A variety of cranial electrostimulation (CES) devices have been commercially marketed since the 1950s. These devices typically generate a small (0.3 to 4 mA) alternating current (0.5 to 15,000 Hz) using patented frequencies that are conducted by sponge electrodes applied to the scalp above the eyebrows, behind the mastoid processes, over the temples or via clips on the ear lobes. Users report being in an “alert, yet relaxed” state, associated with increased brain alpha output. The first human studies in the United States began in the 1960s. CES use was reported in the 1970s and 1980s to attenuate methadone withdrawal and improve cognitive function in chemically dependent patients.

**CASE 1**

A 34-year-old Army Reserve sergeant served two tours in Iraq as a specialist in psychological operations and as an infantryman. His first deployment (from 2004 to 2005) was considerably more dangerous than his second deployment (from 2007 to 2008). On his first tour, he suffered at least six concussions from improvised explosive devices, but he received no treatment or aftercare when he returned home. He lost consciousness for at least 1 minute following one blast, but is unclear about his mental state after the others.

On his first tour, he suffered headaches, mood swings, anxiety, and severe sleep disturbance. Like many soldiers, he began to medicate himself with alcohol and marijuana. As he used more drugs and alcohol, his mood and anxiety deteriorated. He felt more depressed, had almost no ambition or drive, and was very unhappy with his social life and work. The son of a mental health clinician, he pursued therapy and saw psychiatrists who prescribed multiple medications for his sleep disturbance and depression. None of the traditional treatments seemed to help. He abstained from drugs and alcohol for short periods with some improvement, but he could not abstain for longer than a few weeks. He voiced suicidal ideation at his low points, and his parents were increasingly worried that easy access to firearms could endanger his life. During this time he got married and then divorced, adding to the seemingly aimless pattern of his life.

In his second deployment he served in Special Operations but had fewer patrols that exposed him to firefights. The combat theater was heated as the American forces had increased in size for the “surge” to regain control of the countryside.

The young man’s life spiraled down after returning from Iraq in 2008. He enrolled in college but could not pay attention in class or sustain concentration. He suffered headaches, mood swings, anxiety, and severe sleep disturbance. Like many soldiers, he began to medicate himself with alcohol and marijuana. As he used more drugs and alcohol, his mood and anxiety deteriorated. He felt more depressed, had almost no ambition or drive, and was very unhappy with his social life and work. The son of a mental health clinician, he pursued therapy and saw psychiatrists who prescribed multiple medications for his sleep disturbance and depression. None of the traditional treatments seemed to help. He abstained from drugs and alcohol for short periods with some improvement, but he could not abstain for longer than a few weeks. He voiced suicidal ideation at his low points, and his parents were increasingly worried that easy access to firearms could endanger his life. During this time he got married and then divorced, adding to the seemingly aimless pattern of his life.

He received an integrated treatment plan with a menu of standard and alternative interventions. He agreed not to drink or take drugs while awaiting enrollment in a 4-month residential substance...
abuse program for veterans. He did not want medications for sleep or anxiety, but conscientiously used CES as advised. CES was prescribed twice per day for 20 minutes for at least 2 months, and then three to five times per week for at least 1 year. He also started a course of hyperbaric oxygen (HBOT) for blast concussions. The usual protocol for HBOT involves at least 40 sessions at 1.5 atmospheres for 1 hour. He completed the course before transferring to a residential substance abuse rehabilitation program.

The sergeant’s narrative gives the best clues to the effectiveness of treatments. CES helped him tolerate the withdrawal from drugs and alcohol. Prior attempts at abstaining had induced severe anxiety and worsened sleep. He could not withhold from substances for long and would resume drinking within weeks. He refused any psychoactive medication but noticed that he suffered fewer symptoms of physical withdrawal than in the past while using CES. Sleep improved after 5 days.

The HBOT lessened the severe headaches from his concussions and improved disturbed sleep and depressed mood. He reported marked diminution in headache pain after 10 sessions. When he departed for rehabilitation, he had completed 40 sessions and reported much improvement in attention and concentration.

The sergeant completed rehabilitation for substance abuse after 4 months and then returned to his home. He has engaged in regular psychotherapy for posttraumatic stress disorder (PTSD) at a local veterans clinic and occasionally accepted medications. He has continued to use CES conscientiously and relies on it to mitigate anxiety and get recuperative sleep. He suffered one relapse several months ago with alcohol, but regained his abstinence after a few weeks. His current treatment involves counseling and CES. He is now working and attending college courses.

CASE 2
Diana is a 37-year-old single mother of two adolescents. She is unemployed, a recovering heroin addict on maintenance methadone, and taking fluoxetine for major depressive disorder. Even with anti-depressant treatment, she was distrustful (but not psychotic), withdrawn, anhedonic, socially isolated, quiet, shy, sad, fearful, and irritable. She lived alone because she had to give custody of her children to her grandmother. Her only friends were her family. She routinely saw her daughter and would accompany her to routine appointments that I (Michel A. Woodbury-Fariña, MD) had with her daughter. She agreed to 1-hour CES therapy sessions once per week for 6 weeks using the SCS Alpha-Stim device (Electromedical Products International; Mineral Wells, TX). These sessions were done with her alone during the appointments with her daughter. She did not receive any other treatment modalities from me.

The intensity of CES therapy should always be strong enough to induce a sensation of “floating.” In Diana’s case, I successfully achieved a state of “float” that she excitedly described as being as good as the heroin high without bad effects. Except for the history taking that I had already done in the workup of her daughter, this adjustment was the extent of my involvement with her. The effect after the first session was noticeable. She was much more verbal, looked happy, and even seemed to have more energy. When she went to her public psychiatric clinic after 4 weeks, she was told that her recovery from depression was noticeable and to continue with whatever treatment she was on. By the sixth week, she was no longer feeling depressed. No longer anhedonic, she was finding a way to continue her studies. She was no longer distrustful, shy, socially isolated, or as withdrawn according to her boyfriend, who subsequently moved in with her. She was no longer fearful or irritable. Her daughter noticed that she had a more even temperament. She was, in essence, euthymic.

CONCLUSION
Since 1978, the US Food and Drug Administration has labeled CES devices as class III minimal or non-significant risk devices. A

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number of such devices are marketed in the United States and are used for common psychiatric conditions. Numerous studies support efficacy; however, many studies are based on small samples and are often inadequately controlled.

The efficacy of CES in treating various conditions has been demonstrated in five meta-analyses conducted over the past few decades. Several studies suggest that CES triggers changes in neurotransmitters and endorphin release. CES provides an essential adjunctive treatment to standard modalities of care. The very high safety profile of CES makes it an attractive adjunctive treatment for anxiety, depression, sleep disturbances, and drug withdrawal that have not responded to conventional therapy.

REFERENCES