Abstract

Name: Brain Activity Evaluation Using sLORETA Imaging During Imagination and Induction of Flow State

The aim of the study: The aim of this work was to use sLORETA imaging to capture changes in the source brain activity before and after a 3-week movement imagination training. With the help of subjective questionnaires, the second goal was to capture and compare the potential progress of the flow state also within the imagination training.

Methods: 13 healthy probands in the age range of 20-30 years participated in the study. Brain source activity was measured using a surface telemetric 32-channel EEG device Nicolet TM EEG Wireless Amplifier 32/64 from Natus Neurology. The subjects underwent EEG measurements twice, always before the start of the imagination training and after its end. Measurements were performed identically in the following order: 1) resting EEG: 5 min eyes closed, 5 min eyes open; 2) watching video in VR: 3 min + 5 min pause; 3) imagination of movement: 3 min. The initial measurement was followed by a 3-week home movement imagination training with detailed instructions using VR glasses. The subjects were told to watch the video and then train their own imagination 9 times in total. After the initial and control measurements, the probands were asked to fill out the Flow State Scale questionnaire – Long version (Řezáč, 2009), for home training they received a form with the Short Flow Scale questionnaire (Martin et Jackson, 2008), which they filled out after each training session. Data from the source brain activity were evaluated and displayed in the sLORETA program. Statistical evaluation of source brain activity data was performed using a paired t-test with a smoothing parameter of 0.5 and using the permutation method with 5000 randomizations. Both mentioned questionnaires were evaluated using Student's paired t-test with a one-tailed distribution for a significance level of $p \leq 0.05$ using MS Excel.

Results: A comparison of the state during walking and resting state as a part of the initial examination showed significant activation of several BAs (6, 8, 10 and 11) in the Beta 1 frequency band. Statistical evaluation of the same pair of data during the control examination showed an even higher number of significantly active BAs (3, 4, 5, 6, 7, 9, 10, 11, 18, 19 and 40) and frequency bands, which are Delta, Alpha 1, Beta 1 and Beta 3.

When comparing the imagination of movement during the initial and follow-up examination, there was no statistically significant change found. The evaluation of the Flow State Scale and Short Flow Scale questionnaires when comparing the condition during the initial and follow-up examination did not show a statistically significant difference in any case.

Key word: imagination, imagery, movement imagination, virtual reality, movement observation, mirror neurons, imagination training, flow, EEG, sLORETA