Combining sLORETA and 19-Channel Live Z-Score Training:

Targeting HiBeta in Brodmann Areas to Reduce Symptoms of Anxiety

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Nineteen-channel Live Z-score training uses information from surface recordings to generate 5700 quantitative metrics that include absolute power, relative power, power ratios, amplitude asymmetry, coherence, and phase at and between all 19 sites from which EEG is being acquired. These metrics are compared instantaneously to a normative database, and feedback is provided when a clinician-determined percentage of these metrics fall simultaneously within a range of activation that is considered optimally efficient based on previous statistical analysis.

This concept of "range training," or training a multitude of variables to coordinate within a complex system of networks that require different resource allocation patterns depending on the perceived task, is an innovative approach that has only existed for the last five or six years. Referred to as PZOK (or, the percentage of Z-scores within the optimal training range has been achieved, essentially: percent of Z is OK), this training approach uses EEG activity as recorded at the surface of the scalp to create visual or auditory feedback patterns for the client, and instead of a unilateral directionality of feedback (rewarding the brain to increase, "make go up," or decrease, "make go down," particular frequency bandwidths in specified locations), PZOK establishes a range of approved activity and then works with each individual brain to design the most efficient way to use the currently available neural resources to meet changes in processing and network demands.

The unique strengths of 19-channel PZOK training are the direct interaction with connectivity measures as a core element of the feedback, which encourages greater integration and resource sharing between brain regions, while simultaneously providing the brain with an operational paradigm on a global scale, regarding the most efficient ways to allocate resources under a task demand state.

Using 19-channel PZOK as a stand-alone treatment has yielded promising clinical data indicating its potential applicability to alleviate symptoms associated with a number of conditions characterized by hyper arousal. Due to the mechanism of encouraging reallocation of present energy resources, it is possible that range training may be par-

ticularly effective for assisting in the diffusion of symptoms of anxiety, post traumatic stress disorder, traumatic brain injury, obsessive compulsive disorder, insomnia and any syndromes where excess frequency activity is observed.

While favorable clinical improvement has been consistently observed by the practitioners using 19-channel PZOK, the motivation to construct protocol designs incorporating the newest available technology is still driven by the desire to provide the most efficient and cost-effective treatments possible. In this spirit, when the BrainAvatar software debuted the use of the sLORETA inverse solution, utilizing surface EEG recorded at the 19 channels of traditional 10-20 sites to accurately localize specific regions in the brain, clinicians were excited. For the first time, practitioners and researchers could observe a three-dimensional display of the current source density in specified areas of the brain in particular frequency ranges in *real time*. Not only is the activity observable, but it can be utilized as the basis of a feedback paradigm that provides information to the brain, effecting responses in the targeted area. In essence, the BrainAvatar software is rewarding the client when targeted regions of the brain increase or decrease activity in chosen frequency bands.

Following are three cases in which the client reported symptoms of chronic anxiety and difficulty with social interaction, and then experienced a noticeable reduction in anxi-

ety within two sessions or less. The first case was contributed by Dr. Gail D. Sanders, who practices neurofeedback in Greensboro, NC, and the second and third cases were shared by Penijean Rutter-Gracefire, a licensed mental health counselor in Tampa, FL.

Each of the contributed cases began with a qEEG analysis that indicated excess beta activity in regions of the brain associated with regulating arousal and emotional state, and each client was treated with a protocol that combined the global integration of BrainAvatar19-channel PZOK, with a specific region of interest chosen by matching the reported symptoms with observed focal dysregulations.

In the first case, the client is a 30–year-old female with a history of severe generalized anxiety, and currently taking 0.5 Mg of Clonazepam twice a day. She had been under Dr. Durgin's care for some time and had previously received some sessions of 19-channel LORETA neurofeedback from an alternate training software. These sessions targeted deviant metrics associated with obsessive-compulsive disorder and depression, indicated by the other training software. In an effort to maximize efficacy of treatment planning, after a number of sessions Dr. Durgin reviewed the client's most recent qEEG data, paying particular attention to the LORETA analysis. This revealed excess activity in Brodmann area 20 that spanned from 13–30 Hz and ranged between 1.8 and 3.3 standard deviations above the norm. The image in Figure 1
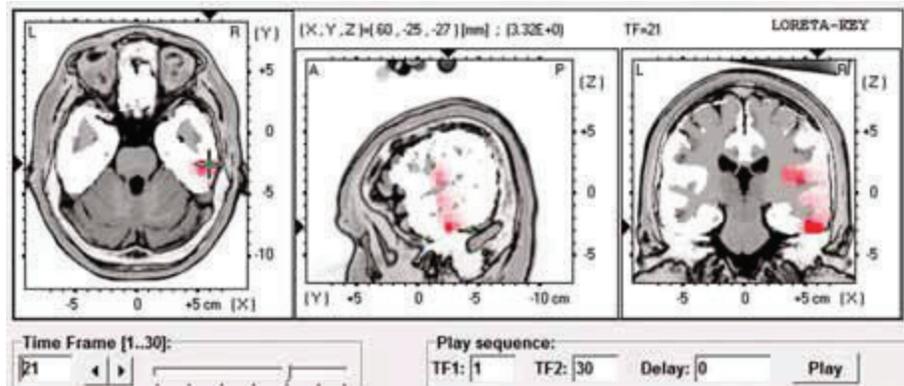

Figure 1

exhibits excess activity at 3.32 standard deviations located in Brodmann area 20.

The "attribution of intentions toward others" is a function associated with this particular region of interest, and also was a particularly problematic area for Dr. Durgin's client, who has spent years in discussing her difficulties with social interaction. Dr. Durgin then trained her client with the BrainAvatar software 19-channel PZOK approach, combined with inhibiting hibeta in Brodmann area 20 using the sLORETA localization and feedback paradigm. The image in Figure 2 was taken immediately after one training session of less than thirty minutes, and when compared to the before-BrainAvatar training image, her 21Hz activity in BA 20 went from

Figure 2

Figure 3

Figure 4

3.32 standard deviations to 2.31.

The client reported, "I felt different after the session, more calm and confident. But the biggest change I noticed was in how I felt in social situations, specifically around people I didn't know, later that evening. Upon walking into a store—something that always makes me self-conscious to some degree—I felt like the fullest, most authentic and powerful version of myself. It was like I "owned the room." I was not afraid to ask for help with finding items, and I joked around with the salesperson a bit. The interaction was easy and light—completely free of my usual worries about others' perceptions of me. I also noticed my senses felt enhanced. It was like the difference between surround sound and high definition TV versus "regular." The thought that kept coming to mind was, "If I could feel like this all the time, what couldn't I accomplish? My limitations would be almost non-existent!' I want to be very clear this was not a state of euphoria; it was a feeling of being fully present and comfortable in my own body, just being myself."

In the second case, the client is a 29-year-old female with severe social anxiety and generalized paranoia that other people are thinking badly of her, that they dislike her, or that they will dislike her as soon as they get to know her a little better, and consistently projecting worst-case scenarios over her social interactions. While not currently on medication, she has taken a number of anxiolytics in the past and had numerous talk therapy sessions, with minimal improvement of her symptoms. A pre-treatment qEEG and LORETA analysis (seen in Figure 3) revealed excess activity from 21–28 Hz in Brodmann area 23. This region is located in the limbic lobe, particularly the cingulate gyrus, and is associated with evaluative judgment, precautionary reasoning, fear conditioning, self/other distinction and response to classical conditioning, among other functions.

After two 20-minute training sessions, consisting of BrainAvatar 19-channel PZOK and inhibiting hibeta at BA 23, Figure 4 demonstrates that her excess activity decreased from 2.96 standard deviations to 1.67. She reported that the paralyzing fear she was experiencing in groups of people and unfamiliar social situations had "gone from a 9 ½ to 2" on a scale of 10, with 10 being the worst. She also said that she felt she was able to relax and enjoy talking to other people for the first time she could remember since third grade without "constantly being on red alert, waiting for the Klingons to attack" (direct client quote). Three weeks after her two sessions, she feels that she is still experiencing benefits; however, she would like to continue training to see what additional progress she can make.

The third case is a 36-year-old male with obsessive-compulsive disorder, who ruminates constantly on whether or not women find him attractive, is prone to emotional outbursts and instability, trends toward behavior that people in his family and social circle describe as "needy, suffocating, and creepy." He has gone to classes, therapy, "dating school," and read countless books trying to learn how to relax and interact with people in a less off-putting and stressful manner.

His qEEG and LORETA analysis (Figure 5) indicated excess beta activity from 24–29 Hz up to 3.12 standard deviations in Brodmann area 23 when compared to the normative database. After one 20-minute session of BrainAvatar using 19-channel PZOK and inhibiting hibeta at Brodmann area 23, his hibeta at 25 Hz decreased from 3.12 to 2.27 standard deviations (see Figure 6). He reported that the week after his initial session, he
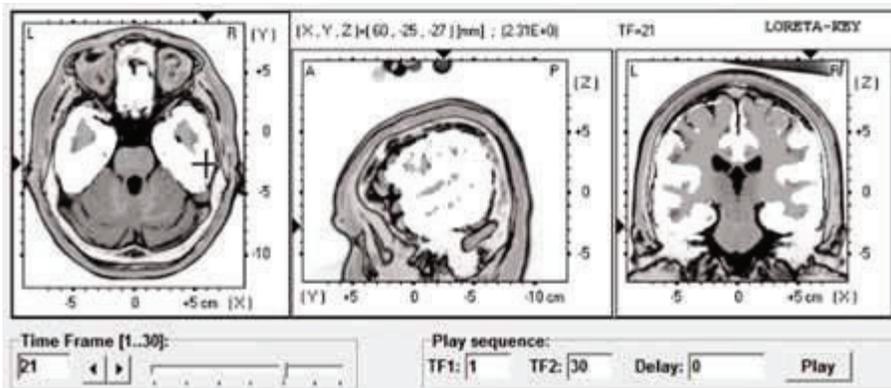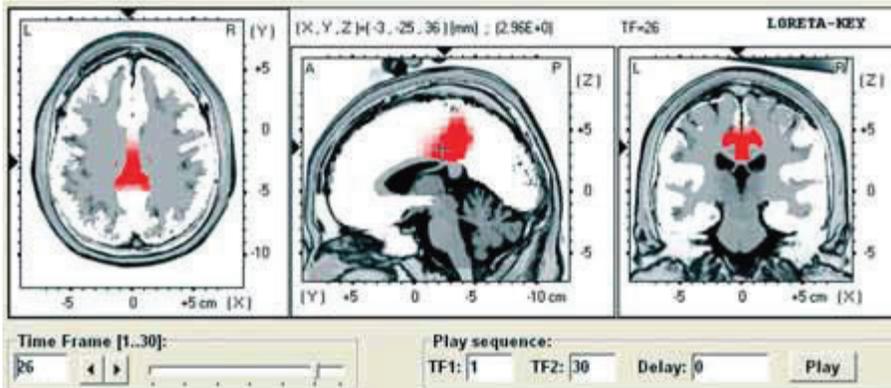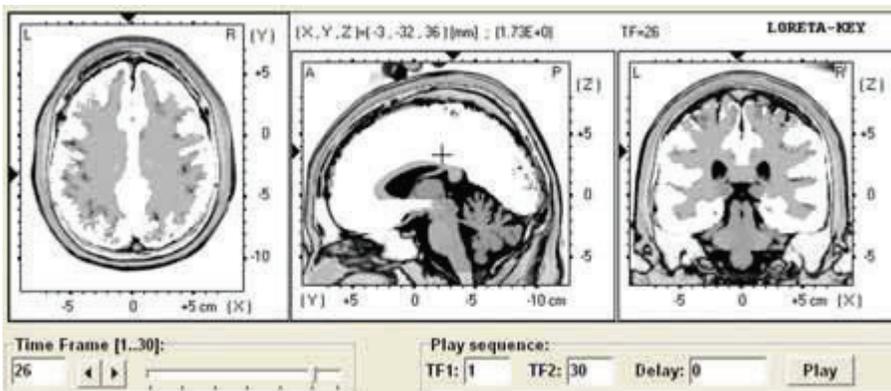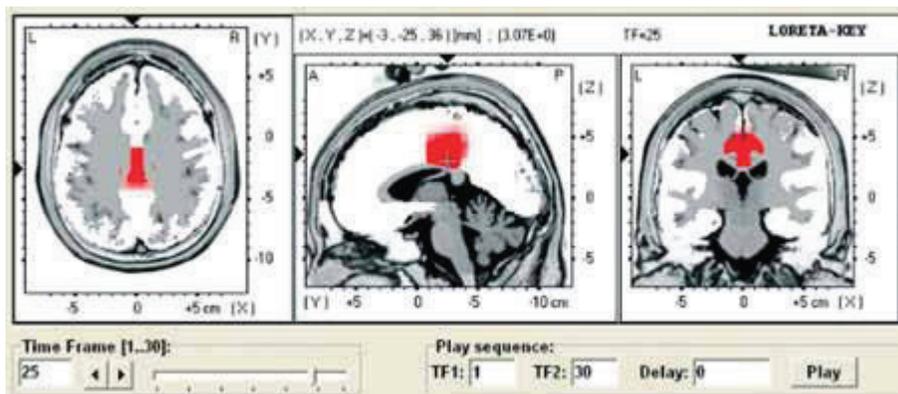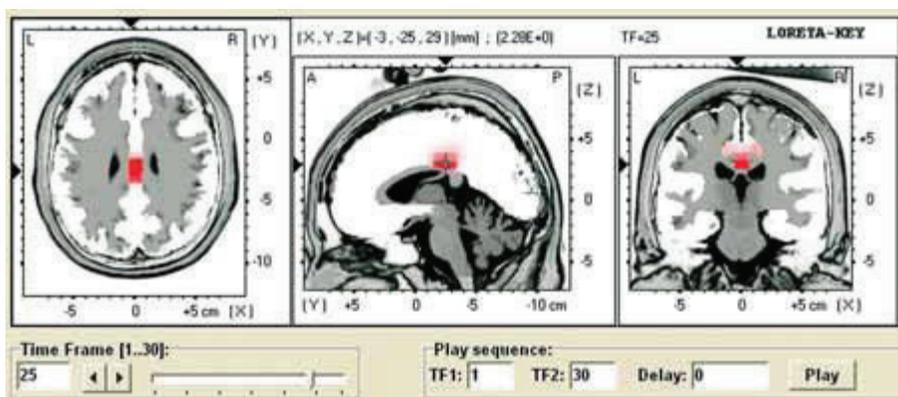
Figure 5

Figure 6

felt "light-hearted and like nothing mattered, but in a good way, as if everything was going to be okay." He described several social outings where he did not obsess beforehand about whether or not he "would get lucky" and "focused on hanging out with people and really listening and getting to know them instead of zeroing in on a hot girl like a guided missile and then crashing and burning as usual."

Although additional neurofeedback sessions and cognitive restructuring and support are intended for the cases discussed in this article, such rapid and early results are an encouraging indication that combining targeted-region training with an overall integrative and balancing global approach can potentially help to alleviate symptoms of hyperarousal and anxiety earlier in treatment, rather than later.

Penijean Gracefire, LMHC, BCN, has eight years' experience working with both low-functioning and high-risk populations, including profoundly disturbed adolescents and adults with severe traumatic brain injury. She contracted for two years with the Center for Rational Living as a cognitive behavioral therapist, rehabilitating DUI and drug offenders on probation, and training new therapists. She served for five years as the Clinical Services Director at CNS Wellness of Tampa Bay, using neurofeedback, biofeedback, and cognitive behavioral interventions on populations with autistic spectrum disorder, chronic anxiety and depression, aging and cognitive decline, traumatic brain injury, substance abuse, ADHD and OCD. Penijean believes in therapeutic interventions that incorporate cognitive, biological, social, and neurophysiological factors into an integrated approach that addresses each individual as a complete person functioning within a complex system. Her recent clinical research has focused on methods to improve neural connectivity in individuals with compromised function. She currently works with StressTherapy Solutions, Inc. as a clinical consultant and educational coordinator, helping to create and teach training programs and materials, and to develop clinical applications for groundbreaking training methodologies and brain imaging software.

Gail Sanders Durgin, PhD, BCN-Fellow, QEEGT, worked in mental health and developmental disabilities for 18 years before beginning her career in neurofeedback in 2000. She has studied with a number of leaders in the field and has presented at several international conferences. She uses a variety of neurofeedback techniques and systems in order to better personalize the treatment for each individual client. She is the owner of Neurofeedback Associates Inc. in Greensboro, NC.

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