Whole body vibration induces basal ganglia activation in young healthy individuals

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Background: We previously performed a double-blind controlled study of stochastic whole body vibration (SWBV) in Parkinson's disease (PD) patients and found improvement of bradykinesia and postural stability in the treatment group (Kaut O et al., 2011), suggesting that SWBV may offer a supplementation to canonical treatment strategies of PD motor symptoms. The mechanisms of SWBV that cause those positive effects on movement dysfunction are not yet understood. We performed a fMRI study to analyze putative specific patterns of cerebral activation induced by SWBV.

***Methods*:** Twenty healthy volunteers were allocated either to the experimental or sham group, respectively (4 male, 6 female, mean age 23,4±3,6 vs. 5 male, 5 female, mean age 24,4±3,0). The experimental group received 2 cycles of stochastic SWBV using the SR-Zeptor® device on two days, each cycle consisting of 6 stimulus trains of 60 seconds duration (frequency 7 Hz) and 60 seconds resting time between stimuli. Patients allocated to the sham group received a sham treatment with 1 Hz.

On day 1 a baseline 1,5T fMRI was performed in resting state and finger tapping test. A second fMRI was performed after application of SWBV as sham or verum treatment. Subsequently, a second cycle of SWBV with consecutive fMRI was performed to detect putative learning effects, followed by a final fMRI on day 2 to evaluated persistent effects. Analysis of raw data was done with fixed effects statistical analysis.

***Results*:** In the experimental group, we observed specifically increased activity in the striatum, especially caudatus head and putamen after SWBV treatment. However, the sham treatment resulted in even more pronounced changes in the mediofrontal cortex and the cingulum., Contrasting previously observed activations, comparison of the experimental and the shem group, revealed significant stronger activation in the right putamen in the experimental group.

Discussion: SWBV has been claimed to modulate the functional state of the peripheral nervous system by other investigators. Here, we found evidence that SWBV also induced neuronal activation in the central nervous systems. Particularly the putamen showed a marked signal change. At present the relation of the particular stimulation parameters employed in the sham and experimental condition and the resulting changes in the activation pattern remains to be investigated. Further studies will show whether the activation of the putamen observed in the experimental condition can be achieved in PD patients, too. The combination of SWBV anf fMRI may offer a tool to decifer the effects of specific physical stimuli on the complex circuits of basalganglia and cortex activity.