

Neurofeedback and Autism

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 Autism Spectrum Disorders (ASD)

Autism Spectrum Disorder is a profound developmental disorder that begins in (early) childhood. Diagnostic criteria include deficits in social communication and interaction, limited repetitive behavioral patterns such as inflexible holding on to routines and hyper- / or hypoactivity to sensory stimuli. Functions of speech, visual spatial skills and movement coordination are often affected by developmental limitations or delays. The term spectrum disorder indicates that different forms of

autistic disorders can be distinguished, especially early childhood autism, atypical autism and Asperger syndrome.

Indicating a prevalence for ASD is not trivial, as there is no uniform approach or criteria, and numbers are not available for all regions worldwide. It may be possible to estimate a prevalence of approximately 1.5% for ASD in industrialized countries¹. The clinical appearance of ASD changes considerably over the life span from infancy to adulthood, both in core symptoms and compensation strategies.

Neurofeedback can be used as a block of therapy for those affected by the autism spectrum. Recent research into the neurophysiology of autism spectrum disorders has shown that autistic individuals have different connectivity networks and specific regions of hyper- and hypoconnectivity than healthy subjects in comparison with a control group². Other theories, such as those on altered mirror neuron activity, or hypotheses on the Theory of Mind and the Polyvagal Theory, also emphasize neurological differences for patients with ASD.

The effect of Neurofeedback is alteration of dysregulated brain activity. It is known from studies that patterns of resting EEG and evoked potentials in patients with ASD differ from those of healthy population. The effect neurofeedback on the brain has been 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 found³. From these results it can be deduced, among other things, that neurofeedback not only has a positive effect on the symptoms of illnesses but can also cause effects in the brain and thus possibly change connectivity patterns in the long term, such as those that occur in chronic pain. These results support the hypothesis of neurofeedback as a method of improving the self-regulating capacity of the brain.

State of Research: Neurofeedback in Autism Spectrum Disorders

Due to the functional neuroanatomical abnormalities in patients with ASD, neurofeedback can be an effective treatment method for reducing the symptoms of dysregulation⁴. This hypothesis is strengthened in a controlled study, in which ASD patients had a reduction of cerebral hyper-connectivity after 20 sessions of Neurofeedback as well as a significant reduction of the symptoms by the treatment⁵. It is also shown that neurofeedback in combination with other treatment methods is a possibility to improve the patients' performance⁶. A follow-up study shows that 12 months after the Neurofeedback treatment, the obtained improvements are still present⁷, which indicates, that Neurofeedback does not only helps with the current symptoms, but it also helps the brain to improve the executive functions.

Previous work⁸ and a recent review of the existing literature concludes that neurofeedback is a promising treatment for autism and cites the evaluation of numerous studies and case reports⁹. However, it is also noted that further studies, particularly controlled and randomized studies, should be conducted to evaluate further details of treatment conditions.

Summary and outlook

Many researchers including BEE Medic GmbH are currently working or supporting on very expensive 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.

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