

## SPECIAL ISSUE

# Negative Effects and the Need for Standards of Practice in Neurofeedback

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*Negative effects associated with psychotherapy have been documented for more than 40 years. In the field of electroencephalography biofeedback, controlled research has likewise demonstrated that negative effects can occur from inappropriate neurofeedback training. New evidence is presented from acknowledgments by practitioners of both transient side effects and more serious adverse reactions that have occurred in response to neurofeedback training. Issues of consumer protection and the future of the profession are discussed. It is imperative that professionals and professional societies emphasize standards of practice and that individuals not use neurofeedback to work with conditions for which they are not trained and licensed to work.*

### Introduction

As early as 1971, Bergin reported 30 psychotherapy studies that documented deterioration in a proportion of patients who underwent treatment. By 1977, there were more than 40 studies that had been found detailing negative effects from therapy (Lambert, Bergin, & Collins, 1977). Bergin and Lambert (1978) defined this phenomenon as follows

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Deterioration implies an impairment of vigor, resilience, or usefulness from a previously higher state. Generally, it has been regarded as a worsening of the patient's symptomatic picture, the exaggeration of existing symptoms, or the development of new symptoms, as assessed before and after treatment. (p. 152)

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Although clinical experience and research (briefly summarized in Hammond, 2006) have found that neurofeedback has great therapeutic value, it has also been pointed out (Hammond, Stockdale, Hoffman, Ayers, & Nash, 2001) that side effects and adverse reactions can occur in association with neurofeedback treatment of various conditions.

There is an abundance of evidence that there is a heterogeneity in the electroencephalograph (EEG) patterns

associated with various symptom complexes, whether it is something relatively more common such as attention deficit disorder/attention deficit hyperactivity disorder (ADD/ADHD; e.g., Monastra, 2005) or a more complex condition such as obsessive-compulsive disorder (OCD; Prichep et al., 1993), schizophrenia (e.g., John, Prichep, & Alper, 1994), or autism (Sutton et al., 2005). Thus, treatment that is not individualized following careful assessment of not only symptoms but also electrophysiological brain functioning can pose a greater risk of either producing an adverse reaction or of simply being ineffective. Everyone does not need the same thing.

Because of the ethical problems inherent in seeking to induce iatrogenic harm, formal research with regard to neurofeedback and harmful effects is of course limited. Nonetheless, some hard research evidence does exist. Lubar et al. (1981) published a reversal, double-blind, controlled study with epilepsy. They demonstrated that problems with uncontrolled epilepsy could either be improved with neurofeedback or be made worse if the wrong kind of training was done. Lubar and Shouse (1976, 1977) likewise documented that both ADD and ADHD symptoms could improve but also could be worsened if inappropriate neurofeedback was done. This study used an A-B-A reversal design and found that when theta (4–7 Hz) was inhibited and the sensorimotor rhythm reinforced, there were improvements in ADHD symptoms. However, when theta was reinforced, there was a deterioration and reversal of the positive improvements.

Whitsett, Lubar, Holder, Pamplin, and Shabsin (1982) similarly performed a double-blind, A-B-A crossover design study with uncontrolled epilepsy patients. This was one of the studies that documented that neurofeedback is not teaching voluntary self-regulation of brainwave activity but is actually reconditioning how the brain is functioning. Anyone familiar with epilepsy knows that there is more epileptiform activity found in the sleep EEG than in a waking EEG. In this study,

sleep EEGs were evaluated, and it was found that training to reduce theta activity and to enhance sensorimotor rhythm resulted in an 18% decrease in paroxysmal activity from a baseline of 72%. However, when the reward contingencies were reversed, there was an increase of 29% in epileptiform activity (which the authors concluded was detrimental to the patients); following subsequent appropriate treatment, there was a decrease of more than 60% in paroxysmal activity. These findings reinforce, once again, that if inappropriate neurofeedback training is done, negative effects can occur.

Incorrect assumptions are sometimes made by less educated neurofeedback practitioners. We have heard a few of these practitioners express to the public that neurofeedback never results in adverse effects. As we have documented, this simply cannot be said. We have also seen it assumed that because quantitative EEG (QEEG) research has found that, overall, alcoholics tend to have an excess of beta activity and a deficit in alpha and theta activity (e.g., John, Pritchep, Fridman, & Easton, 1988) neurofeedback training that inhibits beta activity and reinforces alpha and theta is the treatment of choice for this population. Such an assumption rests on generalities and group averages that do not always apply to individual cases. In the real world of clinical practice, comorbidities are common, and individual patients can be unique. For example, the Figure displays the QEEG map from the Nx Link database for a 25-year-old chronic alcoholic patient. As can be seen, there is an extreme excess of theta, not beta, activity. This patient fits a subtype of 24% of alcoholics who have a diagnosis of ADHD (Schubiner et al., 2000). A lack of individualization and use of an alpha/theta protocol in such a case could be anticipated to have the potential to seriously compromise cognitive function and result in even greater problems with impulse and emotional control. Similarly, a patient with excess beta activity and cortical irritability who was being trained to further reinforce beta activity might become more vulnerable to seizure or tic activity, as might a patient with excess theta and epileptiform activity for which a neurofeedback practitioner inappropriately reinforced theta activity.

### The Need for More Vigorous Standards of Practice

The authors have become increasingly alarmed about the risks of adverse reactions and iatrogenic harm for two reasons. First, there have come to be an increasing number of dealers, manufacturers, and trainers who have been supplying EEG biofeedback equipment directly to lay persons. These individuals have no advanced degrees or health care licenses for independent practice, yet many of them are opening practices and advertising to the public that they have

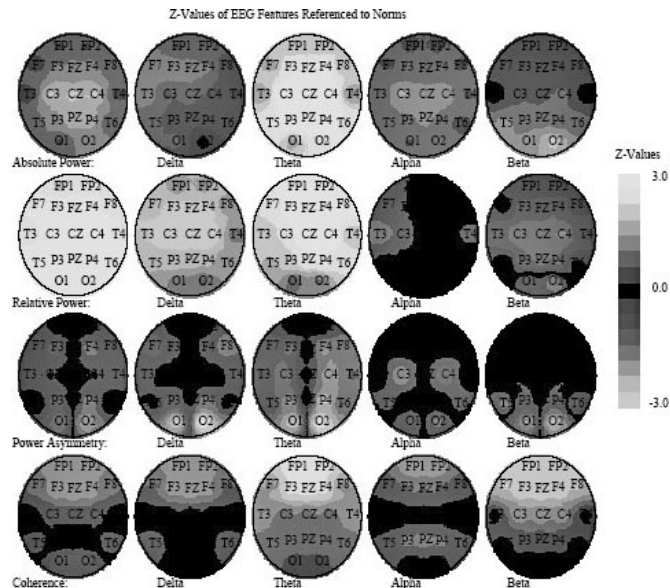


Figure. "Z"-values of electroencephalography features referenced to norms.

competency to work with serious medical, psychiatric, and psychological problems such as depression, bipolar disorder, uncontrolled epilepsy, obsessive-compulsive disorder, traumatic brain injuries, stroke, autism, alcoholism, and drug abuse, as well as ADD/ADHD and learning disabilities. Some equipment and software manufacturers are seeking to fly under the radar of the Food and Drug Administration (FDA) and are evading registration of their equipment, whereas others are violating FDA regulations against the sale of biofeedback equipment to unlicensed individuals (or without the written prescription of a licensed practitioner).

Second, we have been impressed with the number of reports on public and professional Internet list groups about side effects and adverse reactions. These effects range from very mild, transient symptoms such as fatigue or headache to very serious conditions such as exacerbation of depression, manic episodes, emotional lability, seizures, and deterioration in cognitive functioning. Consequently, we believe that it is vitally important for legitimate and legally licensed practitioners to be aware of potential risks and for practitioners as well as professional societies to emphasize standards of practice. We also believe that it is important that future neurofeedback research not only monitor rates of improvement and lack of change but also report the frequency of side effects, adverse reactions, and deterioration in functioning.

### New Data About Adverse Reactions From Neurofeedback Training

Because research on negative effects of neurofeedback is difficult to conduct, the authors have compiled information

from at least seven Internet list groups from which there have been reports of side effects and adverse reactions. In the material that follows, we will describe, and in some cases directly quote, from these reports. In every case, the identity of the list groups, equipment being used, and individual making the report have been left anonymous. We emphasize that these are actual reports of individuals using neurofeedback. The only changes that have been made were in spelling out abbreviations or in punctuation. Headings have been added for the convenience of the reader in identifying types of adverse effects.

### *Emotional Lability and Vocal Tics*

One practitioner “did eyes closed alpha theta” training and found that the patient became “very emotionally labile” after returning home. Another practitioner described a 7-year-old patient who came for help with developmental articulation. They began by training beta at C3 and, after two sessions, added training at C4 because the patient’s sleep was being disturbed by the training. They then shifted training to C3–C4, but after several sessions, the mother commented that she did not notice any improvements. The practitioner added training at C4–PZ, and after 2 sessions, the mother said that her son was crying very easily. Therefore, the practitioner changed training to F3 “for the articulation and to reverse crying,” but instead of improving articulation, the two sessions of training at F3 created a vocal tic. At this point, the practitioner admitted that treatment ended because the mother was “afraid to bring him back,” but he continued to have the iatrogenically developed tic. After all of this trial-and-error guesswork, the practitioner asked for advice in the event the child returned.

### *Deterioration and Loss of Improvements*

Most of the meth addicts with whom I have worked have had excessive alpha. In the past, when working with people with excessive alpha, I have not had good results with alpha/theta training, even after doing 20-30 eyes open training [sessions with another protocol] prior to the alpha/theta training. This group did well with the eyes open [training], but as soon as I switched to alpha/theta training, they lost most of the gains they had made. I then trained the alpha down and they quickly returned to the level of function prior to the alpha/theta training. As a result, I have avoided doing alpha/theta training with the addicts who have excessive alpha. Instead, when working with meth addicts I have done a lot of eyes open suppressing alpha, often over Cz, with excellent results.

### *Regression*

A home-training mother of an autistic child acknowledged, “Adverse events happen from neurofeedback—at least in my home. My son regressed dramatically from the wrong training when we started four years ago.” This smart mother then continued, “But even with three years of home training, I would never train him without supervision.” Nash (cited in Hammond et al., 2001) has also noted a case of decompensation in a borderline or fragile patient.

### *Somatic Symptoms*

A mother described an experience in which interhemispheric training was done, with dominant electrocardiogram artifact present. Immediately following the session, the patient “became very ill, sick to his stomach and terrible headache within an hour of leaving.” Another practitioner reported that following a session, a patient experienced nausea, a very bad headache, worsening of tinnitus, and disturbed equilibrium. Examples have also been given of patients in whom frontal beta up-training has resulted in an increase in their facial muscle activity with a resulting increase in headaches.

### *Muscle Twitches*

Another practitioner described that after a period during which a 6-year-old child seemed to have calmed down, he began “exhibiting jerking and a progression of muscle twitches, going rhythmically through the body.” A different, highly experienced (but unlicensed) practitioner replied, “I believe you might have increased this reactivity. He sounds like the bipolar children I deal with. Definitely training too high [a reward frequency] can increase muscle twitches.”

### *Emotional Lability and Explosiveness*

An experienced practitioner indicated having found that with the right prefrontal neurofeedback training in which they “rewarded beta and SMR frequencies” (e.g., at T4–Fp2), the training had precipitated “emotional meltdowns or explosions.”

### *Tics*

In response to a question about whether neurofeedback could cause or worsen tics, a practitioner responded, “I suggest being very careful with left side training as I have seen tics increase and come back with neurofeedback.” Another practitioner described reducing tics in a patient, but after two to three training sessions at Cz, the tics were exacerbated; further training reduced them again. Still another practitioner described the development of tics that

consisted of mouth movements (such as licking his lips) after training that reinforced a low frequency. There have also been cases of Tourette's syndrome in which tics have increased.

### *Tics and Inadequate History Gathering*

A practitioner described treating a 13-year-old boy who started "clearing his throat" and "making a sniffing sound" in combination shortly after he was put on Adderall. After he was taken off the medication, the tics continued. After 18 neurofeedback sessions, the tics had decreased, and the practitioner then changed the protocol for another 8 to 10 sessions, resulting in still further improvement. "For some reason, I added [training at] CZ to the mix," and tic frequency increased. The practitioner then learned that

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the boy was born without a soft spot in his skull and that he had seizures as a child. He also would sway his head from side to side as a child and did so until the last few years. After treatment with a CZ [placement], he started doing this as he walked out of the office.

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### *Incontinence*

A highly experienced practitioner wrote, "I have had good results with stress incontinence with NF. This is important for all of us doing NF because training too low [a reward frequency] in vulnerable people can increase stress incontinence. We need to track this in poststroke or in older clients." Another practitioner admitted, "I caused bedwetting by going too low [in the reinforcement band]."

### *Enuresis*

A practitioner described working with a 7-year-old boy with a previous history of bedwetting but who had not experienced enuresis in a year. After about 10 neurofeedback sessions, he began having enuresis again. The protocol used prior to the resumption of bedwetting was a broad (squash) protocol inhibiting 15 to 38 Hz at C3 and F3, which also resulted in whiny behavior. After his most recent neurofeedback session, the little boy awakened the next morning and asked his mother, "Why do I always wet the bed after brain training?"

### *Mental Fogginess and Cognitive Inefficiency*

"One reason a practitioner might have to deviate from just doing T3-T4 [training] is because of people who respond to that site like I do—at any frequency, just too disorienting and I have brain fog for two days." Another experienced practitioner using a "one-size-fits-all" neurofeedback system in its default mode reported, "[The neurofeedback system]

is supposed to make people aware of the present moment. But I, and most clients, get zoned out. Semi-conscious. It takes people a little while to recover from being groggy. We ask, 'Are you okay to drive?'" This posttreatment sedation symptom has been previously reported in the literature, with Stockdale (cited in Hammond et al., 2001) noting cases of patients in whom alpha/theta training had created spacey feelings or evoked traumatic memories.

### *Mental Fogginess and Cognitive Disorientation*

Still another well-known practitioner in the neurofeedback field reported the following after alpha/theta training:

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In one case a client drove the car up on a curb after leaving the office; another drove through a red light; another slid through a stop sign at an intersection; and a fourth ran into a light pole only one block from his therapist's office following his first A/T session. Oh, yes, and a fifth went home and could not put two threaded pipes together, being momentarily spatially disoriented. In each of these cases the people involved said in retrospect that it was unlike them to behave that way.

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Imagine the potential liability! Yet another advanced practitioner described how he experimented on himself, rewarding delta activity. The result was the development of significant cognitive impairments that required a considerable number of neurofeedback sessions to remediate.

### *Cognitive Inefficiency*

A practitioner asked for help with a client who presented with complaints of insomnia and anxiety, which were assumed to mean "overarousal." Following an "optimum frequency evaluation" at T3-T4,

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we began training at 3- to 6-Hz [reinforcement] which seemed to be the most positive, but she seemed to be very sensitive and not have a lot of emotional involvement so we trained at C3-C4 instead of T3-T4, and I removed the inhibits. Initially, this seemed to be decreasing her anxiety and she began sleeping better. This week however, she complains of grogginess and lethargy, forgetfulness, so I moved up in frequency and at 18-21 Hz she felt more alert. Today she's still groggy, forgetful, so I replaced the inhibits and gave her a little training at F7 F8 to help with memory. She left still feeling groggy.

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The practitioner reported that the woman did not have ADD and that "her forgetfulness does not seem to be related to inattention issues." Rather, she was an "extremely busy, productive person" who could not stand the "grogginess" that training had produced.

## *Sleep Disturbance*

I would appreciate some feedback in regards to a youngster I am currently working with. He has been diagnosed with mild to moderate autism. I have used neurofeedback with this population before with pretty good success. With this individual I have been training up SMR on the right side. The problem is his mother says his sleep patterns have become disturbed, i.e., waking up in the middle of the night and not going back to sleep for one or two hours. This was not a pattern before neurofeedback.

There have been other reports that an excessive amount of training with a disentrainment type of neurofeedback has sometimes resulted in a patient feeling wired and having difficulty falling asleep. In one case, a patient was up all night without being able to sleep.

## *OCD Symptoms*

Has anyone seen OCD-like behavior result from down-training 3–7 [Hz]? A boy I met recently had about 40 sessions of that training at F3, F4, CZ, T4, FP1 and FP2 (referential montages). He came with a QEEG that indicated the training I listed. His main reason for training prior to his recent issues was ADD, which still seems evident. He is 13 years old, above average intelligence, psychological testing indicates ADD inattentive [type]; no significant learning disabilities. His mother feels his OCD-like stuff resulted from his training.

Another seasoned practitioner reported seeing patients who had been trained by other practitioners for a lengthy period of time with a single protocol focused on beta activation who became very single focused and obsessive.

## *Fatigue*

A considerable number of practitioners have reported transient fatigue, lasting up to the remainder of the day following a neurofeedback session.

## *Seizure*

An experienced practitioner, using neurofeedback with a reinforcement band in the theta or delta range, had a patient with no prior seizure history experience a seizure during training.

## *Anxiety, Agitation, Irritability, Depression, or Manic Reactions*

Excessive reinforcement of beta during neurofeedback has been reported to cause temporary irritability, anxiety, and

sleep disturbance until the level of beta reinforcement was lowered. One autistic boy experiencing a disentrainment type of neurofeedback was “wired,” running around the house for 2 hours following a session. Another practitioner noted cases in which SMR training created agitation and in which overtraining exacerbated manic or depressive symptoms in bipolar disorder patients. One practitioner described inhibiting SMR in himself, which resulted in hyperactivity. Increased depression has also been reported.

The reports cited are uncontrolled case reports from which, first, we cannot know the degree to which other confounding events in the patients’ lives may have contributed to these negative symptoms and, second, we do not know whether the adverse symptoms were short lived or more enduring. After reviewing descriptions of adverse reactions, it is the impression of the authors that a large percentage of negative effects and transient side effects may result from approaches to training that seek to reinforce and increase various bands of EEG activity (whether it is alpha, theta, beta, or delta), as opposed to focusing more on inhibiting or disentraining problematic EEG activity. It has also been reported that coherence training has the potential to create adverse reactions if not carefully monitored. It is the further opinion of the authors that home training that is not regularly supervised by qualified professionals also increases the risk of negative effects.

## **Conclusions**

Neurofeedback is a very valuable therapeutic modality, but it has the potential to occasionally result in side effects. When improperly done, it can sometimes result in more significant adverse reactions and an exacerbation of symptoms. Adverse effects that the authors are aware of that have been reported by clinicians include increased anxiety and agitation, panic attacks, manic-like behavior, headaches, nausea, fatigue, sleep disturbance, anger and irritability, crying and emotional lability, incontinence, enuresis, an increase in depression, a decline in cognitive functioning (decreased concentration, mental fogginess), increase in obsessional rumination and OCD symptoms, increase in somatic symptoms (including tics and twitches), vocal tics, seizures, loss of previous symptomatic improvements, and temporary disorientation or dissociation that could put someone at risk for an accident or injury.

It is apparent that EEG biofeedback is a therapeutic modality that requires clinicians to be vigilant in watching for occasional side effects. Legitimate professionals must acknowledge to patients in an informed consent process that a side effect can occasionally occur, and less frequently, adverse reactions have occurred. Thus, patients should be

told that it is vitally important to report any side effects immediately if they should occur so that training may be modified. We have found it useful to ask patients during and after sessions and at the beginning of each new session about any side effects (even though they are not extremely frequent) and to have the patient rate symptoms on a 0 to 10 scale at the beginning of each session to facilitate discussion and the tracking of progress. When such careful monitoring is done, side effects are usually minor and infrequent because the clinician can immediately modify training protocols before any negative effects escalate. When clinicians are conducting alpha/theta or other types of deep relaxation training, we also consider it very important to ensure at the end of the session that patients feel sufficiently clear headed to drive and function prior to allowing them to leave the office. The possibility of negative effects will also undoubtedly be minimized when practitioners obtain a thorough history of psychological and medical symptoms and employ assessment procedures prior to treatment that allow for individualization. Ethical practice also requires that one seek consultation when problems arise and the clinician is unsure about how to address them.

We believe that the field of neurofeedback is at risk. Increasing numbers of lay persons are inappropriately and illegally obtaining neurofeedback equipment. A significant number of such persons are then presuming that they are qualified to put electrodes on someone's head and to seek to alter the brain functioning of individuals with serious medical and psychological conditions. Issues of consumer protection are involved. Not only do such lay practitioners have the potential to harm members of the public, as well as to be ineffective, but such individuals also place in jeopardy the future of the field of neurofeedback because such practices will undoubtedly result in legal actions for harm done (one current case is pending) and the disparagement of the field by physicians, psychologists, other licensed professionals, and the public at large in reaction to unqualified practitioners.

We believe, therefore, that it is incumbent on licensed professionals to report lay practitioners to state regulatory bodies as practicing psychology and medicine without a license when they are found to be offering services for medical, psychiatric, and psychological conditions. Likewise, our professional societies should not admit individuals to clinical training workshops unless they are licensed for independent practice, have a letter from their graduate school advisers in accredited institutions, or can verify through a letter from their employer that they are a technician whose work is being supervised by a licensed professional. Similarly, allowing lay practitioners to be listed under

provider sections of society Web sites places professional societies in the position of implicitly sanctioning and in a sense recommending to the public the unlawful practice of such individuals. Research studies of neurofeedback should also monitor and report the frequency of side effects and adverse reactions. It is also imperative for both clinicians and professional societies to more actively educate the public about how to select qualified neurofeedback practitioners. Providing them with copies of Hammond's (2006) article can be helpful in this regard.

Competency and continuing education must likewise be encouraged. Licensed clinicians should be strongly encouraged to obtain certification in neurofeedback (e.g., from the Biofeedback Certification Institute of America) and, when they are analyzing their own QEEGs, to pursue certification from the EEG and Clinical Neuroscience Society or the Quantitative Electroencephalography Certification Board. The protection of the public and of our profession requires that we more vigorously emphasize standards of practice. It is our opinion that it is unethical (as well as unlawful) for practitioners to use neurofeedback to work with any medical, psychiatric, or psychological symptoms and conditions that they are not qualified to work with through both their training in other therapeutic modalities and by virtue of their licensure within their state or province.

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There are a myriad of websites advertising health insurance for independent contractors, each promising more than the last. But when choosing a health plan to protect your family, you need to rely on someone you trust.

The Association for Applied Psychophysiology and Biofeedback is pleased to make available health insurance options through the AAPB-endorsed Professional Liability Insurance Program. These are real, comprehensive health insurance plans that may include office and prescription medication co-pays, a wide network of doctors, hospitals and other options depending on which configuration you choose. Plans are available for independent contractors, freelancers or other self-employed people and their families. There are also group plans for businesses interested in adding this valuable benefit to their company.

#### Group Plans:

Designed for employer groups of 2 to 50 employees, these plans are available to all full-time, permanent employees. As a small group, employers are involved in the process of acquiring the plan and determining which plan options to offer. With small group insurance, your program agent will help you determine the right plan for you and your employees.

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