Mirror-box Training in Healthy Subjects and a Patient with Hemiparesis

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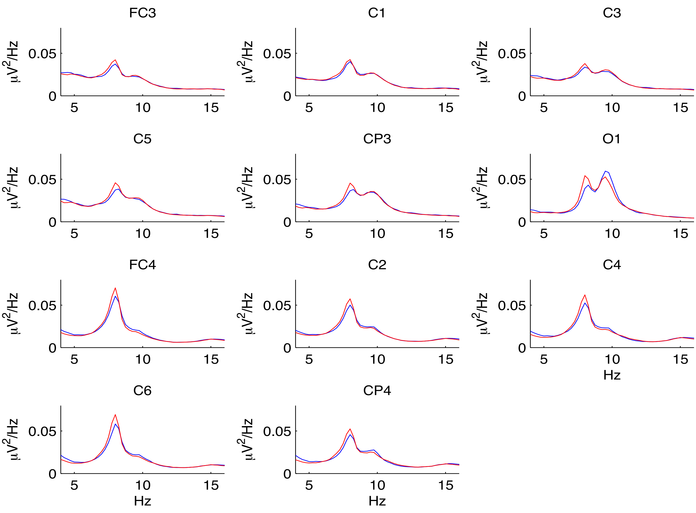
| Objective

Mirror therapy (MT) is an approach of neurorehabilitation improving motor functions after stroke. MT represents a mental process by which an individual rehearses a given motor action by reflecting movements of the non-paretic side in a mirror as if it were the affected side. Although a number of small-scale research studies have shown encouraging results, there is no clear consensus about the effectiveness of the therapy. The aim of this study is to investigate objective changes in EEG after MT.

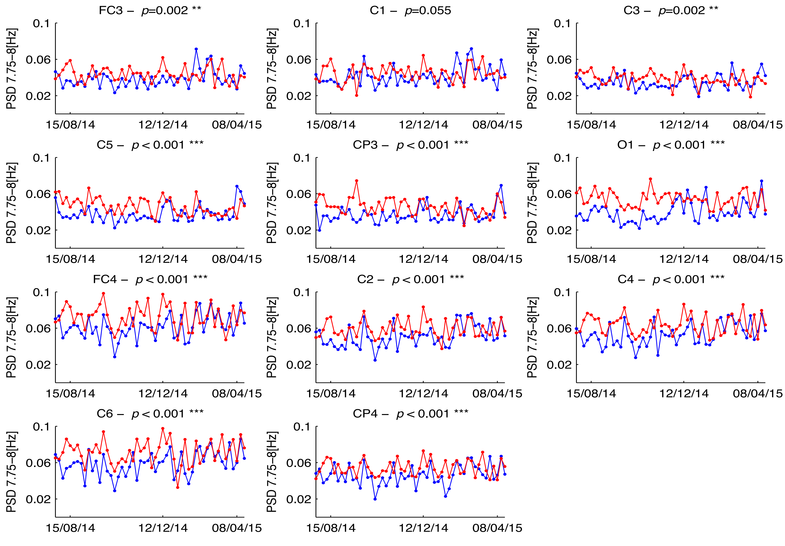
| Methods

Seven healthy volunteers carried out five mirror-box training sessions. The same training was carried out twice a week with a patient with hemiparesis for more than ten months. Eleven channels of EEG placed over the sensorimotor and left occipital cortex were recorded. In addition to the standard power spectral analysis of EEG, we decomposed EEG into elemental components or “atoms”. We estimated EEG atoms using multiway parallel factor analysis (PARAFAC) for modeling.

| Main results



Normalized PSD of the relaxed two-minutes long eye-closed period and averaged over 52 recording days (period of 10 months, 08/2014 – 05/2015) of the 57 year old patient with hemiparesis. Averaged PSD before (blue curve) and after (red) motor exercise with the mirror box. PSD values were estimated using FFT of 4-second long EEG segments, with cleaned up artifacts and normalized with the overall power spectrum in the range of 4–30 Hz.



*Paired t-test comparison of the averaged PSD before (blue curve) and after (red curve) motor exercise with the mirror box in the individual μ-rhythm range of 7.75–8 Hz of the hemiparetic patient. Plotted curves represent averaged PSD at individual electrodes and days - 52 recording days within the period of 10 months. Levels of statistical significance of the test are plotted on top of each graph (***: p < 0.001, **: p < 0.01).*

| Conclusion

By comparison of the resting EEG prior to and after training, we found statistically significant increase of the motor-related oscillatory μ-rhythm in a hemiparetic patient. In addition, atomic decomposition of EEG reveals stable space-frequency components of motor-related synchronization and desynchronization of EEG in a hemisphere contralateral to the mirror box.

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