

Functional connectivity of Sub-thalamic and Pedunculopontine rhythms in  
Parkinson's disease

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**Question:** There is anatomical connectivity between sub-thalamic nucleus (STN) and pedunculopontine nucleus (PPN) in humans. However, the functional linkage between the two has not been fully elucidated. Two questions were asked: 1. through which frequency band(s) are the two nuclei bridged? 2. Which nucleus leads the other one if there is functional connectivity between them?

**Methods:** Three patients with Parkinson's disease (PD) underwent bilateral STN and left PPN deep brain stimulation (DBS) were recruited for the investigation on the 2<sup>nd</sup> day after operation. The local field potentials (LFPs) were recorded from the externalized electrodes in resting states during patients' 'off' and 'on' states. The coherence and cross-power spectral density estimates were conducted for signal analysis.

**Results:** There is a strong coherence at alpha frequency between STN and PPN LFP. The analysis of phase spectra over the alpha frequency showed significant coherence between STN and PPN and PPN led STN at this frequency by 5.9, 7.3 and 5.1 ms, respectively, in three subjects were detected. After levodopa treatment, the leading time increased in subject 2 and 3 (13.7 and 9.5 ms).

**Conclusions:** There is functional connection between PPN and STN with PPN in leading position through alpha frequency band in PD. Levodopa administration lengthened the leading time of PPN. It seems that faster alpha input from PPN to STN would perturb the motor capability in PD and this hypothesis should be further tested by motor tasks.