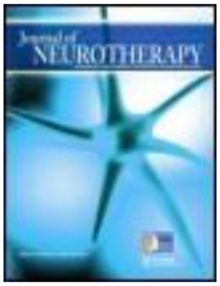

Journal of Neurotherapy: Investigations in Neuromodulation, Neurofeedback and Applied Neuroscience

Poster Presentation Abstracts

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Poster Presentation Abstracts

Effects of Neurotherapy on Attention and Impulsivity in Crack Cocaine Addiction: A Controlled, Single-Blind Study

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Introduction

Sources state substance abuse relapse rates are nearing 80% post-treatment (Alterman et al., 1998). Moeller et al. (2001) propose that one of the possible reasons for the high relapse rates is the impact of impulsivity on cocaine use. That study also sites impulsivity and attention as a significant predictor of high drop out rates in individuals seeking treatment for cocaine addiction. The following is a pilot study implemented within a four-year research project developed by the Southwest Health Technology Foundation (SWHTF) in conjunction with the Open Door Mission drug addiction recovery program.

Method

Twelve control and 12 experimental subjects received seven sessions of placebo or neurotherapy, respectively. Experimental groups received feedback at an Fp1/T4 split, aimed at inhibiting theta and enhancing SMR. Control subjects were hooked-up to the neurotherapy equipment, but were not given any visual or auditory feedback. Changes were measured using the Integrated Visual and Auditory Inventory (IVA) which was administered at session one and session seven.

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Results

After seven sessions, the experimental group exhibited significantly better performance on full scale, visual and auditory impulsivity scales. In terms of attrition, control group subjects left the program at session two on average, whereas no experimental subjects dropped out before the seventh session.

Conclusion

Although the sample size is small, these results suggest that neurofeedback is effective in decreasing impulsivity on continuous performance measures. This is supported by the lack of attrition in the experimental group. These findings are promising, given that decreasing impulsivity may enable an addict to remain in treatment longer, and remaining in treatment longer has been shown to be positively correlated with treatment success in the addictions literature.

REFERENCES

Alterman, A. I., McDermott, P. A., Cook, T. G., Metzger, D., Rutherford, M. J., Cacciola, J. S., et al. (1998). New scales to assess change in the Addiction Severity Index for the opioid, cocaine, and alcohol dependent. *Psychology of Addictive Behaviors*, *12* (4), 233-246.

Moeller, F. G., Dougherty, D. M., Barratt, E. S., Schmitz, J. M., Swann, A. C., & Grabowski, J. (2001). *Journal of Substance Abuse Treatment*, *21* (4), 193-198.

Quantitative EEG Phase Evaluation of Transcendental Meditation

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Introduction

Based largely on experiments showing zero-phase-lag events in widely separated neural regions John (2001) proposed a field theory of consciousness. He placed importance on designation of a "ground state" baseline from which to evaluate "excited states" of cognitive or sensory activity. His ground state consisted of an eyes-closed (EC) resting condition that presumed some cognitive activity. In EC condition he estimated that the common mode resonance (mean zero-phase coherence) of neuronal populations is 40 to 65%. It is suggested here that the ground state of consciousness is by definition void of sensory and cognitive processing. To locate reliable EEG descriptors of the proposed no-thought baseline we investigated here a subjective state of "transcending" or pure abstraction described as "consciousness itself" (Travis & Pearson, 1999). Here comparisons to EC databases predicted higher levels of global neural resonance under experimental conditions.

Methods

Nineteen-channel EEG s were recorded in twelve long-term practitioners of the Transcendental Meditation (TM) technique. Quantitative EEG phase analysis in four frequency bands was performed with the NeuroRep program.

Results

Seven TM subjects exhibited field-like patterns of elevated alpha phase synchrony (and five of these also in the beta). Time-lag values reaching "zero phase lag" were pervasive. Long-range electrode pairings departed most significantly from eyes-closed database normative values (S.D. reaching 6.81, average 3.7).

Conclusion

Deficiencies in long-range phase synchronization have been tied to brain pathology (Bhattacharya, 2002). Researchers suggest that phase locking and phase coupling mechanisms may transfer information and functionally bind or integrate distant brain regions. It is proposed here that "transcending" enlivens a low-entropy core of consciousness with ubiquitously phase-locked alpha and beta oscillations that serve to globally integrate large-scale neuro-cognitive networks.

REFERENCES

Bhattacharya, J. (2002). Reduced degree of long-range phase synchrony in pathological human brain. *Acta Neurobiologiae Experimentalis*, *61*, 309-318.

John, E. R. (2001). A field theory of consciousness. *Consciousness and Cognition*, *10*, 184-213.

Travis, F. & Pearson, G. (1999). Pure consciousness: Distinct phenomenological and physiological correlates of "consciousness itself." *International Journal of Neuroscience*, *100*, 77-89.

QEEG Analysis of Binaural Beat Audio Entrainment: A Pilot Study

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Introduction

Binaural beat audio signals are a technique of the audio entrainment of brainwaves. Binaural beat audio is the independent presentation of two discrete tones to each ear. Each pure tone is of a different frequency but the subject hears only one tone, an amplitude-modulated third tone created by the brain's synthesis of the two independently presented tones. When exposed to binaural beat audio a frequency following effect is reported to occur where the difference between the two tones is the frequency the brain waves will trend toward. For example an 8 Hz difference would result in brain waves moving toward predominantly 8 Hz activity. While binaural beat audio entrainment is a well-known phenomenon, and frequently used in audio-visual entrainment devices, currently there are no published double blind studies demonstrating if it exists. The current study was conducted as the pilot for a double blind study to determine the effect of binaural beat audio on brain wave activity.

Method

Digital EEG for QEEG analysis was obtained from 30 research volunteers during a baseline condition and during ten minutes of binaural beat audio. Binaural beat audio was produced with the software package Brainwave Generator. QEEG data was processed and analyzed with the NeuroGuide system. Statistical analysis of the data was conducted with the NeuroGuide and JMP statistical packages. Digital EEG, blood pressure, heart rate, electrodermal activity and finger temperature was acquired during a baseline condition, and during the presentation of binaural beat audio.

Results

Significant changes from baseline were noted in QEEG during the presentation of binaural beat audio. Entrainment occurred, on average, five minutes after the presentation of the binaural beat audio. The theta frequency group displayed significant increases in theta frequency activity. The delta frequency group displayed significant increases in delta frequency activity. Heart rate, blood pressure, electrodermal response and finger temperature all decreased with the presentation of theta and delta frequency binaural beats.

Conclusions

The changes seen in QEEG were congruent with the presence of a frequency following effect.

Combined Effects of Neurofeedback and Pulsed Electromagnetic Fields

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Introduction

This study used a single subject research design to assess the combined effects of neurofeedback and pulsed electromagnetic fields on the amplitude of brain wave activity in the alpha, beta, and theta frequency bands.

Method

Over 40 neurofeedback trials were conducted with 15-18 Hz rewards and 8-12 and 22-30 Hz inhibits at F3. The author was the sole research subject. Each session began with five 3-minute periods of neurofeedback to establish baseline amplitudes for each frequency band. Then a small electromagnetic field generator (the Enermed device) was applied to the scalp or forehead in the vicinity of F3. The device was worn for 24 minutes (eight 3-minute neurofeedback periods) after the initial 15-minute no-Enermed baseline period, and then was either removed or replaced by a different frequency device for the last 12 minutes of the session.

The presentation focused on the 24 sessions where a "beta" Enermed (programmed to pulse continuously at 15, 16, 17, and 18 Hz) was used, although some data from the F4 sessions using 8-12 and 12-15 Hz Enermeds was also be included.

Results

Results were presented using graphs to display average amplitudes in each frequency band across the baseline period, the first four Enermed periods, the second four Enermed periods, and the final four periods in each session (some with and some without an Enermed). Statistical (repeated measures analysis of variance) and visual analyses revealed three clear trends: (a) the 15-18 Hz Enermed produced a delayed increase (not apparent until periods 10-13) in the average amplitude of the 15-18 and 22-30 Hz bands in the EEG; (b) a 4-7 Hz Enermed immediately suppressed mid- and high-frequency activity; however, amplitudes rebounded to baseline levels within 4 to 6 minutes; (c) consistent effects were only observed when the device was placed toward the forehead just in front of F3.

Conclusion

The limited data available thus far suggest two intriguing possibilities: (a) that very weak electromagnetic fields can affect brain wave activity during neurofeedback training, and (b) that effects of high and low frequency stimulation follow a different time course and possibly operate through different mechanisms.

Additional research may point to ways we can capitalize on these effects to facilitate neurofeedback and/or enhance clinical effects. For example, in this study, the brain appeared to resist being drawn into slow, externally imposed idling states. Challenging the brain to resist the pull of a 4-7 Hz stimulus may prove to be an effective way to strengthen self-regulatory mechanisms. On the other hand, training efficiency may be increased if we use 15-18 Hz stimulation to "boost" people into higher states of arousal. It is hoped that presenting these preliminary analyses will stimulate interest in this kind of research and illustrate a useful application of a single subject research design.

Combining ROSHI and BrainMaster: Three Case Studies

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Introduction

The ROSHI stand alone units have allowed clinicians to implement a variety of new approaches to neurofeedback. This poster examined the use of ROSHI and BrainMaster in combination. Three child/adolescent case studies were presented. All three children were referred for problems with attention and had been previously diagnosed with ADHD. Clinical histories included lead poisoning, fetal alcohol exposure, early childhood abuse, and long term marijuana abuse.

Method

All three children were trained with a ROSHI/BrainMaster combination. Length of training was 20-30 sessions. BMScope was used in conjunction with the BrainMaster 1.9 software. Pre- and post-assessment was done with the Conners CPT.

Results

All three clients had normal post-training CPT scores and were reported by parents and teachers to be functioning well at home and in the classroom.

Conclusion

The combination of the ROSHI stand alone unit and traditional neurofeedback provides a powerful intervention for children with attention problems resulting from a variety of factors.

QEEG Guided rTMS

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Introduction

Repetitive Transcranial Magnetic Stimulation (RTMS) is rapidly emerging as a viable technology, capable of mitigating and remediating numerous human maladies from physical symptoms such as chronic pain to psychological/psychiatric disorders including major depression. RTMS technology uses a pulsing electromagnetic field to stimulate desirable neuronal firing patterns and create consciousness and neurophysiological changes. Initial research results, as documented in numerous controlled studies beginning in about 1996, have shown substantial promise in the eradication of CNS disorders such as major depression and OCD. At this time the NIMH has joined in researching the effects of this technology. The emergence of RTMS brings us into an era that will further expand technology-based self-regulation. The blending of RTMS with QEEG allows for an inexpensive and non-invasive method for tracking changes brought by RTMS.

Method

Earlier this year the presenter began developing a simple noninvasive technique for RTMS monitoring. This QEEG Guided RTMS technique involves a repetitive QEEG mapping sequence, while using RTMS intervals at single or multiple 10/20 EEG sites. The sequence is as follows:

- QEEG baseline acquisition is conducted;
- With QEEG setup remaining in place, the desired rTMS stimulation is initiated by placing the rTMS coil(s) at the desired site(s);
- The coil(s) is removed following the rTMS termination;
- An additional QEEG acquisition and brief interview as to symptom change.

This pattern can be replicated, alternating QEEG acquisition and rTMS stimulation. While shifting between QEEG acquisitions/observations and rTMS intervals, significant findings may occur. Both QEEG and experiential changes can be monitored during the course of the QEEG Guided rTMS assessment. Observation of both the local targeted site and other more distant sites can also be tracked.

Results

A number of initial QEEG Guided rTMS assessments were graphically presented, showing QEEG changes across conditions.

Discussion

Initial exploration of the QEEG Guided rTMS assessment and research technique shows promise for guiding rTMS and uncovering further information related to neuronal energy flow. Areas of particular interest include:

- Home training for consumers using a small commercially available self-improvement rTMS device;
- Clinicians assisting consumers with the self-improvement needs;
- Research in the rTMS area;
- Research in exposing EEG inter-site connections.

While this technique was developed for rTMS research and self-improvement strategies, future developments may integrate this technique into guiding EEG biofeedback.

Examining the Relationship Between EEG Data and Neuropsychological Measures

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Introduction

We are embarking on programmatic research examining the relationships between two channel EEG data and neuropsychological assessments. At present, numerous individuals have been tested in the development of a research study protocol and beginning data collection. It is hoped that this session will not only provide attendees with information but that their input will allow us to improve the direction of this research.

In the literature on EEG utilization, there is not full agreement between researchers in terms of electrode placement in the examination of ADD/ADHD and frontal dysfunction. Therefore, electrode placement utilized a neuroanatomical orientation, specifically placing electrodes over the anterior cingulum. This has been identified in neuropsychological literature as the cortex playing the major role in attention difficulties (Pardo, Pardo, Janer, & Raichle, 1990; Bench et al. 1993). Hale (2003) and others have identified the extensive connections between the anterior cingulum and the orbital frontal and dorsal lateral frontal lobe as playing a central role in ADD/ ADHD.

Method

Twenty subjects were tested utilizing the latest version of the Stoelting A620. Each individual was tested using: (a) baselines, and (b) a one-minute cancellation task and a one-minute Stroop color-word task. Individuals were tested utilizing three different bipolar electrode placements: FZ & CZ, FZ & F3, FZ & F4. The F3 and F4 locations were recommended by Green (personal communication; May 20, 2003) and in some of the older research by Lubar (1991) and the FZ & CZ locations have been recommended in various sources. Baselines were gathered prior to the neuropsychological tasks in each placement conditions and neuropsychological tasks were counterbalances with placement and order of placement was randomized.

Test scores were converted to interval scaling through Rasch scaling (additional data added). Analyses included simple correlations, multivariate correlational techniques and ANOVA designs. The variables used in this study were percent of alpha and percent of beta and a ratio of beta relative to alpha. Data was both raw and rescaled.

Results

Preliminary results from the concentration tasks suggest an increase in beta vs. baseline. With incomplete data collection, it appears that individuals with higher scores on the measures also showed a higher level of beta.

Conclusion

Substantial research is needed to clarify the relationships between neuropsychological functioning and EEG data. This is a first step in a process of ongoing research that will include an examination of measures utilized in the diagnosis of ADHD. We seek the input of others in this research process.

REFERENCES

Bench, C. J., Frith, C. D., Grasby, P. M., Friston, K. J., Paulesu, E., Frackowiak, R. S. J., et al. (1993). Investigations of the functional anatomy of attention using the Stroop Test. *Neuropsychologia*, *31*, 907-922.

Lubar, J. F. (1991). Discourse on the development of EEG diagnostics and biofeedback for Attention-Deficit/Hyperactivity Disorders. *Biofeedback and Self-Regulation*, *16*, 202-225.

Pardo, J. V., Pardo, P., Janer, K., & Raichle, M. E. (1990). The anterior cingulated cortex mediates processing selection in the Stroop Attentional Conflict paradigm. *Proceedings of the National Academy of Science USA*, *87*, 256-259.

Alternative: Phase Sensitivity of Bipolar EEG Training Protocols

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Introduction

When performing bipolar EEG training, the reward waveform is strongly dependent on the phase relationship between the two sites at the center frequency of the reward band. It is also driven by the instantaneous amplitude at the two sites. Effectively, the training rewards all increase in differential mode activity while discouraging common mode activity. This follows from the fact that the in-phase component of the signal is suppressed, and only the out-of-phase component of the waveforms is rewarded. These relationships can easily be represented visually with a straightforward vector calculation.

Method

Two vectors representing the signals at the two sites at a given frequency were combined with varying phase angle and for several representative magnitudes to yield the net output amplitude.

Results

Varying phase angle between the two vectors has the greatest effect on the resultant magnitude when there is a high degree of amplitude parity (high comodulation). The influence of phase is much more modest when comodulation is low. In cases of high amplitude disparity bipolar training reduces effectively to single-site, or referential, training.

Discussion

The theoretical rationale behind bipolar training as a primary approach to self regulation is modest at this time. But the present models of signal interaction suggest that phase relationships play a governing role in bipolar training in the general case. That dependence is moderated by the degree of comodulation between the sites. Hence, bipolar training may activate different mechanisms of control depending upon the degree of comodulation between the two sites. Incorporating such information will likely lead to a further refinement of treatment protocols.