Research Motivation

Parkinson’s Disease (PD) is one of the most common and debilitating neurological disorders among the elderly. PD exhibits key motor symptoms such as tremors, bradykinesia, postural instability and muscular rigidity which significantly reduce quality of life[1]. The aim of this research is optimization of current treatment techniques in symptom treatment through understanding of relevant neural circuits.

Research Background

These symptoms are caused by a significant diminishment of dopamine throughout neural regions directly resulting from a loss of cells in the substantia nigra[3]. High-frequency deep brain stimulation (DBS) of the subthalamic nuclei the STN has become a preferred surgical treatment of advanced PD[2]. While definitive mechanisms of actions are not well understood, activation of the primary motor cortex has been observed with changes of regional cerebral blood flow (rCBF) observed in this area. Blood flow response is maximized in this ipsilateral region[4].

Research Question

Can primary motor cortex blood flow response be monitored and used for both targeting and confirmation of electrode implantation within the STN to assure best surgical outcome?

Blood Flow Results 130 Hz Stimulation

Figure 2: (Left) Magnitude of peak to peak response following initial stimulation at 0.1 mA, 0.3 mA and 0.4 mA (Right) 10 seconds during, before, and after stimulation peak to peak response for all 5 trials at each stimulation parameter.

Surgical Implantation

Figure 1: (Left) Locations of craniotomies for recording/stimulation (posterior to bregma) and for LDF measurements (anterior to bregma) (Right) Recording/stimulation electrode implantation (back of image) LDF probe (front of image)

Figure 5: Neural recordings from implanted electrode showing recorded regions in implantation route. (Left) relatively silent recording region of brain zona incerta which is observed before higher frequency firing patterns (Right) are seen in the STN.

References