

Bilateral double beta peak activity is influenced by stimulation, levodopa concentrations and motor tasks in a Parkinson's disease patient on chronic deep brain stimulation

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Introduction: Subthalamic (STN) local field potentials (LFP) in the beta band are considered as potential biomarkers for closed-loop deep brain stimulation (DBS) in Parkinson's disease (PD). The beta band is further dissected into the low and the high frequency components with somewhat different functions, although their concomitance and association in the single patient is far to be defined. We present a 56-year old male PD patient undergoing DBS showing a double beta peak activity on both sides.

Objective: To investigate how low and high beta peaks were influenced by plasma levodopa (L-dopa) levels, stimulation and motor performances.

Methods: A systematic evaluation of raw LFP, plasma L-dopa levels and motor tasks was performed in the following four conditions: OFF medications/ON stimulation; OFF medications/OFF stimulation; ON medications/OFF stimulation; ON medications/ON stimulation.

Results: The analysis of the LFP spectra suggests the following results: 1) some PD patients show a double beta peak activity; 2) both the high and the low beta peaks are suppressed by stimulation; 3) the high beta peak is influenced also by plasma L-dopa concentration showing a progressive amplitude increment concordant with plasma L-dopa levels, while the low beta peak shows a different behaviour; 4) motor performances seem to impact beta peaks behaviour.

Conclusions: This single exploratory case study illustrates a complex behaviour of low and high beta peaks in a PD patient, in response to stimulation, L-dopa plasma levels and motor performances. Our results suggest the importance to investigate patient-specific individual LFP patterns in view of upcoming closed-loop stimulation.