Primary Psychiatry. 2007;14(3):50-56

Cranial Electrotherapy Stimulation Reduces Aggression in Violent Neuropsychiatric Patients

Allen Childs, MD, FAPA, and Larry Price, PhD

ABSTRACT

The study sought to determine if 3 months of daily cranial electrotherapy stimulation (CES) treatment reduced aggression in violent neuropsychiatric patients in a maximum security hospital. CES was used to treat 48 chronically aggressive neuropsychiatric patients in a maximum security psychiatric hospital. Retrospective chart review compared 3 months pre-treatment with 3 months of active therapy. Early patients had responded positively to CES with a 41% reduction in episodes of violence (P<.001), a 40% reduction in episodes requiring restraint (P<.001) and seclusion (P<.05), and 42% fewer as-needed emergency medications (P<.01). A subgroup of 10 treatment-resistant psychotic patients, who attacked without warning or apparent motivation and were designated as having sudden assault syndrome, were 48% less violent on CES (P<.001). CES has significant anti-aggressive effects in violent neuropsychiatric patients, who are often refractory to medication. This safe, easy-to-administer treatment can benefit long-term severely ill patients.

FOCUS POINTS

- Cranial electrotherapy stimulation (CES) has anti-aggressive effects in chronically ill neuropsychiatric patients.
- CES can be used safely with all psychoactive medications.
- Among 48 patients, 83% responded positively to CES.
- Aggressive episodes as well as use of restraints, seclusion, and as-needed emergency medications all declined following CES in a difficult-to-treat neuropsychiatric population.
- Sudden assault syndrome is characterized by repeated attacks without apparent motivation, medication resistance, and responsiveness to CES.
- CES has United States Food and Drug Administration approval for the treatment of anxiety, depression, and insomnia.

INTRODUCTION

A report from Germany described a 60% improvement rate in medication-resistant schizophrenic patients who had been ill >5 years and who had undergone cranial electrotherapy stimulation (CES) treatment for >2 years.[1] A preliminary report of the first nine cases of the 48 reported herein showed a decline of 58% in number of aggressive episodes, a decline of 72% in number of seclusions, 58% fewer incidences requiring restraints, and 53% fewer required PRN medications.[2]

CES has widespread effects on electrophysiology and neurochemistry. Quantitative electroencephalograms as well as pre- and post-CES have shown significant increases in alpha waves (8–12 Hz) accompanied by decreases in delta waves (1–3 Hz).[3] A comprehensive, annotated bibliography of CES detailing 126 human and 29 animal studies[4] refers to cerebral spinal fluid studies showing a 150% to 200% increase in serotonin following CES treatment.[5] The enzyme monoamine oxidase (MAO)-B rises with CES, indicating increased metabolism of dopamine and tyramine.[6] Meta-analysis of studies of CES in anxiety conducted by Klawansky and colleagues[7] found an effect size of

Dr. Childs is chief psychiatrist in the Multiple Disabilities Unit at North Texas State Hospital in Vernon, clinical associate professor of psychiatry at the University of Texas Southwestern Medical School in Dallas, and medical director at Electromedical Products International. Dr. Price is associate professor of psychometrics and statistics and associate dean for research and sponsored projects at the College of Education at Texas State University in San Marcos.

Disclosure: Drs. Childs and Price report no affiliation with or financial interest in any organization that may pose a conflict of interest.

Please direct all correspondence to: Allen Childs, MD, FAPA, Clinical Associate Professor of Psychiatry, c/o North Texas State Hospital, Vernon Campus, P.O. Box 2231, Vernon, TX 76384; Tel: 940-552-9901; Fax: 940-553-2514; E-mail: allen.childs@dshs.state.tx.

r=.53, meaning the average patient was 53% improved, a strong effect size. CES devices have been in use in the United States for >50 years, and the Food and Drug Administration has granted clearance for CES devices to be marketed for the treatment of anxiety, insomnia, and depression.

MATERIALS AND METHODS

Since 2001, North Texas State Hospital at Vernon (NTSH-V) has treated >120 aggressive neuropsychiatric patients with CES. A retrospective chart review was carried out on all patients receiving CES from 2001–2005, yielding 48 cases with adequate pre-treatment data (2–3 months) and 2–3 months of active treatment data. Outcomes that were tallied in the chart review included the following measures of aggressive behavior: the number of significant physical and verbal aggressive episodes, frequency of the use of restraints, frequency of the use of seclusion, and number of medications given on an as-needed or emergency basis (hereafter referred to as PRN medications). Diagnoses and other demographic data were also gathered.

All patients gave informed consent for CES and were typically treated for 20 minutes to 1 hour twice daily while they went about their activities on the unit. The prescriptive device used was the Alpha-Stim 100,[8] which produces a modified square waveform at a frequency of either 0.5 Hz (cycles per second) or 100.0 Hz at a current of 100–600 microamperes. This treatment involves the transcranial application of extremely low-dose electrical current to the brain (≤600 microamperes) through moistened electrodes attached to the ear lobes from a pocket-sized device.

The patients remained on their usual (often multiple) antipsychotics and mood stabilizers during CES and continued participation in the hospital's social learning, educational, and vocational rehabilitation programs.

PATIENT CHARACTERISTICS

Every patient had multiple comorbidities. Forty-five patients (n=48) carried psychotic diagnoses, 31 patients had mental retardation (28 mild, 3 moderate), and 6 patients had central nervous system (CNS) trauma. Well-controlled seizure disorders were noted in 18 patients. Some form of personality disorder was diagnosed in almost all cases, but only 3 patients were diagnosed primarily with antisocial personality disorder. Two patients had Huntington's chorea, and pervasive developmental disorder with psychosis was noted in two other cases, both of whom were also mentally retarded. One patient met criteria for intermittent explosive disorder. Psychotic diagnoses included 12 patients with schizoaffective disorder (manic type), eight patients with disorganized schizophrenia, seven patients with paranoid schizophrenia, five patients with undifferentiated schizophrenia, and two patients with bipolar disorder (manic type).

The patients, between 18–62 years of age, had been hospitalized from a few months to >20 years and included many of the most resistant people in the maximum security unit of NTSH-V. This 320-bed hospital receives patients whose aggression has exceeded the management capacity of the state's 25 other psychiatric hospitals and state schools. Review boards at these facilities had declared 41 of these patients "manifestly dangerous," who, according to the Texas Administrative Code, are patients whose aggression has not improved in spite of treatment focused on reducing their dangerousness. The remaining seven patients had been found incompetent to stand trial on felony charges involving bodily injury.

SUDDEN ASSAULT SYNDROME

A subgroup of 10 patients had sudden assault syndrome (SAS), exhibiting behavioral characteristics that differed from their other 38 equally aggressive peers. Rather than the more familiar patterns of aggression (eg, obvious anger at someone or something, command auditory hallucinations, fear of attack or humiliation by others), these 10 patients showed none of these traits before or after their repeated assaults. They seldom showed anger or distress, giving staff no warning of impending attacks. Afterward, they never expressed any rationale (psychotic or otherwise) that might be seen as a motivation for hitting others. They were not fearful or angry. Typical responses to staff inquiries were "I don't know" or no response at all.[9]

Although all 10 of these patients were psychotic, staff were unable to identify explanatory surges or patterns of change in delusional thinking that might account for these patients' frequent, unpredictable violence. Their aggression did not result from demands by staff or attacks by peers. Their psychoses were highly medication resistant, as was their assaultiveness, even after years of multiple medication trials. Four of the 10 patients never, or almost never, required restraint, seclusion, or PRN medicine after their assaults, as they did not continue to fight after striking the first blow. They never showed remorse. Curiously, they were not seen by staff as hostile in spite of their repeated attacks, which, when directed at staff, were regarded as "nothing personal."

CASE REPORT

A 57-year-old unmarried Caucasian woman was admitted to the maximum-security unit of NTSH-V, having been found to be "manifestly dangerous" at another state hospital where she had carried out 17 assaults on peers and staff over a 2-month period. In spite of numerous medication changes, 1:1 and even 2:1 staff coverage, and other specialized interventions, she continued to attack, throw furniture, kick walls and doors, and require frequent restraints. She would fall down up to eight times a day, accuse staff of shoving her, and make false reports to the Department of Regulatory Services. She was floridly paranoid, developed grudge lists, and would follow peers and staff around yelling at them to get away from her. At other times, she would target peers for assault when they were taking staff's time and attention, which she was demanding. She sometimes expressed remorse over her actions, but did not change her behavior.

The patient's history of psychiatric hospitalizations began nearly 40 years ago, having first been hospitalized at 15 years of age. Since 1991, she was in state hospitals in Texas 11 times and was in prison for 2 years for stealing a car with a baby in the back seat. For the past 13 years, she was homeless when not incarcerated. Throughout the years, antipsychotics, including clozapine, would produce a certain level of improvement in the schizoaffective disorder in that her hallucinations would become quiescent, but she was never able to be maintained in half-way houses or nursing homes because of her violent behavior. Her last such placement ended when she broke an attendant's arm. She was thought to be of borderline intelligence, but had obtained a general equivalency diploma while in prison. The patient had grown up in a sexually and physically abusive home, had started using alcohol and street drugs at age 12, and described herself as an alcoholic like her father by 21 years of age.

In the first 3 months at NTSH-V, she was treated with maximum doses of quetiapine and ziprasidone along with a large dose of oxcarbazepine and escitalopram. She had 12 episodes of physical assault in this pre-CES period, requiring 12 restraints and 66 PRN medication administrations. In spite of the large doses of medicine, she was sleepless many nights, ate irregularly, and was deeply paranoid and withdrawn between aggressive outbursts.

CES was started at the .5 Hz setting, 1 hour twice daily and 15–45 minutes up to three times/day for her frequent agitated episodes. Compliance with CES improved after 2 weeks, and she began sleeping and eating better. Oxcarbazepine and ziprasidone were discontinued and a small dose of clozapine (200 mg/day) was added. Two weeks later the quetiapine dose was cut in half and she continued the escitalopram. In the first month of CES, she had only five aggressive episodes and required four restraints. PRNs dropped to 19.

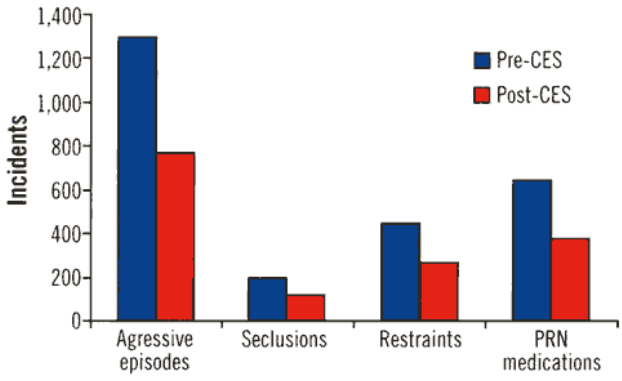
After 6 weeks of CES, the patient's personality changed dramatically. She became outgoing, was no longer accusatory, and her grooming and hygiene became exceptional. Her assaultive behavior stopped altogether, as did the necessity for PRNs and other interventions. At the end of 3 months of CES she passed the dangerousness review board and was returned to the referring hospital. There was no recurrence of her illness on discontinuation of the CES treatments. Observers familiar with the patient from her years at both hospitals commented on what a different person she had become.

RESULTS

Of the 48 cases included in this report, 40 responded positively to CES (an 83% response rate). Figure 1 and Table 1 provide the prevalence (frequency counts) of aggressive episodes, seclusions, restraints, and PRNs from pretest to posttest for the total sample. In the 3 months prior to CES, the 48-person group committed 1,301 acts of aggression, the severity of these episodes reflected in the necessity for restraint and/or seclusion in >50% of the incidents. During the 3 months of active CES treatment, this group committed 767 acts of aggression, a decline of 41%. Number of seclusions required declined from 199 to 120 (a decrease of approximately 40%), and number of times patients required restraint decreased from 446 to 268 (a decrease of approximately 40%). During the same time frame, frequency of

FIGURE 1

CHANGES IN AGGRESSION BEFORE AND AFTER USE OF CES (n=48)



CES=cranial electrotherapy stimulation; PRN=as needed.

Childs A, Price L. *Primary Psychiatry.* Vol 14, No 3. 2007.

TABLE 1

PREVALENCE (FREQUENCY COUNTS) OF AGGRESSIVE EPISODES, SECLUSIONS, RESTRAINTS, AND PRN MEDICATIONS FROM PRETEST TO POST-TEST FOR TOTAL SAMPLE

				Aggressive Episodes		Seclusions		Restraints		PRN Medications	
Diagnosis	*Age*	*Sex*	*Race*	*Pre-CES*	*Post-CES*	*Pre-CES*	*Post-CES*	*Pre-CES*	*Post-CES*	*Pre-CES*	*Post-CES*
Schizophrenia, disorganized; MR	31	F	African American	17	11	9	9	8	2	16	2
Schizoaffective disorder; ASPD; MR	45	M	African American	10	14	0	0	2	0	1	1
CNS trauma; schizophrenia, undifferentiated; MR	57	M	Hispanic	23	15	1	0	0	0	0	0
Schizophrenia, undifferentiated; CNS trauma	28	M	Hispanic	4	17	4	5	1	6	4	3
Schizophrenia, paranoid; MR	47	M	Caucasian	24	17	22	1	2	16	3	3
ASPD; MR	18	M	African American	26	9	1	0	1	0	3	1
Schizoaffective disorder; MR	24	F	African American	35	17	6	12	18	10	18	8
Schizoaffective disorder	50	F	African American	36	29	3	4	4	6	29	11
PDD with psychosis and autism; MR	27	F	Caucasian	34	17	0	0	11	0	10	0
Schizophrenia, antisocial personality; MR	26	M	African American	20	3	2	0	3	0	15	3
Schizophrenia, paranoid; MR	38	M	Hispanic	4	2	0	0	3	1	3	1
Schizoaffective disorder; MR	31	M	African American	36	22	0	0	21	26	23	14
Schizophrenia, disorganized; MR	21	M	Hispanic	43	29	0	0	40	29	40	30
Schizophrenia	45	M	Hispanic	30	25	3	16	26	9	0	4
Schizophrenia, undifferentiated; MR	22	F	Caucasian	25	13	0	1	21	1	25	18
Bipolar disorder; moderate MR	22	M	African American	9	6	0	0	4	2	4	4
Borderline and antisocial personality; MR	51	F	African American	24	1	0	0	5	1	18	7
Schizophrenia, paranoid; MR	34	F	African American	13	5	0	0	1	3	33	8
Schizoaffective disorder	53	F	African American	7	18	1	4	8	9	3	44
Schizoaffective disorder	57	F	Caucasian	12	5	3	3	12	4	66	19
Schizophrenia, paranoid	18	M	Hispanic	148	61	10	0	49	39	54	6
MR, mild; schizoaffective disorder	30	M	African American	1	0	1	0	1	0	7	0
Schizophrenia, undifferentiated; MR	41	M	African American	12	5	2	0	1	1	15	4
Schizophrenia, disorganized; MR	38	M	Hispanic	17	12	0	2	5	0	5	4
Bipolar disorder; borderline personality; MR	31	M	Caucasian	64	63	4	1	5	2	9	23
Schizophrenia, disorganized	56	M	Hispanic	20	11	0	0	9	0	3	0
ASPD; CNS trauma; MR	21	M	Hispanic	27	3	2	0	3	0	0	0
Schizoaffective disorder; MR	25	M	Caucasian	15	3	4	0	11	3	6	1
Intermittent explosive disorder; MR	31	M	Caucasian	27	4	11	1	16	3	9	2
Schizoaffective disorder; borderline personality; MR	34	F	African American	35	24	1	6	1	0	5	19
Schizoaffective disorder; borderline personality; MR*	34	F	African American	45	15	12	6	12	5	16	10
Schizophrenia, disorganized	52	F	African American	9	12	0	5	4	4	12	0
Schizoaffective disorder; borderline personality; MR	41	M	Caucasian	14	11	0	2	2	0	9	7
Huntington's chorea; MR	27	F	Caucasian	19	6	19	4	19	4	12	2
ASPD; MR	30	F	African American	40	64	10	16	20	19	21	18

(Cont. on next page)

PRN medication went from 648 times over 3 months of pre-treatment to 377 times during 3 months of active treatment (a decline of approximately 42%). Table 2 provides the statistical findings for the total sample.

The 10 SAS cases, taken separately, revealed nine responders with the following changes in behavior: aggressive episodes were down from 325 to 170 (a decline of 48%), seclusions decreased by 44%, restraints dropped by 54%, and PRNs were used more than 80% less (Figure 2). Table 3 provides the statistical findings for the patients exhibiting incidence of SAS.

Overall, 32 patients were discharged from the hospital, and only one has been readmitted as of this writing. Five of the six CNS trauma cases improved. All of the 7 previously incompetent to stand trial cases, six of whom were CES responders, have been found competent and have been returned to the courts for judicial processing. None of these patients were diagnosed with antisocial personality disorder. Two other patients, one of whom was primarily antisocial, and the other with pronounced antisocial traits, were non-responders to CES.

There were no troublesome side effects of CES in this population, though early in the treatment a few patients destroyed devices by throwing them on the floor. Some patients noted mild drowsiness. A sensation of lightheadedness may occur early in a treatment session and usually disappears if the current is decreased. Compliance was good for almost all cases, whether responsive or not. Often, patients requested and were given CES treatments on a PRN basis; at other times staff initiated extra CES sessions when patients became agitated. For most patients, the earlier in an outburst the CES treatment was started, the better the calming result. CES has been used up to 4 hours continuously in four highly agitated individuals. All patients who benefited were offered ongoing CES treatments, and some have been using it daily for 4 years.

TABLE 1 (CONT.)

PREVALENCE (FREQUENCY COUNTS) OF AGGRESSIVE EPISODES, SECLUSIONS, RESTRAINTS AND PRN MEDICATIONS FROM PRETEST TO POST-TEST FOR TOTAL SAMPLE

				Aggressive Episodes		Seclusions		Restraints		PRN Medications	
Diagnosis	*Age*	*Sex*	*Race*	*Pre-CES*	*Post-CES*	*Pre-CES*	*Post-CES*	*Pre-CES*	*Post-CES*	*Pre-CES*	*Post-CES*
PDD with psychosis; MR	30	M	Hispanic	24	14	0	0	0	0	0	0
PDD with psychosis; MR*	30	M	Hispanic	3	3	0	0	0	0	0	0
Schizophrenia; disorganized	52	M	African American	26	51	0	1	3	7	15	54
CNS tumor removal	35	M	Hispanic	20	6	0	0	0	1	1	0
Schizophrenia, paranoid; MR	27	M	Caucasian	72	28	0	0	6	0	64	5
Schizophrenia, undifferentiated; MR; cerebral palsy	28	M	Caucasian	14	10	1	0	6	0	7	4
Schizoaffective disorder; borderline personality; ASPD; MR	31	F	Caucasian	50	12	1	6	11	8	17	15
CNS trauma; MR; schizophrenia, undifferentiated	24	M	Caucasian	11	2	1	1	10	1	1	3
Schizophrenia, disorganized; MR	35	F	Hispanic	62	9	53	8	9	1	25	1
Huntington's disease	38	M	African American	21	20	9	5	13	14	1	0
Schizophrenia, disorganized	50	F	African American	30	18	0	1	6	5	0	0
CNS trauma; Alzheimer's disease	60	M	Caucasian	6	3	0	0	3	2	3	1
Schizophrenia; personality disorder	22	F	African American	20	16	3	0	18	16	16	15
Schizophrenia, paranoid	45	M	Caucasian	4	4	0	0	4	4	1	2
CNS trauma	32	M	Caucasian	13	2	0	0	8	4	0	0

* Indicates a second trial of the preceding case.

PRN=as needed; CES=cranial electrotherapy stimulation; MR=mental retardation; F=female; ASPD=antisocial personality disorder; M=male; CNS=central nervous system; PDD=pervasive developmental disorder.

Childs A, Price L. *Primary Psychiatry.* Vol 14, No 3. 2007.

DISCUSSION

These data confirm the previously reported anti-aggressive effect of CES. The favorable impact on these treatment-resistant cases has significantly lowered the level of violence on the wards of NTSH-V. Particularly notable are the relatively large effect sizes found in this study, indicating that not only did this treatment result in significant improvements across numerous outcomes, but that the amount of improvement in these areas was generally quite large.

The most striking improvements occurred in the sudden assault patients, eight of whom had been hospitalized from 10–25 years. There was no other change in their treatment, including medication, that might have otherwise accounted for the sustained improvement in their behavior. In each of the nine patients who responded to CES, relatedness (eg, social skills, interpersonal initiative), hygiene, and program participation improved. Certainly, every psychiatric hospital caring for chronically ill patients has cases like these, whose psychoses have minimally improved on adequate (or even multiple, high dose) psychotropic medications, but who remain unpredictably aggressive. In this group, it is meaningful that seven of the 10 have been declared no longer "manifestly dangerous" and have left the maximum-security hospital without having to return. None of these discharges were anticipated prior to the use of CES.

The reduction of PRN medicine was particularly striking, at 42%. The decrease of 271 PRN medication doses in 3 months resulted in a savings of >$12,000 for these medication expenses alone.

Benefits were cumulative with some of the most robust successes appearing 4–6 months after starting CES. It is likely that a longer course of CES is required in these severe illnesses (eg, disorganized schizophrenia). After the first few days, compliance with CES treatments was rarely a problem even in those patients who were otherwise barely approachable. A clinical trial of 3–6 months in these difficult patients can be confidently recommended.

TABLE 2

STATISTICAL DATA FOR THE CHANGES IN PREVALENCE OF AGGRESSIVE EPISODES, SECLUSIONS, RESTRAINTS, AND PRN MEDICATION FROM PRETEST TO POST-TEST FOR TOTAL SAMPLE*

Variable	*Pretest (N=48)*	*Post test (N=48)*	*z*	*P*	ρ
Aggressive episodes	1,301	767	-4.31	<.01	.97
Seclusions	199	120	-0.63	.53	.53
Restraints	446	268	-3.87	<.01	.97
PRNs	648	377	-3.31	<.01	.95

*Results obtained using the nonparametric Wilcoxon Signed Rank test. Effect size reported as Spearman's Rho (ρ) correlation coefficient and range of values are: small=0.10–0.29, medium=0.30–0.59, large=0.60–1.0.

PRN=as needed.

Childs A, Price L. *Primary Psychiatry.* Vol 14, No 3. 2007.

TABLE 3

STATISTICAL DATA FOR THE CHANGES IN PREVALENCE OF AGGRESSIVE EPISODES, SECLUSIONS, RESTRAINTS, AND PRN MEDICATIONS FROM PRETEST TO POST-TEST FOR SUDDEN ASSAULT PATIENTS*

Variable	*Pretest (N=10)*	*Posttest (N=10)*	*z*	*P*	ρ
Aggressive episodes	325	170	-2.65	.01	.93
Seclusions	39	22	-0.32	.75	.30
Restraints	107	49	-2.36	.01	.92
PRNs	121	21	-2.52	.01	.93

*Results obtained using the nonparametric Wilcoxon Signed Rank test. Effect size reported as Spearman's Rho (ρ) correlation coefficient and range of values are: small=0.10–0.29, medium=0.30–0.59, large=0.60–1.0.

PRN=as needed.

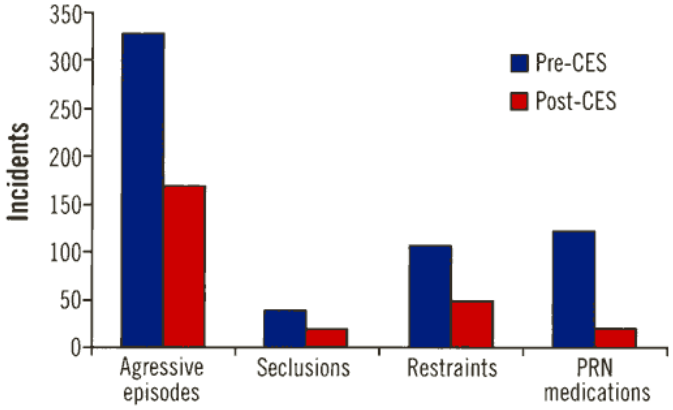
Childs A, Price L. *Primary Psychiatry.* Vol 14, No 3. 2007.

MECHANISMS

Patients regularly reported feeling more relaxed. The mechanism of the anti-aggressive effects of CES may result from

FIGURE 2

CHANGES IN AGGRESSION BEFORE AND AFTER USE OF CES IN SUDDEN ASSAULT SYNDROME PATIENTS (n=10)



CES=cranial electrotherapy stimulation; PRN=as needed.

Childs A, Price L. *Primary Psychiatry.* Vol 14, No 3. 2007.

its ability to induce the brain to generate more alpha waves.[3] CES seemed to augment or even work synergistically with the usually prescribed antipsychotics and mood stabilizers. This was especially apparent when CES was used in conjunction with modest (<300 mg/day) doses of clozapine in the most refractory cases (8 of the 48).

Other mechanisms of the reported improvement may relate to the finding that CES is known to increase the enzyme MAO-B in the CNS, meaning dopamine is being turned over at a faster rate.[6] γ-aminobutyric acid, one of the major inhibitory neurotransmitters in the nervous system, also increases during CES treatment; this increase could contribute to its calming effect.[6] Finally, the steep rise of 150% to 200% in cerebral spinal fluid levels of serotonin subsequent to CES treatment might also be central to its anti-aggressive effects.[5]

CONCLUSION

Regardless of the possible mechanisms, CES has shown itself to be effective in a broad range of significantly ill, highly aggressive, neuropsychiatric patients in this maximum-security psychiatric hospital. Experience suggests CES may be beneficial in violent prison populations, and studies in these institutions are underway. At a time when psychiatric hospitals are under increasing pressure to diminish the use of seclusion and restraint, CES could be a useful addition to the treatment regimen of patients with behavioral dyscontrol.

Interestingly, as the hospital gained more experience with CES, clinicians began to prescribe it earlier in hospital stays (sometimes within hours of admission) because of the urgent need to control medication-refractory aggression. Most of the 50 patients who were treated immediately upon their arrival were as aggressive as the 48 reported herein, and they will be the subject of a separate report.

Since this was an uncontrolled, longitudinal cohort study, it is possible, though highly unlikely, that some other outside influence (eg, season of the year, the passage of time, a new therapist) could have been responsible for the significant reductions in aggressive behavior that were reported. In particular, the passage of time was not a factor, as many of the patients included in this report had maintained highly aggressive behavior for many years prior to CES treatment. Nor did this study control for increased attention to each patient while undergoing CES treatment. Based on the literature regarding the impact of increased attention on aggression, it is not likely that the attention given each patient in connection with CES treatment could possibly have the type of significant effect found in these 48 patients. Late-occurring improvements due solely to medications were unlikely, as most of the patients had been on many medications for years. It is the conclusion of the authors of this article that the data strongly support that CES treatment resulted in the significant decreases in aggression in these 48 patients. As a safe, efficacious, and cost-effective intervention, CES should be considered for wider use in seriously ill patients. ***PP***

REFERENCES

1. Klimke A, Klieser E. Effectiveness of neuro-electric therapy in drug resistant endogenous psychoses [German]. *Fortschr Neurol Psychiatry.* 1991;59(2):53-59.
2. Childs A. Cranial electrotherapy stimulation reduces aggression in a violent retarded population: a preliminary report. *J Neuropsychiatry Clin Neurosci.* 2005;17(4):548-551.
3. Kennerly R. QEEG analysis of cranial electrotherapy: a pilot study. *J Neurotherapy.* 2004;8(2):112-113.
4. Kirsch DL. *The Science Behind Cranial Electrotherapy Stimulation.* 2nd ed. Edmonton, Alberta, Canada: Medical Scope Publishing Corporation; 2002.
5. Shealy NC, Cady RK, Culver-Veehoff D, Cox R, Liss S. Cerebral-spinal fluid and plasma neurochemicals: response to cranial electric stimulation. *J Neurologic and Orthopaedic Medicine and Surgery.* 1998;18(2):94-97.
6. Krupitsky EM, Burakov AM, Karandashova GF, et al. The administration of transcranial electric treatment for affective disturbances therapy in alcoholic patients. *Drug Alcohol Depend.* 1991;27(1):1-6.
7. Klawansky S, Yeung A, Berkey C, Shah N, Phan H, Chalmers TC. Meta-analysis of randomized controlled trials of cranial electrostimulation. Efficacy in treating selected psychological and physiological conditions. *J Nerv Ment Dis.* 1995;183(7):478-485.
8. Alpha Stim Technology. Available at: www.alpha-stim.com. Accessed January 30, 2007.
9. Childs A. CES stops the sudden assault syndrome. Paper presented at: 14th Annual Meeting of the International Society of Neuronal Regulation; Atlanta, Georgia; September 9, 2006.