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## Quantitative EEG Brain Map After CES



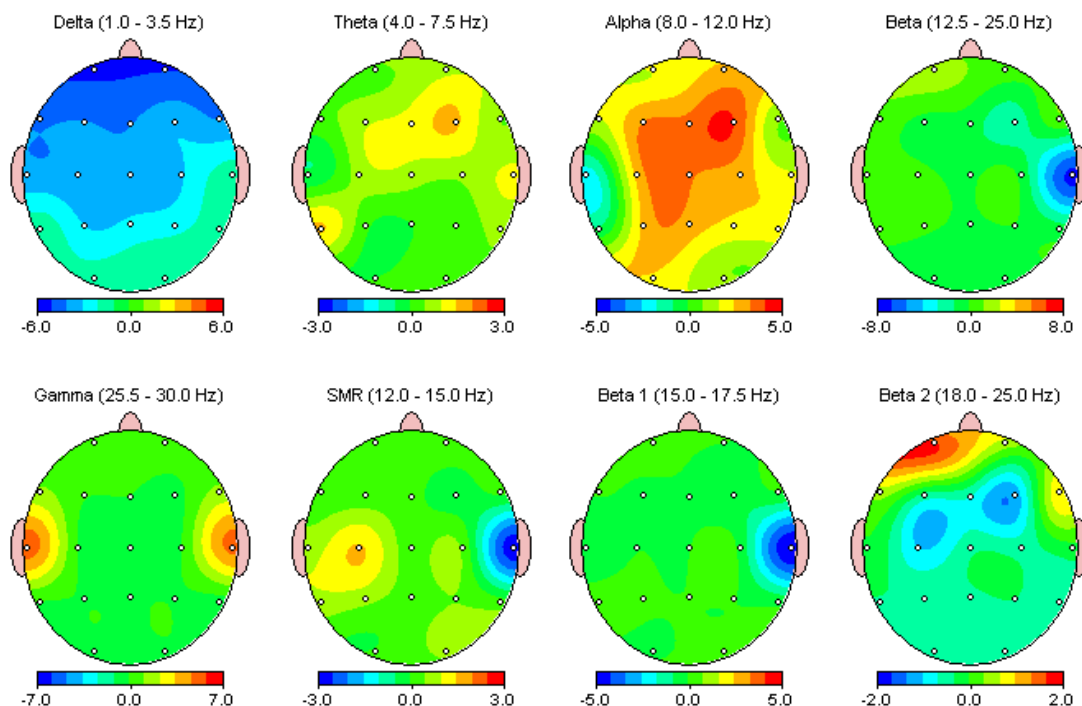
This is a quantitative EEG brain map (QEEG) showing the changes in brain activity by traditional EEG bands of 30 volunteers after a 20 minute treatment with Alpha-Stim® CES at 0.5 Hz. **Blue shows a decrease in activity after Alpha-Stim® while red shows an increase in activity.** There is an increase 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.

Kennerly, Richard (2004). QEEG analysis of cranial electrotherapy: a pilot study.  
*Journal of Neurotherapy* (8)2:112-113.

Montage: DEFAULT

combinedcsb2c.NGA - combinedcsb1c.NGA

### FFT Relative Power Difference (%)



**Methods:** Digital EEG for QEEG analysis was obtained from 30 research volunteers using a Neurodata-24 digital EEG system. CES was provided with Alpha-Stim 100 cranial electrotherapy units set to 0.5 hertz. 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 CES at 0.5 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 CES 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 CES at 0.5 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.