Neurochemical substrates of neurofeedback

ABSTRACT:

Neurofeedback is a brain-based training method that enables a user to control their own cortical oscillations by feed-back of real-time information from EEG (electroencephalogram) activity. The objective of our study was to assess the capability of EEG-based neurofeedback to induce dopamine release in-vivo using Positron Emission Tomography (PET). However, our current knowledge of how neurofeedback induces neurophysiological changes in the brain remains limited. Importantly, no investigations exist exploring the potential impact of neurofeedback on the brain's key neuromodulatory systems. Thirty-two healthy volunteers were randomised to either EEG-neurofeedback (NFB) or EEG-electromyography (EMG), and scanned while performing this task during a single session of dynamic Positron emission tomography (PET) brain imaging. Dopamine binding kinetics were measured with high affinity D2/3 receptor ligand, [18F] Fallypride and radioligand displacement was quantified in thalamic and prefrontal cortical regions of interest (ROI) to determine effects of neurofeedback on endogenous dopamine release. Contrary to our hypothesis of a differential effect for NFB vs EMG training, significant dopamine release was observed in both training groups in the prefrontal cortex. Overall, our findings constitute the first investigation of neurofeedback's effect on the endogenous release of a key neuromodulator, demonstrating its feasibility and paving the way for future studies using this methodology.

Keywords

EEG, Neurofeedback, PET, Dopamine

Researcher's Contacts:

Tomas Ros
University of Geneva
Campus Biotech
9 Chemin des Mines
1202 Geneva, CH
Email: tomas.ros@unige.ch