

# The Effectiveness of Neurotherapy in the Treatment of ADHD

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### Abstract

Research over the last 30 years has confirmed that excessive slow brainwave activity is the most common finding of electroencephalographic (EEG) abnormalities in children with Attention Deficit Hyperactivity Disorder (ADHD) and Learning difficulties . Quantitative EEG (QEEG) studies have confirmed and extended these findings. In the Early 1970s Prof. Barry Sterman at UCLA and later Prof. Joel Lubar at Tennessee University developed Neurotherapy, an EEG operant conditioning technique that specifically targets these EEG anomalies and attempts to retrain them by learning through operant conditioning. This paper provides an overview of Neurotherapy research and its effectiveness in permanently redressing ADHD symptoms in over 80% of subjects.

### Background

Over the last decades, the worldwide increase in the incidence of substance abuse, Attention Deficit/Hyperactivity Disorder (ADHD) anxiety, depression and mental illness in general has caused great concern to health authorities and the public. Genetic interactions with our "modern" diet may be at the root of this epidemic and effective treatment may require that we treat the root causes by promoting better diet and self regulation rather than treating the symptoms with medication.

Faced with the task of improving the behaviours of children with neurodevelopmental disorders we have chosen to adopt a holistic approach. We first attempt to rectify intestinal dysbiosis, leaky gut and malabsorption, this aspect is handled by a GP member of the Australasian College of Nutritional and Environmental Medicine (ACNEM) at the clinic. Second, we stress the importance of a balanced diet with a paleolithic-like profile. Third, we supplement the diet as required with amino acids, Omega 3 fatty acids and associated micronutrients.

Fourth we use Neurotherapy, based on QEEG findings, to redress any abnormalities in slow/fast brainwave ratio in the EEG. Finally, when the biology is normalised, to the extent that it can be, we apply Behavioural and Cognitive Behavioural Therapy supplemented with Metacognitive strategies. This paper focuses on the key aspect of this approach: The effectiveness of Neurotherapy in the treatment of ADHD.

### Neurophysiological factors and brain dysfunction

Chronic behaviours are the result of both biological predisposition and learned environmental interactions encrypted into neuronal firing patterns. Hence while changing a person's microbiology may improve the potential for normal brain function, altering higher order learned

behaviours, may require that the learned neuronal firing patterns be modified.

By repeatedly challenging dysfunctional thinking patterns and changing them through cognitive restructuring and Cognitive Behaviour Therapy Psychologists are effectively reprogramming neuronal firing patterns. However when a disorder is underpinned by a neurophysiological dysfunction, directly retraining brainwave patterns by operant conditioning of the EEG has been shown to be a more effective method of reprogramming neuronal firing patterns. This has been demonstrated in ADHD , depression and post-concussion syndrome .

Research in psychophysiology over the last 30 years supports the view that thalamo-cortical and cortico-cortical oscillations are responsible for the timing and transfer of information between various structures in the brain, and that disruptions in their regulation are responsible for a range of brain dysfunction and consequently mental disorders . There is a wealth of evidence that psychiatric disorders are related to specific dysfunctional brainwave patterns identified in the QEEG

QEEG is the statistical analysis of neuronal activity recorded from the surface of the scalp. In 1988, Dr. E. Roy John, and his research team at the Brain Research Laboratories at New York University Medical Center, published in Science the seminal work in computer-assisted differential diagnosis of brain dysfunctions using QEEG (neurometric analysis). Building on that work, John and Prichep and other research teams since have created an objective evaluation system that is highly sensitive and specific for assessment and interpretation of brain dysfunction . Several researchers have suggested that Neurotherapy could be used to redress the dysfunctional brainwave patterns identified by QEEG neurometric analysis . There is a wealth of evidence indicating that over 80% of subjects in studies to-date are able to change their brainwave patterns towards normal and consequently normalise the associated behaviours IQ scores and academic output.

### Neurotherapy in the treatment of ADHD

Using a 19 channel QEEG recording, Chabot and colleagues were able to discriminate replicably ADHD versus normal children, with a sensitivity of 90% and a specificity of 94% and ADD versus specific learning disorders with a sensitivity of 97% and a specificity of 84.2% . Their most common findings were of generalized or focal theta/alpha excess mostly at frontal and central sites. Monastra and colleagues found that the power ratio of theta/beta measured at the vertex (CZ) was able to distinguish their large sample of ADHD children from normals with a Sensitivity of 86% and a specificity of 98% . Researchers have suggested that Neurotherapy may be the treatment of choice to target the theta and alpha excesses, for example .

Neurotherapy is an operant conditioning paradigm developed in the Seventies by Professor Barry Serman of UCLA. Serman successfully trained cats to increase brainwave activity by operant conditioning of the EEG. The cats were rewarded for producing SMR Rhythm (12-15Hz) over the sensorimotor cortex in a study of brainwave activity . Subsequently when NASA commissioned Serman to investigate the seizure causing effects of Hydrazine fuel, it was discovered serendipitously that the same cats were highly resistant to seizures. A series of published studies followed which indicated that EEG operant conditioning or EEG-Biofeedback, now called Neurotherapy was highly effective in reducing seizure incidence in humans .

Since the 1960s, research in neuroscience, psychophysiology and clinical practice in universities and clinical settings have shown that through Neurotherapy (EEG biofeedback) patients can be taught to restore self-regulation in the brain by retraining their brainwave patterns. A more recent improvement in Neurotherapy protocols is in the use of QEEG neurometrics to identify the specific brainwave patterns that need to be redressed .

During Neurotherapy, real-time QEEG is displayed on a computer in the form of a game, and the patient is given contingent audio-visual rewards for producing less Theta and more Beta waves. There is now significant evidence in the literature, which suggest that most ADHD children can learn to produce a brainwave pattern with more normal theta/beta ratios .

Typical Neurotherapy training screen. The forward movement of the spaceship on the left is dependant on theta activity ( 4-7Hz) , That in the middle on Beta (15-18Hz) and the one on the right on high beta and muscle artifact (>25Hz).

Thresholds are set so that the child is rewarded (audio-visual rewards, points and tokens) when the middle ship is winning the space race. In other words reward is contingent on increasing beta (15-18Hz) and suppressing theta and muscle activity.

Improvements in theta/beta ratios of ADHD subjects following Neurotherapy have been found to correlate significantly with a number of empirical and subjective measures; studies have shown improvement in impulsivity, attention, response time and variability of response time scores on Continuous Performance Tasks (TOVA). In addition, there were reductions in hyperactivity and impulsivity on behaviour scales, increases in attention and cognitive skills in Individual Achievement Tests scores, and increases in IQ scores . Overall, results of several studies indicate that Neurotherapy treatment is effective in over 80% of cases in significantly reducing the undesirable ADHD symptoms, and the effects appear to be permanent . In many of the studies cited, the ADHD subjects were on psychostimulant medication at the start of the study. In all of the studies where medication was involved, the subjects were able to reduce their stimulant medication or completely come off the medication by the end of Neurotherapy treatment .

Critics have rightly pointed out that other "non-specific" causes may be responsible for the observed effects, since no double blind placebo controlled studies of Neurotherapy have been carried out to prove that the observed outcome are indeed due to Neurotherapy treatment effects. While the preferred double blind method is well suited to the investigation of the effectiveness of medications, it is not applicable to client intensive psychotherapies for ethical and practical reasons. However many outcome studies, including controlled studies, lending support to the effectiveness of Neurotherapy have been published in peer reviewed journals and suggest that Neurotherapy should be viewed as a scientifically viable treatment for ADHD with results capable of permanent remediation of symptoms .

The January 2000 edition of Clinical Electroencephalography, was entirely devoted to Neurotherapy. The editorial opinion by Neurology Editor, Frank Duffy M.D. stated:

"The literature, which lacks any negative study of substance, suggest that Neurotherapy should play a major therapeutic role in many difficult areas. In my opinion if any medication had demonstrated such a wide spectrum of efficacy it would be universally accepted and widely used."

The most effective treatment methodology may be one that uses a multidisciplinary team approach, where medical, nutritional, psychophysiological and psychological approaches are tailored to the individual patient presentation for the benefit of the patient. The challenge in this new century is for healthcare professionals to seek to understand each other's perspectives and to freely cooperate with each other to promote the best treatment outcome for their patients.

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