Any time a new medical treatment comes on line, there is pressure to explain how it works. While Cranial Electrotherapy Stimulation (CES) has been in medical use for the past 53 years (it came into being as “electrosleep” in Europe in 1953), there has been no definitive, settled explanation of its mechanism of action.

To explain its mechanism satisfactorily, a treatment has to be understood within one of the accepted explanatory concepts currently in vogue in medical science. Some of the theories that are more or less active at present are as follows:

The Nervous System. The major current concept is that the body functions via a more or less hard wired nervous system. In this theoretical system, the body is neuronally wired to receive incoming stimuli via its afferent neurons, send them to the central nervous system, which then sends out response stimuli via its efferent neurons. One touches a finger accidentally to a hot surface and the finger is immediately jerked away from the hot stove, for example.

Since the neurons don’t ordinarily physically touch, the neural wiring functions via synaptic endings on the neurons in which the pre synaptic membrane discharges neurochemicals from stored vesicles into the synapse between the neurons and these stimulate receptors on the post synaptic membrane (the receiving membrane of the neuron next in line to fire) and that neuron fires the next neuron or the sensitive membrane on a muscle receptor, and so forth.

To work as efficiently as it was designed to work, all the neurons must be intact, and all the neurochemicals that are involved in the neurological firing patterns have to be in balance with all the others. If one neurochemical is out of balance, either it over fires or under fires the system for which it is responsible, in which case physical or emotional symptoms of one kind or another arise. For example, if there is not enough dopamine, Parkinson like symptoms develop. If there is not enough serotonin, depression results, etc.

If CES is to be effective within this system, then it must be shown that CES acts to bring back into balance neurotransmitters that are out of balance with their associates. Pozos completed a series of interesting experiments with canine subjects that looked at this possibility. They examined the adrenergic-cholinergic balance in the brain.

His research group theorized that if CES actually stimulated neurons to fire, as CES salesmen were claiming, he could give some of the dogs reserpine plus CES stimulation and the reserpine would block the reuptake of dopamine into the presynaptic vesicles. That would reduce the amount of dopamine available in the presynaptic vesicles to fire the postsynaptic neurons on the adrenergic side, and the cholinergic system would gain the upper hand. He did that, and discovered that in doing so he had thrown the adrenergic system out of balance with the cholinergic system and the dogs began to show Parkinson like symptoms.

Pozos was not directly measuring dopamine in the dog’s brain, however, so he thought he would do some more experiments to make sure he was in the right ballpark. He decided to block the uptake of
acetylcholine on the other side of the adrenergic-cholinergic equation. It was the acetylcholine uptake that was firing that side of the equation and instigating the Parkinson like symptoms. To do this, he gave his CES stimulated dogs, which were still in Parkinson like tremors, some atropine to block the acetylcholine uptake. The tremors ceased.

He decided that since he was not, after all, measuring either dopamine or acetylcholine, he would check the system further by taking another group of CES treated, tremoring dogs, remove the atropine from the cholinergic side and add phystostigmine instead. Phystostigmine would actually stimulate the cholinergic nerves to fire more rapidly than usual. He did this, and the dogs showed the most pronounced tremors ever.

Pozos was reasonably certain that he had the correct system and had shown that CES could effectively stimulate an increase in the manufacture of dopamine. But wait. If that were the case, then CES should be able to put the terribly out of balance system in the dog's brain back to normal when all provoking chemicals were removed. To that end, he removed the drugs from all the dogs' systems, gave all of them regular food and water for the following week. In addition, a third received L-Dopa, and another third of them received CES stimulation.

The non-treated animals returned to normal, non-Parkinson like states within three to five days. The CES treated animals, however, returned to normal, non-Parkinson like states within 3 to 7 hours, as did the third of the animals receiving L-Dopa.1

Another study actually counted the number of presynaptic vesicles in presynaptic membranes of squirrel monkeys before, after several minutes of CES stimulation, and for a time following the cessation of stimulation. Their findings convinced them that CES acted essentially to stimulate the vesicles to empty their contents, thus reducing them in number. But CES then acted to dramatically increase the number of new vesicles formed as stimulation continued. Once the stimulation had ceased, the number of vesicles tended to gradually return to their pre-stimulus levels over time.2

A similar study was run in human narcotics addicts in which the depletion of endorphin by the narcotics had presumably thrown off the balance between the endorphin and norepinephrine systems in the locus ceruleus of the brain. Once the narcotics, which had been mimicking endorphin and thereby down-regulated that system, were removed, norepinephrine got the upper hand and physiological withdrawal symptoms began. The researchers knew that they could block the post synaptic receptors to norepinephrine with alpha methyl dopa and thereby stop the withdraw symptoms, but thought they would also try CES stimulation on half of the patients to see if CES could stimulate increased endorphin production, and thereby rebalance the system.

They found that both treatments worked equally well, so that the physicians who monitored the double blind research could never tell which patients were treated with alpha methyl dopa and which were receiving CES. Until after the study, that is, when the drug patients went into rebound depression and the CES treated patients did not.3

**Acupuncture theories.** Following President Nixon’s visit to China, acupuncture treatment came into a sort of vogue in the U.S. and still plays a role in some medical circles. The theory behind acupuncture is that the body works on an energy homeostasis and at times, and for any number of reasons that system can be thrown out of balance. It was for that reason that earlier on CES was thought by many to perhaps have its effects by stimulating this system to increased energy balance when insufficient energy was present in the system to keep the body working normally.

Energy is known to flow through the collagen connective tissues of the body, and some areas of the body are more sensitive to energy incoming in to that system than others. These sensitive areas are
known as acupuncture points, and CES may well supply energy to that system, though not necessarily by stimulating those points directly.

CES electrodes are placed at various places on the head so that the stimulating current is allowed to pass through the head. CES current has been shown to spread around the head and scalp while also going through the entire brain, though canalizing along the limbic, or “emotion” brain.4

As anyone knows who has placed CES electrodes on the mastoid processes behind the ears and turned the current up, one tends to get an involuntary grin when the current spreads to the facial muscles, and similarly, there can be light flashes keeping time with the CES pulse as the energy passes through the ocular apparatus in the eyes. For this reason, it is very likely that any acupuncture points on or about the head would receive sufficient stimulation, wherever they are located, to respond to CES stimulation. For example, in some therapeutic strategies, several of those points on the face are said to be dramatically activated by merely softly tapping on them with the finger tips.5 Not enough is known about the acupuncture system by the present author to speculate further on just how CES may effect bodily changes via the acupuncture route, but it may be shown to do so in the future.

There are other energy flow systems that are active throughout the body, such as the vascular system as an electrical transmission system. Nordenstrom has shown that the vascular system acts as a biologically closed electric circuit in which energy flows readily, pulling and pushing electrically charged blood components so as to keep the body in functional homeostasis. That system is active both in the arteries and veins, whose walls act as insulation, and in the vascular-interstitial spaces.6 To date, no known studies of how CES effects or interacts with this system exists.

Nor are any CES studies known to exist regarding the perineural electrical system which Becker has shown also acts throughout the body as an electrical system acting peripherally to, but separately from the nervous system.7

**EEG studies.** Numerous EEG studies, MRI studies and the like have been done with CES stimulated subjects, several of which are reported in the sleep studies and addiction studies sections. Several of those studies are ongoing, and new ones are being planned as this is being written. In looking through the various studies that have been done over the years, it can be stated that CES is invariably found to work changes in the brain’s neural firing pattern. While the effects of those changes can be difficult to decipher, none has been thought to have a negative impact of any sort on the patients studied. For example, no seizures have ever been detected accompanying CES treatment, even among known seizure patients.8

**Neurohormonal studies.** Several studies have been done on the ability of CES to effect a return to more normal conditions hormones that are out of balance in depressed patients,9 and those such as DHEA, testosterone, estrogen, and IGF-1 in older subjects in whom those hormone levels were low.10

**Synchronicity Theory.** The science of spontaneous order as the synchronicity field is now being called appears to be rising fast as a new way of describing medically related phenomena.11 In this theory, every part of the body is seen to be functionally synchronized with every other part, and each organ is specifically functionally synchronized within itself. The entire body is also synchronized with the external environment. When any part of the body becomes desynchronized on any of the three synchronicity levels illness results.

Synchronicity can easily be seen on TV nature channels when thousands of schooling fish dart first in one direction and then another, quite spontaneously and never hitting another nearby fish when
attacked by a feeding shark. Large flocks of migrating birds can be seen wheeling at high speeds overhead in first one direction and then another without ever colliding even though there may be hundreds of birds flying in the close formation.

Similarly, in the human body, all liver cells have to be functioning in sync for the liver to get its work done. The same is true of the pancreas, the heart muscles, the adrenal glands, and so forth. Further all the various organs, even while entraining their separate rhythms, have to work in synchrony with all the others if the body is to function properly.

The master clock that regulates circadian rhythm in the rat has been found to be a monosynaptic neural pathway from the retina in the eye to the two small suprachiasmatic nuclei in front of the hypothalamus. This pathway, while originating in the eye, has nothing to do with vision, nor does it fire into any visual centers of the brain. It appears to be dedicated specifically to the purpose of regulating the synchronicity between the rat and its external environment.

Researchers are still looking for the master clock within each of our body’s organs and in the body as a whole. The future may well show that the incoming, timed rhythmic pulsations of electric energy involved in CES treatment acts in some way to reset a desynchronized body back into normal synchronicity and thereby produces a more healthful functioning.

Summary

CES has been shown to travel throughout the brain, and in the process bring back to normal neurohormonal systems that have been deliberately thrown out of balance by researchers or by patients themselves, in the case of narcotics addicts. It has been shown to bring back to more youthful levels several hormones that are typically reduced in aging.

CES, then, is thought to act to balance physiological systems that have become unbalanced by whatever means. An interesting corollary to that is the often obtained clinical finding that once a patient is back in balance – these are often seen in the drug abstinence syndrome, for example – CES ceases to have an effect and the patient stops using it. For that reason it is known to not be addicting or habit forming in any way. And in none of the studies to date has a significant negative side effect been reported.

References


