood flow while no specific task is performed during examination. The methods of fcMRI are similar to that of fMRI, where blood flow changes of brain regions are mapped using a sequence of rapid data acquisitions. These areas of blood flow changes can be correlated with areas used during task performance while examination occurs. fcMRI combines previous methods of functional connectivity study, and fMRI methods to map the temporal change in signal intensity to regions of the brain. It is important to note that fMRI and fcMRI are both useful in obtaining information about brain functionality, and have proven their reliability in mapping these regions under their specific conditions. However, the purpose of this study is to explore the feasibility and functionality of fcMRI when specific tasks are performed during examination.

The exploration of fcMRI in this study is geared to obtain between fMRI and fcMRI to allow fcMRI feasibility during task performance to be compared to fMRI. The specific mathematical parameters of each test can be referenced in the first paragraph of the Methods section. The tasks performed in the experiment are designed to map the activation related to sensorimotor, language, auditory, and visual tasks. The tasks were finger-tapping, silent word generation, text listening, and video viewing, respectively. These were performed during an interval of 64 seconds, split in half between task activation and followed by rest, and repeated this interval four times.

fcMRI does map correlated regions of the brain to areas of activation. However, this is only accurate for certain regions during certain tasks. Finger-tapping did demonstrate that fcMRI detected correlations in voxels of the sensorimotor complex and resembled mapping performed through fMRI, however, the fcMRI mapping that matched was obtained in the rest phases, and not the activation phases or fcMRI. The same was true for Broca’s area, the auditory cortex, and the striate cortex, related to word generation, text-listening, and video watching, respectively. However, constructing a task-related map was able to be generated when specifically selecting voxels in these regions during the task performance phase. The potential of fcMRI to produce functionality connectivity mapping was significant, as only a select few voxels, and as minimally as a single voxel could produce such a result, but only during phases of inactivation. This small window does allow detectable means for synchronous blood flow changes in relation to rest, in comparison to functional connectivity studies conducted on entire regions. However, due to temporal changes, task activation cannot be correlated to regions of functional connectivity under typical approaches used in previous functional connectivity. As a result, there is a lack of correlation between fcMRI and fMRI during task activation. And thus, regions of the brain that demonstrate functional connectivity are not always correlated with regions activated during a specific task. fcMRI and fMRI cannot be used interchangeably. Furthering the study between fcMRI and fMRI can be continued in alternative contexts to investigate the feasibility of fcMRI while performing tasks.

fcMRI does show it can perform similarly to previous methods of functional connectivity of intravenous administration of radioisotopes and monitoring with invasive electrodes, while being non-invasive. This method of fcMRI is useful, as it does allow for function connectivity mapping of several regions of the brain.