

Cortex – basal ganglia synchronization in Parkinson’s disease

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Increased synchrony in the beta band in cortico-basal ganglia circuits is well described in patients with PD. Less is known, however, about how these abnormal firing patterns are correlated across these brain regions. In this study we investigated how this intra-operative data recorded from STN correlates with scalp recorded EEG. Intraoperative single unit recordings and LFPs were obtained from STN and scalp EEG recordings were collected from four electrodes positioned over prefrontal and motor areas. We computed the STN spike-LFP (Local Field Potential) phase synchrony over short temporal windows as it fluctuates in time. We also computed the EEG phase synchrony index time series for all 6 pairs of EEG electrodes. Next we explored cross-correlation between the two synchrony level time-series of the spike-LFP vs. EEG pairs. EEG synchrony was found to be correlated with spike-LFP synchrony. Correlation between surface EEG and STN was strongest for ipsilateral EEG and STN recordings. Spike-LFP synchronization is believed to characterize the input-output characteristics of STN dynamics and to be strongly relevant to the expression of motor symptoms. Our results indicate that non-invasive and relatively simple EEG recordings retain some information about synchronous dynamics in the subcortical regions, which can be accessed only in an invasive manner during functional neurosurgical procedures.