This is a quantitative EEG brain map (QEEG) showing the changes in brain activity by traditional EEG bands of 30 volunteers after a 20 minute treatment with Alpha-Stim® CES at 0.5 Hz. Blue shows a decrease in activity after Alpha-Stim® while red shows an increase in activity. There is an increase in alpha activity (relaxation brain waves) with a simultaneous decrease in delta activity (sleep brain waves) after using Alpha-Stim® for 20 minutes. The changes near the ears were found on raw EEG to be artifact.

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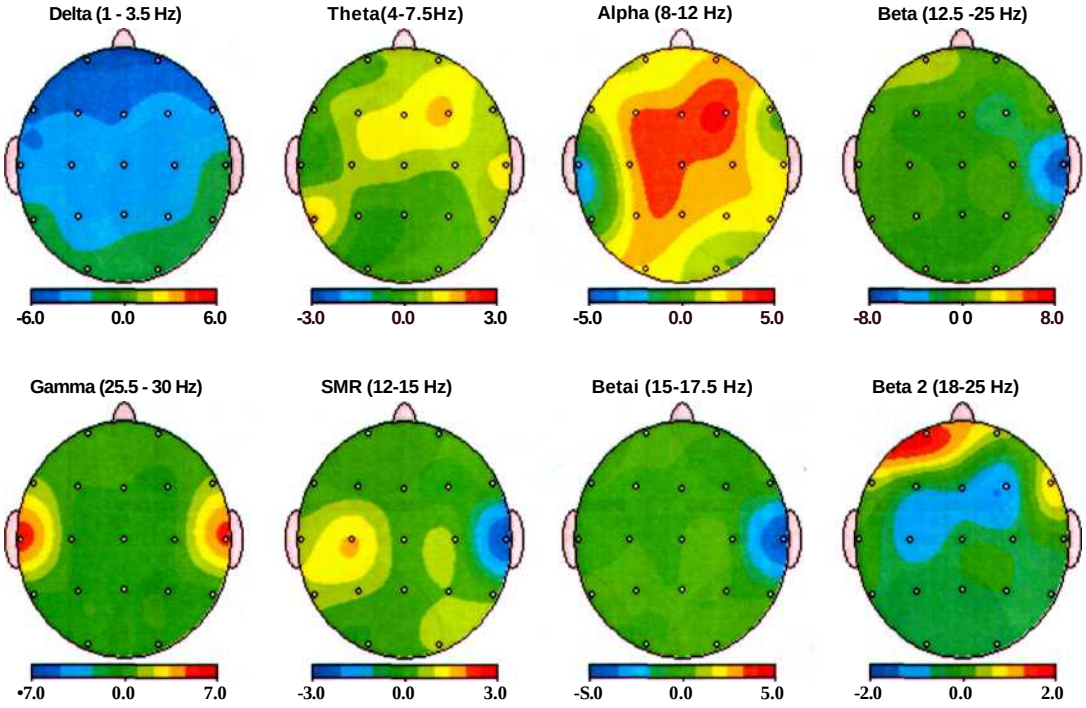
FFT Relative Power Difference (%)



QEEG Analysis of Cranial Electrotherapy: A Pilot Study

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Introduction

Cranial electrotherapy stimulation is the use of low level electrical current applied to the head for therapeutic purposes. Cranial electrotherapy stimulation (CES) is also known as electrosleep, cranial electrotherapy (CET), cranial stimulation (CS), transcranial electrotherapy (TCET), neuroelectric therapy (NET), cranial TENS and auricular electrical stimulation. The FDA authorizes the production and sale of medical devices for cranial electrotherapy in the United States for the treatment of pain, depression, anxiety, and sleep disorders. To date 112 of 126 published studies in the United States on CES have had positive outcomes, involving 4,541 subjects (in all 126 studies) without significant side effects from the treatment (Kirsh, 2002). The current study was conducted to determine the effect of cranial electrotherapy on cortical activity as measured by QEEG before and after a single 20-minute use of cranial electrotherapy. This pilot study is being followed up by a double blind placebo controlled study of cortical activation changes from baseline with three and six weeks of CES treatment.

Method

Digital EEG for QEEG analysis was obtained from 30 research volunteers using a Neurodata-24 digital EEG system. Cranial electrotherapy was providing with Alpha-Stim 100 cranial electrotherapy units set to .5 Hz. QEEG data was processed and analyzed with the NeuroGuide system. Statistical analysis of the data was conducted with the NeuroGuide, SPSS and JMP statistical packages. Digital EEG, blood pressure, heart rate, electrodermal activity and finger temperature was acquired during a baseline condition, during cranial electrotherapy, immediately after electrotherapy, and after three weeks of daily use of cranial electrotherapy.

Results

During cranial electrotherapy stimulation at .5 Hz significant increases were seen across the entire cortex in delta and gamma frequencies. This effect was uniform for all volunteers. After a single 20-minute session of electrotherapy decreases were seen in delta and theta frequency activity with concomitant significant increase in alpha activity. The study volunteers generally

reported feeling more relaxed after 20 minutes of CES. Some volunteers reported feeling as if their head had cleared and they felt more awake. Research volunteers who reported pain or anxiety before the single session of CES treatment reported significant reductions in pain and anxiety after the 20-minute treatment.

Conclusions

This pilot study indicates that cranial electrotherapy at .5 Hz entrains delta and gamma frequencies during active stimulation. After a single 20-minute treatment with CES there is a significant increase in alpha frequency activity and a significant decrease in delta and theta activity. The post treatment maps indicate the effect of single session cranial electrotherapy treatment on QEEG is congruent with the reports of the research volunteers of decreased anxiety, increased alertness and increased relaxation.