

CRANIAL ELECTROTHERAPY STIMULATION (CES) AS A TREATMENT FOR REDUCING STRESS AND IMPROVING PREFRONTAL CORTEX FUNCTIONING IN VICTIMS OF DOMESTIC VIOLENCE

Ronald R. Mellen, Ph.D., Professor, Department of Criminal Justice, Jacksonville State University, Jacksonville, Alabama, and an IACFP Member, Jan Case, Ph.D., Professor, Department of Mathematical, Computing, and Information Sciences, Jacksonville State University, and Deanna J. Ruiz, M.S., Counseling, Student and Research Assistant for the Study, Jacksonville State University

rmellen@jsu.edu

“The meaning of life is to find your gift, and the purpose of life is to give it away” (Picasso, 1881-1973).

Abstract

Many females, in free-world and prison, have suffered the effects of domestic violence including elevated and chronic levels of stress and symptoms of post-traumatic stress disorder (PTSD). This pilot study examined the efficacy of cranial electrotherapy stimulation in reducing clinical symptoms and improving prefrontal cortex functionality (“executive functioning”) in non-incarcerated women who had experienced significant domestic violence and were residing in a secured shelter.

Despite limitations associated with using a small sample (N=10), a repeated measures design and a highly restricted number of treatment sessions (N=5), the Alpha-Stim SCS, a cranial electrotherapy device, produced statistically significant reductions in stress levels. These measures were based on the Brief Symptom Inventory’s (BSI’s) assessment of global anxiety. Statistically significant improvements in executive functioning were also found using two global measures provided by the Behavioral Rating Inventory of Executive Function—Adult Version (BRIEF A): (a) Behavioral Regulation Index, and (b) Metacognition Index.

Introduction

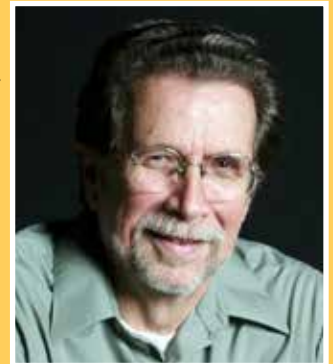
In her publication, *The Battered Woman* (2009), Lenore E. Walker described the Battered Women’s Syndrome. This syndrome included symptoms such as intrusive recollection of events, hyperarousal, high levels of anxiety and/or avoidance, emotional numbing, depression, dissociation, minimization, repression, and denial. These, and other symptoms she noted, are consistent with today’s diagnosis of PTSD.

The treatments for PTSD in victims of domestic

violence tend toward cognitive-behavioral counseling and the provision of social services. The present study focuses on a biologically-driven treatment to reduce stress symptoms in victims of domestic violence and improve their cognitive abilities. Such a treatment could add another dimension to current correctional treatment protocols.

Review of the Literature

The most common diagnosis among women suffering from domestic violence has been identified as PTSD (Jones, Hughes & Unterstaller, 2001). In addition to psychosocial issues, cortical, and subcortical neuro-network dysfunctions have also been related to PTSD. For example, Milad et al. (2009) proposed an amygdalocentric model, which identified dysfunctions in PTSD subjects’ amygdalae, hippocampi, and prefrontal cortices. The specific dysfunctions included hyperarousal of the amygdala (fear and rage) and deficient arousal in the top-down medial pre-frontal cortex (executive function). There were also dysfunctions associated with



RON MELLEN



JAN CASE



DEANNA RUIZ

(Continued on page 13)

CRANIAL ELECTROTHERAPY *(Continued from page 12)*

the hippocampus (memory) which makes the extinction of traumatic events difficult. These issues are also consistent with the deficiency of “extinction ability” found in PTSD subjects. In this pilot study, the Alpha-Stim SCS was utilized to apply cranial electrotherapy stimulation (CES) treatments to 10 residents living in a secured environment.

Alpha-Stim SCS

The Alpha-Stim SCS has been used successfully in treating varied psychological dysfunctions. While the device has been Food and Drug Administration (FDA)-cleared for the treatments of depression, anxiety and sleep dysfunctions, cranial electrotherapy stimulation has also been used successfully in research with alcohol and/or drug abuse subjects as well as related comorbid disorders and impulsively violent individuals. More specifically, CES has been used successfully to treat a variety of symptoms frequently associated with PTSD. Examples include anxiety, (Voris, 1995; Overcash, 1999; Bystritsky, Kerwin, & Feusner, 2008; Barclay & Barclay, 2014) drug and alcohol abuse, (Schmitt, Capo, & Boyd, 1986; Braverman, Smith, Smayda, & Blum, 1990; Amr, El-Wasify, Elmaadawi, Roberts, & El-Mallakh, 2013) and Bianco’s 1994 research in which patients suffered from both depression and anxiety found significant reductions in symptoms.

Because the Alpha-Stim SCS has an impact on the total brain, researchers have found global improvements in thinking (global modulation effect) are possible. Such improvement has been reported in a number of studies including Kennerly’s, 2004 qEEG assessments, Braverman, Smith, Smayda, and Blum’s (1990) study which found increases in P300 bandwidth activity. Improvements in IQ scores secondary to Alpha-Stim treatment were also found by Schmitt, Capo, and Boyd (1986) and Smith (1999).

Two studies (Brovar, 1984; Mellen & Parmer-Shedd, 2009) examined the effect of Alpha-Stim SCS on retention in substance abuse treatment programs. In Mellen et al. (2009), the retention rate for treated subjects was 100% compared to untreated subjects, who had a washout-rate of 46%. Results in the Brovar study also

found 100% retention rate in the treated subjects.

In a single-case study (Mellen & Mitchell, 2008) researchers applied the Alpha-Stim SCS to a 19-year-old jail inmate with an extensive history of impulsive and violent behaviors. He was remanded to the county jail with the injunction that he complete the substance abuse treatment program. The court order stated failure to complete the program would result in his going to the state prison system. While in the treatment program, the inmate continued with physical attacks on other inmates and one jail correctional officer. The jail Director, who liked the young inmate, pulled him twice from the treatment program and put him in solitary confinement hoping that the young man would calm down and be able to finish the program and avoid prison. Although he had little hope, the Director allowed the inmate into the treatment program for the third and final time. It was at that juncture that the researchers began the Alpha-Stim treatment protocol. As a result

The Alpha-Stim treatment encouraged the inmate’s neurons to produce higher levels of serotonin which calmed him down and blocked noradrenergic effects.

of the 15 treatment sessions, the inmate was able to complete the substance abuse program and was eventually promoted to pod leader.

The Alpha-Stim treatment encouraged the inmate’s neurons to produce higher levels of serotonin which calmed him down and blocked noradrenergic effects. These two effects tend to enhance global modulation which can lead to better

decision making.

Experimental Design and Location of Study

The present study took place at a shelter for female victims of domestic violence in Northeast Alabama. The shelter provides free comprehensive assistance to its residents.

Subjects

The sample included 10 women living in a shelter environment: five were Caucasian, four African-American, and one Hispanic. The subjects’ average age was 45 years and all but one had completed high school. Most reported having completed some college and were either married to or were living with the abuser. About 40% of the subjects had been with their abusing partner between 6 and 10 years. Eighty percent of the victims

(Continued on page 14)

CRANIAL ELECTROTHERAPY *(Continued from page 13)*

were unemployed and 80% of the subjects reported not being chemically dependent or were recovering from chemical dependency. Half of the subjects reported being threatened by the abuser with a weapon. The most common weapons were feet, hands, and knives. One in five had been threatened with a handgun.

Repeated Measures Design

Due to a high turnover rate in the shelter, a repeated measures design was utilized. That is, the same subjects were used in both control and treatment conditions. During the treatment condition, the subjects received 5 days with the Alpha-Stim SCS for 20 minutes per day. The control group's postdependent measures were then utilized as the pretreatment dependent measures for the study's treatment component.

Independent Variable

The Alpha-Stim SCS is a cranial electrotherapy stimulation device that has been cleared by the FDA for the treatments of anxiety, depression, and insomnia. The treatment's microamperage (uA) is a proprietary waveform (square-wave) that creates an electronic harmonic resonance in neurons and neuro-networks. The device uses a 9-volt battery to provide electrical current that ranges for 100mV to 500mV. The treatment both increases serotonergic (5HT) activity and reduces noradrenergic (NE) effects in the brain (Kirsch, 2002).

Side effects are minimal with the most common being nausea and dizziness. These are generally self-correcting or can be addressed by reducing the uA current level. The one potentially harmful negative side effect has been increased agitation which occurs in about one in 5,000 cases. The recommended response is to remove the subject from the study (Kirsch, 2002).

There have been over 125 human subjects' studies completed using CES to treat a wide range of emotional and drug-related problems (Kirsch, 2002). Well over 90% of Alpha-Stim studies have reported positive results.

Dependent Variables

In an effort to establish the effectiveness of the Alpha-Stim SCS as a treatment two instruments were utilized as dependent variables: (a) BRIEF-A and (b) BSI. Both have established validity and reliability.

The BRIEF-A (Roth, Isquith, & Gioia, 2005) is a

self-report instrument that assesses the quality of the prefrontal lobes, the area of the brain that is responsible for executive functioning. One set of subscales addresses the subject's ability to manage his or her behavior. These include the Inhibit, Shift, Emotional Control, and Self-Monitor scales. The second set of subscales relate to an individual's meta-cognitions such as short-term memory and problem-solving skills. These subscales include: Initiate, Working Memory, Plan/Organize, Task Monitor, and Organization of Materials. Finally, an overall rating of executive functioning is included. T-scores are utilized in presenting the data.

The BSI (Derogatis, 1993), is also a self-report instrument. The three global scales provide a measure of the subject's overall level of life stress: (a) Global Severity Index (GSI), which provides an overall measure of a subject's stress levels, (b) Positive Symptom Total (PST), which records the total number of stress-related items endorsed by the subject, (c) Positive Symptom Distress Index (PSDI), which is calculated by dividing the sum of the item values by the PST.

The BSI also provides information on a subject's responses to nine clinical scales that relate to mental disorders. The scales include: (a) Somatization: Subjects' reports of bodily dysfunctions, (b) Obsessive/Compulsive traits: Unremitting thoughts and impulses, (c) Interpersonal Sensitivity: Difficulties in relating to other people, (d) Depression: Dysphoric mood and emotions, (e) Anxiety: Nervousness, tension, and apprehension, (f) Hostility: Anger-related thoughts, feelings and/or actions, (g) Phobia: Persistent fear of a person, place, object, or situation, (h) Paranoia: Projective thought, delusions, fear of loss of autonomy, and (i) Psychoticism: Withdrawn, schizoid lifestyle, thought control, and schizophrenia.

Findings

On the BRIEF-A, three statistical measures were reported: (a) Global Executive Composite score (GEC): $p = .028$, (b) Metacognition Scale (abilities to Inhibit, Shift Thinking, Control Emotions & Self-Monitor) resulted in a $p = .06$, and (c) Behavioral Regulation Scale (Working Memory, Planning and Organizing, Task Monitoring and Ability to Initiate) gave a $p = .009$.

Results from the BSI's measures of stress were:
1. Global Severity Index $p = .02$

(Continued on page 15)

CRANIAL ELECTROTHERAPY *(Continued from page 14)*

2. Positive Symptom Total $p = .05$
3. Positive Symptom Distress
Index $p = .012$

The nine clinical measures of the BSI did not achieve statistical significance; however, the trend lines indicated positive changes in all nine of the clinical variables suggesting movement toward more normalized functioning in each category.

Discussion and Summary

All three BSI global scales found significant reductions in stress levels for the 10 sheltered residents secondary to treatment with cranial electrotherapy stimulation. As noted above, the clinical scales, while not achieving statistical significance, the subjects' trend lines demonstrated reduced symptoms in all nine categories. Specifically, there were reductions in somatization, obsessive-compulsive thinking, reduced levels of depression, anxiety, hostility, and improved ability to relate interpersonally. There were also reductions in phobic anxiety, paranoid ideation, and psychoticism.

Results from the BRIEF-A were also statistically significant and supported the possibility of a global modulation effect. The global assessment of executive functioning showed significant improvement, $p = .028$.

Residents' abilities to engage in metacognitions such

as self-monitoring, ability to control emotions, ability to self-inhibit, and the ability to shift one's thinking all showed improvements, although the $p = .06$ fell just below the accepted level.

Results from the Behavioral Regulation Scale were statistically significant $p = .009$. These results showed improvements in the residents' working memory, planning and organizing, task monitoring, and ability to initiate. As noted above, changes in the subjects came after only five treatment sessions, which demonstrated the ability of the Alpha-Stim SCS to produce rapid, positive improvement in the subjects' emotional and cognitive lives.

In summary, results from this pilot study suggest cranial electrotherapy stimulation may contribute to reductions in the psychological stress experienced by victims of domestic abuse. In addition, results from the BRIEF-A suggest improvements in global functioning within the cortical and subcortical areas of the brain that may improve the victims' abilities to think more clearly and make better decisions. Future research is recommended to see if this treatment will work as well with female inmates.

References available from the first author.

 **SAGE Track**

**Authors! Submit your
article to CJB online
with SAGE Track**

SAGE Track is a web-based peer review and submission system powered by ScholarOne® Manuscripts.

The entire process, from article submission to acceptance for publication in *Criminal Justice and Behavior (CJB)*, is now handled online by the SAGE Track website. SAGE Track's graphical interface will guide you through a simple and speedy submission with step-by-step prompts.

**To submit a manuscript, please visit:
www.mc.manuscriptcentral.com/cjb**

