One set of researchers was interested in the effect CES would have on drug abusers. Low P-300 brainwaves (recognition waves) are one cortical marker of individuals at significant risk of drug abuse and dependence. Braverman, E.; Smith, R.; Smayda, R.; Blum, K. (1990) found drug abusers who received CES significantly increased P-300 amplitudes when compared to a control group. This normalization of electrophysiological changes is one goal of pharmacological interventions. There were also significant and positive changes found in the alpha, delta, theta, and beta bandwidths, which underscored a more comprehensive brain modulation than found with pharmacological interventions. That is, in a broad general sense, the brain appeared to function in a more modulated manner with CES.

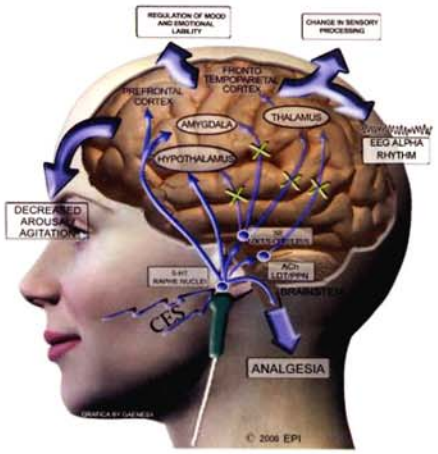
When alcoholics in short-term remission can no longer self-medicate with their drug of choice, coping with stressful situations can be difficult. This leads to increasing levels of anxiety and depression and a greater risk of relapse. It is not uncommon for this population to have low concentrations of MAO-B and GABA. MAOs play a role in reducing the ability of neurotransmitters to activate. Likewise, GABA is the primary inhibitory neurotransmitter. When these function normally, the subject has greater ability to inhibit undesirable behaviors. If these could be increased, then the alcoholics would have fewer affective disturbances and an increased probability of not relapsing. Krupitsky, E.; Burakov, A.; Karandashova, G.; Katsnelson, J.; Lebedev, V.; Grinenko, A.; and Borodkin, J. completed a study using CES on 20 such subjects and found increased levels of GABA and MAO-B in blood samples secondary to CES. These changes were not found in the control group.

The above studies point to important positive biological and psychological changes found in subjects who used CES as a treatment.

Independent Variable

The CES utilized was the Alpha-Stim SCS®, by Electromedical Products International. It is a hand-held unit that uses a 9-volt battery to provide an electrically based treatment for many stress-related symptoms. The device has been cleared by the FDA for treating depression, anxiety, and insomnia. It is simple to use, effective for large segments of the population, and cost effective. To initiate treatment, one connects an ear clip to each ear lobe, sets the level of electro-current desired, and sets the timer. The subject can continue office tasks, talk to others, watch TV, and/or carry out other daily tasks. Driving a car, however, is not recommended.

Figure 1
Pathways Activated and Inhibited by CES



(Illustration courtesy of Electromedical Products International.)

Arrows indicate electro-current pathways. CES not only activates areas of the cortex that calm a person down, but the "X's" in figure 1 present the cortical and subcortical areas where CES inhibits the thalamocortical activity, which contributes to arousal and agitation (cholinergic and noradrenergic systems).

The "microcurrent waveform activates particular groups of nerve cells that are located at the brainstem.... These groups of nerve cells produce the chemicals serotonin and acetylcholine which can affect the chemical activity of nerve cells at nearby and more distant sites in the nervous system" (Giordano 2006). These actions modulate the brain and encourage the production of alpha waves that help an individual focus and remain relaxed while under stress.

This form of CES uses a microamperage (uA) designed to gently stimulate the brain's neuronal activity. The current range is from 10 to 500 uA. As figure 1 demonstrates, the Alpha-Stim modulates brain activity by increasing serotonergic activity (5-HT). This increase enhances the Alpha (8–13 Hz) bandwidth, necessary for a relaxed and focused mental state.

The application of CES with correctional and law enforcement personnel has not been reported in the literature; however, as noted previously, research with other populations has reported positive outcomes.

Dependent Variables

The assessment tools utilized were the Brief Symptom Inventory (BSI)® (Derogatis 1993), Beck Depression Inventory® (Beck 1996) and the Beck Anxiety Inventory® (Beck 1990). There were 12 subscales on the BSI, including a depression scale and an anxiety scale. Because depression and anxiety are two major components of stress, the Beck Depression and Beck Anxiety Inventories were included to compliment the BSI findings in these two domains.

BSI Subscales

- Somatization. Seven items measuring stress from physical ills.
- Obsessive/Compulsive. Six items addressing thoughts and/or actions that are unremitting and unwanted.
- Interpersonal Sensitivity. Four items addressing feelings of inadequacy and self-deprecatory.
- Depression. Six items dealing with symptoms of clinical depression such as dysphoria, and a lack of motivation.
- Anxiety. Six items looking at symptoms such as nervousness, tension, apprehension, and panic.
- Hostility. Five items reflecting anger and other negative feelings.
- Phobic Anxiety. Five items addressing irrational fears and avoidant behaviors.
- Paranoid Ideation. Five items dealing with suspiciousness, delusions, hostility, and thought projection.