The Use of Biofeedback, CES, Brain Mapping and Neurofeedback with Youth who have Sexual Behavior Problems

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Abstract

This chapter will address the use of Biofeedback, Cranial Electrotherapy Stimulation (CES), QEEG Brain Mapping, and Neurofeedback with young people who have sexual behavior problems. Current knowledge in neuroscience, trauma, theory, rational, and case examples will be addressed. The chapter will review selected biofeedback and neurofeedback protocols and there use in treating conditions common to young people with sexual behavior problems. Implications for the future will be discussed.

Keywords: Biofeedback, neurofeedback, Cranial Electrotherapy Stimulation (CES), Brain mapping, quantitative electroencephalograph (qEEG)

Introduction

During the early part of this decade, an increasing number of researchers, practitioners, and clinicians, within the field of assessing and treating sexually abusive and sexually aggressive behavior, among others, have begun to address the impact of trauma on the brain, especially in young people with sexual behavior problems, Teicher (2007), Creeden, (2006), Bengis & Cunningham (2006). This information and knowledge also has direct application to those young people who also have histories of abuse and/or neglect, Ziegler, (2005), Ogden, Minton, & Pain, (2006). In particular the professionals listed above and others have addressed the impact on youth with sexual behavior problems and those who have been sexually abused. This is important because many young people with sexual behavior problems have a history of abuse and neglect.

Teicher, (2008), notes that exposure to childhood abuse, particularly childhood sexual abuse, is a risk factor for development of impulse control disorders, and can lead to a cycle of violence and perpetration. Exposure to early stress can exert enduring effects on brain development that may underlie many of the consequences of exposure to sexual abuse. Research indicates there are negative effects of childhood sexual abuse on development of the hippocampus, corpus callosum, prefrontal cortex and visual cortex.

Martin Kafka, MD, Clinical Associate Professor of Psychiatry at Harvard Medical School notes, that the following are risk factors for sexual recidivism in adult males: negative mood states, mood disorder, ADHD combined subtype, PTSD, Conduct Disorder, and BiPolar Dysthymic Disorder. Kafka notes that 10-15% of males with anxiety and/or depression had sexual risk taking behaviors; and that “mood and anxiety disorders may be so common among sexual offenders, that these conditions and their associated effects are not distinctly identified as correlated with recidivism.”

Trauma and Its Impact on the Brain

Trauma resulting from early childhood abuse and neglect impacts the brain in a variety of ways. The Training & Research Institute, Inc. in Albuquerque, NM (2004) notes that childhood physical, emotional, sexual abuse and neglect can cause antisocial behavior by over-excitation of the limbic system; the primitive midbrain region that regulates memory and emotion, and the prefrontal cortex; which is associated with judgment, consequential thinking, and moral reasoning. They note, for example: 1) The left hemisphere is responsible for regulation and oversight of logical responses to a situation; and control and mediation of emotional responses generated by the right hemisphere.
The impact of childhood abuse or neglect results in diminished control of emotional response, resulting in poor or inappropriate reactions to emotional situations, angry outbursts, self-destructive or suicidal impulses, paranoia, psychosis, and a tendency to pursue intense ultimately unstable relationships.

2) The prefrontal cortex is the internal editor of emotional states, consequential thinking, moral reasoning, and reactions to emotional crisis.

The impact of childhood abuse or neglect results in increased potential for depression and delinquent and criminal behavior.

3) The corpus collosum creates communication between the right and left hemispheres.

The impact of childhood abuse or neglect results in a significantly smaller corpus collosum, causing nonintegrated, inappropriate responses to everyday situations.

4) The temporal lobes regulate emotions and verbal memory.

The impact of childhood abuse or neglect results in poor modulation of emotions, and an increased chance for temporal lobe epilepsy.

5) The hippocampus (part of the limbic system) is responsible for the formulation and retrieval of verbal and emotional memories.

The impact of childhood abuse or neglect results in lower performance on verbal memory tests, possible continued mental problems, and concerns during the adult years.

6) The amygdala, (also part of the limbic system) creates emotional content for memories, mediating depression, irritability, and hostility/aggression, and governing reaction and responses to fear.

The impact of childhood abuse or neglect results in a significantly smaller amygdala raising the risk for depression, irritability and hostility/aggression; and is also responsible for incorrect emotional “memories”, absence of fear conditioning, and an increased chance of psychopathic tendencies.

7) The purpose of the cerebellar vermis is to modulate production and release of neurotransmitters, and has a significant number of receptor sites for stress related hormones.

The impact of childhood abuse or neglect results in an increase in potential risk for psychiatric symptoms such as depression, psychosis, hyperactivity, and attention deficits, and in rare cases, psychotic symptoms are possible.

For patients who suffer from trauma, depression, and other mental disorders, we now know that we can use cognitive behavioral therapy (CBT) and trauma focused cognitive behavioral therapy (TFCBT) to reduce or even eliminate the need for psychotropic medications (Begley, 2007). CBT can:

a) mute over activity in the frontal cortex (while antidepressants often raise activity there),

b) can raise activity in the limbic system, and

c) “rewires” the brain to adopt new “thinking circuits”.

In other words, one’s own thoughts can virtually reshape one’s emotions by redirecting one’s own thought process, which in turns opens pathways for people to change their perceptions about themselves and others. This process is often referred to as “mindfulness” (Siegel, 2007; Kabat-Zinn 2005).
The brain is often negatively impacted when a person is traumatized. Trauma can result from a variety of experiences, which include, but are not limited to:

a) actual physical injury to the head or traumatic brain injury (TBI),
b) neglect, physical abuse, sexual abuse; and
c) exposure to traumatic events such as the death of a sibling or parent, the killing of a family pet or farm animal, natural disasters, life-threatening experiences, among others.

The use of effective treatments however, helps the brain’s response to trauma, and problematic thoughts, feelings, and behaviors that can be altered and changed from unhealthy responses to healthy ways of coping. When patients are diagnosed with PTSD, they are likely to have experienced terror and affect dysregulation (dissociation) immediately after the trauma (Siegel, 1999).

**Biofeedback & Self Regulation**

When using trauma focused cognitive behavioral therapy, the treatment the goal is to first teach affect regulation, and then begin Narrative Therapy with a focus on internal states awareness.¹ Traumatized patients and patients who suffer from stress related disorders including insomnia, anxiety and depression can benefit from participation in peripheral biofeedback. Peripheral biofeedback may include learning self-regulation skills through the measurement and monitoring of breathing/respiration rate (RR), heart rate (HR), heart rate variance (HRV), skin conductivity level (SCL), and body temperature (thermofeedback).

Self regulation is important in working with traumatized patients because as the patient works through the trauma and works towards creating a new narrative, retrieving such memories can create both a psychological and physiological response. These responses can result in the patient shutting down during the session and not making further progress, (Ogden, Minton, & Pain, 2006). The use of biofeedback, and self-regulation techniques assist the patient in coping with trauma and developing the skills that are necessary to remain in the “Window of Tolerance” (Ogden, Minton, & Pain, 2006).

Diagram #1 illustrates how peripheral biofeedback and cranial electrotherapy stimulation (CES) assisted a 15 year-old male patient who was diagnosed with ADHD and ODD ( in addition to sexual behavior problems), and quantitative electroencephalograph brain mapping (qEEG)² revealed the patient had ADHD, moderate depression, severe anxiety, and moderate learning disability.

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¹ [http://tfcbt.musc.edu/](http://tfcbt.musc.edu/)
² qEEG stands for quantitative electroencephalograph. Recorded from either 12 or 19-channels. The resulting EEG data are computer processed to provide a statistical analysis of brain electrical activity. In turn, these data are presented in various visual forms such as "brain maps" and other images which can show the ways in which different areas of the brain are functioning.
05/09/08 Post-Treatment

Diagram #1: 2/4/08 Pre-Treatment

The above diagrams are from pre-post brain mapping on a 15 year old male with sexual behavior problems also diagnosed with ADHD and Oppositional Defiant Disorder (ODD). The patient participated in weekly biofeedback and CES sessions over a three month period. Of significance is the lowering of Delta and Theta brain wave magnitude.

Biofeedback, Cranial Electrotherapy Stimulation (CES), Brain Mapping & Neurofeedback

Treatment Benefits

Biofeedback has been around for approximately 40 years, and in recent years has gone through a “renaissance” or resurgence. Many major hospitals and clinics, i.e., Harvard’s Brigham and Women’s Hospital and Duke University Medical Center now offer biofeedback to patients with a variety of physical and/or mental health concerns.3

Whether biofeedback actually teaches permanent skills remains unproven. However, the evidence and studies do suggest that therapy works to lower stress-related problems, including physical aches and

3 The Benefits of Biofeedback. www.wilddivine.com newsletter 8/27/08,(Wild Divine newsletter@wilddivine.com.)
pains. Evidence also indicates that biofeedback helps with non-stress related conditions as well. A newer technique, neurofeedback or EEG biofeedback, appears promising for restoring normal brain wave function that has been disrupted by TBI, PTSD, severe migraines, and other disorders.

There is even some evidence that biofeedback and neurofeedback (a subset of biofeedback) can work with attachment disordered children, and that underdiagnosis of a mood or developmental disorder can lead to ineffective treatment. Anxiety disorders, traumatic disorders, and physiological factors must also be taken into account. Many of these patients are misdiagnosed with ADHD instead of addressing what may very well be behavioral disorders.4

The use of biofeedback to impact heart rate variability (HRV) through the practice of controlled breathing is becoming more popular and has a growing body of research and clinical evidence to support its benefits. Striefel (2008) notes, “HRV serves as both a diagnostic marker of adaptability and health and as a treatment approach for a wide variety of client problems”.

The ethics of most, if not all mental health and physical health disciplines and those practitioners of biofeedback, are (and in most cases, state and/or federal regulations mandate as a patient’s right), that patients have the right to be free from pain and anxiety in the shortest amount of time and through the use of the least intrusive methods. Thus these issues must be addressed in the patient’s treatment plan.

More recently HRV has been used to reduce trauma-related symptoms, including depression in patients (Gevirtz, R. & Dalenberg, C. 2008). The Trauma Research Institute protocol for Post Traumatic Stress Disorder (PTSD) treatment includes psychoeducation, Cognitive Behavioral Therapy (CBT), Acceptance and Commitment Therapy (ACT), and HRV Biofeedback. Karavidas (2008) notes, “autonomic nervous system (ANS) dysfunction is thought to play a significant role in depression. Prior research indicates that individuals suffering from depression often show decreased vagal tone, increased heart rate, fatigue, sleep disturbance, and sympathetic arousal.” Karavidas (2008) states,

“Biofeedback techniques are known to facilitate treatment for a wide variety of disorders with a psychosomatic component, including asthma, cardiovascular disorders, hypertension, cephalopathies, anxiety, and duodenal ulcers... Nevertheless, it remains unclear how the patient who has undergone training with such biofeedback techniques learns how to control his or her autonomic responses... Generally, the instructions given to such patients have been aimed at achieving a general state of relaxation in many cases by using progressive muscle relaxation... Some studies are now highlighting the importance of respiration in order to improve learning of biofeedback techniques.”

What is Biofeedback?

“Biofeedback is a non-invasive form of treatment. The therapist attaches sensors or electrodes to the body and these sensors provide a variety of readings--feedback--which is displayed on the equipment for the patient to see. The signals typically measure skin temperature, muscle tension and/or brainwave function. With this information, patients can learn to make changes so subtle that at first they cannot be consciously perceived. With practice, however, the new responses and behaviors can help to bring relief and improvement to a variety of disorders.”5

4 Alston, J.F. The complex issue of attachment disorders
http://www.psychiatrictimes.com/display/article/10168/54326 8/26/08
5 Definition adopted by BCIA, AAPB and ISNR May 18, 2008.
Peripheral biofeedback is a non-medical technique in which people learn to use their own body’s signals to improve their health. Biofeedback training teaches how to consciously change and control the body's vital functions that are normally unconscious, such as breathing, heart rate, blood pressure, and temperature through information provided by electronic devices/sensors that take readings through a software program. The process of learning to control these body functions gives the patient moment by moment information about their physiological conditions, of which they are normally unaware.

Biofeedback has been shown to be effective with many stress related disorders and conditions that may be made worse under stress such as high blood pressure, muscle pain, migraine and tension headaches, and anxiety disorders, such as panic attacks, phobias, and obsessive–compulsive disorder. The biofeedback professional serves as a coach and the patient as the trainee. By teaching the patient the process of self-monitoring (becoming sensitive to and aware of one’s stress patterns and symptoms), the patient develops skills for self-regulation (changing responses to decrease or eliminate discomfort and unpleasant sensations), which in turns results in the skill of self-regulation, providing the patient with a sense of self-control.

Patients are provided with the opportunity to learn basic biofeedback techniques through the use of biofeedback hardware and software, (i.e., the Wild Divine Project® Healing Rhythms®). The Healing Rhythms software guides the patient through 15 biofeedback and relaxation steps. Patients place sensors on the fingers of one hand which measure HR and SCL, both of which increase when the patient is stressed or anxious, and decrease as he/she becomes more relaxed. Another probe placed on the middle section of the middle finger measures skin temperature; which increases as the patient becomes more relaxed and less anxious. When training down headaches and migraines, for example, the thermometer probe is placed on the middle section of the middle finger of the hand on the opposite side of the head/body where the patient is experiencing headache pain. Patients are expected to practice their breathing and relaxation techniques each day.

How Biofeedback Works

Sensors are placed on the patient’s fingers (an ear-clip sensor may also be used (i.e., with HeartMath), and the patient is then instructed to use relaxation, meditation, or visualization to bring about the desired response, whether it is muscle relaxation, lowered heart rate, slower breathes, or lower temperature. The biofeedback device reports progress by changes in the vital signs being monitored. Peripheral biofeedback includes physical responses:

- Thermal - skin temperature (thermofeedback) measured on hand or foot
- Sweat gland activity - electrical conductivity of the skin, galvanic skin response (SCL, SCR, GSR)
- Heart rate - with an electrocardiograph (ECG) (HR)
- Heart rate and blood pressure (heart rate variability (HRV)
- Brain-wave activity, with an electroencephalograph (EEG)
- Respiratory sinus arrhythmia is a noninvasive measure of vagal cardiac input, or RSA feedback (respiratory sinus arrhythmia feedback (RSA)\(^7\))
- Respiration - respiratory function-breathing patterns and rate, breaths per minute (BPM)

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\(^6\) www.wilddivineproject.com

\(^7\) RSA is the natural cycle of arrhythmia that occurs through the influence of breathing on the flow of sympathetic and vagus impulses to the sinoatrial node (http://biomedical.com/news_display.cfm?newsid=63)
Muscular reactivity and tension, electromyography (EMG)

Biofeedback Measures

Breathing rates, breaths per minute (BMR):
- Normal 12 BPM
- Range 4 (relaxed) - 18 (tense/anxious) BPM
- Normal resting adult 10-18 BPM
- Anxiety 20 - 30 BPM
- Hyperventilation 57 BPM

Thermofeedback Temperature: The measure of body temperature via the finger in degrees Fahrenheit or Celsius.
- 95 + F/35+C is very relaxed
- 90 – 94/32.2 – 34.3 is calm / relaxed
- 80 – 90/26.6 – 32.2 is nervous
- 75 – 80/23.8 – 26.6 is tense / stressed
- <75/23.8 is very stressed and tense

Skin Conductivity Level (SCL), Galvanic Skin Response (GSR) or Skin Resistance Level (SRL):
The measure of sweat and moisture in the fingers, the lower the measure the more calm and less anxious/stressed. Sweat glands are surrounded by blood vessels.
- Range: 2 – 100 microhms
- Stressed out: 20 microhms
- Relaxed baseline: 2 – 5 microhms

Coherence (Coh): Coherence is the interaction of the body’s heart rate, SCL, and breathing which then registers in the brain as a relaxed state. To achieve good coherence the patient needs to have a Coh. of .80 or higher up to 1.00

Heart Rate Variance (HRV): During biofeedback when the heart rate becomes rested and even between beats; the body and mind are more relaxed and a smooth sinusoidal rhythm appears.

Conditions Treated by Biofeedback
Peripheral biofeedback is particularly useful and can help with stress-related conditions where there is sympathetic or adrenal stress. It is also useful for conditions where there is inadequate control over muscle groups or muscle dysfunction. Conditions treated with biofeedback include but are not limited to:
- stress
- anxiety
- depression
- sleep disorders
- headaches
- asthma
- muscle injury
- pain relief
- insomnia
- TMJ
- high blood pressure
- digestive disorders
- attention deficit disorder
- irritable bowel syndrome
- hyperactivity.

Cranial Electrotherapy Stimulation (CES)

What is Cranial Electrotherapy Stimulation (CES)

Cranial Electrotherapy Stimulation (CES) involves the use of the Alpha Stim 100®, a small hand held device that delivers small electrical pulses, one milliampere (mA) or less, directly to the brain. Pulses are

8 http://alpha-stim.com/default.htm
used to promote relaxation, sleep, and relieve some psychological and emotional conditions like depression and anxiety. CES electro-technology causes production or reduction of certain neurochemicals in the brain. For example, levels of norepinephrine and dopamine, (that reflect relaxed mental and emotional states), can increase using CES technology, and biochemical compounds related to emotional stress can be seen to decrease. Cortisol is an important hormone (also know as the stress hormone) in the body, is secreted by the adrenal glands and involved in many functions including regulation of blood pressure. Cortisol is an important and helpful part of the body’s response to stress. Higher and more prolonged levels of cortisol in the bloodstream (like those associated with chronic stress) have been shown to have negative effects. Cortisol9 is involved in the following functions and more:

- Proper glucose metabolism
- Immune function
- Insulin release for blood sugar maintenance
- Regulation of blood pressure
- Inflammatory response

 Normally, it’s present in the body at higher levels in the morning and at its lowest at night. Although stress isn’t the only reason that cortisol is secreted into the bloodstream, it has been termed “the stress hormone” because it’s also secreted in higher levels during the body’s ‘fight or flight’ response to stress, and is responsible for several stress-related changes in the body. Small increases of cortisol have some positive effects:

- Heightened memory functions
- Lower sensitivity to pain
- A quick burst of energy for survival
- A burst of increased immunity
- Helps maintain homeostasis in the body

 While cortisol is an important and helpful part of the body’s response to stress, it’s important that the body’s relaxation response to be activated so the body’s functions can return to normal following a stressful event. Unfortunately, in our current high-stress culture, the body’s stress response is activated so often that the body doesn’t always have a chance to return to normal, resulting in a state of chronic stress. Higher and more prolonged levels of cortisol in the bloodstream (like those associated with chronic stress) have been shown to have negative effects, such as:

- Impaired cognitive performance
- Blood sugar imbalances such as hyperglycemia
- Decreased bone density
- Lowered immunity and inflammatory responses in the body, slowed wound healing, and other health consequences
- Suppressed thyroid function
- Higher blood pressure
- Decrease in muscle tissue
- Increased abdominal fat, which is associated with a greater amount of health problems than fat deposited in other areas of the body. Some of the health problems associated with increased stomach fat are heart attacks, strokes, the development of, higher levels of “bad” cholesterol (LDL) and lower levels of “good” cholesterol (HDL), which can lead to other health problems.

9 http://stress.about.com/od/stresshealth/a/cortisol.htm
To keep cortisol levels healthy and under control, the body’s relaxation response should be activated after the fight or flight response occurs. Patients can learn to relax their body with various stress management techniques (i.e., biofeedback), and through making lifestyle changes in order to keep their bodies from reacting to stress in the first place.

**How does CES work?**
The Alpha Stim 100®, has the proven ability to alter brain wave patterns through electronic stimulation. This stimulation is delivered through two small earclips (electrodes) attached to the ear lobes. The microcurrent stimulation coaxes the brain into the desired state. Effectively, CES offers many benefits. All of these benefits are centered around the brain, which is in control of the rest of the body.10 Figure #1 below illustrates how the Alpha Stim 100 CES current enters, stimulates and activates the brain.

![Figure #1](image)

**Electroencephalography - Mini-Q qEEG**

**Mini-Q qEEG**

Electroencephalography (e-lec-tro-enceph-a-lo-graphy ~ EEG) is a neurological diagnostic procedure that records the changes in electrical potentials (brainwaves, Delta, Theta, Alpha & Beta) in various parts of the brain. The EEG is a recording of the electrical activity of the brain from the scalp. Quantitative Electroencephalography (qEEG) is the measurement, using digital technology, of electrical patterns at the surface of the scalp which primarily reflect cortical activity or "brainwaves". A multi-electrode recording of brain wave activity is recorded and converted into numbers by a computer. These numbers are then statistically analyzed and are converted into a color map of brain functioning. qEEG provides a method to take EEG recorded from a variety of locations and statistically analyze the data to provide topographical maps as illustrated in the diagrams below. This output can be used to assess clients and develop Neurofeedback protocols. Learning to process and read qEEG reports typically takes years of experience.11

10 http://www.alpha-stim.com/default.htm
11 https://www.newmind-apps.com/
Neurofeedback
Zalaquett, C.P. & Bell, T. (2008) note that neurofeedback, unlike medicines, when done properly has no negative physical side effects and the training appears to produce permanent alterations in learning and behavior. Some studies have shown that neurofeedback is linked to improved I.Q. scores\(^\text{12}\), (see Diagram #2 below).

Diagram #2 ~ 02/20/08 Pre-Treatment

Diagram #2 shows pre-post treatment mapping of a 51 year old female with a recent TBI, and who was suffering with depression, mild anxiety and learning disability. After 26 sessions of neurofeedback, the patient had reduced magnitude. Pre-post IQ testing revealed that the patient had an IQ increase of 12 points. Elevated Beta at C3 and C4 (Sensory & Motor Functions) reflect pain the patient has from a lower back injury. Elevated Beta at P3 and P4 likely indicate problem areas with self-boundaries, excessive thinking, vigilance personality, excessive self-concern, and victim mentality based upon the recent departure from an abusive relationship.

Neurofeedback, also called neuro-biofeedback or EEG biofeedback is a therapy technique that presents the patient with realtime feedback on brainwave activity, as measured by sensors on the scalp, typically in the form of a video display, and sound. When brain activity changes in the direction desired by the neurofeedback protocol, a positive "reward" feedback is given to the patient. Rewards/reinforcements can be as simple as a change in pitch of a tone or as complex as a certain type of movement of a character in a video game.

\(^\text{12}\) http://www.coedu.usf.edu/zalaquett/n/neurofeedback.htm 8/26/08
The most common and well-documented use of neurofeedback is in the treatment of attention deficit hyperactivity disorder. Multiple studies have shown neurofeedback to be useful in the treatment of ADHD. Other areas where neurofeedback has been researched include treatment of substance abuse, anxiety, depression, epilepsy, Obsessive Compulsive Disorder (OCD), learning disabilities, Bipolar Disorder, Conduct Disorder, anger and rage, cognitive impairment, migraines, headaches, chronic pain, autism spectrum disorders, sleep dysregulation, post Traumatic Stress Disorder (PTSD), and Mild Traumatic Brain Injury (MTBI).

Below are pre-post measures of magnitude qEEG. In qEEG brain mapping, “the magnitude analysis system provides a reference database system that is tailored specifically for clinicians instead of researchers. Instead of using standard deviations, the maps provide simple output indicating whether EEG is high or low in the various dimensions of analysis. The cognitive output automatically flags areas of possible problems based on correlations between map output and MRI research. Emotional output information provides similar information based on MRI research and standard neurology texts as well as clinical experience. Clinicians can see at a glance the salient issues likely to be present due to the EEG distribution as well as being provided with an appropriate protocol option.”

Magnitude is the most important reading, as it is the power of individual brain waves. “Magnitude is used instead of power because most neurofeedback practitioners work with magnitude. Professionals feel it is important that they be able to easily refer to their statistics and see what the actual microvolt value when an area is indicated as high on the map. Magnitude is merely the average amplitude over time. The magnitude values in brain maps are based on a statistical sample in addition to being cross validated with the major databases. The meaning of high or low magnitudes varies with location and distribution. Learning to interpret their meaning takes considerable experience.”

Diagram #3 - 1/18/08 Pre-Treatment
03/27/08 Partial completion of Biofeedback & CES

13 https://www.newmind-apps.com/
14 https://www.newmind-apps.com/
15 year old male with a history of sexually abusive behavior and an admitting diagnosis of ADHD, PTSD, ODD. Patient completed 15 sessions of biofeedback with CES and 20 sessions of Neurofeedback.

Diagram #4 Pre-Treatment 06/04/08
Diagram #4 shows pre-post treatment effects of a 16 year old male sexual abuser with an admitting
diagnosis of PTSD and conduct disorder, after completing 15 sessions of biofeedback, CES, and 9
sessions of neurofeedback.

Brain Waves

Delta Waves
Delta brainwaves are of the greatest amplitude and slowest frequency. They are typically irregular, and center around the range of 1.5 to 3 cycles per second. Deep dreamless sleep would take the patient down to the lowest frequency, typically, 2 to 3 cycles a second. These brainwaves occur during coma. Delta brainwaves are normally found in deep sleep and in "normal" infants, and young children. Unhealthy Delta brainwave patterns often reduce one's ability to focus and maintain attention. They indicate an abnormality in an awake adult.

Theta Waves
Theta brainwaves are typically of greater amplitude than Delta and are slow frequency. This frequency range is normally between 4-7Hz, with a sinusoidal rhythm or square top. Theta waves are usually suggestive of creativity, spontaneity, and distraction/daydreaming. A person who begins to daydream is often in a Theta brainwave state.

Alpha Waves
Alpha brainwaves are the second highest frequency brainwave category (in order of frequency - the highest frequency being Gamma waves), and typically occur in a pattern of 8-12 cycles per second. Alpha represents non-arousal. Alpha brainwaves are slower, and higher in amplitude. When an adult’s eyes are closed, Alpha has the highest amplitude. Most of the recorded waves in a normal adult's EEG are the occipital Alpha waves, which are best obtained from the back of the head when the adult is resting quietly with the eyes closed but not asleep.

Beta Waves
Beta brainwaves are present in normal waking consciousness. When the brain is aroused and actively engaged in normal mental activities, it generates Beta waves. Beta waves are of relatively low amplitude, and are the fastest of the five different brainwaves ranging from 13-30Hz. Healthy levels of Beta enable analytical problem solving, decision making and sound judgments, and are characteristics of a strongly engaged mind. Some neurotherapists have observed that SMR (LoBeta) brain wave frequencies (12-15 cycles per second) make individuals feel more present, and in the moment.

The Application of Biofeedback, CES, and Neurofeedback with Sexually Abusive Youth

Working with young people who have sexual behavior problems is no different than working with other patients when the practitioner is considering the use of biofeedback, CES, qEEG brain mapping, and/or neurofeedback. The majority of patients coming into our stress reduction clinic and biofeedback lab are residential male adolescent patients between the ages of 11 and 17 who have sexual behavior problems. As noted above, most of these patients have attentional problems, learning disabilities, depression and/or anxiety.

To date our clinic has conducted over 110 brain mapping sessions on 85 patients of which 63 are adolescents and over 35 are young people with sexual behavior problems. Every brain map conducted on
a young person with sexual behavior problems has revealed that the patient suffers from either depression, anxiety or both.

While biofeedback and neurofeedback hold much promise for working with this population, no one therapy, treatment or intervention can claim a perfect success rate. The case illustrations (Diagrams 5 & 6) below, demonstrate some of the differences between patients.

02/06/08 Pre-Treatment

06/11/08 Post-Treatment

Diagram #5

Diagram #5 illustrates a pre-post treatment mapping on a 15 year old male with a history of sexually abusive behavior and an admitting diagnosis of ADHD, PTSD, ODD, and CD. At the onset of treatment and during the first several months, patient demonstrated non-compliant behavior and severe acting out behavior resulting in the need to place him in therapeutic holds. Towards the end of treatment the patient was engaged in intensive therapy dealing with family issues related to his being adopted. Patient completed 15 sessions of biofeedback and CES and approximately 12 sessions of neurofeedback.
Diagram #6 illustrates a pre-post treatment mapping on a 15 year old male with a history of sexually abusive behavior and an admitting diagnosis of ADHD, and ODD. At the onset of treatment, during the first several months, and after dropping out of neurofeedback, the patient demonstrated non-compliant behavior and severe acting out behavior resulting in the need to place him in therapeutic holds. The patient dropped out of neurofeedback treatment at a time when the patient was engaged in intensive therapy dealing with family issues related to his being adopted. Patient completed 15 sessions of biofeedback and CES and 9 sessions of neurofeedback, prior to dropping out of neurofeedback. Patient’s behavior continued to worsen and he requested to be reinstated in neurofeedback. The first brain map revealed that the patient had mild attentional problems, severe depression, and moderate anxiety. Follow-up mapping after biofeedback, CES and 9 sessions of neurofeedback revealed that he had no attentional problems, however his depression and anxiety remained the same at that time. The third mapping on 08/28/08 shows how the patient relapsed due to a variety of emotional problems that occurred prior to his request to re-enter treatment.
Implications for the Future
The US Food and Drug Administration (FDA) notes that biofeedback is a standard relaxation “Therapy”. Biofeedback and neurofeedback are primarily operant conditioning, and reinforcement of a naturally occurring event. Patients can reinforce the desired brain activity with EEG biofeedback. When patients participate in neurofeedback, he/she often experiences significant change in 15-40 sessions; and the average change occurs in 20-25 sessions.

Neurotherapists and other mental health professions are turning to the above discussed treatments and therapies in increasing numbers. Some in psychiatry are suggesting that brain mapping is so important, that patients should not be prescribed psychotropic medications until a qEEG brain map has been conducted (Walker, 2008). While brain mapping cannot be considered as diagnostic at this time, those working in this field are increasingly hopeful that brain mapping diagnostics is not too far from being a reality. Given the benefits of biofeedback and the treatments discussed above, there is no good reason why these treatments should not be used with any youth who has emotional, cognitive and/or behavioral problems. Ethically, we will become more challenged by our disciplines and specialties if we do not turn to these methods of helping others.

Combining Therapies
Combining therapies to assist patients in learning to relax and decrease stress related responses including anxiety and depression, can further facilitate recovery. For example, patients who received a combination of EMG biofeedback and CES showed greater improvement that those who underwent biofeedback alone.15 Neurofeedback should generally not be done without other supportive therapies.

Generally, there are no contraindications for using any of the above treatments and therapies with adults, young people, and specifically young people with sexual behavior problems. There are benefits to combining CES and biofeedback and combining biofeedback with neurofeedback. Any of these treatments and therapies will enhance sex offense specific treatments as well as the use of CBT, TFCBT and other treatment modalities and therapies as described above.

Summary
While this chapter has limits to the degree to which any of the above treatments and therapies can be described in detail, it serves as an overview and hopefully an impetus for professionals who treat young people with sexual behavior problems, to consider expanding their practice and services to include them.

Research has shown that the majority of young people who have sexual behavior problems do not differ significantly from those youth who become involved in the juvenile justice system and/or have other delinquent behaviors (Hunter, 2006), Chaffin, M. & Longo, R.E. (2004), Longo, R.E. (2003), Longo, R.E. and Calder, M.C. (2004), Prescott, D.S. & Longo, R.E. (2006). However, research does show that many of these young people do suffer from depression and anxiety, among other mental health concerns and problems. The use of biofeedback, CES, brain mapping and neurofeedback can further assist these patients in working toward healthier lifestyles and full recovery.

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