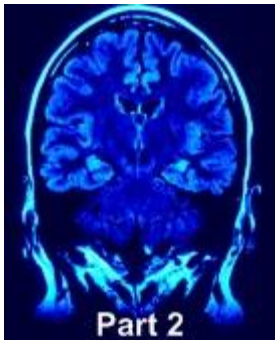
The Behavioral Medicine Report: What Is Cranial Electrotherapy Stimulation? (Part 2)

Chris Fisher, bmedreport.com (http://www.bmedreport.com/archives/5920) September 30, 2009

Categories: Meta-Analyses, Commentaries and Review Articles



In Part 1 of this series, a basic introduction to Cranial Electrotherapy Stimulation (CES), also known as Cranial Electrical Stimulation and Cranial Electrostimulation, was given that included a technical overview, typical treatment protocols, and common side effects. Next, Part 2 details CES' proposed mechanism of action and treatment effectiveness with depression, anxiety, insomnia, and chronic pain, as well as a few closing thoughts. Readers can expect many more future posts on CES and its treatment of various ailments. I anticipate that the first will cover a well-designed CES for mild traumatic brain injury (mTBI) study.

CES Mechanism of Action

Although the exact mechanism of action for CES, including Alpha-Stim, are not known, Alpha-Stim's pulsed electrical currents are believed to affect the limbic system, the reticular activating system, and/or the hypothalamus (Gilula & Kirsch, 2005) and to stimulate regions that control pain messages, neurotransmitter creation, and hormone production via the hypothalamic-pituitary axis (Kirsch & Smith, 2004).

Alexander Bystritsky (2008) provided an excellent technical overview of the current state of knowledge in regard to CES' mechanism of action. Readers are encouraged to read his paper. Dr. Bystrisky states that,

"Some of the signals from these afferent nerves eventually reach the ventral posteromedial nucleus of the thalamus. Animal studies indicate that 42% to 46% of CES current enters the brain, with the highest levels of current recorded in the thalamus. The thalamus is a region that seems to be important in the pathophysiology of anxiety. Evidence of this comes from positron emission tomography (PET) and functional magnetic resonance imaging (fMRI) studies in GAD patients, which show changes in thalamic activity (as well as in other regions) with medication treatments. A single photon emission computed tomography (SPECT) study in other anxiety disorders including obsessive-compulsive disorder, post-traumatic stress disorder, and social anxiety disorder also found decreases in thalamic activity with treatment with the medication citalopram. Therefore, CES could hypothetically exert anxiolytic effects by affecting the thalamus and/or its afferent pathways. Future neuroimaging studies examining the brain regions and circuits associated with CES treatment will be needed to understand its mechanism of action" (pgs. 415-416).

Dr. Bystritsky went on to hypothesize that CES may also reset the brain to prestress homeostasis levels – this has important treatment implications for post-traumatic stress disorder (PTSD) and substance dependence, which may explain the current research interest in these areas.

CES And QEEG

Kennerly (2006) found that persons treated with CES for 20 minutes exhibited significant changes in the EEG, including increased alpha (8-12Hz) relative power and decreased relative power in the delta (0–3.5Hz) and beta (12.5-30Hz) frequencies. Increased alpha typically correlates with improved relaxation and possibly increased mental alertness or clarity (Thompson & Thompson, 2003), while decreased delta suggests reduced drowsiness. Beta reductions were exhibited mostly between 20-30Hz and this frequency band correlates with reductions in anxiety, ruminative thought, and obsessive/compulsive-like behaviors (Demos, 2005). Kennerly further reported that quantitative electroencephalography (qEEG) and low resolution electromagnetic tomography (LORETA) analyses showed that the electrical pulses generated by the Alpha-Stim reached all cortical and subcortical areas of the brain.

CES Treatment Effectiveness

Based on qualitative criteria recommended by Kirsch & Gilula (2007a), large effect sizes (i.e., >.50) are well established across a number of controlled and uncontrolled studies in the Alpha-Stim treatment of a wide variety of psychological and physical disorders (Kirsch & Smith, 2004; Kirsch & Gilula, 2007a; Kirsch & Gilula, 2007b; Kirsch & Gilula, 2007c; Kirsch & Gilula, 2007d; Matteson & Ivancevich, 1986; Moore, 1975; Rosenthal & Wulfsohn, 1970; Rosenthal, 1972; Smith & O'Neill, 1975).

Depression and Anxiety

A meta-analysis of CES for depression that included 20 studies and 975 subjects revealed a mean effect size rating of .50 (Kirsch & Gilula, 2007c; Kirsch & Gilula, 2007d). A meta-analysis of CES for anxiety which included 41 studies comprising 2049 participants found a mean effect size ratings of .57. This large effect size decreased to .53 using only double-blinded studies in the analysis (Kirsch & Gilula, 2007a; Kirsch & Gilula, 2007b). A recent uncontrolled pilot study into CES for chronic and pervasive anxiety (i.e., generalized anxiety disorder) found a 50% average reduction in self-reported anxiety by a majority of treatment completers (Bystritsky, Kerwin, & Feusner, 2008).

Insomnia

A meta-analysis of 20 studies involving 1083 participants that received CES for sleep difficulties (mostly insomnia) was recently completed. CES for insomnia achieved a mean effect size rating of .64 (Kirsch & Gilula, 2007e).

Chronic Pain

There are no known meta-analyses currently published for CES for chronic pain (i.e., headache). Soloman et al. (1989) conducted a randomized, double blind study with 100 men and women receiving outpatient care for chronic tension headache. All participants had received analgesic therapy for at least 1 year and had a minimum of 4 headaches a month for inclusion into the study. The researchers reported a statistically significant 35% reduction in pain severity scores. The percent of participants that reported statistically significant subjective headache improvement following CES treatment compared to the control group were: 12% "highly effective," 24% "moderately effective," 26% "minimally effective," and 38% "not effective."

Summary

CES for the treatment of anxiety, depression, and insomnia achieved impressive effect sizes in the studies reviewed. CES for chronic pain produced acceptable results given that participants had chronic headaches (1 year or longer) that were presumably treatment non-responsive to frontline medications.

In my experiences, CES and neurofeedback can be complementary treatments for some patients. Patients often seek treatment in a crisis and need immediate relief. Neurofeedback is not known for its immediate results and usually takes extended sessions to realize significant gains. The addition of CES provides immediate symptom relief (often the very first session), which allows neurotherapy to continue with significantly less patient stress and possibly improved outcomes (based on personal experience – not research). Kennerly's QEEG study described above provides guidance as to who might respond to CES treatment, alone or combined with neurotherapy.

On a final note, I personally believe that Alpha-Stim, a prominent brand of CES, remains one of the most underused, cost-effective treatments on market. Alpha-Stim is a safe and effective treatment for anxiety, depression, and insomnia with mild and time-limited side effects that can be used in conjunction with most psychotropic medications (Childs & Price, 2007). I am quite frankly perplexed as to why CES is not prescribed more often, especially for persons who do not respond to front-line treatments.

Enjoy.

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References:

Please see Part 1 of this series for a complete list of references.