

Abstract

Title: Changes in brain activity in tactile stimulus therapy and Ruka Ruk therapy compared to mirror therapy in upper limb rehabilitation

Objectives: The aim of the research project is to determine the changes in source electrical activity in sLORETA imaging using virtual reality operating on the principle of mirror therapy in the Ruka Ruk program and in conventional mirror therapy with tactile and haptic upper limb stimulation, compared to the resting state with open eyes.

Methods: 12 healthy volunteers aged 23–42 participated in the experiment. The electrical activity of the brain was measured by scalp EEG in 7 phases of the experiment. Brain activity was measured at rest, during therapy with a sagittally placed mirror reflecting the movement of the right upper limb, and during therapy with a Leap motion sensor and a monitor with Ruka Ruk software, where participants saw only virtual upper limbs. The software mirrored the movement of the right upper limb on both virtual limbs. The electrical activity of the brain was sensed in three modifications in both types of therapy with the addition of a haptic or tactile left upper limb stimulus with a 10 cm wide foam cylinder. The order of modifications was randomized. The EEG record was processed and statistically evaluated in the sLORETA program, for localization and 3D display of source activity. The source activity during therapy was compared with the resting state before therapy. A paired t-test with logarithmic transformation of data with a smoothing parameter of 0.8 using a permutation method using 5000 randomizations was used to evaluate statistically significant changes in brain activity.

Results: We found a statistically significant difference in the source activity of the brain at the level of significance $p \leq 0.05$, in therapies with tactile stimulus foam cylinder and without tactile stimulation in the frequency bands alpha1-2, beta1-3, delta and theta. Especially in the frontal, parietal and occipital lobes specified according to specific Brodmann areas.

Keywords: mirror therapy, virtual reality, haptic contact, tactile stimulation, EEG, SLORETA, Leap motion

