Visual Concentration Attention Therapy plus Cranial Magnetic Therapy (VCAT+CMT-Headset) is a non- invasive and non-electric induced Magnetic Field Producer for enhancement of Co-Occurring Psychological/Psychiatric Disorders such as Depression, Anxiety, ADHD, and Substance and or Alcohol Addiction

Abstract

Visual Concentration Attention Therapy Plus Cranial Magnetic Therapy (VCAT+CMT) is making progress as a new noninvasive and non-electric induced method of regional brain stimulator to improve symptoms of co-occurring psychological/Psychiatric disorders such as depression, anxiety, Attention Deficit Hyper Activity Disorder (ADHD), and or Substance and or Alcohol Addiction. This multi-center clinical research of 4 weeks with a 6 months follow up results used a quantitative, open label randomized controlled study design in which subjects in the study participated voluntary in an in- home 5 days a week 20 minutes intervention of non- electric induced and non- invasive VCAT+CMT therapy. The paired of magnetic field principles of CMT with non-invasive neuropathway therapy (VCAT; Siahdohoni, 2011; 2007) has shown to significantly improve and or eliminate symptoms of ADHD, depression, anxiety, and the urge of using drugs and or alcohol in adults with a dual diagnosis of these co-occurring disorders with each other. The headset device of CMT was identical to the active and FDA cleared Fisher Wallace Stimulator, FDA approved and or cleared Transcranial Magnetic Stimulation (TMS), Repeated TMS (rTMS), and the Transcranial Direct Current Stimulation (tDCS) devices, except CMT-Headset did not induce an external electrical current to the brain instate it empowered and expanded brain's naturally reinforced electromagnetic field stimulated by non-invasive VCAT and VCAT's systematic Self-Stimulatory Methodology (VCATSSM) to recuperate and balance the brain functioning system (Siahdohoni). The social change implications are the value of a non-pharmaceutical intervention for ADHD, depression, anxiety, and substance and alcohol addiction particularly in terms of no drug side effects, reduced health care costs, and improved quality of life for those suffering from these co-occurring disorders, who are not responding well to medications and or psychotherapy.

Introduction to the Study

According to National Survey on Drug Use and Health (NSDUH, 2014), an estimated 43.6 million (18.1%) Americans ages from 18 and up have experienced some form of mental disorders and substance abuse. The NSDUH conducted survey from 2013 shows 20.2 million adults (8.4%) were diagnosed with substance and alcohol abuse of which 7.9 million were carrying both mental illness and substance use disorders (dual diagnosis) as the co-occurring disorders. Additionally, anxiety, depression, and Attention Deficit Hyperactivity Disorder (ADHD) are reported to be the most common type of mental disorders that frequently co-occur with each other and with substance use (Substance Abuse and Mental Health Services Administration, 2014).

Attention Deficit Hyperactivity Disorder (ADHD) is neurobehavioral developmental disorder that is most often diagnosed during childhood, marked by the core symptoms of inattention, hyperactivity, and impulsivity which is carried on to the adulthood (Mannuzza, Klein, Bonagura, Malloy, Giampino, and Addalli, 2010). According to Merikangas, et al. (2010), ADHD is not only a childhood disorder and as matter effect the disorder affects an estimated 4.4% of adults in the US. Although the disorder has a prevalence of 3–9% in the general childhood population and 1–5% in the general adult population, it affects between 11 and 35% of "substance-abusing" adults, which often times is intertwined with depression and anxiety (Kandel, Chen, Warner, 1997). The ADHD has been accounted as the risk factor for substance abuse and psychiatric comorbidity increases this risk (Biederman, 1998). Adults with ADHD start using substances at a younger age and are prone to psychiatric disorders specifically depression and anxiety compared to their peers without ADHD (Biederman , Petty, Wilens, 2008). Furthermore, according to Wilens and Spencer (2010), studies incorporating structured psychiatric diagnostic interviews assessing ADHD,

depression, and anxiety disorders in substance abusing adults have shown significantly high comorbidity between such disorders and addiction within this group of population.

Current and previous research indicates that therapies using TMS and other magnetic field induced devices including non-electric conducted devices such as "CMT-Headset" would affect the brain's functioning system by enhancing its neural activities and related neurotransmitters leading to improvement of depression and anxiety disorders. However, there is a gap in those research about whether enhancing brain's neural activity using the non-electric induced magnetic field coming direct from the magnetic coil (main principle of TMS) placed over the head (frontal and parietal cortex) combined with brain's natural electromagnetic field coming from within the brain itself stimulated by external non-invasive visual field stimulator (VCAT) would play a role in improvement of depression, anxiety, ADHD and reduce or eliminate the regular use of drugs and alcohol. Therefore, the purpose of the proposed research is to compare the effectiveness of VCAT+ CMT neuromagnet stimulator to other similar noninvasive CMT devises that are already cleared by FDA and test it's efficacy in participants who are presenting co-occurring symptoms of ADHD, depression, and anxiety with substance and alcohol addiction and or with each other.

Background of the Study

Substance Abuse, ADHD, depression and Anxiety as A Co-occurring Condition

An individual is diagnosed with a dual diagnosis when he or she has both a mental disorder and an addiction (Slesnick, Kaminer, & Kelly, 2008). A Dual Diagnosis can be made up of any combination of a mental disorder (anxiety, depression, bipolar disorder) and addiction (drugs, alcohol, sex, gambling). As reported by Journal of Clinical Psychiatry, one in three adults who

struggle with alcohol or drug abuse also suffer from ADHD, depression and or anxiety. Individuals with ADHD and or substance and alcohol addiction who also have a mental illness are said to have a co-occurring condition, or carry a dual diagnosis. Co-occurring conditions are often very difficult to diagnose since these two conditions are entwined within one another, making it difficult to determine which condition is causing each symptom (Wilens, & Spencer, 2010).

Often times Attention Deficit Hyper Activity Disorder (ADHD) develops substance abuse, which frequently leads to psychiatric problems such as depression and anxiety (Katusic, Barbaresi, Colligan, Weaver, Leibson, Jacobsen, 2005). According to the study conducted by Merikangas, He, Burstein, 2010), the presence of psychiatric disorder is also a risk factor for substance abuse and or ADHD. Other studies have shown a strong connection between ADHD, drug abuse, and alcoholism as well. As reported by Mannuzza et al., (2010), ADHD is five to 10 times more common among adult alcoholics than it is in people without the condition. Among adults being treated for alcohol and substance abuse, the rate of ADHD is about much higher.

People often use drugs and alcohol as a relief to their depressive and or anxious feelings and to escape their negative emotions (Lambert, & Hartsough, 2008). The regular use of drugs and alcohol will soon turn into full-blown addiction as they continue ineffectively to self-medicate. The co-occurring ADHD, depression, anxiety, and substance abuse feed into each other, and one condition will often make the other worse. As emphasized by Wilens and Spencer (2010), if individuals have been using alcohol and or drugs for years to depress their symptoms, they may find that those symptoms rise to the surface in sobriety, which is why it's so important to receive integrated treatment for both psychological induced symptoms and substance abuse at the same time. Thus, without treating ADHD, mental and psychological symptoms that drives addiction, or

vice versa, more likely individuals will go back to the addictive behaviors or to experience the return of the related psychological symptoms. In many cases, individuals with co-occurring condition and substance abuse drop out of conventional rehab programs because sobriety is too much to handle their symptoms without the right level of therapeutic support (Wilens & Spencer).

Exploring Brain's Chemical Imbalance Basis of the Relationship between ADHD, Depression, Anxiety and Substance and Alcohol Abuse

Current and previous studies have identified the dopamine transmission as the central source to current models of both ADHD and substance abuse (Volkow, Wang, Fowler, & Ding, 2005). Subjects with ADHD were compared with unaffected control subjects, shown to have greater dopamine transporter density, which may result in rapid clearance and low levels of synaptic dopamine (Volkow, Wang, Fowler, & Ding). Abusing drugs such as cocaine, amphetamine, methamphetamine, Ecstasy, nicotine, alcohol, opiates, and marijuana, all increase synaptic dopamine concentrations, most notably in the brain's reward center, the nucleus accumbens (Kalivas, Volkow , 2005). Stimulant medications manage ADHD symptoms by increasing synaptic dopamine concentrations in the striatum (which includes the nucleus accumbens) via presynaptic transporters (Cavacuiti, 2001). Theoretically, some individuals with ADHD may use substances to increase synaptic dopamine concentrations as a form of self-medication (Wilens, Adamson, Sgambati et al., 2007).

Alcohol affects the information-processing capacities of the brain including motor control, which is sub served by the primary/supplementary motor areas, the basal ganglia, and the cerebellum (e.g., Bjork & Gilman, 2014). Alcohol also affects the motivational processes, mediated by the ventral striatum and the nucleus accumbens, and a host of executive functions supported by

the dorsolateral prefrontal cortex (DLPFC) and the anterior cingulate cortex (Bjork & Gilman). Alcohol reliably impairs basic executive functions like attentional control, motor control, working memory, and inhibitory control (Zoethout, Delgado, Ippel, Dahan, & van Gerven, 2011).

As reported by Edwards and Kendler, (2012), when there is a dysfunction in the "brain reward cascade," especially in the dopamine system, causing a low or hypo-dopaminergic trait, the brain may require dopamine for individuals to avoid unpleasant feelings. This high-risk genetic trait leads to multiple drug-seeking behaviors, because the drugs activate release of dopamine, which can diminish abnormal cravings. The nature of addiction is frequently debated as either a personal ''lifestyle choice'' or a ''biological vulnerability.'' Current evidence shows that most drugs of abuse exert their initial reinforcing effects by activating reward circuits in the brain and that, while initial drug experimentation is largely a voluntary behavior, continued drug use impairs brain function by interfering with the capacity to exert self-control over drug-taking behaviors and rendering the brain more sensitive to stress and negative moods (Edwards & Kendler). Indeed, individuals with genetic vulnerabilities, exposed to chronic stress, or suffering from comorbid psychiatric conditions, as well as those who abused drugs during early adolescence, are at greater risk of transitioning into the automatic and compulsive behaviors that characterize addiction (Wise, 2008). According to Wise, Dopamine (DA) neurons located in the ventral tegmental area (VTA) and projecting to the nucleus accumbens (NAc) play a key role in the processing of reward-related stimuli, including those associated with drugs of abuse.

According to Mansvelder (2014), dopamine is released, and then picked up by nerve cells. When drugs, like meth, are introduced to the system, they block this absorption, increasing availability of dopamine and amplifying the pleasure signals a thousand times over. This increase

doesn't pass by unnoticed. The brain takes note of the experience and through a process known as incentive sensitization, develops sensitivity to the substance, leading to a rapid release of dopamine in subsequent uses. It is the first step in physical dependency, leading to strong cravings for the drug.

The Interaction between Frontal Cortex, Limbic System, and Parietal Cortex in individuals with Depression, Anxiety, ADHD and Addiction

As it is already established previously in this study ADHD with substance and alcohol abuse can alter the way people think, feel, and behave by disrupting neurotransmissions proper functioning. Many scientific studies conducted over decades have established that drug dependence and ADHD affect frontal cortex and limbic system the most (Kalivas & Volkow, 2005). According to Kalivas and Volkow, frontal cortex and the limbic system together play an important role in depression, anxiety, and cognitive deterioration caused by ADHD and or drugs' cumulative impacts on neurotransmissions such as dopamine and serotonin (Figure7). For example, as reported by Cannistraro & Rauch, 2003), one important set of connections for people with chronic depression and or anxiety is the connection between key areas of the limbic system and the prefrontal cortex (Figure7.2). It appears that depression and anxiety associated with significant alterations in functioning in both of these areas. This is where most of the brain cells that contain dopamine, norepinephrine, and serotonin are located and most of the medications that are used to treat these disorders primarily affect those brain cells (Strakowski, DelBello, & Adler, 2005; Biederman & Faraone, 2005).

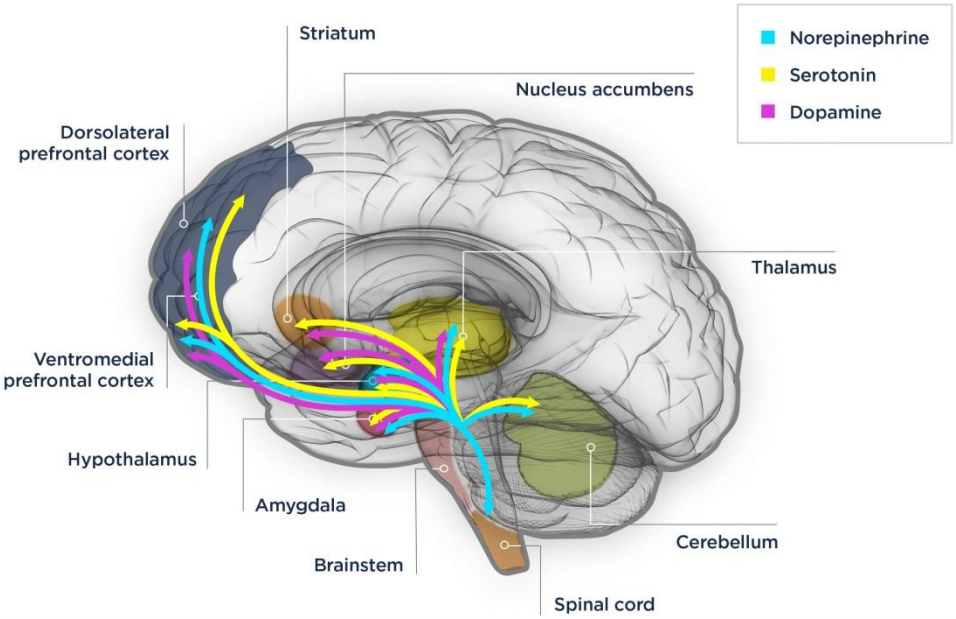

Figure7.2

In summary, functional imaging and wider cognitive neuroscience literature, research and studies conducted on ADHD, addiction, and interrelated psychological disorders such as depression and anxiety have identified abnormalities in frontal cortex, limbic system, and parietal cortex (Biederman & Faraone). These brain regions are normally involved in attention, cognition, executive function, motor control, response inhibition, working memory, and/or reward/motivation. Furthermore, as reported by Berman and Colby (2008), together these regions also comprise the main components of the cingulo-fronto-parietal (CFP) cognitive–attention network that along with the striatum, premotor areas, thalamus, and possibly cerebellum, which have been identified as nodes within parallel networks of attention and cognition that are very much involved with ADHD, substance abuse and psychiatric disorder such as depression and anxiety (Berman & Colby, 2008; Cabeza & Nyberg, 2000).

Brain Lobes	Dominant Neurotransmitters	Note
Frontal	Dopamine	ADD, Depression, Anxiety, Cognition, and Addiction
Parietal	Acetylcholine	Memory, Attention, Learning, ADHD
Occipital	Serotonin	Mood regulation, Addiction

Figure7. In individuals with co-occurring psychological/Psychiatric disorders such as depression, Anxiety, ADHD, and or Substance and or Alcohol Addiction, an imbalance develops in the neural circuits that link the prefrontal and parietal cortex with the limbic system.

Statement of the Problem

A main objective of the current study is to contribute to the growing body of research demonstrating effectiveness of Transcortical magnetic field stimulation therapy in treating various psychiatric conditions such as ADHD, depression, and anxiety disorders combined with substance and alcohol abuse that did not responded to medication and or psychotherapy. One example of this research is the use of a non-invasive and non-electric Cranial Magnetic Therapy (CMT) device (Headset) in remediating the effects of various psychiatric disorders by balancing and improving brain's chemicals and neurotransmitters within the brain system (Wassermannn & Lisanby, 2001). Similar to CMT the Transcranial Magnetic Stimulation (TMS) therapy is one strategy that has only recently started to be promoted within clinical psychology. Specifically, practitioners are now beginning to examine the practice of TMS and magnet stimulation therapies such as CMT as an effective clinical intervention (Wassermannn & Lisanby). Magnet stimulation therapy similar to CMT is a process that involves neurostimulation and neuromodulation technique, based on the principle of electromagnetic induction of an electric field in the brain (Ridding & Rothwell, 2007). Magnetic field stimulates areas of the brain which control mood such as prefrontal cortex, parietal

cortex, and limbic system that are thought to be underactive in people with ADHD, substance and alcohol addiction, depression and or anxiety disorders (Ridding & Rothwell).

Purpose of the Study

In the recent years has been a substantial increase in use of Magnetic Field Stimulation (MFS) such TMS and CMT to study cognition, brain-behavior relations and the pathophysiology of various neurologic and psychiatric disorders (Devlin & Watkins, 2007). In addition, studies have shown MFS effectiveness in modulating brain activity in a specific, distributed, cortico-subcortical network so as to induce controlled and controllable manipulations in behavior (Rossini & Rossi, 2007).

This research aims to introduce a wearable brain magnetic field stimulator device (headband/headset) that has the potential to expand the brain components' functioning systems to a higher level of activity. The CMT-Heaset is a non-invasive and non-electric induced Transcranial Magnetic Stimulation (TMS) like device that utilizes 13000 to 13500 gauss (10,000 gauss equals 1 tesla) magnetic field to energize the localized brain's neural networks that are stimulated through VCAT and VCATSSM (Siahdohoni, 2011) based on theory of Magnetic Field (MF) stimulation and 10/20 international system. Using VCAT with CMT-Headset is believed to improve brain function by producing higher activity and plasticity, better blood flow throughout the brain tissue, restoration, and the regeneration of neurons. It optimizes brainwave patterns that increase cognitive abilities and trains the brain to produce these activities on its own. Improved brain activities lead to mental clarity helping the brain discharge and balance needed neurotransmitters to the stimulated region of the brain. These are the very mechanisms that underlie addiction, ADHD, and

psychiatric/psychological disorders such as depression and anxiety, which could be improved through the use of the non-invasive and non-electric, induced CMT-Headset.

There would be a major impact on thousands of adults with co-occurring and dual diagnosis of psychiatric disorders such as depression and anxiety, ADHD, and substance and alcohol addiction if the results of this study are found to be significant. Adults with such co-occurring disorders would have the option of selecting a non-electric, noninvasive, low-cost, and drug-free intervention that could remediate the brains functioning system and its chemicals influencing their everyday lives. Furthermore, the improvements generated in the ability to improve ADHD related symptoms, eliminating the substance use, and taking control over the symptoms of depression and anxiety would greatly increase the individual's productivity, performance, and the quality of their lives. This study would also be a major contribution to the body of research on non-electric and non-invasive MFS therapy. An increased knowledge base including the examination of the efficacy of a CMT-Headset could potentially result in greater funding pertaining to the value of CMT within other areas of psychopathology and addiction.

Nature of the Study

This study may establish that reinforcing the brain's natural within cells (neurons) generated electrical discharges through magnetic field (MF) using a non-invasive and non-electric wearable TMS like device (CMT-Headset) could lead to a possible treatment of individuals with co-occurring and/or dual diagnosis with ADHD, substance and alcohol addiction as well as interrelated neural and psychological disorders such as depression and anxiety. While other studies have already asserted the efficiency of such devices (MFS) in treatment or reducing psychiatric disorders by stimulating brain's neural networks, the goal of this research remains to investigate the outcomes of

the non-invasive and non-electric CMT-Headset on ADHD, drug and alcohol addiction along with interrelated psychiatric/psychological disorders such as anxiety and depression.

Research Questions and Hypotheses

The following hypotheses will be tested in this study:

Null Hypothesis One: There will be no short-term and or long-term positive changes in Sobriety from alcohol and substance abuse, ADHD, depression and anxiety among adults diagnosed with a dual diagnosis and co-occurring disorders participating in a 4 weeks five days a week CMT-Headset as measured by the Goldberg Depression Scale (GDS) for depression, Hamilton Anxiety Scale (HAS)for anxiety, Wender Utah ADHD Rating Scale (WURS)for ADD/H, Michigan Alcohol Screening Test (MAST), and the Drug Abuse Screening Test (DAST) for alcohol and substance abuse using CMT-Headset device along with VCAT and VCATSSM.

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Null Hypothesis Two: There will be no positive long term effect in Sobriety from alcohol and substance abuse, ADHD, depression and anxiety among adults diagnosed with a dual diagnosis and co-occurring disorders after a 6months follow up assessment compared to posttest week4

participating in a 4 weeks five days a week CMT-Headset as measured by the Goldberg Depression Scale (GDS) for depression, Hamilton Anxiety Scale (HAS)for anxiety, Wender Utah ADHD Rating Scale (WURS)for ADD/H, Michigan Alcohol Screening Test (MAST), and the Drug Abuse Screening Test (DAST) for alcohol and substance abuse using CMT-Headset device along with VCAT and VCATSSM.

Research Hypothesis Two: There will be no positive long term effect in Sobriety from alcohol and substance abuse, ADHD, depression and anxiety among adults diagnosed with a dual diagnosis and co-occurring disorders after a 6months follow up assessment compared to posttest week4 participating in a 4 weeks five days a week CMT-Headset as measured by the Goldberg Depression Scale (GDS) for depression, Hamilton Anxiety Scale (HAS)for anxiety, Wender Utah ADHD Rating Scale (WURS)for ADD/H, Michigan Alcohol Screening Test (MAST), and the Drug Abuse Screening Test (DAST) for alcohol and substance abuse using CMT-Headset device along with VCAT and VCATSSM.

Assumptions of the Study

As previously revealed psychological/psychiatric disorders such as depression and anxiety in adults with ADHD and or substance and alcohol abuse or dual diagnosis of addiction in adults with ADHD, depression, and anxiety frequently co-occur with each other. Additionally we also cited that the core component of these co-occurring disorders often relates to the brain's neural network dysfunction and chemical imbalance in the areas of prefrontal and parietal cortex as well as limbic system deep in the brain (Strakowski, DelBello, & Adler, 2005; Biederman & Faraone, 2005; Zoethout, Delgado, Ippel, Dahan, & van Gerven, 2011). Furthermore, we presented in this research the effectiveness of Cranial Magnetic Therapy (CMT) Headset in treating of psychiatric

disorders such as depression and anxiety as well as addiction by improving the activities of brain's neural networks and the discharge of certain neurotransmitters in the specific areas of the brain (Wassermannn & Lisanby, 2001; Ridding & Rothwell, 2007). Thus, it is assumed in this research that if such neural network dysfunction and chemical imbalance among adults with either co-occurring disorders of depression, anxiety, ADHD and substance and alcohol addiction is treated with CMT-Headset using VCAT and VCATSSM, many fewer people would continue suffering from any of the mentioned co-occurring disorders. We also assume that the selection of participants will be based on an accurate medical history, neurological functioning and psychosocial factors that contribute to the clinical presentation. In addition, it is significant assumption to this study that adults with depression, anxiety, ADHD, and or substance and alcohol addiction will have the ability to practice visual field and mental brain exercises successfully.

The reliability of the study will be ensured by the use of standardized test procedures together with the well-establish reliability of the Goldberg Depression Scale (GDS), Hamilton Anxiety Scale (HAS), Wender Utah ADHD Rating Scale (WURS), Michigan Alcohol Screening Test (MAST), and the Drug Abuse Screening Test (DAST).

Limitations of the Study

Having an inaccurate dual diagnosis of depression, anxiety, ADHD, and substance and alcohol addiction within the sample population would be the most significant limitation to the study. Although the DSM-IV (APA, 1994) criteria will be used in the initial diagnosis, many researchers and practitioners still question its validity in appropriately diagnosing adults with co-occurring psychological disorders with ADHD and substance and alcohol addiction and with each other. Other variables including age, demographics, and intelligence will be controlled in the study.

Significance of the Review

This study will consider the use of a magnetic field stimulator/producer (CMT-Headset) based upon Transcortical Magnetic Stimulation (TMS) therapies and examine its efficacy within a clinical context. Visual Concentration Attention Therapy plus Cortical Magnetic Therapy (CMT-Headset) is the device that will be investigated, as a non-medication, noninvasive, and a nonelectric neuro cranial magnetic stimulator/producer device to treat problems with sustained attention, concentration, and memory (basis for ADHD) and being able to stay sober (clear from alcohol and substances) including improvement on the associated psychiatric disorders such as depression, anxiety in adults diagnosed with such co-occurring disorders. This study (effectiveness of CMT-Headset) is particularly important because it will be the first non-invasive and non-electric device to use magnetic field stimulation (MFS) part of TMS therapy and visual field brain stimulation methodology such as VCAT and its self-stimulatory brain training in adult population with dual diagnosis of psychiatric disorders such as depression and anxiety combined with ADHD and or drug and alcohol addiction. Given the growing evidence regarding the neurological role in all mental disorders, stimulating the brains' neural networks may help to alleviate many of the mental disorders that are related to poor neural functioning in ADHD (Barkley, 1998) and substance abuse (McClure, 2015) as well as brain chemical imbalance which may be leading source for depression and or anxiety (Kavirajan, 2014). Treatment methodologies such as CMT have the potential to improve neural function and recovery from such disorders. The results of this study would certainly

have great relevance for a variety of fields, such as clinical psychology, education, neurocognitive science, psychopathology, as well as alternative and complementary therapies.

In support of assessing the hypothetical relationship between CMT, magnetic field, and brains' neural activities, related neurotransmitters, and cognitive and psychological consequences related to co-occurring disorders such as ADHD, depression, anxiety, and drug and alcohol addiction a detailed review of brain's neural pathology, clinical, and psychological literature will be presented. The literature review will also discuss in detail hypotheses regarding the effect of CMT-Headset, a Trancortical Magnetic Stimulation (TMS) device, and Magnetic Field (MF) to the brain and its neural network. The objective here is to proceed toward developing a study or research design that explains any significance concerns regarding CMT-Headset in relevance to treatment of co-occurring symptoms of depression, anxiety, ADHD, and addiction in adult population with a dual diagnosis. The search for provided literature was conducted through electronic databases PsycINFO, PsycARTICLES, Eric, Mental Measurements Year Book, the International, and Academic Search Premier. Using the key words co-occurring disorders, dual diagnosis, ADHD, sustained attention, ADHD and neurotransmitters, ADHD and brain functioning, ADHD and drug and alcohol addiction, substance abuse and brain's neural activities, Neurotransmitters involved with ADHD and addiction, psychological and psychiatric disorders associated with ADHD and drug and alcohol addition, depression and anxiety associated with ADHD and drug and alcohol addiction, chemical imbalance associated with ADHD and drug and alcohol addiction, cognitive therapy, TMS therapy, magnet therapy, magnetic field and its effect on brains neural activity, effects of external attentional stimulus to the brain and its neural activities, and last but not least ADHD and drug and alcohol related symptoms. The chosen scientific articles were published within

the last 10 years prior to year 2008. Some older articles were also considered based on their importance to the topic of the study.

Summary and Transition

The importance of high comorbidity rates, developmental patterns, and mutual maintenance between co-occurring ADHD, depression, anxiety, and substance use disorders is underscored by the clinical impact of these disorders pairings. Considering the mutual maintenance pattern of this comorbidity, it is not surprising that these co-occurring disorders with one another impact the course and treatment outcome for the counterpart condition. Studies have shown that such co-occurring disorders are related to an increased severity of lifetime mental health and substance and alcohol use disorders, increased lifetime service utilization among individuals with such co-occurring disorder, increased severity of substance and alcohol withdrawal, and higher relapse rates following substance abuse treatment (Wilens & Morrison, 2012). Thus, taken together, these collective findings highlight the importance of finding new and innovative approaches such as the non-invasive and non-electric induced cranial magnetic field stimulator (CMT-Headset) with VCAT and VCATSSM to treat individuals with co-occurring disorder of ADHD, depression, anxiety and substance and alcohol use disorders.

Literature Review

Transcranial Magnetic Stimulation (TMS) as an effective Magnetic Brain Stimulation Therapy

Overview

There is a strong relationship between magnetic field and brain. A technology known as Transcranial Magnetic Stimulation (TMS) can therapeutically alter activity in the brain by creating a magnetic field that produces a mild electrical current in the targeted brain region. Small amounts of electricity are naturally generated by neuronal connections, so any new electrical input can change these connections. According to the recent studies magnetic brain stimulation therapies can play a role in treating certain mental disorders (Mischoulon, 2015). Brain stimulation therapies involve activating or inhibiting the brain directly with electricity, which could be induced by Magnetic Field (MF) applied to the head. While magnet therapy is less frequently used than medication and psychotherapies, they hold promise for treating certain mental disorders that do not respond to other treatments (Mischoulon). Based on the principle of electromagnetic induction and magnetic field theories TMS modulates the brain's electrical environment using magnetic fields passing through the scalp and skull. These fields are produced by passing rapidly alternating electrical currents through a coil with a ferromagnetic core (ie, an electromagnet in lieu of a permanent magnet). The magnetic field strength produced by TMS varies from 1.5 to 3 T and is comparable to an MRI device, except that it focuses on a limited area of the cortex using a circular, conical, or helmet-like coil design (O'Reardon, Solvason, Janicak, et al., 2007).

Introduction

According to Mischoulon, TMS as an advanced electromagnets alter the activity of targeted brain regions by inducing a localized varying magnetic field that causes a weak electrical current (Figure3.1). The brain's overall processing and functioning systems rely on electrical currents conducted by neurons, and these currents are what keep our numerous organs and

anatomical areas working as one cohesive whole to regulate and balance us mentally, emotionally, cognitively, and physically. TMS simply causes these electrical currents generated by neural networks at all the time, to occur at higher levels in certain targeted areas of the brain (Carpenter, Janicak, Aaronson et al., 2012).

Brain stimulations such as TMS has been used for decades in treating psychiatric disorders which commonly caused by the chemical imbalance in the brain's functioning system (Mischoulon). The efficacy of TMS in the treatment of depression has been extensively studied. TMS has also been shown to have some beneficial effects in the treatment of posttraumatic stress disorder (PTSD) and obsessive compulsive disorder (OCD) (Sadock & Sadock, 2000). In 1995, the first pilot clinical trial was published reporting the results of TMS in six highly treatment-resistant depressed (TRD) patients (Garcia-Toro, Pascual-Leone, Romera, et al., 2001). This was followed by multiple preliminary and two large trials (Boutros, Gueorguieva, Hoffman, et al., 2002) ultimately leading to FDA clearance of the first TMS device for the treatment of major depression in 2008. A subsequent large trial with a "deep TMS" device led to its clearance in 2013(Hoppner, Schulz, Irmisch, et al., 2003).

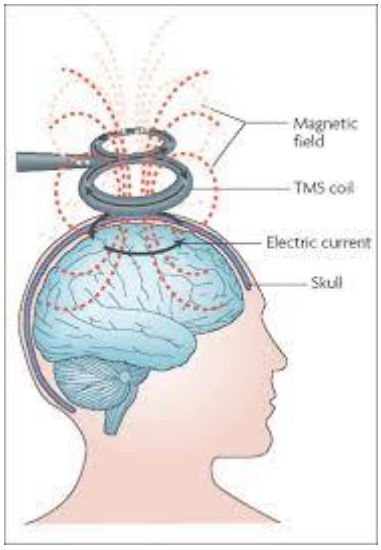

Figure3.1.

The effect of Magnetic field Therapy such as Transcranial magnetic stimulation (TMS) to Brain

TMS is drug-free and non-invasive magnetic instrument that works by stimulating the prefrontal cortex to regulate mood using a magnetic field (Figure3). Numerous studies on TMS have verified its affect to the brain at the molecular and electrophysiological level in treating of various neuropsychiatric disorders (Wassermann & Zimmermann, 2013). For example in regard to depression and anxiety treatment, research has shown similar biological effects associated with response to TMS and response to other brain stimulation therapies such as Electroconvulsive Therapy (ECT) or antidepressant medications, suggesting that their mechanism of action is similar (Fox, Buckner, White, Greicius, Pascual-Leone, 2012).

As reported by Herrmann,Katzorke, Busch, Gromer, Polak, Pauli, and Deckert (2017), depolarization of cortical neurons with magnetic field coming from a magnet (magnetic coil) will reinforce higher neural activities, which temporarily increases blood flow and metabolism enabling an optimal plasticity in under active areas of the brain beneath where the magnetic coil is placed. Furthermore, more recent research utilizing both brain imaging technology such as MRI and fMRI confirms brain stimulation piloted through magnetic field affects cortical and subcortical networks and may alter blood flow as well as neurotransmitters discharges in the areas of limbic structures such as the amygdala, an area often implicated in the modulation of anxiety and fear, which are prominent features of many depressive episodes (Fidalgo, Morales-Quezada, Muzy, et al., 2014).

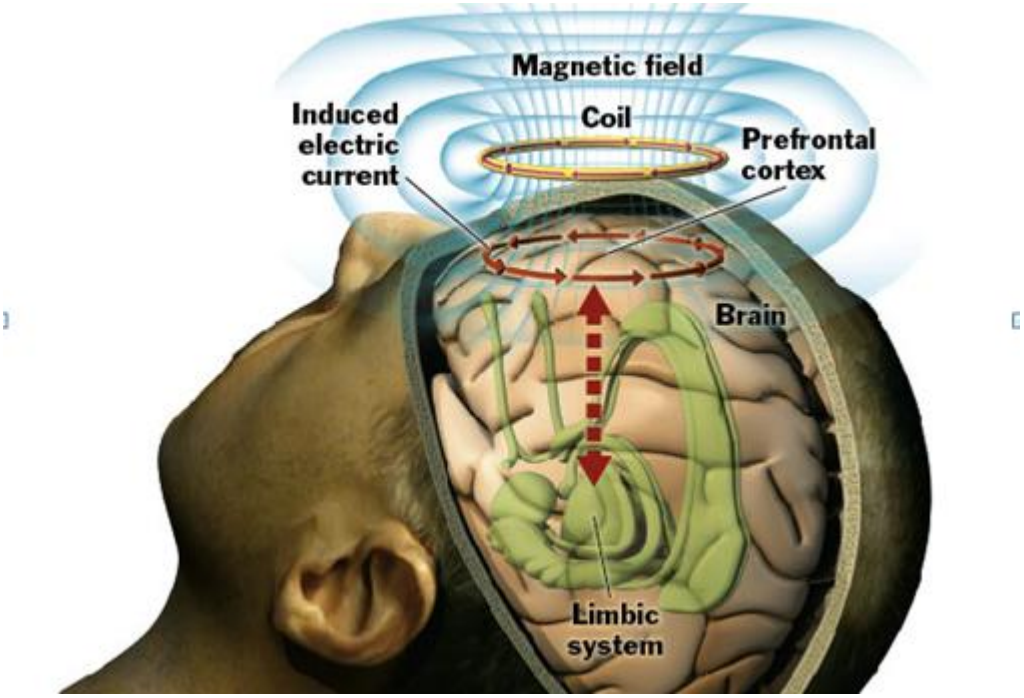

Figure3.

Clinical use of TMS Therapy

Transcranial magnetic stimulation (TMS) is an established, noninvasive, and non-convulsive neuromodulation technique initially developed in the mid-1980s as a tool to study human neurophysiology (Janicak et al., 2007). Since that time, several diagnostic and therapeutic clinical applications for TMS have been developed that are part of the standard of care in neurology, neurosurgery, and psychiatry clinics around the world. As reported by Baeken, Marinazzo, Wu, et al. (2014), TMS is a novel, noninvasive intervention that is effective in treating Major Depressive Disorder (MDD), possible treatment of Anxiety, OCD, ADHD, and pain. In addition, TMS research continues to study the most effective placement for the magnet, the level of electromagnetic current to treat each individual, and whether medications can be used in conjunction with TMS

(Wassermann & Zimmermann). Furthermore, according to Fox, Buckner, White, Greicius, and Pascual-Leone (2012), the use of magnetic stimulation and its effect on human tissue is now one of the most exciting new tools for clinicians working within Neurology, Neuroscience, Psychiatry and Rehabilitation.

Notably, in 2008 the Food and Drug Administration (FDA) cleared the use of high-frequency repetitive TMS (rTMS) to the dorsolateral prefrontal cortex for the treatment of major depressive disorder (MDD) (2). Four TMS systems have since been cleared by the FDA and are commercially available for the treatment of depression in the United States (US Food and Drug Administration Center for Devices and Radiological Health, 2013).

Visual Concentration Attention Technology (VCAT) plus Transcranial Magnetic Stimulator (VCAT+TMS)

The TMS/rTMS magnetic field stimulation is based on the laws of electromagnetic induction, where a current passing through a coil of wire generates a magnetic field perpendicular to the current direction in the coil. A rapid change of this magnetic field elicits in turn a transient electric field. This electric field affects the membrane potential of the nearby neurons, which may lead to depolarization and neuron discharging or interfere with the ongoing action potentials. Commercially available stimulators offer the possibility to generate peak of magnetic field up to 2.5 tesla, with frequencies up to 30 Hz (Rossi, et. al, 2009). According to Veniero, Brignani, Thut, and Minussi (2011), a magnetic field of 1 to 1.5 tesla is required in order to be able to interact and depolarize neural networks of the targeted brain locations. The power of the stimulators and coils is

measured in Tesla which is the International System of Units of magnetic-field strength or magnetic-flux density, commonly denoted as T, defined in 1960 in honor of the inventor of the Tesla Coil, Nikola Tesla. Modern devices develop 1.5 – 4 tesla (T) measured at the coil's surface with studies showing that cortical neurons are activated beneath the scalp to a depth of 1.5 – 2 cm (Virtanen, Ruohonen, Naatanen, Ilmoniemi, 2011).

CMT-Headset uses the same magnetic field theory and principles as the TMS and rTMS (Siahdohoni, 2018). The CMT-deice consist of a 2 U-shaped pieces of adjustable headbands fixed in a complete headset. Each headband is built with a flat coil of copper wire in a closed circuit with attached of 4 therapeutic polymeric coated neodymium magnets (2x1" and 2x1/2" 13500 to 15000 gauss) to generate a constant magnetic field of approximate of 1.5 tesla with a penetration up to 6 inches (2.36 cm) to depolarize and interact with neurons' electrical discharges at a cellular level reinforcing an expansion of reginal neural activities in prefrontal cortex, parietal cortex, and limbic system (Eichenbaum, 2007). As previously verified these areas of the brain are the main areas affected by ADHD, addiction, mood and emotional disorders such as depression and anxiety. According the 10/20 international system (Buzsáki, Anastassiou, & Koch, 2012), the VCAT+TMS frontal headset covers Fp1, Fp2, F7, F3, F2, F4, and F8; The central/parietal headset covers T3, C3, C2, C4, T4, T5, P3, P2, P4, and T6 (Siahdohoni, 2018) (figure2). It is assumed that this 10/20 international based locations on each headband would strengthen the neural activities and neurotransmitters discharges generated in limbic system areas (Morgane, Galler, & Mokler, 2005). The limbic system supports a variety of functions including emotion, behavior, motivation, and long-term memory (Morgane, Galler, & Mokler) (Figure7.2).

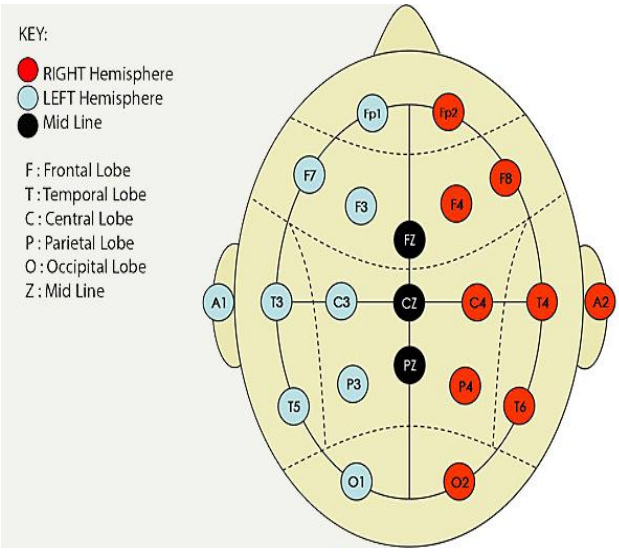

Figure2.

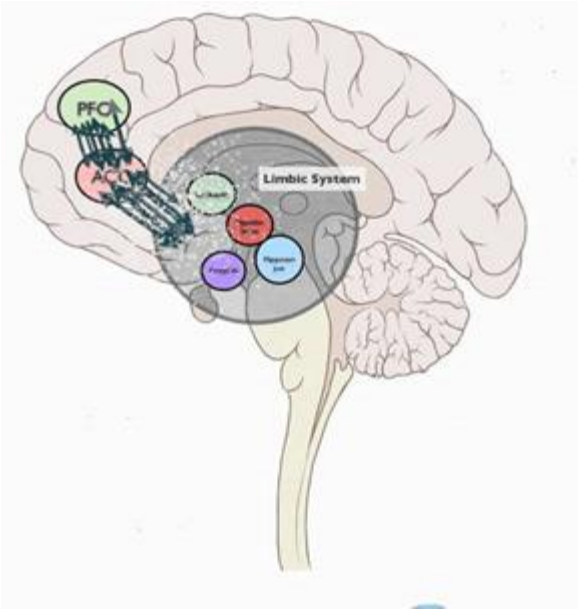

Figure7.2

CMT-Headset as an effective Transcranial Magnetic Stimulator (TMS) Device

Transcranial magnetic stimulation, known as TMS, may be a safe, effective, and noninvasive magnetic field stimulation for localized brains' neural network activation (Wassermann,1997; O'Reardon, Solvason, Janicak, Sampson, Isenberg, Nahas et al., 2007) that has shown improvement in verity of psychological/psychiatric symptoms such as depression and anxiety as well as enhancement in cognitive functioning such as memory for individuals who are not responsive to medications and or psychotherapy (George & Post, 2011). TMS creates a magnetic field to induce a small electric current in a specific part of the brain; the current comes from the magnetic field created by an electromagnetic coil that delivers pulses through the head (O'Reardon et al., 2007). CMT-Headset is a noninvasive and non-electric induced magnetic device which is assumed to increase localized and regional neural activities, improving blood flow, and stimulating the brain to produce and balance neurotransmitters such as dopamine and serotonin in adults with ADHD and or substance and alcohol abuse (Attwell, Buchan, Charpak, Lauritzen, MacVicar, & Newman, 2010). A multi-center clinical research of 4 weeks was conducted with a quantitative open label randomized pre-posttest controlled trial study design in which subjects in the study participated in an 4 weeks in-home 5 days a week 20 minutes intervention of non- electric induced and non- invasive magnetic field producer using CMT-Headset along with non-invasive Visual Attention Concentration Therapy (VCAT and VCATSSM). The six months follow up evaluation results have shown a significant reduction in subjects' ADHD, depression, anxiety, and the urge of using drugs and or alcohol (Siahdohoni, 2018).

The CMT device was identical to the active and FDA cleared and approved TMS/rTMS, the FDA cleared Fisher Wallace Stimulator, and the FDA cleared and or approved Transcranial Direct

Current Stimulation (tDCS) devices, except CMT-Headset did not induce an electrical current instate the brain was stimulated with non-invasive VCAT and VCATSSM (Siahdohoni).

CMT-Headset similarities and difference to already FDA Approved and or Cleared TMS/rTMS and other Magnetic Neuro Stimulators

Transcranial magnetic stimulation (TMS) uses a targeted pulsed magnetic field, similar to what is used in an MRI (magnetic resonance imaging) machine to stimulate directly areas of the brain that is underactive (Mantovani, Pavlicova, Avery, Nahas, McDonald, Wajdik, et al., 2012). For example, TMS as a non-invasive procedure is assumed to stimulate the prefrontal cortex and the limbic system structure to control mood, emotions, and behavioral patterns by activating the neural network in these targeted areas (Levkovitz, Harel, Roth, Braw, Most, Katz, et al., 2009).

The repetitive transcranial magnetic stimulation (rTMS) is another form of non-invasive brain stimulation therapy that uses an external magnet to stimulate certain areas of the brain. The rTMS has been studied as a treatment for depression, psychosis, anxiety, and other disorders (Berlim, van den Eynde, Tovar-Perdomo,& Daskalakis, 2014). In 2008, the U.S. Food and Drug Administration approved rTMS as a treatment for depression because it has proven effective for people who have not experienced improvement with other, more traditional therapies such as antidepressant medications and psychotherapy (Berlim et al., 2014)

These instruments (TMS/rTMS) stimulating or activating natural electrical currents within the brain cells in prefrontal cortex and limbic system areas associated with mood, including anxiety and depression as does CMT-Headset as a non-invasive and non-electric brain stimulator. CMT-Headset uses magnetic field along with VCAT and VCATSSM (Siahdohoni, 2011; 2007) to

reinforce the natural electrical currents within the brain cells in prefrontal cortex, parietal lobs, and limbic system areas to regulate the attention deficit, cognitive dysfunction, and the mood regulation related to ADHD and or substance and alcohol addiction in individuals who are resistant to medication and or psychotherapy.

According to Batsikadze, Moliadze, Paulus, Kuo, and Nitsche (2013), neural network stimulation, connection, and a three way communication between prefrontal cortex, parietal lobes, and limbic system could lead to improvement of depression, anxiety, and cognitive functioning (attention, concentration, and memory) as part of ADHD and or addiction (Allan, Herrmann, & Ebmeier, 2011). Furthermore, CMT-Headset is also similar to the Fisher Wallace Stimulator as a non-invasive and non-electric neural stimulator in activating and stimulating brain's neural networks and its neurotransmitters (Barclay & Barclay, 2014; Debener, Helps, James, & Sonuga-Barke, 2009). The Fisher Wallace Stimulator, previously branded the Liss Cranial Stimulator, was cleared by the FDA in 1990 for the treatment of depression, anxiety, insomnia and chronic pain (Bystritsky et al., 2008)). According to the Fisher Wallace website (https://www.fisherwallace.com/pages/published-research), the safety and effectiveness of the Fisher Wallace Stimulator has been proven in multiple published studies, including a "clinical trial conducted at Mount Sinai Hospital and published in the Journal of Nervous and Mental Disease in 2015."

The CMT-Headset main difference to common TMS and other neuro stimulator devises is that CMT-headset is a non-electric neural stimulator and instate of using external electrical power source (batteries and or electrical discharges coming from an outlets) to the brain it uses the magnetic field induced direct from magnetic coil (13000 to 13500 gauss) to strengthen and

reinforce the natural neural generated electrical currents (magnetic field) deep within the brain cells stimulated by VCAT and VCATSSM (Siahdohoni). The CMT device is a wearable and portable headset which could also be used safely at home and or in a clinical setting. Furthermore, it is cost effective and affordable with no reported side effect.

Visual Concentration Attention Technology (VCAT) and CMT-Headset

Visual Concentration Attention Therapy (VCAT) embraces the non-invasive visual field brain stimulator (Visual Concentration Attention Therapy, VCAT) with VCAT's neuropathway systematic therapy (VCAT Self-Stimulatory methodology, VCATSSM). VCAT is developed and researched by Nader Siahdohoni, PhD., as part of dissertation for his doctorate degree in clinical psychology (Siahdohoni, 2010, 2011) as well as evidence based research study as part of thesis for his master's degree in psychology (Siahdohoni, 2007). The IRB approved quantitative pre and post treatment research study conducted by Dr. Nader Siahdohoni concluded that VCAT program would provide an effective treatment in relieving ADHD symptoms such as attention, concentration, and memory in adults by enhancing and balancing neural network activities in the specific areas of the brain. VCAT and its sophisticated self-stimulatory brain training and exercising technology with therapeutic approach are designed to fit many different neural network related dysfunction in a very special way. It uses variety of patterns, strategies and techniques with sophisticated steps to empower its efficacy and validity. VCAT predicts that such steps will have an enormous impact in relieving neuropsychological as well as psychological related disorders such as anxiety, depression, addictions, schizophrenia, ADHD, dementia, pre-Alzheimer's, seizures, and etc. (Siahdohoni).

The science behind VCAT is based on systematic theories of serial, parallel, peripheral and selective attention stimulations built into VCAT's visual field (VF) treatment's Template. Visual stimulations are analyzed by Thalamus near the mid brain and sent to the cortex for further processing. In addition, action potentials like visual stimulations coming from the left VCAT-VF-Template stimulate the neural networks in the right hemisphere and stimulations coming from the right VCAT-VF-Template stimulate the neural network in the left hemisphere (figures 5 and 5.1-Diagram of lateralized visual pathways of the human brain). VCAT improves brains functioning system and guide the brain through its science based systematic patterns to create new neural pathways and connections enabling restoration, regulation and balanced of neurotransmitters. It enhances brain waves' frequencies and the oxygenated blood flow throughout the brain for an optimal plasticity which are basis of addiction, ADHD, depression, anxiety and many other psychiatric disorders (Siahdohoni).

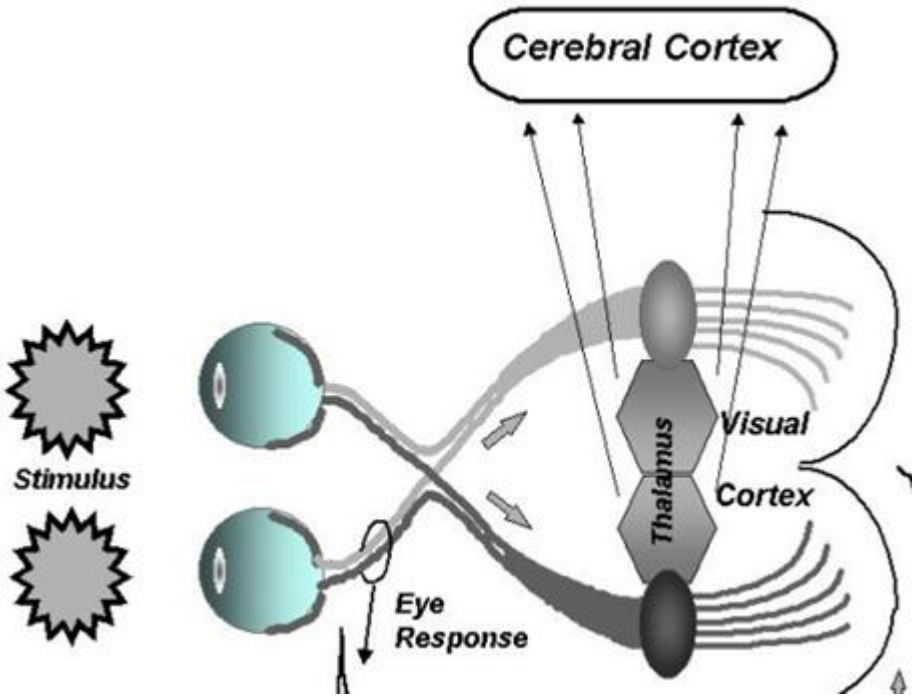

Figure5.

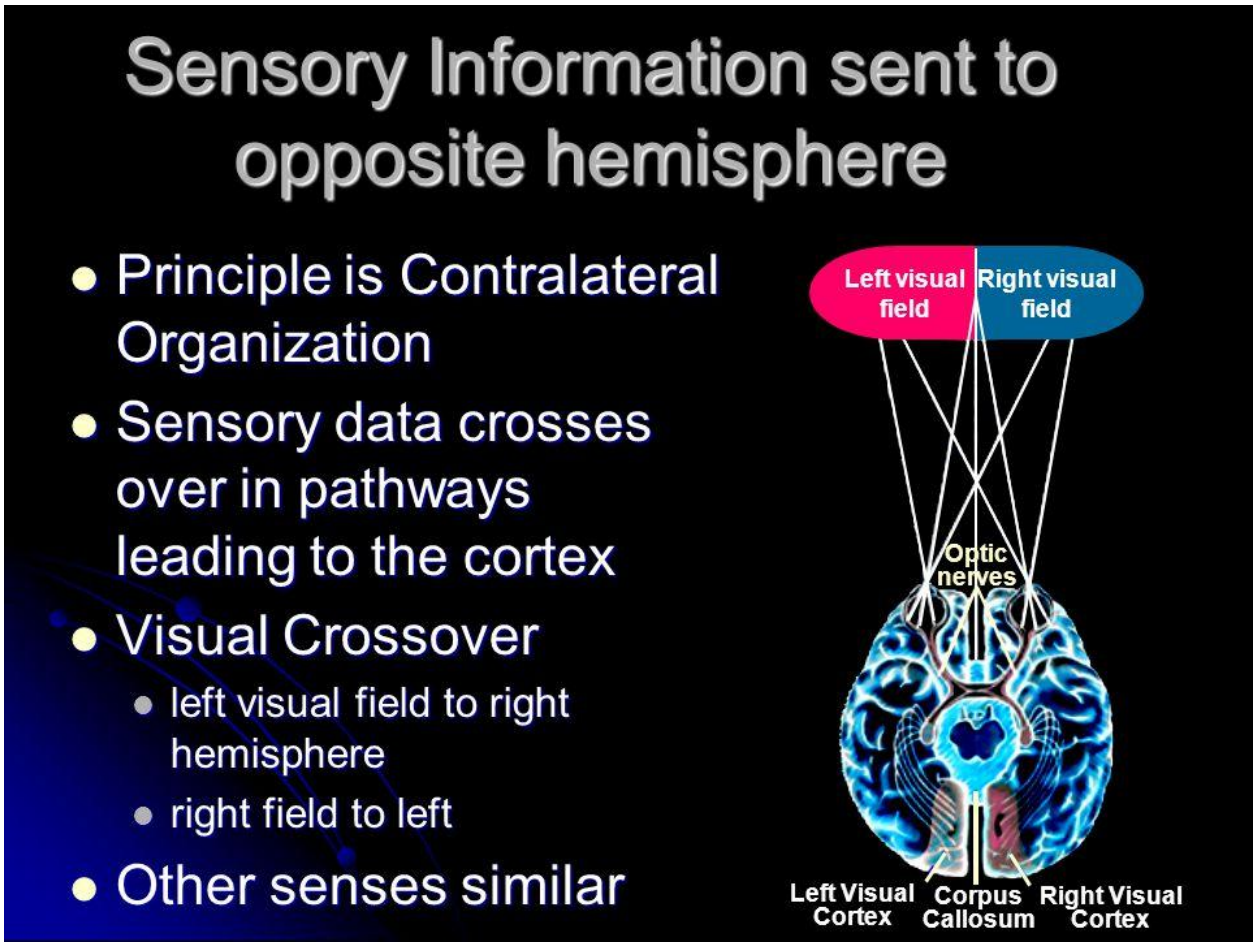

Figure 5.1- Diagram of lateralized visual pathways of the human brain

As reported by Baumeister and Heatherton (1996), including hundreds of pilot studies and empirical and evidence based-studies regular attention and selective attention neuropathway training (e.g., VCAT and VCATSSM program) promote efficient communication among the nerve cells (neural network) and functional centers located throughout the brain including the sensory motor system leading to improvement of attention, concentration, perception, cognition, and memory. VCAT improves brain function by producing higher activity and plasticity, increases blood circulation and the oxygen and glucose throughout the brain tissue, restoration, and the regeneration of neurons (Neurogenesis) (Bailey, Thomson, Hoy, Hernandez-Pavon, & Fitzgerald, 2016; Dutta, 2015). It optimizes brainwave patterns that increase cognitive abilities and trains the brain to produce these activities on its own. These are the very mechanisms that underlie psychological disorders such as such as depression, anxiety, ADD and ADHD, which could be improved by regular practicing of VCAT. According to Siahdohoni, VCAT explains behavior in terms of the activities of the brain. How the brain organizes its billions of individual nerve cells to produce behavior, and how these cells are influenced by external visual stimulations through the visual field. Thus, it is assumed CMT-Headset with its magnetic field capabilities reinforce and expand the natural neural electrical discharges induced by VCAT treatment plan and VCATSSM in frontal cortex, parietal cortex, and the limbic system to facilitate an effective three way communications between neural networks in these areas of the brain to reduce and or eliminate symptoms of ADHD and substance addiction leading to relieve of possible induced psychological/psychiatric disorder such as depression and anxiety.

Clinical Applications of CMT-Headset

Magnetic stimulators such as CMT-Headset is being used, or evaluated, in many applications. These include stimulation neural networks to enhance brain's processing system; treatment of depression, anxiety, addiction, and schizophrenia in psychology/ psychiatry (Attwell et al., 2010). Particularly active areas at present are investigating whether magnetic stimulation can be used as an alternative to electroconvulsive therapy (ECT) to treat severe depression, and stimulation of the motor cortex to encourage plasticity as an adjunct to post-stroke rehabilitation (Attwell et al.). According to Bailey et al. (2016), the therapeutic applications of magnetic stimulators such as TMS and CMT are frequently used in clinical settings and are more subjects of research in the way magnetic field affects the brain functioning system. Furthermore, over 3500 papers have been published using or further developing the technique in the 20 years following the first demonstration of TMS (Datta, Baker, Bikson, & Fridriksson, 2011). It seems likely that the range of clinical and research applications will continue to grow as more is learnt about how best to apply the stimuli and as the stimulator hardware continues to improve.

Research Method

Introduction

Drawing upon literature demonstrating effectiveness of TMS and magnetic field therapy in treatment of psychiatric disorders associated with ADHD and or drug and alcohol addiction this research study will describe the procedures in a quantitative open label randomized pre-posttest controlled trial study design intended for investigating the effectiveness of a noninvasive and nonelectric induced TMS device such as CMT-Headset along with the VCAT AND VCATSSM in

improving of co-occurring symptoms of depression, anxiety, ADHD and or drug and alcohol abuse and whether addressing either of ADHD, addiction, and or depression and anxiety would help such adult population reduce or eliminate ADHD, depression and anxiety symptoms and continue to stay sober and eliminate their addictive behavior. Furthermore, the study continues with an overview of the design methodology including discussion of experimental conditions to be introduced and the test instruments used in the assessment process. Here, in this study materials used are included a structured clinical interview and feedback questionnaire designed by the primary researcher, a structured interview for drug and alcohol abuse and underlying psychiatric and psychological symptoms, Goldberg Depression Scale (GDS), Hamilton Anxiety Scale (HAS), Wender Utah ADHD Rating Scale (WURS), Michigan Alcohol Screening Test (MAST), and the Drug Abuse Screening Test (DAST).

Participants

In total, 88 participants started the study. Eight participants did not complete the study due to a variety of reason (N=80). The research was accounted for 80 male and female aged 18-65 volunteered participants with and without current and previous ADHD, depression, anxiety, and or drug and alcohol abuse. The mean age of participants was M = 35.24 with a SD = 10.19.

Prospective research subjects were screened and evaluated for the inclusion to the research by a licensed clinical psychologist. Research subjects were carefully informed by study's director and explained how CMT-Headset would work with magnetic field and brain's functioning system. They were made to understand the differences and similarities between CMT-Headset and other TMS and magnetic field stimulators and they would not receive and or experience any electrical current since CMT-Headset is non- invasive and non- electric induced TMS and or magnetic field

stimulator. They were told they might experience mild sensation at the magnet location. The research investigator made it clear to each subject that although there was no known physical or psychological danger to these treatments, they could withdraw from the procedure at any time. No beneficial effects were promised from the study. Pertinent information was printed on the subject informed- consent forms which were signed by each subject- volunteer after the project had been fully explained and the subjects' questions answered.

Design

The proposed study is a quantitative open label within-subject pre- and posttest study design. This design will allow for gathering information of fundamental processes that are basis of clinical treatments as well as determination of the relationship between two factors, like the short and long term effectiveness of a noninvasive and nonelectric magnetic field induced by CMT-Headset in improving of co-occurring symptoms of depression, anxiety, and ADHD with drug and alcohol abuse and whether addressing these symptoms would help adult population with drug and alcohol addiction continue to stay sober and eliminate such addictive behavior. This type of design will allow collecting and analyzing of numerical data in exploring relationship and/or interaction between variables for a comparison between and within different treatment groups as well as assessing changes in symptoms over time.

Sampling Determination

Our muliti out patient centers and general public of the large orange County California metropolian was used for the porpose of sampeling determination. Participants are recruit by public advertising such as Criagslist, colleges and university (Public bulletin borders on compas). The intent of drawing a sample from a large metropolitan community is to increase the probability of an ethnically diverse group across socioeconomic and educational strata; thereby enhancing external validity.

Inclusion Criteria

The control group was consisted with n=36 randomized healthy subjects with no current and or previous symptoms of ADHD, depression, anxiety and or dual diagnosis of psychiatric/psychological disorders with any kind of substance and or alcohol addiction. In addition, the participants in the control group must not being on any psychiatric medication and or participated in any kind of psychological, psychiatric, TMS and or magnetic therapy of any kind.

The CMT-headset treatment group was enclosed with n=44 randomized voluntaries outpatients from our multicenter and voluntaries from other mental health communities who were dual diagnosed of depression and anxiety with ADHD, substance and alcohol addiction (40% were primarily alcohol abusers, while the other 60% were single or polydrug abusers with the average number of drugs abused ranging from prescription drugs to street drugs, including heroin, amphetamines, and cocaine). Participant's pool was consisted of mixed race with 47.5% Caucasians and 35% female. Diagnosis was verified using the Structured Clinical Interview (SCID-P) (First et al., 1995) based on the Diagnostic and Statistical Manual (DSM-IV-TR) (American Psychiatric

Association, 1994, 2000). To be eligible to participate in the study's CMT-Headset treatment group, participants had to be carrying a dual diagnosis of depression, anxiety, ADHD, and substance and or alcohol abuse at the time of their recruitment.

Exclusion Criteria

Patients were excluded from the study if they had a history of schizophrenia, schizoaffective disorder, other (non-mood disorder) psychosis, depression secondary to a medical condition, psychotic features in this or previous episodes, amnestic disorder, dementia, delirium, mental retardation, an active suicidal plan, or history of suicide attempt within the past 12 months, as determined by the Columbia Suicide Severity Rating Scale (CSSRS) (Posner et al., 2011). Additional exclusion criteria were significant current history of autoimmune or endocrine disorder affecting the brain, unstable cardiac disease, uncontrolled hypertension, sleep apnea, history of skull fracture, cochlear and or metallic implants, seizures, epilepsy, pregnancy, or having a pacemaker. Study participants were allowed to take part in the study if they maintained stable dosages of their antidepressant medications for 2 weeks before entering the study and throughout the treatment period.

Protection of Participant's Rights

Only the researcher will recruit potential participants for taking part in the research. The recruitment process will primarily consist of sending out emails and letters to potential participants. In addition, researcher will sign a confidentiality agreement and will keep all of the participants' personal data locked and secured in a location where only the researcher has access. Any

information provided by the participants will be kept confidential and the researcher will not use any of this information for any purposes outside of this research project.

Interview & Screening Instruments

Participants eligible for the study based upon inclusion criteria will be contacted to determine their willingness to participate. Those volunteering for the study will be scheduled for a screening interview to last no more than an hour. Those passing these initial screening procedures will be deemed eligible for the baseline assessment.

The screening process will include administration of the Goldberg Depression Scale (GDS), Hamilton Anxiety Scale (HAS), Wender Utah ADHD Rating Scale (WURS), Michigan Alcohol Screening Test (MAST), and the Drug Abuse Screening Test (DAST).

Measures

The Goldberg Depression Scale. The GDS is an 18-item self-rating scale (Fig. 1), with each item rated on a 0–5 point Likert scale. The total score can therefore range from 0 (complete absence of depressive symptoms) to 90 (most severe depression).

Validity

The validity of a scale covers both internal and external validity. Internal validity covers the extent to which the total score is a sufficient statistic. Factor analysis has been used to measure the internal consistency of the GDS. Thus, an overall, general factor is indicative of internal validity. The factor analysis is extremely sensitive to the dispersion of scale scores in the population investigated. The Loevinger coefficient of homogeneity is a test of uni-dimensionality, i.e. of the

summed total score being a sufficient or adequate statistic. Coefficients of 0.30 or higher indicate homogeneity or uni-dimensionality. The GDS has been compared to the HAMD for Loevinger coefficients. An essential aspect of external validity is responsiveness. This is the ability of a scale to measure improvement in patients during a period of treatment. In the acute therapy of major depression a response is defined as a 50% (or more) reduction of the baseline scores at endpoint. The GDS has been compared to the HAM-D in this way in relation to its responsiveness and a correlation coefficient was calculated by use of the Spearman rank-order method.

The instruments to be used for the study include as follow:

GOLDBERG DEPRESSION SCALE (GDS)

This scale consists of 18 items with 6 choices. For choice (to a great extent) score 5, choice (a-lot) score 4, choice (quite a lot) score 3, choice (partly) score 2, choice (only slightly) score 1 and choice (not at all) score 0 are allocated. The more total scores are the higher depression level will be.

0	points Not at all
1	point Just a little
2	points Somewhat
3	points Moderately
4	points Quite a lot

5	points Very much

Screening test scoring ranges:

0-9	No Depression Likely
10-17	Possibly Mildly Depressed
18-21	Borderline Depression
22-35	Mild-Moderate Depression
36-53	Moderate-Severe Depression
54 and up	Severely Depressed

HAMILTON ANXIETY SCALE (HAS)

The Hamilton Anxiety Scale (HAS or HAMA) is a 14-item test measuring the severity of anxiety symptoms. It is also sometimes called the Hamilton Anxiety Rating Scale (Hamilton, 1959). For the 14 items, the values on the scale range from zero to four: zero means that there is no anxiety, one indicates mild anxiety, two indicates moderate anxiety, three indicates severe

anxiety, and four indicates very severe or grossly disabling anxiety. The total anxiety score ranges from 0 to 56. The seven psychic anxiety items elicit a psychic anxiety score that ranges from 0 to 28. The remaining seven items yield a somatic anxiety score that also ranges from 0 to 28 (W Maier, R Buller, M Philipp, & I Heuser, 1988).

Sum of Scores from all 14 parameters

18 - 24	Moderate Anxiety
25-30	Severe Anxiety
31-56	Very Sever Anxiety

Wender Utah ADHD Rating Scale (WURS)

The Wender Utah ADHD Rating Scale (WURS) is a 61-item retrospective self-report scale used to evaluate adults for ADHD. In completing the WURS, the adult reports on their recollection of how they were as a child. The WURS has been shown to be a valid retrospective screening and dimensional measure of childhood ADHD symptoms to replicate and correlate with Connors Abbreviated Parent and Teacher Questionnaire and demonstrate internal consistency reliability and to exhibit good construct validity. The WURS has been shown to demonstrate good psychometric

properties for ADHD assessments for various populations such as college students, men and women, and numerous non-US countries.

Each item is rated 0 (not at all) to 4 (very much).

Data suggest a cutoff score of 46 or higher correctly identified 86% of the patients with attention deficit hyperactivity disorder and 99% of the normal subjects (Ward MF Wender PH Reimherr FW, 1993).

Minimum Score	0
Cutoff Score	46- predictive of having childhood ADHD
Maximum Score	100

MICHIGAN ALCOHOL SCREENING TEST

(MAST)

One of the most widely used measures for assessing alcohol abuse, the MAST is a questionnaire designed to provide a rapid and effective screening for lifetime alcohol-related problems and alcoholism. The MAST has been productively used in a variety of settings with varied populations (Selzer, M.L. ,1971).

This quiz is scored by allocating 1 point to each 'yes' answer — except for questions 1 and 4, where 1 point is allocated for each 'no' answer — and totaling the responses.

SMAST Score	Degree of Problem Alcohol Involvement	Suggested Action
0-1	No real problems/No treatment	None at this time
2-3	Slight problem/ Treatment Probably not required	No Further action

4-5	Moderate/ Potential Alcohol Abuse Some treatment	Further investigation is required
6-7	considerable problem/treatment necessary	Full Assessment Required
8-more	Extreme problem/treatment necessary	Full Assessment Required

The Drug Abuse Screening Test (DAST)

The Drug Abuse Screening Test (DAST) was developed in 1982 and is still an excellent screening tool. It is a 28-item self-report scale that consists of items that parallel those of the Michigan Alcoholism Screening Test (MAST). The DAST has "exhibited valid psychometric properties" and has been found to be "a sensitive screening instrument for the abuse of drugs other than alcohol.

Scoring and interpretation: A score of "1" is given for each YES response, except for items 4,5, and 7, for which a NO response is given a score of "1." Based on data from a heterogeneous psychiatric patient population, cutoff scores of 6 through 11 are considered to be optimal for screening for substance use disorders. Using a cutoff score of 6 has been found to provide excellent sensitivity for identifying patients with substance use disorders as well as satisfactory specificity (i.e., identification of patients who do not have substance use disorders). Using a cutoff score of <11 somewhat reduces the sensitivity for identifying patients with substance use disorders, but more accurately identifies the patients who do not have a substance use disorders. Over 12 is definitely a

substance abuse problem. In a heterogeneous psychiatric patient population, most items have been shown to correlate at least moderately well with the total scale scores. The items that correlate poorly with the total scale scores appear to be items 4, 7, 16, 20, and 22.

Procedures

Participant eligibility was based upon the initial interview questionnaires, and inclusion and exclusion criteria.

Participants who passed the initiation screening and were willing to continue toward the study were assigned to two groups. Healthy Control Group (HCG) with n=36 healthy participants as the control group and CMT-Headset group with n=44 participants carrying a dual diagnosis of depression, anxiety, ADHD, and drug and alcohol abuse as the investigative/treatment group.

Prior to start the research participants in both groups were assess for depression with Goldberg Depression Scale (GDS), anxiety with Hamilton Anxiety Scale (HAS), ADHD with Wender Utah ADHD Rating Scale (WURS), Alcohol abuse with Michigan Alcohol Screening Test (MAST), and the Drug Abuse Screening Test (DAST) for a pretest baseline. In addition, each participant in CMT-Headset group was trained (eight hours of orientation) of how to use the CMT-Headset along with training on using VCAT and its VCATSSM. Each participant in the CMT-Headset was also provided with an in-home use CMT porotype headset and a USB flash drive with additional instructions and training. The flash drive has also contained VCAT's daily treatment plan and daily activity log for the first 2 weeks of the study. Every 2 weeks new VCAT treatment plans and logs were downloaded in to the flash drive throughout the study. On the end of the study flash drive was returned to the researcher with an option of keeping the CMT's porotype headset if the

participant wished to do so.

Step1. Prior to start the research- participants were assessed for pretest baseline.

Step2. At the end of the week two: CMT-Headset- group were assessed for the first posttests baseline using GDS, HAS, WURS, MAST, and DAST. Computed data was compared to Hpre/posttest healthy control group (Tables 2a).

Step3. At the end of the week four: CMT-Headset- group were assessed for the second posttests baseline using GDS, HAS, WURS, MAST, and DAST. Computed data was compared to Hpre/posttest healthy control group (Table, 2a). In addition, the scores were further assessed for paired comparisons of the means (Table, 2b).

Step4. At the end of the week twenty-eight: CMT-Headset group were assessed for the follow up tests baseline (finaltest) using GDS, HAS, WURS, MAST, and DAST. Computed data was compared to posttesttotoal scores (Table, 3a). In addition, the scores were further assessed for paired comparison of the means (Table, 3b).

The purpose of analyzing score differences in the above steps is as follow:

step1. This step established an overall baseline for the use of CMT-Headset therapy.

Step2. This step informed the researcher about the short-term effects of CMT-Headset therapy.

Step3. This step informed the researcher about long-term effects of CMT-Headset therapy.

Step4. This step stablished the overall improvement of targeted co-occurring symptoms and the overall effectiveness of CMT-Headset device in a long-term period.

Data Collection and Analysis

Hypothesis

Null Hypothesis One: There will be no short-term and or long-term positive changes in Sobriety from alcohol and substance abuse, ADHD, depression and anxiety among adults diagnosed with a dual diagnosis and co-occurring disorders participating in a 4 weeks five days a week CMT-Headset therapy as measured by the Goldberg Depression Scale (GDS) for depression, Hamilton Anxiety Scale (HAS)for anxiety, Wender Utah ADHD Rating Scale (WURS)for ADD/H, Michigan Alcohol Screening Test (MAST), and the Drug Abuse Screening Test (DAST) for alcohol and substance abuse using CMT-Headset device along with VCAT AND VCATSSM.

Research Hypothesis One: There will be short-term and or long-term positive changes in Sobriety from alcohol and substance abuse, ADHD, depression and anxiety among adults diagnosed with a dual diagnosis and co-occurring disorders participating in a 4 weeks five days a week CMT-Headset therapy as measured by the Goldberg Depression Scale (GDS) for depression, Hamilton Anxiety Scale (HAS)for anxiety, Wender Utah ADHD Rating Scale (WURS)for ADD/H, Michigan Alcohol Screening Test (MAST), and the Drug Abuse Screening Test (DAST) for alcohol and substance abuse using CMT-Headset device along with VCAT AND VCATSSM.

Null Hypothesis Two: There will be no positive long term effect in Sobriety from alcohol and substance abuse, ADHD, depression and anxiety among adults diagnosed with a dual diagnosis and co-occurring disorders after a 6months follow up assessment compared to posttest week4

participating in a 4 weeks five days a week CMT-Headset therapy as measured by the Goldberg Depression Scale (GDS) for depression, Hamilton Anxiety Scale (HAS)for anxiety, Wender Utah ADHD Rating Scale (WURS)for ADD/H, Michigan Alcohol Screening Test (MAST), and the Drug Abuse Screening Test (DAST) for alcohol and substance abuse using CMT-Headset device along with VCAT AND VCATSSM.

Research Hypothesis Two: There will be positive long term effect in Sobriety from alcohol and substance abuse, ADHD, depression and anxiety among adults diagnosed with a dual diagnosis and co-occurring disorders after a 6months follow up assessment compared to posttest week4 participating in a 4 weeks five days a week CMT-Headset therapy as measured by the Goldberg Depression Scale (GDS) for depression, Hamilton Anxiety Scale (HAS)for anxiety, Wender Utah ADHD Rating Scale (WURS)for ADD/H, Michigan Alcohol Screening Test (MAST), and the Drug Abuse Screening Test (DAST) for alcohol and substance abuse using CMT-Headset device along with VCAT AND VCATSSM.

Data is analyzed using SPSS version 16.0. Tables are provided to indicate descriptive statistics (i.e., mean, standard deviation) between the two groups for age, gender, and race (Table1). A sample t test is performed to determine if the groups differ at baseline on any of the above, potentially confounding variables. Additional tables provide average group means and standard deviation for the following variables as a result of pre and posttest evaluation of HCG and CMT-Headset scores based on the test results. Scores are converted to standardize T-scores to allow for easier comparison and interpretation across measures in this category.

A 2 (time: pre, post) X 5 (measures: GDS, HAS, WURS, MAST, and DAST) Independent Samples t Test was performed with the score analysis of GDS, HAS, WURS, MAST, and DAST as

the dependent variables. A significant interaction was expected between the participants in improving the co-occurring symptoms of ADHD, depression and anxiety including a longer constant sobriety (substance and alcohol use) over time, as measured by GDS, HAS, WURS, MAST, and DAST. Further, the Independent Samples t Test is expected to show an overall effectiveness of CMT-Headset therapy in short-term (at the end of week2), long-term (at the end of the week4), and a significantly greater rate of effectiveness in improving and possible elimination of co-occurring symptoms of ADHD, depression and anxiety as well as elimination in cravings for drug and or alcohol use at the posttest at the end of the week 28 using CMT-Headset device.

A Paired Samples Test measures is used to analyze pair wise comparisons of the means to determine the nature of the relationship between variables and to find out the short term and long term effect of CMT-Headset therapy (device) accordingly. This data will support hypothesis testing by using eta-squared (eta^2) evaluating mean scores between the variables (ADHD, depression, Anxiety, drug and alcohol use) to determine significance and establish the strength of the relationship between these variables.

H_0: $\mu_{mm} = \mu_{ct} = \mu_{wl}$

H_1: Not all means are equal

The Paired Samples Test (Table2a) will determine the relationship of scores between the pretest and posttest compared to Hpre/posttest. Here, we look to assess whether there are any short-term, long term, and or a significantly greater rate of effectiveness in improving and possible elimination of co-occurring symptoms of ADHD, depression and anxiety as well as elimination of drug and or alcohol abuse at the end of the week 28 (finaltest) using CMT-Headset device.

All the posttests' scores are (statistically) significantly higher than those scores from the pre-tests (Table2a). In addition, all the posttests' scores of participants in CMT-Headset therapy group are almost equal to those scores of participants in the Healthy Control Group (HCG); Furthermore, the Paired Samples Test (Table3b) showed a significant higher mean value for the 6 month follow up test (finaltest) compared to the week 4 total posttest (posttesttotal) confirming substantial reduction in symptoms of ADHD, depression, anxiety, and cravings for substances with considerable increased in sobriety and relapse cycle. The Paired Samples Test measures (mean) a comparison ($p < .05$) at a 95% confidence interval is provided in tables (2b and 3b).

In summary, this research finds strong evidence that CMT-Headset along with VCAT and its self –Stimulatory Methodology (VCATSSM) could significantly effect and improve symptoms of ADHD, depression, anxiety, and the urge of using drugs and or alcohol in adults with dual diagnosis with these co-occurring disorders.

Table 1

Demographic Characteristics

	Sex		
Ethnicity	Male	Female	Total
Caucasian	25	13	38
African American	19	11	30
Hispanic	8	3	11
Other	0	1	1
Total	52	28	80

	Male	Female	Total
HCG (Healthy Control Group)	26	10	36
CMT-Headset (TR/Investigative)	24	20	44

Total	50	30	80

Primary Analysis

The study used the five dependent variables GDS, HAS, WURS, MAST, and DAST as the measurement tools for assessing adults with dual diagnosis of depression, anxiety, ADHD, alcohol, and drug abuse as the co-ocurring disorders while CMT-Headset and its VCAT self-stimulatory brain exercising is used as the independent variables.

Table 2a provides the mean and standard deviation scores of participants difference scores (between pre- and posttest)

Table 2a

Independent Samples t test's scores on Objective Measures and Compares Mean scores for Dependent and Independent Variables

Objective	Week2	Week4
Participants	CMT-Headset Hpre/posttest	CMT-Headset Hpre/posttest

Measures	Mean/SD	Mean/SD	Mean/SD	Mean SD
PretestGDS	40.87/17.99	7.83/1.18	15.23/7.38	7.83/1.18
PosttestGDS	15.23/7.38	7.83/1.18	11.35/6.28	7.83/1.18
Pretest HAS	50.43/10.07	9.23/1.69	21.90/9.26	9.23/1.69
PosttestHAS	21.90/9.26	9.23/1.69	10.46/6.89	9.23/1.69
Pretest WURS	82.36/14.88	12.31/4.54	56.36/10.07	12.31/4.54
PosttestWURS	56362/10.07	12.31/4.54	42.65/9.78	12.31/4.54
Pretest MAST	3.78/1.09	1.06/0.41	1.50/0.75	1.06/0.41
PosttestMAST	1.50/0.75	1.06/0.41	1.18/0.63	1.06/0.41
PretestDast	22.80/7.27	0.88/0.38	7.67/3.01	0.88/0.38
PosttestDAST	7.67/3.01	0.88/0.38	5.91/2.91	0.88/0.38

The review of the participants' mean scores for CMT-Headset week4 and week2 (pre/posttests, Table 2a) compared to the mean scores of HCG (Hpre/posttest) indicate a significant

improvement in depression (M =11.35, SD=6.28), Anxiety (M=10.46, SD=6.89), ADD/H (M=42.65, SD=9.78), Alcohol (M=1.18, SD=0.63) and substance use (M=5.91, SD= 2.91) at the end of week4 of CMT-Headset Therapy.

The following paired Samples Test (Table 2b) measures is used to analyze pair wise comparisons of the means for posttest week4 and posttest week2 on Pair1week4GDS, Pair2week4HAS, Pair3week4WURS, Pair4week4MAST, and Pair5week4DAST for the long term affect with four weeks of CMT-Headset therapy. The analysis indicated the differences between means were significant for all dependent variables derived from the posttests of week 4 compared to all posttest of week 2 assessments. Furthermore, all the posttest scores were positively correlated with participants' level of perceived performance on the tests after using CMT-Headset along with its VCAT and VCATSSM. In fact, according to the final posttest conducted after 6 months participants continued to improve their co-occurring symptoms with longer sobriety span.

Table 2b

Paired Samples Test measures for comparisons of the means (week4posttest- CMT-Headset to week2posttest- CMT-Headset) for long term affect Paired Differences

Measures	Mean(dif)	SD(dif)	t	df	Sig. (2-tailed)	95% Confidence Interval
Pair1week4GDS	-3.88	-101	23.515	43	0.009	-3.239 to 4.520
Pair2week4HAS	-11.44	-2.37	32.044	43	0.006	-7.3355 to 15.523
Pair3week4WURS	-13.71	-0.29	31.372	43	0.001	-0.77 to 1.970
Pair4week4MAST	-0.321	- 0.12	17.777	43	0.033	-0.314 to 0.325
Pair5week4DAST	-1.76	-0.1	117.333	43	0.007	-1.733 to 1.786

Furthermore, the Paired Samples Test (Table 2b) compares five paired groups. It calculates the difference between each set of pairs, and analyzes that list of differences based on the assumption that the differences in the entire population follow a Gaussian distribution. If the significance value is less than .05 (alpha), there is a significant difference; and if the significance value is greater than. 05, there is no significant difference between the pairs. In addition, the measure of effect (Eta2 = t2/(t2 + DF)) will show what percentage of the variability in the DV (test scores) is actually due to the IV (CMT-Headset device).

Pair1 is statistically significant, $t(43) = 23.515$, $p < .05$, with M = -11.44 and SD = -2.37, and Eta2 result (0.93) of 93% , Pair2 is statistically significant, $t(43) = 32.044$, $p < .05$, with M = -

11.44 and SD = -2.37, and Eta2 result (0.96) of 96%, pair3 is statistically significant, t(43) = 31.372, $p < .05$, with M = -13.71 and SD = -0.29, and Eta2 result (0.96) of 96%, Pair4 is statistically significant, t(43) = 17.777, $p < .05$, with M = -0.321 and SD = -0.12, and Eta2 result (0.88) of 88%, and Pair5 is statistically significant, t(43) = 117.333, $p < .05$, with M = -1.76 and SD = -0.1, and Eta2 result (0.99) of 99% meaning that there is a significant difference between all the posttest week4 compared to the posttest week2 scores. These variabilities in the scores confirm all participants gained improvement due to the use of CMT-Headset device along with VCAT and VCATSSM with the effect of 93% in depression, anxiety 96%, ADD/H with 96%, alcohol and substance use with an effect in sobriety of 88% and 99%, which is a large effect.

Another Paired Samples Test (Table3a) measures is used to analyze pair wise comparisons of the means for Finaltestweek28 and Postest/week4 on Pair1FinaltestGDS, Pair2FinaltestHAS, Pair3FinaltestWURS, Pair4FinaltestMAST, and Pair5FinaltestDAST for the longest effect with a 6months follow up. The analysis indicated the differences between means were significant for all dependent variables derived from the week 28 finaltests compared to all posttests of week four assessments to conclude stability and continues improvement in participants' level of perceived performance on the tests six months after participating in the CMT-Headset therapy along with its VCAT and VCATSSM (depression M =9.54, SD=5.38), Anxiety (M=10.21, SD=6.22), ADD/H (M=39.09, SD=8.08), Alcohol (M=1.01, SD=0.60) and substance use (M=4.98, SD= 2.662).

Table 3a

Independent Samples t test's scores on Objective Measures and Compares Mean scores for Dependent and Independent Variables with follow up (Finaltest) scores after six months (week 28) compared to Week4 posttest scores

Objective	Week28		Week4	
Participants	CMT-Headset Hpre/posttest		CMT-Headset Hpre/posttest	
Measures	Mean/SD	Mean/SD	Mean/SD	Mean SD
Pair1FinaltestGDS	9.54/5.38	7.83/1.18	11.35/6.28	7.83/1.18
Pair2FinaltestHAS	10.21/6.22	9.23/1.69	10.46/6.89	9.23/1.69
Pair3FinaltestWURS	39.09/8.08	12.31/4.54	42.65/9.78	12.31/4.54
Pair4FinaltestMAST	1.01/0.60	1.06/0.41	1.18/0.63	1.06/0.41
Pair5FinaltestDAST	4.98/2.62	0.88/0.38	5.91/2.91	0.88/0.38

Table 3b

Paired Samples Test measures for comparisons of the means (week28 and week4) for continues improvement after six months follow up affect Paired Differences

Measures	Mean	SD	t	df	Sig. (2-tailed)	95% Confidence Interval
Pair1FialtestGDS	-1.81	-0.9	13.407	43	0.037	-1.565 to 2.054
Pair2FinaltestHAS	-0.25	-0.67	2.475	43	0.038	-0.224 to 0.275
Pair3FinaltestWURS	-3.09	-1.7	12.074	43	0.001	-2.299 to 3.881
Pair4FinaltestMAST	-0.17	- 0.03	5.666	43	0.035	-0.0219 to 0.023
Pair5FinaltestDAST	-0.93	-0.29	21.627	43	0.046	-0.889 to 0.969

Additional follow up Paired Samples Test (Table3b) compares all five paired groups at the end of week28. It calculates the difference between each set of pairs, and analyzes that list of differences based on the assumption that the differences in the entire population follow a Gaussian distribution. If the significance value is less than .05 (alpha), there is a significant difference; and if the significance value is greater than. 05, there is no significant difference between the pairs.

The six months follow up assessments compared to the week four posttests verifies that participants continued to stay sober with improved of their co-occurring symptoms of depression (Pair1FialtestGDS was statistically significant, $t(43) = 13.407$, $p < .05$, with M = -1.81 and SD = -0.9), Anxiety (Pair2FinaltestHAS was statistically significant, $t(43) = 2.475$, $p < .05$, with M = -0.25 and SD = -0.67), ADD/H (Pair3FinaltestWURS was statistically significant, $t(43) = 12.074$, $p < .05$, with M = -3.09 and SD = -1.7), Alcohol use (Pair4FinaltestMAST was statistically significant, $t(43) = 5.666$, $p < .05$, with M = -0.17 and SD = -0.03), and substance use (Pair5FinaltestDAST was statistically significant, $t(43) = 21.627$, $p < .05$, with M = -0.93 and SD = -0.29).

Discussion

Attention-Deficit Hyperactivity Disorder (ADHD), depression, anxiety, and substance use disorders are inextricably intertwined. Recent research and studies including dozens of surveys found that significant number of adults with ADHD was suffering from depression and or anxiety with dependence to alcohol and or drugs. Similar studies have also shown majority of adults with substance and alcohol abuse present symptoms of ADHD, depression and or anxiety disorders (Sydney, Lauren, & Tamara, 2003). Many used substances and or alcohol to self-medicate (getting high) to improve their mood, sleep better, and enhance sustained attention and memory for a short

period of time hoping to calm their brain enough to be productive. According to Sydney, Lauren and Tamara, co-occurring disorders such as depression, anxiety, and ADHD makes substance abuse harder to treat since often adult with both ADHD and substance-use disorders are at heightened risk for depression and anxiety. Untreated, these coexisting conditions interfere with recovery.

In summary, according to current and previous studies conducted on adults with drug and alcohol addiction, ADHD, depression, and or anxiety verifies present of dual diagnosis with co-occurring symptoms. ADHD maybe even more associated with cognitive dysfunction causing symptoms of depression and anxiety with in such population leading to drug and alcohol abuse. Thus, the aim of this research was to determine the effect of non-invasive and non-electric magnetic field stimulator (CMT-Headset) to the brain (frontal and parietal cortex) as a new treatment methodology in adult population suffering from co-occurring symptoms of depression, anxiety, ADHD and or drug and alcohol abuse after not responding to other common therapies such as psychotherapy and medication.

Limitations and Suggestions for Future Research

When considering the generalizability of the results of this study to other samples, it is important to note the limitations that may affect how well these data will apply. Several characteristics of the research sample were less than optimal. For one, the overall research sample was relatively small and results pertaining to the co-occurring diagnosis were based on even smaller numbers; however, this is not uncommon for studies within this area of research. There also was limited ethnic and socioeconomic diversity among research study participants that may impact generalizability of these results. Due to the number of examiners used in data collection for both the

standardization sample and the research sample, likelihood for examiner error also may be a limitation in the study.

In the future, studies should be conducted to ascertain whether the factor structure proposed here is supported in various clinical populations and across demographic groups. Furthermore, alternative assessment tools such as Electroencephalography (EEG) and brain imaging technology such as quantitative electroencephalogram (qEEG) and or functional MRI (fMRI) should be used in combination with the currently used assessments in this study to determine the effectiveness of CMT-Headset in improvement of co-occurring symptoms of depression, anxiety, ADHD, and drug and alcohol abuse.

Conclusion

According to the results of study's measurements at the end of week4 and week28 (six months follow up) CMT-Headset therapy significantly improved the co-occurring symptoms of anxiety, depression, ADHD and substance use (Table 3b). Subjects reported to continue sobriety after the six months follow up and reported no adverse events during the study.

Conflict of Interest Statement

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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