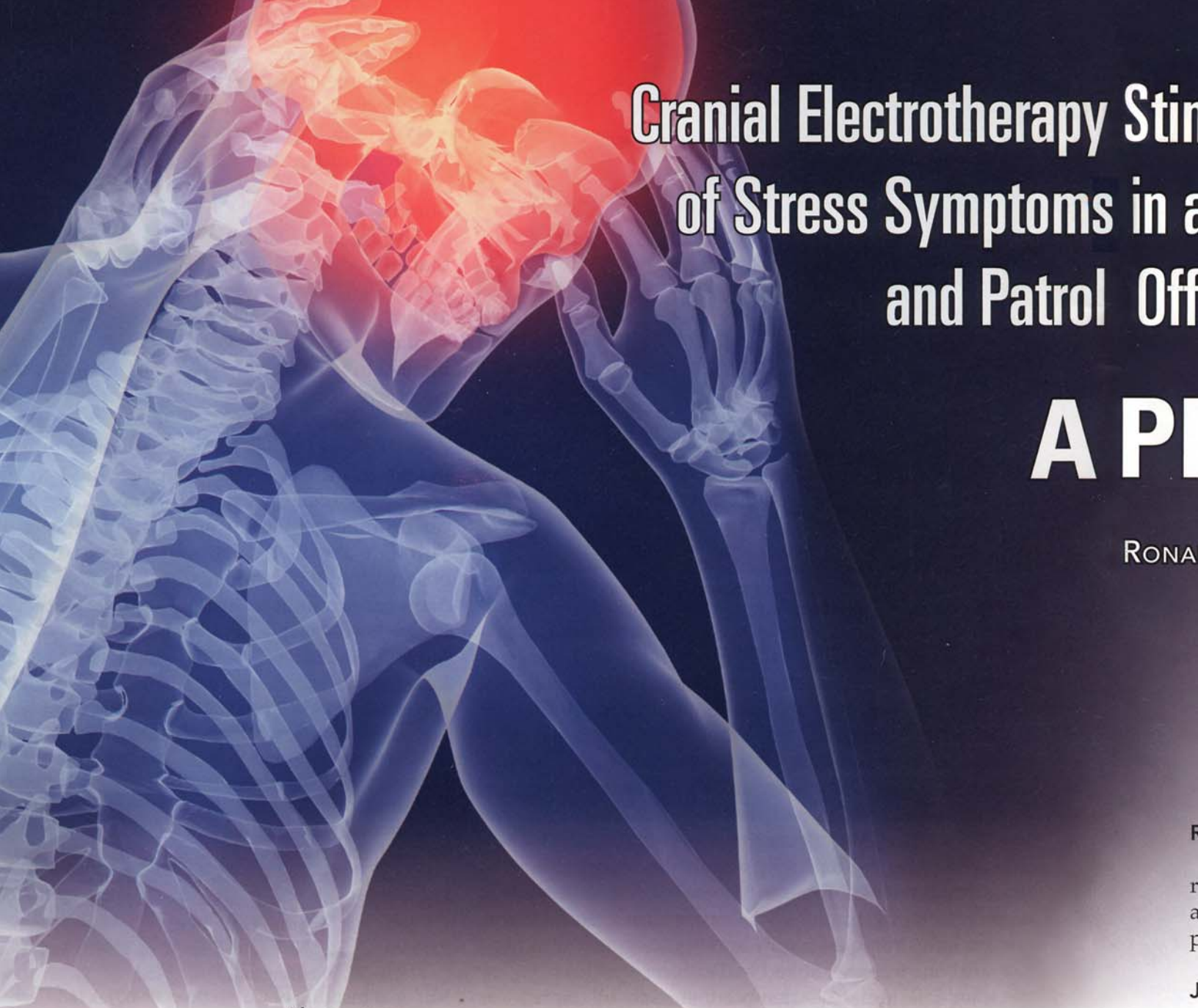


**Cranial Electrotherapy Stimulation (CES) and the Reduction  
of Stress Symptoms in a Sheriff's Jail Security  
and Patrol Officer Population:**

**A PILOT STUDY**

RONALD R. MELLEN, PH.D., AND WADE MACKEY, PH.D.



# Cranial Electrotherapy Stimulation of Stress Symptoms in a Security and Patrol Officer Staff

## A PILOT STUDY

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### Abstract

**The present pilot study examined the ability of cranial electrotherapy stimulation (CES) as a treatment to reduce stress-related symptoms in the security and patrol officer staff of a rural sheriff's jail. Because of the small N and the minimal level of therapeutic treatment (electro-current) utilized, the researchers anticipated support for the null hypotheses. And as anticipated, no statistically significant difference between the treatment group and a student control group was found.**

However, all dependent variables, 14 scales total, trended in the direction of reduced stress for the officers. Consequently, the experimental group's main-effects and a Sign test (trend analysis) were applied to the data.

Significant main-effect reductions were found in 11 of the 14 psychological measures, Sign test =  $p < .001$ . All dependent measures demonstrated some degree of reduction in negative symptoms for the officers.

Decreases were found in hostility, somatization, disorganized thinking, obsessive-compulsive symptoms, two measures of anxiety, two measures of depression, and three global scales: general stress index, the positive symptom distress index, and total number of symptoms endorsed. The positive results of the pilot study suggest further research with a larger sample could provide even stronger support for this treatment modality.



# Stimulation (CES) and the Reduction in a Sheriff's Jail Security Officer Population: PILOT STUDY

RONALD R. MELLEN, PH.D., AND WADE MACKEY, PH.D.

## Research Question

Would the application of CES reduce variables related to stress in a county sheriff's jail security and patrol officers?

## Job Stress

Research has demonstrated on numerous occasions the exceptionally high levels of job-related stress of officers in jail, correctional, and law enforcement agencies (Van Blarcum 2008; Scott 2004; Griffin 2003; Zhao 2002; Finn 2000). Stress levels are reflected in a number of mental health disorders, including but not limited to clinical anxiety, clinical depression, hostility, and somatization of symptoms. Pharmacological treatments are standard fare by far. They, however, can have serious side-effects, are costly, and patients can be refractory (not helped) to this treatment protocol. CES offers an electrotherapy-based protocol with few side effects and is cost efficient when compared to pharmacological treatments.

## Review of Literature

There have been well more than 125 human subjects' studies completed using CES as a treatment modality. Following is a small sampling drawn to demonstrate the many populations with which CES has been successfully utilized. These include business executives, drug abusers, alcoholics, subjects with migraine headaches, outpatients with clinical levels of anxiety, the violent mentally retarded, and one study that used a hospitalized sample with a variety of mental health diagnoses. Most of the following studies used psychological assessments to measure change in stress and depression levels. However, two used biological measures to identify stress reductions secondary to CES treatment. One used EEG P-300 brainwaves and the other assessed MAO-B (enzyme) and GABA (neurotransmitter) blood levels to determine the effectiveness of CES in reducing stress.

Business executives frequently live under exceptional levels of stress. Matteson, M. and Ivancevich, J. (1986) recruited individuals who were both in an MBA program at the University of Houston and employed in middle-management positions in corpora-

tions. Post-CES treatment revealed significant differences between the treatment group and the control group. These reductions were found in measures such as state and trait anxiety, depression, dejection, anger, hostility, fatigue, inertia, and confusion/bewilderment. The treatment group reported fewer health complaints, fewer sleep problems, less stress, faster reductions in tension, and improved physical energy.

Overcash, S. (1999) used 197 patients, with clinical levels of anxiety, in an outpatient setting. This meant the subjects' disorders were not of a magnitude requiring hospitalization. About 26 percent had proven refractory to the use of anxiolytic medications and 58 percent had no previous therapy for their anxiety disorders. Post-treatment was measured using self-assessments and biological measures. The subjects were divided into three biological assessment groups. One group was assessed with electromyogram (EMG), a second group was assessed with a measure of the electrodermal response (EDR), and the third group was assessed with peripheral digit (middle finger) temperature. Results showed positive reductions in stress, as a result of CES, in all three biological measures and self-assessments. Follow-up assessments found 73 percent of subjects were "well satisfied" with their treatment outcomes.

In a double-blind study, Brotman, P. (1989) found significant reductions in the symptoms of "classical" migraine headaches when CES was combined with Quieting Reflex Training or hand thermal biofeedback.

Passini, F.; Frank, G.; Watson, C.; and Herder, J. (1976) used CES in the treatment of anxiety and depression in a variety of inpatient volunteers. The diagnoses for the 60 subjects included alcohol and drug dependence, depression, manic-depression, anxiety neurosis, organic brain dysfunctions, and schizophrenia. A sample of subjects was on standard protocol medications, including psychotropics, and still demonstrated significant reductions in anxiety and depressive symptoms. No side effects were reported.



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.

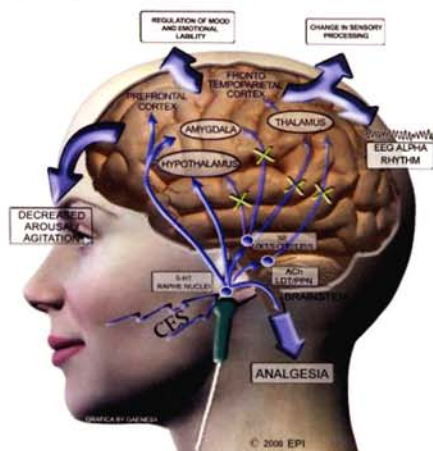
The above studies point to important positive biological and psychological changes found in subjects who used CES as a treatment.

### Independent Variable

The CES utilized was the Alpha-Stim SCS<sup>®</sup>, by Electromedical Pro-

ducts 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 thalamo-cortical 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 micro-ampere (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)<sup>®</sup> (Derogatis 1993), Beck Depression Inventory<sup>®</sup> (Beck 1996) and the Beck Anxiety Inventory<sup>®</sup> (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.



- Psychoticism. Five items addressing withdrawal, interpersonal alienation, psychosis and thought dysfunctions:

### Three Global Scales

- Global Severity Index (GSI). It is the most sensitive indicatory of stress in the clinical and global scales.
- Positive Symptom Total (PST). The total number of symptoms endorsed by the test taker.
- Positive Symptom Distress Index (PSDI). A scale that provides information on whether the test taker is minimizing or exaggerating stress.
- Beck Anxiety and Beck Depression measure only one dimension each.

### Administration of Treatment

Each subject completed 20 sessions using the Alpha-Stim SCS. Each session was 20 minutes in length and the units were permanently preset at the factory with the electro-current placed at the lowest therapeutic level. Treatment times were set by the individual subjects and the sessions were completed while the officers were on duty. Each subject received a \$20 gift certificate upon completion of the 20 sessions.

Only one subject was removed from the study. After the third session, he expressed distress that the treatment increased his level of agitation. He was replaced. In the literature, which covers approximately 5,000 subjects, there was only one similar incident reported.

### Hypotheses

- The treatment will significantly reduce the subjects' BSI anxiety score.
- The treatment will significantly reduce the subjects' BSI depression score.
- The treatment will significantly reduce the subjects' BSI somatization score.
- The treatment will significantly reduce the subjects' BSI obsessive and compulsive score.

- The treatment will significantly reduce the subjects' BSI interpersonal sensitivity score.
- The treatment will significantly reduce the subjects' BSI hostility score.
- The treatment will significantly reduce the subjects' BSI phobic score.
- The treatment will significantly reduce the subjects' BSI paranoid score.
- The treatment will significantly reduce the subjects' BSI psychoticism score.
- The treatment will significantly reduce the subjects' BSI GSI scores.
- The treatment will significantly reduce the subjects' BSI PST scores.
- The treatment will significantly reduce the subjects' PSDI scores.
- The treatment will significantly reduce the subjects' Beck Anxiety scores.
- The treatment will significantly reduce the subjects' Beck Depression scores.

### Results

As noted earlier, there were no statistical differences between the treatment group and the control group, which may have been due, at least in part, to the small sample size and low electro-current volume. However, on the positive side, using all 14 BSI subscale scores, the Sign test ( $p < .01$ ) found all scales reflected reductions in negative symptoms. In addition, using t-tests, 11 of the 14 scales had

significant main-effects when pretest and posttest results from the experimental group were compared. Eight scales were significant at the .05 (two-tail test) or .01 levels, while three scales were significant at the .05 level (one-tail test). The remaining three scales were insignificant.

Results from the two sets of anxiety scales and depression scales supported one another. These were scales of primary interest for the two researchers. The remaining scales, which reflected decreases in negative symptoms, suggest brain modulation can have an impact on mental dysfunctions beyond the three Food and Drug Administration (FDA) symptoms noted earlier: anxiety, depression, and insomnia.

Reduced depression and anxiety suggests that officers had more energy and that the energy was put to more productive use, as opposed to worry and being anxious.

Lower somatization scores suggests the high levels of stress may have been mitigated by the treatment and provided officers an improvement in their general sense of physical well-being.

Changes in the obsessive/compulsive scores may reflect a reduction in such needs as excessively checking and double checking, also feelings of being blocked by their thinking patterns which could lead to difficulty making decisions, and trouble concentrating.

Reductions in psychoticism may mean the officers had an improved sense of connectedness with other

Table 1

#### BSI Subscales with T-scores

Scales	Somatiz	O/C	I/Sensit	Depress	Anxiety	Hostility	Phobia
T-scores	3.90***	2.68**	1.54ns	2.57**	2.48**	2.06*	0.85ns

#### Beck Scales

Scales	Paranoia	Psychist	GSI	PST	PSDI	Beck A	Beck D
T-score	1.62ns	1.84*	2.43**	2.68**	2.49**	1.89*	3.34***

Where \* =  $< .05$  (one-tail test) \*\* =  $< .05$  (two-tail test)  
 \*\*\* =  $< .01$  (one-tail test) ns = nonsignificant result

(A two-tail test requires a stronger association, between the treatment variable and the dependent variables, than a one-tail test).

officers and greater ability to communicate with others.

### Posttreatment Anecdotal Comments

Anecdotal remarks can add a touch of flavor to the statistics. Officers' comments were generally favorable and some entertaining. For example, one female investigator noted: "I did feel more relaxed and less stressful." She went on to say that about a week after completing the 20 treatment sessions, her husband asked if she was still using the "ear-clip thing?" She responded in the negative. He then asked if they could buy one of the units for her to use at home. Comments by six other officers included:

- "I feel more relaxed and less irritable. My thoughts are not as negative."
- "I would like to have my mother (recently widowed) try the system."
- "I felt better, on a more even keel. Things just didn't seem to bother me as much. Could tell when I didn't use the Alpha-Stim."
- "Far more calm while using the Alpha-Stim."
- "I would recommend the Alpha-Stim if someone needed a stress releaser. It would be great for them."
- "At the end of the Alpha-Stim I felt more relaxed and ready for the day."

### Summary

The most noteworthy data was the reduction in depression and anxiety on the BSI and Beck scales. These were the two mood disorders for which the Alpha-Stim had been cleared by the FDA and hence of greatest interest to the researchers. However, positive results went beyond these two dysfunctions. Indications of strong reductions in other emotional disorders were also found.

Obsessive thinking and compulsive behaviors showed significant reductions. Changes such as these could contribute to more flexible thinking in the officers.

Somatic related complaints are often the end result of turning excessive stress inward, such as headaches, stomach disorders, and shoulder

tension. Lower stress levels reduced somatic complaints by the officers, which could result in healthier living.

Officers frequently develop greater hostility due to job stress. Results showed reductions in hostility, which could result in their improved ability to handle the inherent challenges of their jobs.

Results also suggest the officers experienced reduced feelings of alienation. Reducing one's sense of alienation could translate into a better workplace environment for the offi-

cer and those with whom he/she worked.

Increased cortical control means the officers were better able to use thinking processes to control their emotions. This result could lead to greater clarity of thought when dealing with highly intense jail situations.

In addition to improved subscale scores, the three global measures of stress were at the <.01 level reflecting important reductions in officers' perceived stress. Perhaps the most noteworthy was the reduction in




**Table 2**  
**Sign Test**

Sub-scale	Mean Score Pre-treatment	Mean Score Post-treatment	Difference	Direction of Difference
SOM	.453	.195	.258	Down
DC	1.153	.513	.640	Down
IS	.818	.386	.432	Down
DEP	.864	.348	.516	Down
ANX	.712	.273	.439	Down
HOS	1.042	.455	.654	Down
PHOB	.309	.145	.164	Down
PAR	1.042	.600	.442	Down
PSY	.636	.273	.363	Down
GSI	.779	.356	.423	Down
PST	24.730	15.364	9.366	Down
PSDI	1.515	1.143	.372	Down
Beck (BAI)	10.636	6.00	4.636	Down
Beck (BDI)	11.000	5.636	5.364	Down

Number of differences DOWN = 14 Number of Differences UP = 0 Number of Ties = 0 (Sign Test  $p < .001$ )

the number of endorsed symptoms. The T-test score was impressive, but even it paled when compared to the percent drop, 41 percent, in endorsed symptoms between pre- and posttreatment.

Given the low cost of CES, ease of administration, minimal side effects, and the results noted previously, a study with a larger sample size is in order. 

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