Neurofeedback and Aphasia

Neurofeedback is a computer-supported therapy procedure for clinical use, in which selected parameters of the patient's own brain activity are made perceptible. For this purpose, brain waves are measured in real time on the surface of the head (neuro), which influences an audiovisual animation (feedback). Since all signals, recorded by the sensory organs of the central nervous system, are constantly analyzed for their relevance, the audiovisual neurofeedback signals represent kind of mirror for the brain of its own activities. Such a direct feedback, based on proven treatment protocols and electrode positions, aims to improve the brains' ability to regulate itself. Since self-regulation is an essential and fundamental function of the brain, the clinical spectrum of treatment is very broad, in which neurofeedback can be used as a lead therapy or therapy component to alleviate the symptoms of mental disorders and illnesses, for attention and concentration problems and in rehabilitation.

There are various neurofeedback methods, which all follow the principle of EEG measurement and frequency component dependent feedback outlined above, but differ in their implementation, EEG feature extraction and feedback control. So-called "frequency band" methods follow the rules of standardized frequency ranges within the "classic" EEG spectrum (1-40 Hz) for feature extraction and aim at the brain reducing certain activities and increasing others. In contrast, during neurofeedback training of slow cortical potentials (SCP) aim to control those activities in the very low frequency ranges below 0.1 Hz. The so-called Infra-low Frequency-Neurofeedback (ILF) has proven to be particularly effective and represent a combination of frequency band and SCP training with regard to the frequencies of the extracted brain activities, but beyond that also follows a stand-alone, individualized and symptom-based approach. In ILF neurofeedback the training frequency of the slow SCP activities is individually optimized and the course of therapy is dynamically adapted to changes in clinical symptoms

In order to represent the research results as broadly as possible, the following studies are methodologically based on various neurofeedback methods – hence, they all have in common to aim for an improved regulation of the brain.

Neurofeedback as a therapy component for Aphasia

Aphasia means malfunctions in speech production or speech comprehension due to central nervous system impairments. Aphasia as a symptom can manifest in speech morphology, semantics, limited vocabulary, syntax forming or pathological phonology. Causes of Aphasia can be pathological changes in the CNS as stroke, brain hemorrhage, traumatic brain injuries, tumors or brain inflammation. It can also be a symptom for pathological development and occur in combination with dysphasia It should also be taken into consideration, in which context aphasia occurs.

Neurofeedback can be used as a block of therapy for those affected by aphasia. The effect of

Neurofeedback is alteration of dysregulated brain activity. The effect neurofeedback has on the brain was confirmed in a recently published study. The functional connectivity (communication between neurons) in the brain of subjects was examined by fMRI before and after a 30-minute neurofeedback session. After the neurofeedback session, an increased connectivity of neurons in the brain was found[1]. From these results it can be deduced, among other things, that neurofeedback not only has a positive effect on the symptoms but can also influence connectivity patterns.These results support the hypothesis of neurofeedback as a method of improving the self-regulating capacity of the brain.

State of Research: Neurofeedback and Aphasia

In multiple case studies beneficial effects of neurofeedback on post-stroke patients were reported. Those improvements were found for example in variables and symptoms of attention, concentration and balance but also in speech fluency and less word finding difficulties. One of the case studies especially describes a post stroke patient (male, 55 y.o.) with aphasia and speech related problems. The patient demonstrated significant pre–posttraining changes on neuropsychological tests assessing aphasia, on a self-report inventory of psychological distress, and from an independent speech evaluation[2]. Amongst the reduction of neuropathological symptoms and perceived distress, also normalization of neuronal activity was pointed out in other cases[3-6].

In patients with central impairments due to brain damage usually more neurofeedback sessions on a higher frequency are needed compared to patients without damage of brain tissue[7]. Amongst the neurofeedback associated hypothesis regarding the brain's self regulation also neuronal plasticity[8] and functional connectivity play a crucial role in rehabilitation. In regard to functional connectivity, Sreedharan and colleagues (2017)[9] found in a sample of four stroke patients with expressive aphasia that real time fMRI neurofeedback contributed to strengthen connections in language areas in both hemispheres.A systematic review of neurofeedback as a form of cognitive rehabilitation therapy after stroke concluded that the majority of studies identified improvements in participant cognitive deficits following the initiation of neurofeedback therapy[10].

Summary and outlook

In line with this research and current clinical knowledge we would state that neurofeedback can be tried on aphasia symptoms. Many researchers including BEE Medic GmbH are currently working on supporting more neurofeedback studies. For further information on neurofeedback as well as on scientific work, please do not hesitate to contact us. Please also contact us if you are interested in participating in research on neurofeedback, for example, by submitting a case study in your practice. You can reach us at **medwiss@beemedic.de**.

We are also happy to put you in touch with practices or clinics that already use our system in therapy and/or research.

Literature

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