

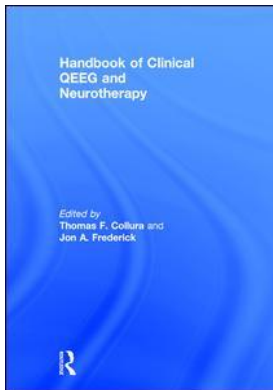
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Thomas F. Collura, Jon A. Frederick

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Robert E. Longo, G. Michael Russo

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6

WORKING WITH FORENSIC POPULATIONS

Incorporating Peripheral Biofeedback and Brainwave Biofeedback into Your Organization or Practice

Robert E. Longo and G. Michael Russo

Abstract

Since the turn of the century, one of the core themes in mental health has been the treatment of trauma especially from a brain-based perspective. The verification that the brain has plasticity opened new avenues for treatment and reinforced the use of biofeedback and brainwave biofeedback (neurofeedback) techniques as viable treatment options. The principle author has specialized in the fields of treating victims and perpetrators of sexual abuse, and began adapting treatment interventions addressing self-regulation skills for traumatized victims and interventions focusing on impulsivity and decision making skills for perpetrators. These physiological assessment and treatment modalities have direct application to most, if not all, forensic populations. This paper provides a brief overview of key aspects of using biofeedback, QEEG, and neurofeedback, and addresses why administrators and clinicians should incorporate the use of peripheral biofeedback and neurofeedback into the array of services used to address sexual perpetrators with the inference of its direct application to treat the majority of forensic populations in both public and private settings.

Introduction

Until the past decade, the majority of programs treating perpetrators of sexual abuse did not incorporate the use of self-regulation treatments and interventions outside of traditional talk therapies. In fact, national surveys conducted by the Safer Society Foundation in the United States revealed that the majority of treatments, interventions, and methods were sex offender specific, i.e., empathy training, arousal reconditioning, victim impact issues, etc. (Bengis et al., 1999; Burton, Smith-Darden, Levins, Fiske, & Freeman-Longo, 2000; Freeman-Longo, Bird, Stevenson, & Fiske, 1995; Knopp, Freeman-Longo, & Stevenson, 1993). Sexual offenders and substance abusers are two of the most likely populations to receive treatment in prison systems, community corrections, and in the community when placed on probation or parole.

With forensic clients, few if any interventions have been geared towards self-regulation skills except for traditional talk therapies and limited and often misguided relaxation techniques. For example, interventions using biofeedback and neurofeedback were not being used in sex offender programming until

the early 2000s. Most sex offender specific treatment programs did not incorporate biofeedback; and with one or two exceptions, to this date only a small handful of programs utilize neurofeedback (Bengis et al., 1999; Burton et al., 2000; Freeman-Longo et al., 1995; Knopp et al., 1993; Longo & Prescott, 2006; Longo, Prescott, Bergman, & Creeden, 2013; Prescott & Longo, 2010). This began to change in 2001 when the field became more informed about trauma and its impact on the brain (Longo, 2010, 2011).

One organization that has recognized and implemented updates based on this information is The Council for Accreditation of Counseling and Related Educational Programs (CACREP). In 2009 CACREP mandated that accredited programs include material that facilitates knowledge pertaining to neurobiological development. With this development in the counseling education standards comes a unique opportunity for the inclusion of neurofeedback. Based on these standards, some universities have opted to include additional coursework that focuses specifically on neurofeedback and satisfies The Biofeedback Certification International Alliance didactic course requirements for certification. However, the 2009 standards are not intended to add courses, but rather to include multiple presentations of neurobiological material in current courses as educational opportunities for the students and, in turn, their future clientele (Ivey, Ivey, Zalaquett, & Quirk, 2009). Those counselors who implement neurofeedback as a tool in their practices will likely realize that a vital function of neurofeedback that positively contributes to its success is the sense of empowerment that individuals experience by understanding, recognizing, and altering mental states in order to promote growth and wellness (Myers & Young, 2012).

With the turn of the century and the newfound understanding that the brain in fact does have plasticity, mental health treatments and therapies began to make a major shift. Neuroplasticity became a focal point in understanding mental health and brain function. We now understand that the brain has the ability to change and adapt to new and different experiences as well as the ability to grow new brain cells; a theory that was often rejected in the field of neuroscience and neurobiology just a few years before (Begley, 2007).

Given the research findings supporting the use of both peripheral biofeedback and neurofeedback for the treatment of a variety of mental and physical health problems, and the advancement of knowledge regarding brain function and mind-body treatment, it becomes more difficult to turn a blind eye towards the use of these treatments. One might argue that individual practitioners, clinics, and programs could be challenged on a variety of levels regarding the quality of care they offer patients and clients if they are not providing these services.

For example, The American Academy of Pediatrics¹ has determined that biofeedback, including neurofeedback, is an evidenced-based treatment for ADHD, and is considered a Level 1 Best Support intervention. For those parents not wanting their children on medications for ADHD, biofeedback and neurofeedback become viable options.

This article argues that treatment for forensic clientele should add biofeedback and neurofeedback to the existing treatment methods and modalities used with these populations. Biofeedback, neurofeedback, and QEEG are not substitutes for traditional mental health counseling and therapies, but rather should be considered as adjunct to a comprehensive program.

Self-Regulation

Self-regulation is simply regulating oneself or itself. Self-Regulation Theory or SRT is a system of conscious and purposeful personal health management. Self-regulation is one of the focal points involved with the treatment of individuals in forensic populations due to its ability to address impulse control issues and focus on short-term desires. Often times individuals with low impulse control act on immediate desires resulting in an increased likelihood of partaking in deviant or criminal

behaviors. One such example of this deviant behavior is sexually abusive behaviors, which often occurs in the heat of the moment. For non-violent people, lack of self-regulation skills and impulsivity can lead to personal problems (i.e., addictions), financial problems (i.e., impulsive buying, gambling, etc.), interpersonal problems and loss of relationships, and health-related problems including but not limited to stress, anxiety, and sleep problems.

So, a question that some readers might be asking is: What exactly is biofeedback? Dr. DeLee Lantz, Ph.D., a Senior Fellow and Board Certified in Biofeedback, describes biofeedback as:

A modality that assists our mind and body to interact more effectively. Body signals (e.g. Heart Rate Variability, breathing, skin temperature, etc.) are often very subtle and often overlooked. With training we can learn to regulate these signals thus contributing to an increased sense of wellness.²

Both biofeedback and neurofeedback are valuable treatment modalities for helping patients and clients enhance their self-regulation skills. Research suggests that trauma treatment is more efficacious when biofeedback, specifically somatic modalities such as heart rate variability, and neurofeedback are used in conjunction as opposed to individually (Gevirtz & Dalenberg, 2008). Furthermore, Longo (2010, 2011) has demonstrated positive pre- and post-treatment outcomes and enhanced self-regulation skills using both biofeedback and neurofeedback with juveniles with sexual behavior problems.

In the primary author's clinical experience, the use of biofeedback and neurofeedback as an adjunctive therapy in a secure hospital facility has led to treatment successes with difficult cases that otherwise would have been discharged from the programs they participated in due to poor progress or a lack of satisfactory progress.

What Is Neuroplasticity?

Neuroplasticity is the term used to describe a change in the connections of neurons as a result of a systematic reinforcement of stimuli over a period of time.³ However, not all persons experience neuroplasticity all of the time. This is often the mistaken belief and message given by uninformed persons. Neuroplasticity occurs when the following is present (PBS, 2009):

- 1) Change occurs only when the brain is in the mood (attention is critical including behavioral circumstances/neurotransmitters are released).
- 2) Change strengthens connections between neurons engaged at the same time.
- 3) Neurons that fire together wire together. This process is strengthened when events/stimulus reliably occurs.
- 4) Initial changes are just temporary. If the brain judges the experience to be novel (good or bad) they are more likely to become permanent.
- 5) Brain plasticity is not a one-way street, meaning that the brain can "wire" so that neuronal firing occurs more frequently or less frequently. This possibility helps to explain behaviors such as addiction or chronic pain management techniques/treatments/theories.
- 6) Memory is crucial for learning. The brain recalls previous situations as we develop a skill.
- 7) Motivation is a key factor for brain growth and plasticity. When changes occur new networks are developed. The brain can repair itself and reorganize itself. New skills acquisition is important for plasticity and change.

In the majority of cases, patient and clients will make progress and improve as a result of the treatment process. However, there are some patients/clients who will not make enough progress to justify

continued treatment. In some cases the absence of progress may be related to brain function based upon a history of psychological trauma or traumatic head injury. In these cases it is not that the patient/client is unmotivated but rather incapable of adequate participation.

Trauma and Its Impact on the Brain

Despite age and/or gender, those who sexually abuse others have often times been victims of sexual abuse and/or neglect (Freeman-Longo, 1986, 1989; Longo & Prescott, 2006). Forensic populations in general are no different. In fact even non-forensic populations have histories of trauma that ultimately affect their overall health (more of this concept will be discussed in following sections regarding The Adverse Childhood Experiences (ACE) study). Both physical and psychological trauma can have a direct impact on the brain and brain development (Longo et al., 2013).

The Training & Research Institute, Inc. (2004) in Albuquerque, New Mexico, notes that antisocial behavior can result from excessive activation of the limbic system (which is theorized to regulate memory and emotionality) and the prefrontal cortex (associated with judgment, moral rational, and insight) through perceived traumatic events such as: childhood neglect, physical, sexual, or emotional abuse. They also report that trauma, abuse, and neglect can affect the development of the amygdala, hippocampus, corpus colosum, prefrontal cortex, temporal lobes, cerebellar vermis, and left hemisphere as noted in more detail below.

The amygdala is known as the “seat of emotion” due to its involvement with: charging memories with emotions, the mediation of sadness/depression and irritability/aggression, and determining the magnitude and risk associated with fearful situations. Childhood abuse or neglect leads to a significantly smaller or atrophied amygdala resulting in the increased risk for clinical depression, anger disorders, inaccurately charged emotional memories, difficulties or absence of fear conditioning, and psychopathic tendencies (Training & Research Institute, Inc., 2004). An overactive amygdala in those coping with Post-Traumatic Stress Disorder (PTSD) may result in generalization of the fear response, leading to an overall increase in fearful behavior (Ogden, Minton, & Pain, 2006). Some individuals may develop “limbic irritability” with a tendency toward overactive amygdalic responses to traumatic stimuli (Perry, Pollard, Blakley, Baker, & Vigilante, 1995).

The hippocampus is known for the role that it plays in the creation and recall of verbal and emotionally based memories. Abuse or neglect in childhood often results in lower scores on verbal memory tests and mental health concerns during adulthood.

Like the hippocampus, the temporal lobe is associated with the regulation of emotions and verbal memory. Additionally, childhood abuse or neglect impacts both the hippocampus and the temporal lobe in terms of decreased modulation of emotionality. However, the marked difference is that the impact of childhood abuse or neglect increases the chance for temporal lobe epilepsy.

The largest neuronal mass bridging both the left and right hemispheres is known as the corpus colosum. It is due to this connectivity component that the corpus colosum plays a crucial role in coherence between the two hemispheres of the brain. Childhood abuse or neglect results in the atrophy (shrinkage) of the corpus colosum, which can negatively affect responses to everyday situations due to dilemmas with integration.

As noted previously, the prefrontal cortex is associated with judgment, moral rational, and insight and acts as an editor of internal emotional states and defining crises. Childhood neglect and abuse impact the prefrontal cortex resulting in the increased likelihood of the development of clinical depression and/or unlawful behaviors.

The cerebellar vermis regulates the creation and use of neurotransmitters. This structure has a large number of receptor sites for the stress-related hormones. Childhood abuse or neglect results in an increased chance for the development of depression, hyperactivity, attention deficits, and in some cases psychotic symptoms are possible.

In general, the left hemisphere is viewed as more “logical” and contributes to rectilinear or rational thought while providing a sense of balance to the “emotional” right hemisphere of the brain. The impact of childhood abuse or neglect results in a decreased control over emotionality resulting in ineffective sociability. Irritability, paranoia, psychosis, a tendency to pursue toxic relationships, self-sabotaging, or suicidality, are some of the inadequate social responses that those who have histories of childhood trauma could suffer from.

Additionally, Ogden et al. (2006) note that the Anterior Cingulate Gyrus is responsible for emotional awareness, the experiential aspects of emotion, and integration of emotion and cognition, and it orchestrates the behavioral expression of emotion. When an individual experiences abuse and/or trauma, these experiences can impact all of the above functions.

Leading trauma researcher, Bessel van der Kolk states, “Neurofeedback is a powerful treatment for traumatic stress.”⁴ His trauma center goes on to report, “Our treatment outcome data show that 70%–80% of neurofeedback clients show significant improvement after their first twenty sessions. . . . In 20 neurofeedback sessions, with feedback every half second, you get 72,000 chances to learn. That’s a lot of repetition and practice. Brain science has shown that repetitive exercise of brain networks reshapes the brain. Neurofeedback allows you to reshape your brain.”

Regarding biofeedback, Gevirtz and Dalenberg (2008, p. 22) state:

Recent research in the neurobiology of trauma supports the likelihood of more effective treatment with the inclusion of somatic techniques such as heart rate variability biofeedback. . . . Recent work in the trauma field has pointed to the need to integrate somatic techniques into the empirically based cognitive techniques such as cognitive behavioral therapy (CBT), acceptance commitment therapy (ACT), and dialectical behavioral therapy.

The ACE Study

One of the most notable studies regarding the impact that childhood experiences have on health was The Adverse Childhood Experiences (ACE) Study. The study took place between The Centers for Disease Control and Prevention and The Kaiser Permanente’s Health Appraisal Clinic in San Diego from 1995–1997.⁵

One aspect that made The ACE study worth notation was the sheer size, which consisted of 17,337 Health Maintenance Organization (HMO) members. The members underwent a comprehensive physical examination, and provided details regarding family discord, abuse, and neglect. Through the findings of this study a few major risk factors were identified which were listed as leading causes of poor quality of life, sickness, and death in the United States. These include chemical dependency; liver disease; smoking; depression; suicidality; chronic obstructive pulmonary disease (COPD); ischemic heart disease (IHD); and relational difficulties such as: increased risk of intimate partner violence, multiple sexual partners, sexually transmitted diseases (STDs), unintended pregnancies, fetal death, adolescent pregnancy, and premature involvement with sexual activity.⁶ The ACE Study illustrated the above-mentioned factors and prevalence percentages in Table 6.1.

Although the ACE study was conducted on a non-forensic population, one might infer that forensic populations would share similar statistics and thus similar health-related problems as noted above, of which chemical addiction/use, clinical depression, partner or relationship violence, and suicidality could benefit from either peripheral biofeedback, neurofeedback, or both interventions.

Table 6.1 ACE study.

ACE Category	Women (N = 9,367)	Men (N = 7,970)	Total (N = 17,337)
Abuse			
Emotional Abuse	13.1	7.6	10.6
Physical Abuse	27.0	29.9	28.3
Sexual Abuse	24.7	16.0	20.7
Neglect			
Emotional Neglect	16.7	12.4	14.8
Physical Neglect	9.2	10.7	9.9
Household Dysfunction			
Mother Treated Violently	13.7	11.5	12.7
Household Substance Abuse	29.5	23.8	26.9
Household Mental Illness	23.3	14.8	19.4
Parental Separation or Divorce	24.5	21.8	23.3
Incarcerated Household Member	5.2	4.1	4.7

Practical and Ethical Considerations

The majority of treatment providers and programs working with sexually abusive persons, and who are members of the Association for the Treatment of Sexual Abusers (ATSA; an international organization dedicated to the prevention and treatment of sexual abuse), adhere to the Code of Ethics and standards of practice as outlined by that organization. Most providers use “sex offender specific treatments” and follow the ATSA Code of Ethics (2001). The ATSA Code of Ethics requires members to participate in continuing education and professional growth, follow the regulations and expectations of his/her discipline/training, and attend an adequate number of training sessions and supervision in order to be deemed competent to accurately and reliably administer treatment modalities (Association for the Treatment of Sexual Abusers, 2001).

Most professionals assessing and treating sexually abusive persons have relied on the Diagnostic and Statistical Manual of Mental Disorders (DSM), in its various versions as the “divine text” of diagnosing our patients and clients with sexual disorders as well as other mental health problems, i.e., depression, anxiety, ADHD, etc. The DSM, published by the American Psychiatric Association, allows clinicians and others a uniform basis for language and criteria when describing and diagnosing mental disorders. The current version, DSM-V, was met with disapproval and apprehension regarding its restrictions.

Belluck and Carey (2013) noted in a *New York Times* article that the DSM suffers from a lack of scientific validity, resulting in a level of concern from the public, patient groups, and notable senior members from within the field of psychiatry. However, despite the discord, Dr. Thomas R. Insel, the Director of The National Institute of Mental Health (NIMH), describes “that one notable shift is occurring within DSM-V; the shift likely aims to facilitate a new focal point in the research from symptom description towards causal identification through additional research in biology, genetics imaging, cognitive and neurosciences. . . . Much of the previous research has guided us to the understanding that mental disorders often involve neural circuits which implicate specific areas of cognition, emotion, or behaviors.”⁷

Given the above, it is no surprise that individuals have looked to alternatives to medications; oftentimes the medications do not improve mental health problems and may have side effects whose consequences can negatively impact the individual's overall quality of life (Longo, 2013).

As professionals we are required to keep up our education on new and emerging topics and issues related to our work through the reading of books and journals and attendance at workshops and conferences. When faced with science or professional findings that challenge our existing practices and belief systems, then we have an obligation to move with the science in order to provide our patients and clients with optimal care. The denouncing and rejection of the DSM-V is one such instance. One now must question whether the criteria in the DSM that we have used to diagnose a patient or client with a paraphilic disorder are reliable, as we have been led to believe. The field's inability to clearly establish an etiological pathway or pathways for sexual offending is one such example.

Longo and Prescott (2013) note that ethical practice requires proper training and recognition of scope of practice. They go on to say that before one begins to practice treatment techniques involving neurobiological practices, professionals must engage in proper supervision and training.

On the other hand, these authors would throw out a slightly different challenge. For example, while it might be considered unethical to operate outside of one's scope of practice, would it not be equally unethical to ignore the science and technology that can presumably provide our patients and clients with better and maybe more optimal assessment and care? If we invest in equipment, training, certification, and services to measure sexual interest and arousal such as the Abel Screen and Penile Plethysmography; the assessment of psychopathy with the Hare Psychopathy Checklist; and the measurement of truth versus deception regarding sexual history and behavior with Polygraphy, then are we not equally as obligated to utilize QEEG for assessing brain function and biofeedback and neurofeedback to treat disorders that might better respond to these treatment tools and modalities? If we pay professionals upwards of \$1000 or more to provide a psychosexual evaluation, should we not spend the same amount for assessing one's brainwave function?

The authors strongly advocate that programs and practitioners who work with both perpetrators and victims of sexual abuse should incorporate biofeedback, QEEG, and neurofeedback into their assessment and treatment methods and modalities. The remainder of this chapter provides a brief overview and description of biofeedback, neurofeedback, and QEEG assessment, and briefly defines or covers related areas of interest.

What Is Biofeedback?

Biofeedback has been around for over five decades. In recent years biofeedback has become a more sophisticated area of health and its definition has evolved. The BCIA,⁸ AAPB,⁹ and ISNR¹⁰ view biofeedback as a non-invasive treatment modality where the therapist attaches small sensors to the body. These sensors record specific bodily functions that are fed back to the client. Often times the feedback is provided either visually or by way of a sound/tone. Some of the common bodily functions that are recorded are skin temperature, muscle tension, and/or neuronal (brainwave) activity. With this technologically facilitated guidance, clients are able to make small changes that are not consciously perceived at first but can lead to symptom relief for a variety of disorders over a period of time. Generally, the term peripheral biofeedback refers to biofeedback techniques used to regulate heart rate, breathing, and the areas described below, and neurofeedback is the term used to specifically describe brainwave biofeedback.

The Impact of Breathing on Heart Rate

The basis of all self-regulation skills involving both peripheral biofeedback and neurofeedback is proper breathing. Proper breathing skills are grounded in diaphragmatic breathing, or belly breathing.

The client can visualize this process when they place their hands on their belly button and watch their hands rise and fall with each breath. This is contrasted to the significant rise and fall of the shoulders in non-diaphragmatic breathing. Breathing is oftentimes one of the first steps in the self-regulation process. This is due to the impact that breathing has on processes like heart rate. Faster and shallower breaths (shoulder breathing) can be observed in those who are experiencing a higher or a more aroused physiological state such as an acute stress response. This is correlated with a rapid heart rate. Conversely, a slower breathing rate is also correlated with a slower and more relaxed heart rate. Heart coherence occurs when your heart rhythms are smooth and balanced resulting in the optimization of all bodily systems.¹¹ By adopting a pattern of 10-second rhythmic breathing techniques (5-second inhalation and 5-second exhalation), we are able to modulate the heart's rhythm resulting in increased relaxation and increased heart coherence.¹²

What Measures Are Used in Peripheral Biofeedback?

Peripheral biofeedback includes physical responses. The most common physical responses for which peripheral biofeedback is used include:

- EMG—Muscular reactivity and tension (Electromyography)
- Thermal—Hand and foot temperature (Thermofeedback)
- HRV—Heart rate and blood pressure (Heart Rate Variability)
- SCL/GSR—Sweat gland activity (Galvanic Skin Response)
- Respiration—Respiratory function through breathing patterns and rate
- RSA Feedback—Heart rate variability in synchrony with respiration (Respiratory Sinus Arrhythmia)

What Is Brainwave Biofeedback?

Brainwave biofeedback is most commonly referred to as neurofeedback but is also known as EEG biofeedback, and neurotherapy. For the sake of simplicity we will refer to brainwave biofeedback (etc.) as neurofeedback. Neurofeedback is a type of biofeedback that allows the client to train his or her own brainwaves in live-time using operant conditioning techniques. However, neurofeedback is different from other biofeedback techniques due to the focus on the central nervous system, most often the brain. Neurofeedback involves attaching very sensitive, non-invasive sensors on the surface of the scalp. These sensors are able to record various brainwaves, which differ based on the frequency and power that they create. Delta is often described as the slowest but most powerful brainwave. Theta is slightly weaker but occurs more rapidly and is followed by Alpha and Beta. Gamma is the weakest but most rapidly occurring brainwave.

By identifying the types of brainwaves, licensed and trained clinicians are able to create treatment protocols to assist the client with coping with specific symptomologies. When brain activity changes and falls within the neurofeedback protocol, a positive “reward,” typically in the form of a visual display and/or sound, is given to the patient (Soutar & Longo, 2011). Rewards/reinforcements can be as simple as a change or onset of an auditory pitch or occur visually as in the character moves on the TV/computer screen in a game. At first this will seem like a randomly occurring process to the client; however, their brain will begin to associate the reward with various patterns of firing. Based on the previously mentioned concept of neuroplasticity neuronal changes can occur. Over the course of treatment the client will begin to associate brainwave activity with specific mental states and begin to automatically apply these mental states to their day-to-day lives.

Treatment sessions often range from 10–30 minutes in length and must occur minimally one time per week. Often times sessions will occur two times per week but in some cases this can occur more frequently for a minimum of 30–40 sessions. Conditions such as Traumatic Brain Injury (TBI) can

require 50–60 sessions while Autism Spectrum Disorder (ASD) can require 60–100 or more sessions in order for a lasting change to be made. Some clinicians report that clients can notice a change in as little as 5–10 sessions, depending on the symptomology; however, without the reinforcement of these neuronal pathways the client will likely experience a regression towards their initial baseline. Like most mental health concerns, session frequency differs based on the severity of the illness. However, some of the most common diagnoses/mental disorders where neurofeedback has been shown to be effective include: ADHD, chemical use/dependency, depression, anxiety, Post-Traumatic Stress Disorder (PTSD), epilepsy and seizures, Mild Traumatic Brain Injury (MTBI), sleep regulation, cognitive impairment, migraines, headaches, and chronic pain. It is important to note that in most states and countries treatment of mental disorders/illnesses fall within the scope of practice of specific licensures and professions. Those who wish to treat these clients should first consult their regional governing body to determine their treatment abilities.

Additionally, before beginning neurofeedback, patients should have practice with basic biofeedback and diaphragmatic breathing which often helps to reduce anxiety and therefore enhance the neurofeedback experience. Skin temperature training, for example, could be beneficial with high anxiety clients due to the notion that it is associated with the “theta state” (Hall, 1977). However, it is the belief and practice of both of the authors of this chapter to conduct a QEEG Brain Map *before* beginning neurofeedback.

What Is QEEG?

A QEEG (quantitative electroencephalography) brain map usually includes a complete 19-channel recording based on the international 10–20 system of electrode placement where an individual’s brain activity is compared to a standardized database. Once compared and computed, the clinician can see a range of differences that are depicted in terms of z-scores between the individual’s neuronal activity and the database as seen in the example figure 6.1.

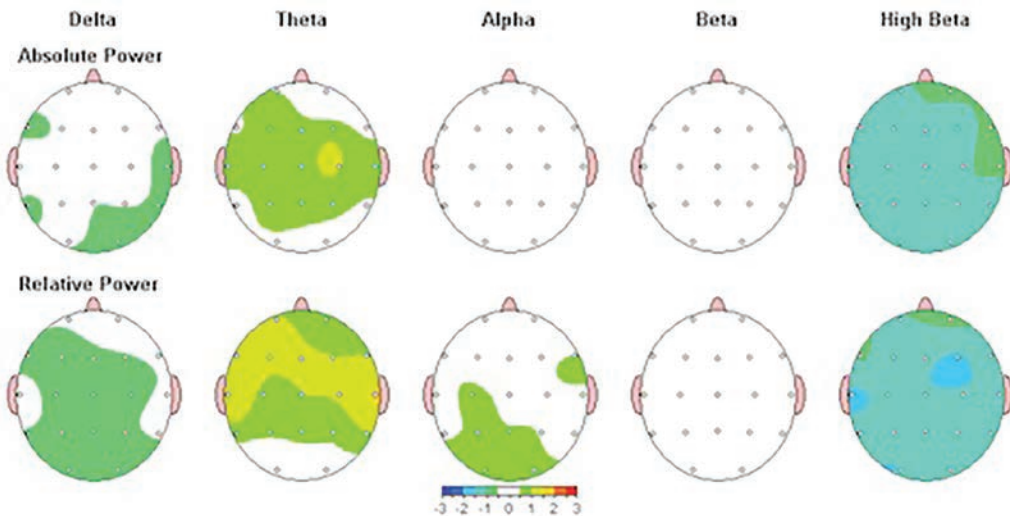


Figure 6.1 An example of a QEEG.

The picture displayed above is intended as an example only. The brain map indicates areas of abnormality and is used in conjunction with client concerns in the development of treatment protocols for neurofeedback training. EEG (electroencephalography) records the changes in electrical potentials from sensors that are placed on the surface of the scalp and displays these changes as “brain-waves.” EEG measures electrical activity originating from cortical structures (neocortex, cortex). The frontal lobes and temporal lobes are the largest connection to the neocortex. Hans Berger is identified as the first individual to record human brain activity in 1929; however, similar studies had been carried out on animals as early as 1870.

Understanding QEEG

Taking an exam or providing a professional presentation: this mental state is often associated with high levels of anxiety. On a QEEG for an individual suffering from an anxiety-related disorder, such as PTSD, this similar state of mind might be noticed and identified as excessive Beta/HiBeta wave activity. This example is given to illustrate the point that our current brainwaves have a significant impact on our thoughts, feelings, and behaviors. Diagnostic brainwave patterns/disorders vary widely; and while QEEG is not currently used to make a diagnosis, it is commonly used for purposes of differential diagnosis. Another such example would be that of excessive Delta waves, which are slow but powerful waves and often range 1–3 cycles per second. When reviewing the QEEG of an individual who is suffering from a traumatic brain injury, this waveform might be quite profound around the area of the marked neurological damage. With this said, it is important that the trained neurotherapist recognize that there are numerous etiologies for these brainwave activities and the QEEG should be examined within the context of the patient’s medical history, goals/reasons for seeking treatment, and additional assessment techniques.

Some Common Findings with QEEG/Brainwaves

Delta Waves

The brain stem and cerebellum generate Delta waves (a slow wave). Delta generally does not give us clear indications for differential diagnostics. Arrhythmic Delta is normal, while rhythmic Delta may indicate pathology. Extremely slow Delta is significant of TBI, LD, and Dementia. Increased Delta in posterior area is indicative of learning disorder (LD). Increased Delta may also be indicative of head injury (TBI). Parietal lobe Delta affects association and cortex/processing. A Delta deficit is indicative of problems with working memory. Increased global Delta may indicate cognitive decline with age (Delta, Theta, and Alpha start to slow). Delta is usually a measure of white matter and can reflect white matter damage.

Theta Waves

Theta emerges from the hippocampal loop (the septal hippocampal circuits in the limbic system), and is involved with memory searching, network linking, and emotional valence. Generally when there is increased Theta, there may be increases in Delta and Alpha (all slowing waves). High amplitude non-rhythmic Theta bursts are often seen with migraine headaches. Increased frontal region Theta is indicative of being overwhelmed, and emotions will often shut down. Elevated Theta may be indicative of a person not being able to grasp concepts, ideas, information, etc., and may also be indicative

of PTSD and/or depression. Frontal Theta and increased Theta in the front (and is higher than in the posterior) is also indicative of ADHD.

Alpha Waves

Alpha represents the brain in a resting state or neutral state but prepared for action. It is often referred to as the idling frequency. Alpha is generated from resonance between the thalamus and the cortex, and should be higher on the right. The thalamus is thought of as the pacemaker of the brain. The brain idles in Alpha, and constantly shifts up into Beta and down into Theta. The traumatized brain idles too fast in the Beta direction or too slow in the Theta direction. Low Alpha may be indicative of anxiety, PTSD, and short-term memory impairment. Alpha should be higher in the right hemisphere than in the left hemisphere. Alpha asymmetry and locally increased Alpha are indicative of depression (too much Alpha in the left hemisphere). Slow (or low) Alpha can be indicative of: metabolic problems, toxin related issues, bipolar/depression, and substance abuse (i.e., marijuana use/abuse). Increased fast Alpha in the posterior may indicate emotional rumination.

All sensory information coming into the body goes through the thalamus, which is divided up into regions that correspond to different areas of the brain. The thalamus acts as a sensory relay station due to its role in passing information to surrounding cortices. It is due to this function that the thalamus plays a crucial role in regulating cognitive and physiological arousal levels. The thalamus is also responsible for regulating sleep states and wakefulness.

Decreased Alpha and increased Beta in frontals is indicative of impulsivity, controlled by anxiety, feeling overwhelmed, and impulsivity with explosiveness. Elevated Alpha is indicative of the brain locking up/overworking. Low Alpha is indicative of the brain not activating normally.

Beta Waves

Beta is generated from resonances within the cortex. Beta should be higher on the left than on the right. Increased Beta asymmetry (global elevated Beta in the right hemisphere) is indicative of anxiety. Increased Beta in the left frontal area has been associated with blocking amygdala input. Beta hypercoherence may indicate anxiety, panic attacks, and test anxiety (panic attacks can look like a full body seizure—especially when there are sensory integration problems). Increased Beta alone is often indicative of withdrawal, that is the Alpha and Theta wave activity are lower. Increased Beta in the frontal lobes can be indicative of the person hiding feelings and emotions (flat affect may be seen). Increased Beta and decreased Alpha in the frontal region is indicative of impulsivity, controlled by anxiety, feeling overwhelmed, and impulsivity with explosiveness. Low Beta is often indicative of information/cognitive processing difficulties.

Summary and Recommendations

In the United States of America, The Food and Drug Administration (FDA) is the governing body that oversees and regulates the usage of medical equipment. They identify the process of biofeedback as a form of relaxation therapy. Both biofeedback and neurofeedback work based on the principles of operant conditioning and reinforcement techniques of naturally occurring biological activity. With guidance, the client is able to apply these theories in order to reinforce specific neurological activity (in neurofeedback). This process usually results in permanent changes between 30–40 sessions, depending on treatment goals; the average noticeable change can occur in as little as 15–30 sessions.

Neurofeedback has been identified as the most applicable and accessible form of technology (based in neuroscience) that counselors might employ in either private practice or academic settings (Myers & Young, 2012).

In order to be effective when administering biofeedback and/or neurofeedback to clients and patients, it is essential that the profession undergo proper training. There is more to using biofeedback with patients and clients than buying software and hardware and using it with a particular population. Basic education in the use of biofeedback and neurofeedback is important, and a solid understanding of human anatomy and physiology is essential.

The authors of this text and other professionals practicing biofeedback and neurofeedback encourage those interested in using these treatments in their organizations or practices to become board certified. To become board certified, one could do so through the Biofeedback Certification International Alliance (BCIA).¹³

The Biofeedback Certification International Alliance (BCIA) was originally founded in 1981 under the name of “The Biofeedback Institute of America” with the goal to provide a common certification source for individuals who meet educational and training standards necessary to accurately and reliably apply biofeedback techniques.¹⁴ BCIA is a registered nonprofit corporation whose board of directors consists of an alternating group of distinguished professionals from various scholarly backgrounds.

BCIA certification requires recertification through continuing education every four years for both biofeedback and neurofeedback. The Association of Applied Psychophysiology and Biofeedback (AAPB), the Biofeedback Foundation of Europe (BFE), and the International Society for Neurofeedback and Research (ISNR) have identified BCIA certification as the standard for professional identity and practice; however, this certification does not override or take the place of clinical and regionally/nationally mandated licensure to practice.

BCIA offers a clinical certification for Biofeedback, Neurofeedback, and Pelvic Muscle Dysfunction Biofeedback as well as technician-level certification for Biofeedback and Neurofeedback. Clinical Certification is designed for individuals who are primary treatment providers in clinical populations and carry appropriate licensure for such. Technician Certification is intended for individuals who use biofeedback and neurofeedback modalities under the licensure and direct supervision of a BCIA Certified individual. Often times the technicians do not have their own clinical degree/licensure.

Those who are certified in biofeedback may use all biofeedback modalities as mentioned previously (Electromyography, Thermofeedback, Heart Rate Variability, Galvanic Skin Response, Respiration, Respiratory Sinus Arrhythmia), where those who are certified in neurofeedback specialize in EEG biofeedback. All certification programs through BCIA follow a strict set of regularly updated professional and ethical standards that can be located on their website.

All BCIA coursework is based on their *Blueprint of Knowledge*, which covers specific information that provides a comprehensive understanding of the history, science, and application of biofeedback-specific areas.¹⁵ Additionally, those who wish to pursue certification require a clinical degree in a health-related field (with the exception of technician-level certification); completion of anatomy/physiology coursework; clinical supervision and mentorship; and the successful completion of a certification exam that signifies competency.¹⁶

The authors would also encourage that any professional considering the incorporation of biofeedback and/or neurofeedback into their private practice, agency, or organization visit a biofeedback/neurofeedback practice to see how other professionals use these highly specialized treatments and to have a trained and board certified professional mentor you.

There are several levels and brands of equipment that can be purchased for biofeedback and/or neurofeedback, and some brands provide the option to do both. It is advised that you do not buy a brand based upon a single recommendation. Take the time to look at various brands of equipment and watch it demonstrated. Ask other users what they consider to be the pros and cons of any particular brand. Do your homework before you invest your money.

Finally, ethics is an important aspect of incorporating new treatment techniques with a specific or specialized population of clients and/or patients (Longo & Prescott, 2013). One must be sure to

keep within one's scope of practice based upon one's licensure and/or state-driven standards and guidelines. Join local, national, and/or international organizations that are founded in this specialized treatment such as the International Society for Neurofeedback and Research (ISNR)¹⁷ and/or the Association for Applied Psychophysiology and Biofeedback (AAPB),¹⁸ each of which has by-laws, a code of ethics, and provide ongoing education and training.

Notes

- 1 <http://www.isnr.org/catalog-1/1f5zb3hx69/American-Academy-of-Pediatrics-lists-Neurofeedback-as-Level-1-Research-Best-supported-Interventions>
- 2 <http://dlantzphd.com/what-is-biofeedback/>
- 3 <http://www.medterms.com/script/main/art.asp?articlekey=40362>
- 4 <http://neurodevelopmentcenter.com/psychological-disorders/ptsd/neurofeedback-for-ptsd/>
- 5 <http://www.cdc.gov/ace/>. Modification of table from Centers for Disease Control and Prevention, "Percentage of adults aged 18 years reporting adverse childhood experiences (ACEs), by ACE category and selected characteristics," in *Behavioral Risk Factor Surveillance System (BRFSS), Five States, 2009*. December 17th, 2010. Link: <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5949a1.htm>
- 6 Ibid.
- 7 <http://www.nimh.nih.gov/about/director/2013/transforming-diagnosis.shtml>
- 8 Biofeedback Certification Institute Alliance
- 9 Association for Applied Psychophysiology and Biofeedback
- 10 International Society for Neurofeedback Research
- 11 www.heartmath.org/support/faqs/research/
- 12 http://www.emwavepc.com/emwave_pc_science_research.html
- 13 <http://www.bcia.org/>
- 14 Ibid.
- 15 <http://www.bcia.org/i4a/pages/index.cfm?pageid=3636>
- 16 Ibid.
- 17 <http://www.isnr.org/>
- 18 <http://www.aapb.org/>

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