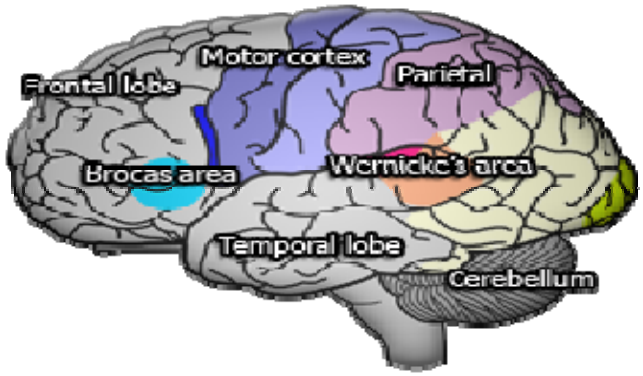
Evaluation of Neurofeedback Efficacy with Mentally Disordered Offenders (MDO)



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Date: October 2018

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Objectives

The primary objective of this study is to evaluate the effectiveness of Neuro-feedback training (NFB) on incarcerated Mentally Disordered Offenders (MDO) who have a history of PTSD, Violence, Anxiety and Depression and other psychiatric symptoms.

Design and Outcomes

The study is a pilot clinical trial to test the efficacy of EEG neurofeedback in individuals 18- 65 years of age with PTSD, behavioral difficulties, mental health problems including neuro-cognitive deficits. It is hypothesised that NFB therapy will impact the client's symptomatology including PTSD, Anger, emotional dysregulation, ADHD symptoms, attention and other cognitive aspects of the individual attending treatment. Targeted symptoms will be evaluated at baseline with psychometric testing and at treatment completion (after 12 and 24 training NFB sessions, and 4-6 weeks after the completion of the Neurofeedback training).

The primary outcome will be change from baseline on the targeted symptomatology i.e. PTSD, ADHD, Anger, Depression, Anxiety variables of the Test of Variables of EEG. Data collected during psychological testing at baseline will be used to model EEG differences between pre-existing conditions and post-intervention conditions. Data will be collected prior to the trainee commencing treatment and at treatment completion (following the delivery of a package of 24 NFB sessions) and it will be used to develop statistical models to use as indicators of neurofeedback efficacy.

Interventions and Duration
Sample Size and Population

The target population is incarcerated mentally disorder offender who are service users at Her Majesty's Prison System (HMP) in Cambridgeshire and Peterborough, supported by NHS Foundation Trust it aged 18-65. Fifty participants who have diagnoses of PTSD, ADHD, Depression, Anxiety, Conduct Disorder (i.e. violence) participate in the study. Participants receive 24 sessions of neurofeedback. The duration of the intervention is between 5 and 12 weeks, depending on how frequently participants agree to attend sessions (maximum of 3 visits per week and minimum of 2 visits per week). A follow up will also be conducted. Total time on study is 6 months.

1. STUDY OBJECTIVES

1.1 Primary Objective

The primary objective is to test the hypothesis that 20 training (NFB) sessions using dynamical neurofeedback will significantly improve attention in young adults diagnosed with ADHD as indexed by scores on the ADHD variable on the Test of Variables of Attention (TOVA) or behavioural inhibition with individuals with conduct disorder (Violence). It is hypothesised that NFB training will have an impact on the targeted symptomatology as indexed by scores on the TSI (Trauma Symptom Inventory), the Beck Depression Inventory II (BDI), the Beck Anxiety Inventory (BAI and the MVQ (Maudsley Violence Questionnaire Scoring Sheet).

1.2 Secondary Objective

Test the hypothesis that neurofeedback increases mindfulness as measured by the Mindful Attention Awareness Scale (MAAS).

2. BACKGROUND AND RATIONALE

Compared with the general population, Mentally Disordered Offenders (MDO), persons with mental Illness and personality disorders are at increased risk to commit aggressive acts, suffer from neurological problems including conduct disorder, ADHD, Anxiety and Depressive symptoms. Most persons who suffer from mental disorders and neurological problems require medications. Mentally disordered offenders (MDO) present with multiple problems and co-morbid conditions. Medications are only one part of the treatment required by this population. Research suggests that those with PTSD and mental health, behavioral and cognitive deficits will benefit from other form of therapies such as cognitive behavioural approach and neurological interventions. Inattention and distractibility, impulsivity, anxiety and depression as well as hyperactivity are the hallmark symptoms of this client group that are at higher risk for learning, behavioral, and emotional problems.

2.1 Study Rationale

Electroencephalography (EEG) biofeedback (also termed, neurofeedback, NFB) is an alternative/complementary treatment for people with ADHD, Depression, Conduct Disorder, Anxiety Disorder as well as PTSD, that is rapidly growing in popularity. In a prison system with Mentally Disordered Patients, a non-medical procedure that improves significantly the general well-being of inmates, resulting in reduction of violence, isolation and recidivism is a highly desirable intervention. The positive impact of neurofeedback on multiple components/symptoms of the disordered state, broadly within the ADD and PTSD domains, supports the rationale for this study. As this is a pilot study, it is proposed that a cohort of 50 participants be recruited, of whom, 40 are actively trained and 10 are a matched wait-list control group.

2.2 EEG-based Neurofeedback in Behavioural Disorders

Electrical events generated in brain tissue create EEG activity that can be recorded through sensors placed on the scalp surface. EEG waveforms are dynamic and reflect many brain areas oscillating synchronously. EEG waveforms are a mixture of several different frequency bands, which are transformed and decomposed for further analysis. When examining EEG activity, investigators categorize activity within and between specific frequency bands. Frequency refers to the number of oscillations (or cycles per second, hertz, Hz) within a given time period (e.g., four cycles per second). Amplitude reflects the power or intensity of the signal being received at a given frequency or grouping of frequencies, averaged over time.

Certain maladaptive cognitive processes and behaviors have been associated with power discrepancies in particular frequency bands. Four frequency bands that are of interest to researchers are theta (4-7 Hz), alpha (8-12 Hz), sensorimotor rhythm (SMR, 12-15 Hz, "low beta"), and beta (13-21 Hz). For instance, on average, people with ADHD display increased theta power, slight elevations in frontal alpha power, and decreases in beta mean frequency (Chabot & Serfontein, 1996; Loo et al., 2009), relative to a matched "normal" population. Increased theta power is the most consistent EEG finding in the literature on ADHD, indicating that cortical under-arousal is common in ADHD. In PTSD patients, power spectra analysis

showed a widespread increase of theta activity (4.5–7.5 Hz) in parietal lobes and in frontal lobes (Iperatori 2014).

2.2.1 Operant Conditioning Neurofeedback

In "classical" or operant conditioning neuro-feedback, electrical activity recorded from sensors on the patient's scalp is processed by a computer and a computed average of a subject's spectral power in selected frequency ranges is calculated. Spectral power ratios are represented as images or graphically represented on a video display. Based on the principle of operant conditioning, participants learn to consciously influence select components of their EEG, such as a spectral power of a given frequency. Images and auditory reflections of the individual's response to these conscious efforts is fed-back to the individual by changes in the representation. When the desired changes in the EEG are detected, positive feedback is given and/or points are awarded.

2.2.2 NeurOptimal Dynamical Neurofeedback

One issue with conventional neurofeedback is "over-training". If too much beta training is given, participants may have increased difficulty falling asleep, exhibit mild anxiety, hyperactivity, irritability or increased impulsivity. If too much SMR training is given they may have increase inattentiveness, lack motivation, have increased nightmares, or feel overly sensitive. These reasons require the titration of the intensity of the frequency training and protocols must be adapted according to the prevailing state of the patient.

In the proposed Neurofeedback study, NeurOptimal uses advanced, dynamical EEG processing, in which the EEG signal is computed as a non-stationary, or evolving, non-linear dynamical system.
The EEG is the representation of a biological process which is dynamically interacting. Despite global increases in the average power of selected bands, dynamical modulation is occurring within and between bands, depending on the cognitive demands, all the time. The theory of nonlinear dynamical systems, also called 'chaos theory', has now progressed to a stage where it becomes possible to study self-organization and pattern formation in the complex neuronal networks of the brain (Stam, 2005). Brain oscillations exhibit long-range temporal correlations (LRTCs), which reflect the regularity of their fluctuations: low values representing more random (decorrelated) while high values more persistent (correlated) dynamics. LRTCs constitute supporting evidence that the brain operates near criticality, a state where neuronal activities are balanced between order and randomness. Criticality is the state of maximal neuronal adaptability to induced change.
The NeurOptimal system detects EEG patterns in real-time, reflecting certain changes in the brain's electrical activity and hemispheric locus, corresponding to development of attractor states. The dynamical interplay between these selected spectral targets (Time-frequency envelopes selected within the four frequency bands of the EEG spectrum: Theta; Alpha (SMR); Beta and Gamma) and their hemispheric expressions, are computed to identify the occurrence of relationships or features. Distortions in LRTCs are detected in real time, whenever the mathematically-transformed EEG signal reflects a transit through a complexity relationship, this

information is immediately fed back to the subject in the form of auditory or video interrupts, which sends continuous, real-time, positive and negative feedback signals to the brain.

The interrupts become a conscious cue to an otherwise unconscious event. An awareness develops as this information teaches the brain to *self-regulate endogenous brain rhythms*. Over time, behavioural adjustments are made. In contrast to operant conditioning, in dynamical neurofeedback, no conscious activity is demanded of the subject. This form of neurofeedback works especially well with compromised brains because it only provides information — it doesn't require a tired brain to do more than it can at any given time. Hence, when exposed to appropriate training, spontaneous cortical activity reveals a residual capacity for "self-tuning" its own temporal complexity, despite manifesting the abnormal dynamics. This training has been used to advantage in a wide variety of individuals with psychiatric disorders. As the brain acquires new information it makes new synaptic networks, restores previous connections and helps to revive prior functional capabilities. The advantage of this technique lies in the fact that no a-priori diagnosis or power relationships are assumed or required and once the electrodes are placed, NeurOptimal training results in normalization of power relationships in the EEG intrinsically, it no longer requires active therapist intervention during the course of the session.
A recent study (Alvarez 2014) reported a highly significant impact of NeurOptimal® training on post-chemotherapeutic cognitive impairment. NO training resulted in stress reduction, memory enhancement, sleep improvement and enhanced social interaction. This study showed objective improvements in several symptomatic areas that are parallel to PTSD: Stress and sleep recovery. These should be evaluated in this study, as well as potential improvements in PTSD clinical and symptomatic scores.

2.3 ADD

Neurofeedback proponents have proposed that it is EEG conditioning that produces changes in the neurological systems involved in attention (Loo, 2003; Loo & Barkley, 2005). No other treatment approach has been reported to demonstrate such generalization or maintenance effects (Leins et al., 2007; Pelham et al., 1998; van de Loo-Neus, Rommelse, & Buitelaar, 2011).
Given the average excess of theta and decreased beta activity observed in individuals with ADHD and anxiety, researchers and clinicians who treat patients with ADHD and anxiety disorder using NFB often focus on increasing the ratio of beta to theta power ("beta-theta up-training") using operant conditioning. NFB participants learn to produce the desired EEG brain waves and such conditioned EEG changes have been reported to be associated with improved or normalized symptoms of ADHD, Smartwood & O'Donnell, 1995; Monastra, Monastra, & George, 2002; Sherlin, Arns, & Lubar, 2010). Many studies have shown that it is associated with attention-directed early stage information processing (Bekisz & Wróbel, 2003; Deiber et al., 2007; Egner, 2004; Hale et al., 2010; Lansbergen, Martijn Arns, van Dongen-Boomsma, Spronk, & Buitelaar, 2011; Liang, Bressler, Ding, Truccolo, & Nakamura, 2002; Wróbel, 2000). More specifically, beta is hypothesized to be associated with mechanisms that regulate the early stage of sensory information selection by attention (Bekisz & Wróbel, 2003; Deiber et al., 2007; Wróbel, 2000). Consistent with this hypothesis, EEG activity in the beta band tracks specialised operations that place different demands on the left and right cerebral hemispheres; during

verbal tasks, more beta amplitude is observed in the left cerebral hemisphere and beta amplitude increases in the right hemisphere during non-verbal tasks (Ray & Cole, 1985; Schutter, Putman, Hermans, & van Honk, 2001).

Neuroimaging evidence also supports the hypothesis that NFB can normalize activity in the anterior cingulate cortex (ACC), a brain region involved with selective attention, in ADHD patients (Cannon, Lubar, & Congedo, 2007). For instance, ADHD patients show abnormal patterns of activation the ACC while performing tasks that place high demands on selective attention, such as the Counting Stroop task. ADHD patients who received NFB sessions normalized the activation levels measured (via functional magnetic resonance imaging) in the ACC during the Counting Stroop task (Beauregard & Lévesque, 2006; Lévesque, Beauregard, & Mensour, 2006). The International Society for Neurofeedback and Research (ISNR) estimates that 7,500 mental health professionals offer NFB as part of their practice and that more than 100,000 Americans used it over the first decade of this century (Ellison, 2010).

Whether ADHD and patients with anxiety or conduct disorder who receive NFB show improvement in their symptoms is not in question. The issue is whether or not it is the reinforced conditioning of EEG activity, per se, that is responsible for the changes in patients' symptoms. Previous studies by Vernon et al. (2005) and Ros et al. (2009) demonstrate that high functioning individuals can benefit from NFB training.

In the extensive therapist survey from a reported 2.96 million hours of client sessions, conducted by Zengar Institute (Zeitsmar et al. 2013), a greater than 40% response to NeurOptimal training in ADD/ADHD was reported to occur in 83% of clients after 20 or more sessions.

	NONE	1-10%	11-20%	21-30%	31-40%	41-50%	51-60%	61-70%	71-80%	81-90%	OVER 90%	>40% IMPROV
ADD/ADHD												
After 1-5 sessions	13%	41%	21%	13%	2%	2%	2%	3%	1%	1%	1%	10%
After 6-10 sessions	2%	8%	23%	18%	19%	16%	4%	4%	5%	1%	1%	30%
After 11-20 sessions	2%	4%	6%	8%	14%	23%	18%	12%	7%	4%	2%	67%
20+ sessions	2%	3%	2%	7%	3%	7%	8%	22%	20%	16%	10%	83%

2.4 PTSD

The prevailing hypothesis is that symptoms of PTSD are the result of disruptions in the mechanisms involved in the response to fear (Charney, 2004). The amygdala hyperactivity and ventro-medial prefrontal cortex (vmPFC) hypoactivity, which are markers of PTSD, would explain the difficulty for the vmPFC to regulate the response to the amygdala-induced fear (Milad et al., 2009; Shin & Liberzon, 2010). Recently, multiple studies of EEG power spectra on PTSD patients have revealed widespread anomalies relative to normal subjects in both power and in regional or in hemispheric origin. These are reflected as increased theta activity (4.5-7.5Hz) in parietal lobes and in frontal lobes. Frontal alpha power asymmetry, a biomarker derived from electroencephalography (EEG) recordings, has been plausibly linked to

neuropsychological abnormalities seen in PTSD. In neural connectivity analysis, PTSD patients also showed increase of alpha connectivity (8-12.5Hz) between the cortical areas.

In order to explore the possibility of treating PTSD with a non-painful emotional method and requiring little or no staff, our study aims to explore the clinical effectiveness of NeurOptimal NF training on PTSD subjects. This could be particularly appropriate in the case of Mentally Disordered Offenders, who are exposed to trauma and other causes of PTSD (aggression, motor-vehicle accidents, etc.).

The best current treatments for PTSD are EMDR (eye movement desensitization and reprocessing), cognitive and behavioral therapies, and prolonged exposure (Van Etten & Taylor, 1998; Bradley et al., 2005). However, in light of the recent EEG studies, Neuro-feedback (NF), designed to modulate or normalize brain EEG patterns, would appear a promising new avenue. Indeed, a recent study (Nicholson et al., 2016) showed that a single neurofeedback session could reduce EEG activity in the alpha band and increase connectivity of the amygdala with prefrontal structures in PTSD patients.

A very recent study entitled 'A Randomized Controlled Study of Neurofeedback for Chronic PTSD', showed comparable efficacy to the most effective evidence-based treatments for PTSD. The published neurofeedback technique (NF), administered 24 times over twelve weeks, showed a sustained reduction in the proportion of PTSD-defining symptoms in the study group by 72.7%, compared to a 32% reduction in a Wait-List Control group, both groups receiving standard psychotherapy (van der Kolk et al., 2016).

Thus, therapy by NF opens new perspectives in the treatment of PTSD, because if its effectiveness is further confirmed, it would reduce PTSD-defining symptoms, without the subjects being obliged to revive their traumas as in the current therapies (EMDR, prolonged exposure, cognitive and behavioral therapies). In addition, with recent advancement coming from knowledge of Brain-Computer Interface techniques, such as used in the NeurOptimal system, there is no training of specific frequency relationships. There are no published studies on NeurOptimal training in PTSD patients, but extensive practitioner survey reports by Zengar Institute and presentations have strongly attested to its clinical benefits, with >40% improvement in 82% of patient self-reports after 20+ sessions.

	NONE	1-10%	11-20%	21-30%	31-40%	41-50%	51-60%	61-70%	71-80%	81-90%	OVER 90%	>40% IMPROV
POST TRAUMATIC STRESS DISORDER (PTSD)												
After 1-5 sessions	6%	27%	29%	17%	6%	2%	2%	5%	2%	4%	0%	16%
After 6-10 sessions	2%	6%	16%	20%	15%	17%	12%	2%	4%	4%	2%	41%
After 11-20 sessions	1%	0%	7%	15%	11%	15%	15%	18%	12%	0%	7%	66%
20+ sessions	0%	3%	3%	8%	4%	7%	13%	13%	24%	11%	15%	82%

2.5 Measurement Instruments

For ADD, the instrument is most commonly used is the TOVA. We will also use the Mindful Attention and Awareness Scale (MAAS). We also include the NeurOptimal® Check-list of Symptoms.

For PTSD, the choice of the questionnaires covers the content that is described in the DSM-V classification: Criteria A-H for the Detection and Clinical Diagnosis of PTSD and are responsive to a PTSD therapeutic intervention, eg van der Kolk 2016 pilot study. The Maudsley Violence Questionnaire measures intrinsically held beliefs in the Machismo and the Acceptance components of violence. In a comparison study between offenders and matched non-offenders, Machismo was robustly associated with self-reported and officially recorded violence with large statistically significant differences between offender and non-offender adults. Bowes (2013).

PTSD DSM-V Category Symptoms	Questionnaires used in van der Kolk study	Proposed HMP Questionnaires
Criterion A: Experiencing a Traumatic Event	Traumatic Events Screening Inventory, DTS	Trauma Symptoms Inventory
Criterion B: Intrusion or Re-experiencing a traumatic event	Davidson Trauma Scale (DTS)	Trauma Symptoms Inventory
Criterion C: Avoidant symptoms	Clinician Administered PTSD (CAPS)	BAI
Criterion D: Negative alterations in mood or cognition	Inventory of Altered Self-Capacities (IASC)	
Criterion E: Increased arousal symptoms	CAPS	Maudsley Violence Questionnaire (MSQ).
Criteria F, G and H: Dis-association & Severity descriptors	CAPS, DTS, IASC	BDI
ADD		TOVA, MAAS

3. STUDY DESIGN

The study design will be a randomized waiting list vs active training trial. Participants will be selected according to their willingness to voluntarily participate and a triage of their clinical symptoms as described in Section 4.0 and absence of Exclusion Criteria. The participants will be randomly assigned to the active training group or the waiting-list control group. The study will embody a total of 20 neurofeedback sessions, on a schedule of 2 sessions per week, no less than 1 session per week. Prior to the first neurofeedback session participants complete a survey that assess symptoms to be used as a base score for each inventory category. Participants in the study sit in a comfortable, relaxed environment for approximately 35 minutes watching patterns displayed on a video screen and listening to a musical composition. Both groups will have the same musical score. The active neurofeedback protocol is entirely dependent on the patterns observed during the course of the session. No frequency response data from previous sessions are incorporated in subsequent sessions. The system will dynamically adapt to response changes during a training session, by setting the triggering limits to greater or lesser stringency. It is entirely autonomous once the electrodes are placed and the initial eyes open/eyes shut component is completed. They are primed to think about and notice their symptoms as described by a Client Assessment questionnaire that is given before each session.

4. SELECTION AND ENROLLMENT OF PARTICIPANTS

4.1 Inclusion Criteria

Participants must meet all of the inclusion criteria listed below to participate in this study.

- Male and female patients aged 18 to 65.
- Diagnosed with a PSTD, mental disorder or disability of mind (as listed on the DSM IV)
- Has an history of conduct disorder and must have scores consistent with the Maudsley Violence Questionnaire (MVQ).
- ADHD participants must have a previous diagnosis of ADHD (inattentive or mixed type) by a licensed psychologist or psychiatrist and must have TOVA scores consistent with ADHD (Leark, Greenberg, Kindschi, Dupy, and Hughes, 2007)
- History of emotional dysregulation
- Patients with a history of Depression and Anxiety with a previous diagnosis and must have Beck Depression Inventory II (19 or above) or Beck Anxiety Inventory (20 or above) scores consistent with those diagnosis

4.2 Exclusion Criteria

All candidates meeting any of the following exclusion criteria at baseline will be excluded from study participation*:*

- All those that do not fit the above criteria.

- A history of seizures.
- Known neurological disorders.
- Current drug or alcohol use or dependence that, in the opinion of the site investigator, would interfere with adherence to study requirements.
- Inability or unwillingness of individual to give written informed consent.

5. STUDY INTERVENTIONS

5.1 Interventions, Administration, and Duration

When participants arrive for each of sessions 2-20 they will complete a brief questionnaire about their attention, mood, energy levels, and sleep since the previous visit.
The questions will be asked by the study personnel to confirm that the positive or negative effects do not appear to result from other causes such as excessive caffeine, alcohol use or significant life changes.

Then the EEG sensors will be positioned and checked to confirm that they are functioning properly and neurofeedback sessions lasting approximately 35 minutes will be carried out.

Participants will complete the relevant psychometric measure.

Each subject is assigned a unique login credential that is entered on the computer login page prior to each neurofeedback session and the computer will deliver true neurofeedback such that neither the research subject nor the neurofeedback technician can know the group assignment (see above). Only the Independent Monitor will be able to access the file that will contain the subject assignments and it will be stored in a file cabinet in her office.

5.2 Concomitant Interventions

Participants will not be required to alter their medications of therapy interventions

5.3 Adherence Assessment

Adherence will be defined as completion of 22 of the 24 scheduled neurofeedback sessions. Adherence will be assessed by referral to records of neurofeedback sessions.

6. PARTICIPANT RIGHTS AND CONFIDENTIALITY

6.1 Ethical Committee This protocol and the informed consent document (available on request) and any subsequent modifications will be reviewed and approved by Cambridgeshire and Peterborough NHS Foundation Trust Committee responsible for oversight of the study.

6.2 Informed Consent Forms

Written informed consent will be obtained from each subject at entry into the study. Informed consent is obtained by the following process:

- The subject will be asked to review the study consent form;

- The PI or Co-Investigator (Co-I) will meet with the subject to review the form, to confirm the subject's understanding of the study, and to answer any questions that the subject might have; and
- Once the subject demonstrates understanding of the study and agrees to participate in the study, the consent will be signed in the presence of the PI (or Co-I) and a witness.

All participants will patients, at least 18 years old, and able to read and write. The consent form will describe the purpose of the study, the procedures to be followed, and the risks and benefits of participation. A copy will be given to each participant and this fact will be documented in the participant's record.

6.3 Participant Confidentiality

Participant's confidentiality will be maintained according to the Ethical procedures. Electronic data will be stored on a central computer. All paper documents will be locked in file cabinets in the laboratory. Original source data will be retained for a minimum of five years after publication of study results.

Any data, forms, reports, and other records that leave the site will be identified only by a participant identification number to maintain confidentiality. All records will be kept in a locked file cabinet. Information will not be released without written permission of the participant.

Confidentiality during Reporting - Each report will only include the identification code.

7. STUDY PROCEDURES

Informed Consent Form
Demographics
DSM-IV Checklist

Beck Depression Inventory
Beck Anxiety Inventory
TSI (Trauma Symptoms Inventory)
Maudsley Violence Questionnaire (MSQ).
Mindful Attention and Awareness Scale
TOVA
Psychiatric Interview & History
Current Medications
Inclusion/Exclusion Criteria

EEG & Continuous Performance Task
Treatment Administration Form

Appendix I: What is Neurofeedback?

Neurofeedback, a form of biofeedback, begins with measuring electrical activity in the brain via a non-invasive EEG. We analyses that information and programs a training goal into a computer, which then runs a video game for the participant to play. The goal of the game might be for the brain to speed up, in the case of someone who is depressed, or to operate more slowly, if the person suffers from anxiety.
In this way the brain learns how to more easily and more frequently operate at the more desirable level. When that occurs, many bothersome symptoms caused by the formerly dysregulated brain dissipate.
Changes in the EEG due to feedback tend to correlate with improved behavior, mood and attention. Additionally, these changes often result in reduced reliance on medications or allow medications that weren't working well to work better.
Common conditions that often get significant relief from Neurofeedback are the following

- ADD/ADHD
- Depression
- Violence
- Addiction
- PTSD
- Sleep Disorders
- Anxiety, Obsessive Thinking
- Panic Attacks, Migraines
- Learning Difficulties
- Autism/Aspergers,
- Bipolar Disorder
- Traumatic Brain Injury.

All of the above conditions have at least one thing in common — a dysregulated brain. When the brain is not functioning properly a host of symptoms can arise. If brainwave patterns are running too fast, too slow, or are not communicating with each other properly, this will have a corresponding negative effect on cognitive function, moods, behavior, sleep and a variety of other human functions.
In order to provide relief for such a variety of issues, multiple areas of the brain may have to be targeted for training. The training is customized according to each person's needs.

For example:

Training the temporal lobes: helps positively affect emotional regulation.
Training the frontal lobe: aids with depression, mood and affect.
Pre-frontal lobe training: enhances attention, organizational skills, and executive function.
Parietal lobe Training: assists the body with relaxation, learning how to be calm, and sensory integration.

After brain training, clients who previously struggled with brain dysregulation are often pleasantly surprised to discover they are able to accomplish more with less effort. When their brains perform better, they perform better — symptoms diminish or disappear. Overall, they experience a greater sense of happiness and well-being.
For example:

- Depression often shows up in brain imaging studies as too little activation in the left frontal lobe. By encouraging more activity over that area, depressive symptoms often decline.
- Problems falling asleep can often be improved by training for calmness over the right hemisphere's central motor strip.

Appendix II: References:

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