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The effect of dopaminergic therapy on functional connectivity in Parkinson's disease

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Dopamine presents an important component of cortico-striato-thalamic system, where it plays a crucial role in modulating functional segregation within basal ganglia and between multiple parallel cortico-subcortical functional loops. Its role in the control of the information flow within frontal lobes as well as to and from other brain areas is believed to underlie cognitive dysfunctions in diseases such as schizophrenia, Parkinson's disease and Tourette syndrome. Additionally, pharmacological studies have established that an optimal level of dopamine is required for effective performance in working memory tasks and inhibition control. While its importance is well established, the exact influence of dopamine on the functional integration of brain regions needed for the performance of cognitive tasks has not been explored in detail. New advancements in functional connectivity analysis of fMRI data enable us to address that question. Recently we have developed a processing approach that enables separate assessment of functional connectivity reflecting the degree of coactivation of regions required for task performance, and one reflecting the functional coupling of regions during task performance. We have applied the analysis to block-design fMRI study of 2-back working memory task and go/no-go task performed by patients with Parkinson's disease and matched controls, during intravenous administration of L-Dopa or saline. The design of the study enabled us to assess the level of impairment of task related functional connectivity in Parkinson's disease, the therapeutic effects of L-Dopa, as well as the effect of enhanced dopamine levels on task related functional connectivity in healthy adults. The talk will present the theoretical and methodological background as well as the results of the study.