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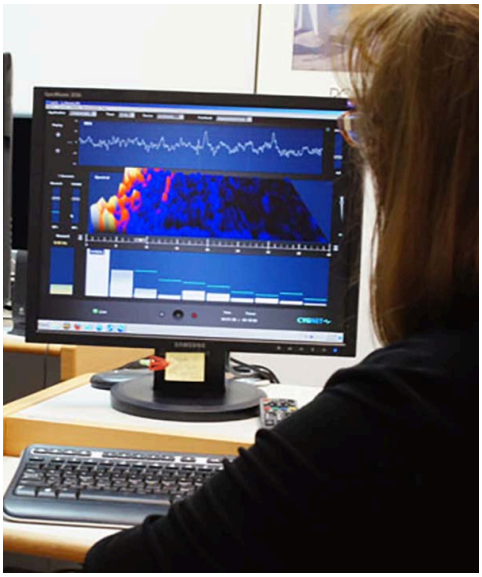
Questions and Answers About EEG Neurofeedback



EEG biofeedback, or **neurofeedback** as it's more commonly known, is a form of biofeedback obtained from a noninvasive electroencephalogram (EEG) that collects and measures brain activity. Originally researched as early as the 1950s, scientists discovered that this technique was very effective in reducing epileptic activity even in those whose seizures could not be medically managed. At its inception, it was used for the treatment of seizures, Attention Deficit Disorder, and learning disabilities.

Neurofeedback also had a prolific and profound influence on many other functions and dysfunctions. Practitioners and patients soon observed that the methodology had healing and stabilizing effects on a wide range of symptoms and ailments.

The span of symptoms and conditions that respond positively to neurofeedback may seem too broad a panacea—until you consider that the brain is the control center for so much of how we function internally, metabolically, and how we perceive and respond to ourselves and the environment. Scientifically valid, both in theory and empirical evidence, neurofeedback can be used to train and improve our neuronal self-regulation and brain stability.

Performing neurofeedback is essentially an exercise of the brain. By showing the patient their electrical brain activity in real time on a computer screen, the process of observing the brain in action helps the brain to regulate itself and become stronger, more durable, flexible, and resilient.

As a context for grasping the pervasive effects of this simple yet highly effective intervention, consider the uses of aspirin and antibiotics in vanquishing the ravages of infection, inflammation, and pain. These medicines are effective across a wide spectrum of afflictions that, by examining their prominent divergence, might seem unrelated or unresponsive to analgesics or antibiotics. But when we delve into the underlying biological mechanisms, we see that differing symptoms and illnesses respond well to the biochemical interactions between these chemicals and our immune and nervous systems. A headache and a swelling may not appear to bear semblance; yet analgesics often relieve both. A raging fever afflicts differently than a persisting sore; yet both usually respond well to antibiotics.

Similarly, as the delicate regulatory balances in our brain control and manage so many operations, "training" the brain (bringing disorder back into order) normalizes many functions and maladaptive responses that may appear quite disparate. Sleep disorders, pain, behavioral aberrations, mood swings, developmental disorders, thought problems, fears, and many other ailments fall under the rubric and control of brain regulation. As such, many seemingly unrelated symptoms are, in fact, essentially connected by underlying brain mechanisms and respond quite well to neurofeedback brain training.

What does neurofeedback help with?

The following are among the symptoms and conditions that have responded positively to neurofeedback:

- Attention problems, including ADD and ADHD

- Moodiness and serious mood disorders (such as bipolar disorder)
- Anxiety and depression
- Addictions
- Sleep problems—insomnia, waking, restlessness
- Focus and brain fog
- Obsessive thinking and worrying
- Behavior problems and disorders
- Learning problems
- Autistic spectrum and pervasive developmental delay
- Asperger's syndrome
- Head injury and brain injury
- Seizures and subclinical seizure activity
- Headaches and migraines
- Teeth grinding
- Bed-wetting and soiling
- Nightmares and night terrors
- Sleepwalking and sleep talking
- Obsessiveness and compulsions
- Tics and Tourette syndrome
- PMS and menopause
- Postpartum depression
- Antisocial behavior
- Stroke
- Tremors and restless leg
- Fears and phobias
- Eating disorders
- Weight and appetite control
- Study habits
- Recovery from surgery and anesthesia
- Chronic pain
- Anger
- Language disorders
- Indifference and motivation problems
- Oversensitivity and lack of sensitivity
- Muscular coordination
- Memory issues

This list is not exhaustive. It's a compilation of results attained and reported by patients and practitioners who, collectively, have administered tens of millions of sessions.

How can neurofeedback help my symptoms?

Like any exercise, neurofeedback takes practice. This mental/neurological exercise utilizes the brainwaves as seen in an EEG (electroencephalogram) as a platform for exercising the brain. Rather than exercising the muscles or cardiovascular system, neurofeedback exercises the neuronal activity that shows up in the EEG. Gradually, the brain becomes fitter, sharper, more relaxed, more self-regulated, and more adaptive, similar to going to a gym for the brain to become more mentally fit.

How long does it take to see results?

Results are gradual, cumulative, and vary among individuals, subject to factors such as severity and length of impairment, health status, neurological sensitivity, and the types of symptoms, conditions, and deficits. Anxiety generally begins to respond within eight to fifteen sessions (often sooner), depression lifts incrementally within twelve to twenty sessions, and focus responds gradually within ten to twenty sessions. Chronic sleep problems typically require twenty sessions or more to see noticeable changes that will last.

Though the majority of patients improve within the first twenty sessions, completing a regimen of forty sessions is recommended to establish the brain's better and longer-lasting self-regulation. Progress accumulates gradually and deepens as training progresses.

How does watching the activity of my brain on a screen help my brain?

The EEG is displayed through digital special effects as a livestream blended and superimposed on whatever type of entertainment the patient chooses. Watching a movie or game is used simply to attract attention and keep the patient occupied focusing on the screen. Digital special effects show live feedback information on how much and how often the brain is "in the zone" according to individually set filters and parameters determined together with the therapist. The feedback, which encompasses thousands of subtle signals per session, gently encourages and rewards the brain for spending more brainwave time within the specified ranges. This essence of the brain exercise is the critical agency of the effects.

Just as watching a movie on an airplane keeps you occupied while traveling from point A to point B—the primary intended activity, both activities occur simultaneously. With neurofeedback, your brain is working effortlessly while you are watching the screen. With this treatment, you have no need to problem solve or think any particular thoughts. You don't have to *try*—just observe.

What does the computer say about my brainwaves and progress?

The answer is *neurological* rather than logical. The computer doesn't report anything about progress, nor does it indicate anything useful about treatment. Specialized software operates with algorithms and generates plenty of mathematical data. However, these data are not relevant to progress or improvement. Think of it this way: at a gym, the exercise equipment does not say anything about your fitness progress. After spending time on a treadmill, the machine may show various data on your time, intensity, etc. But it cannot measure how you feel or tell you how you are improving in strength, flexibility, endurance, and so forth. These bottom-line results are what you experience after a period of correct and sufficient training.

Similarly, with mental fitness, clinicians are most interested in how you feel along the way and what symptoms are improving. We make adjustments based on patient reports, not squiggly lines on the computer. Training protocols do not follow specific brainwave patterns. Though basing the treatment on quantitative electroencephalograms (QEEGs) or brain maps is in vogue among many practitioners, I believe this is errant. Though I have conducted QEEGs for more than thirty years (as there is some value in them for certain purposes), they have not proven helpful in my experience for attaining the optimal results we typically get. After carrying out many QEEGs, before and after treatment, it became apparent to me that the beneficial effects observed in the training don't tend to line up with changes that may occur in the EEG over the course of training. And the EEG may not change significantly at all, even though the patient changes!

The EEG scroll shows basic morphology (shape of the brainwaves) and a spectral display that can highlight deviations and excesses of certain frequencies. For example, people who are very tense or anxious may show excessive or sporadic deviations in frequencies associated with muscle tension. If a patient falls asleep, this is usually noticeable on the screen. But more importantly, we monitor and watch the patient and gently wake them up to continue to participate in the training.

The agency of the training process, however, lies with the brain itself. The sophisticated software averages over the EEG and yields a more slowly varying waveform that informs the brain of its instantaneous status. The brain recognizes itself in that signal, and on that basis, anticipates its forward progress. There is always a slight gap between the emerging reality and the brain's intentions for the signal. Bringing closure to that gap is the brain's ongoing challenge, which exercises the brain's control mechanisms. This "brain anticipation" enables the brain's underlying neural networks to chart a better course—and that is the natural biological wisdom of the brain that we evoke in real time. Your brain knows how to do this when shown the relevant information. We don't put anything in—we simply show it what it's doing moment by moment and let it guide itself toward more harmony and stability and more resilient self-regulation.

To approximate how this EEG anticipation works, picture a car equipped with headlights that sense the curvature in the road ahead as your car turns. The headlight beams anticipate the turn and gradually lead into the upcoming road to best assist your vision.

It's a difficult and abstract concept, yet still rigorously scientific. Because of internal signal processing delays, the brain has to act on the basis of its prediction of the immediate future. As an example, if the brain were not to anticipate, a baseball player couldn't hit a fastball except by luck. So the brain is organized for prediction in life, and that allows it to project the EEG forward as well. That, in

turn, lets us to do neurofeedback in the way that we are doing it.

How can I tell if I'm getting better?

The bottom lines: *Are your symptoms improving? How do you feel? Can you remember (and compare) how you are now relative to what was going on when you first started treatment? Are there any observations from others in your life?*

We keep notes, and we ask and remind you as part of monitoring progress. We ask patients to rate their symptom status online using a private website symptom tracker account. I review these as treatment progresses and use the reports to interact with patients and make any adjustments.

Though improvement is typically gradual and cumulative, some patients notice improvement quickly in certain symptoms, and these accelerate as training progresses. More symptoms reduce, and overall wellness builds as the accumulating sessions further strengthen and stabilize the brain. People know if their sleep is improving and/or if their anxiety is quieting or their dark moods gradually lift. The individual patient is the arbiter of their status and improvement. In the case of children, it's often the parents who notice significant positive changes.

A computerized continuous performance nervous system test (Qiktest) is used at the beginning of treatment and after each twenty-session interval to track the status of brain performance on an objective task. This yields statistical data on attention, impulsivity, and neurosynaptic response time and consistency. For many patients who show marked impairment at onset, the test reveals their improvement. For others, the test is only one data set that may or may not change significantly over treatment time, but which nevertheless provides useful tracking information to factor into adjusting treatment protocols. I also use other neuropsychological tests. Data can predict, track, evaluate, and confirm. But the patient's subjective experience is still the most important standard.

I have observed something peculiar over the decades that I've provided neurofeedback. When patients report improvement (as do the vast majority), many question whether it's due to the neurofeedback or something else. Interactive feedback can help patients track and overcome any underlying skepticism.

After inquiring what else they might have done or changed, I ask when they noticed the improvements, and I correlate that with their length and timing of treatment. I can point out how their reported improvement coincides with the period since they started neurofeedback. By reflecting back their answers and what my records show, I help patients track and confirm their own correlation and conviction about how the neurofeedback was indeed the critical factor.

In one sense, of course, patients are right not to credit the instrument or the procedure. The critical change agent is the brain itself. Every part of the neurofeedback process is in service to the brain and of its owner.

How long do improvements last?

People want sustainable improvement. Of course, this is understandable. Most of my patients have already sought various interventions that may have provided hope or temporary relief—only to be disappointed when the effects don't last or aren't strong enough.

In the discussion about longevity of effects, the "elephant in the room" is the fact that many mental health patients use medications that must be taken regularly (daily or multiple times a day), often indefinitely. Positive effects from meds are transient, yet negative side effects can outlast the beneficial ones, even when meds are discontinued. Psychopharmacology can help, usually more in the short term, but meds can also bring dependence, bad side effects, and diminishing relief over time. Often, dosages need to be increased, which incurs a higher likelihood of side effects and recommendations for other meds to offset those.

Alternatively, neurofeedback results build and last. The effects are not based upon chemical "cruise control" (like drugs) or insights, but rather accrue from the brain learning and practicing new and more adaptive neurological firing rhythms and network relations. When the brain accesses what it already can do neurologically and brings these patterns forward as its default neural operations, the mind and body feel better and function more optimally. Thus the brain invokes, practices, and habituates to the neural mechanisms that keep symptoms at bay and promotes the desired growth underlying the effects: strength, endurance, flexibility, and resilience.

In response to patient questions about lasting effects, I explain that we are training their brain to make significant neurological operational habit change and that, for the majority of patients, these positive changes are enduring. If there are new traumas, periods of intense circumstantial stress, marked illness, or for patients with a chronic history of mental illness or gross maladjustment, further treatment may be needed at some point.

Some patients return years later for "tune-ups." They typically respond more quickly to this refresher intervention, because they have previously laid the groundwork for better brain functioning.

Overall, most patients maintain the gains they have made with neurofeedback.

Are there any negative side effects?

I am not aware of any documented negative side effects from neurofeedback that have lasting impact. Like any influence that affects the brain—even exercise, foods, lack of sleep, injuries, etc., our bodies and minds can react with unsettling responses to impingement, new or destabilizing stimuli, or novel experiences.

With neurofeedback, we are not putting anything into the brain (no intrusion or direct stimulation). We are observing the brain signals coming outward. Still we are appealing to the brain through the feedback to modify its firing and timing mechanisms. This is a safe procedure, and also very powerful.

Some individuals are highly sensitive in general. They may overreact at first because their brain is not accustomed to changing states so profoundly. Some unpleasant side effects occur in a small percentage of individuals. Temporary side effects may include sleepiness, restlessness, internal pressure, or other miscellaneous but *innocuous temporary* discomfort. These effects are transient and harmless. They are also uncommon, occurring in perhaps 4–5 percent of new patients. They disappear within a session or two, especially as my supervision attends to the treatment and makes subtle but significant adjustments to the protocol settings.

What about medications?

Many patients have taken or are taking psychotropic medications when they first present for neurofeedback treatment. Many don't like taking these drugs for a variety of reasons. Often, they help only minimally to mitigate the symptoms. Many patients have taken them for years and are hesitant to stop for fear of reverting to a worse condition.

Good news is that meds rarely interfere with neurofeedback treatment. Brains improve with or without medication. We are making an "end run" around the biochemical "cruise control" that psychotropics implement.

Patients are often highly motivated to get off their meds. I always advise them to consult their physician, as I am not able to prescribe or unprescribe. Though many of my patients have been able to reduce or stop their psychotropic meds after neurofeedback, it's an individual matter.

Another issue may be the determination or "teasing out" of what is the effective agent when patients are doing multiple interventions. Neurofeedback almost always makes people better and often amplifies the effects of other interventions.

Because people tend to normalize when training their brain, many patients are eventually able to titrate down (reduce the dosage) of their mental health meds and retain or augment improvement. This is very helpful for avoiding drug side effects or the need for additional meds.

Are QEEGs necessary?

A QEEG (quantitative EEG), also called a brain map, is an electronic imaging study of the brain's electrical patterns. Using multiple electrodes at different brain sites, we record the brain's activity and correlate it with databases that offer comparisons with "normal" activity and associations with different types of dysfunction. This can be useful in identifying severe deficits, such as seizures, tumors, or brain trauma, but using QEEGs for diagnostic or treatment purposes can be problematic.

Although QEEGs are somewhat helpful in confirming what is already know from the patient's history, symptoms, or other studies, *we cannot predict behavior from the QEEG*. But we can sometimes predict the QEEG from behavior. This is an important distinction. For example, a person who has a history of explosive or violent behavior will likely have particular abnormalities that show up in the

QEEG. But we already know from empirical evidence what the problem is: unrestrained aggression. Evidence from the QEEG merely adds data to what we already know. People who have sustained substantial or prolonged trauma typically show certain patterns in areas of the brain that store traumatic emotional memories, and we know before, and independent of imaging studies, that the problem is severe and enduring. The QEEG only gives us colorful graphics and math to confirm what is previously evident.

QEEGs are not predictive of behavior. Aberrations and deviations in the QEEG do not tell what the person will or may do. I've conducted and reviewed an abundance of QEEGs that look either normal or indistinguishable from those with marked impairment. Yet many of these patients show no behaviors that are consonant with or predictable by their brain studies. Even doctors experienced in reading these studies cannot distinguish or predict with any degree of reliability.

Years ago, I did an experiment with startling results. I sent ten QEEGs to a few "experts." I told each expert that two QEEGs were those diagnosed with autism, three were bipolar, two were relatively normal, and three were either PTSD or panic patients. I asked them to identify which were which. The "experts" mistakenly missed the autistics, identified one of the "normals," and equivocated on the others, using language like "consistent with abnormalities."

I've observed many times that the QEEGs and brainwaves of autistic people cannot be distinguished with any reliability from normals —and would definitely not predict obviously autistic impairment that is clinically observable.

In another case study from my clinical practice years ago, I treated an adolescent who was impaired with attention, trauma, and emotional disarray. He was expelled from high school for the "violent behavior" of "stabbing" a student with a pencil. He vehemently denied this, and eventually he had a court hearing at which I testified. Among the evidence and testimony I presented was my patient's QEEG. I explained to the judge that his QEEG bore none of the markers for overly aggressive activity. On the contrary, his QEEG indicated brain patterns that were associated with fear and withdrawal. My testimony helped this adolescent avoid incarceration.

While no QEEG evidence is definitive, in some cases it can be helpful.

Where it is not helpful is in targeting neurofeedback treatment according to the QEEG correlations. Whereas some practitioners rely on the QEEG's colorful data that is impressive to patients, I have not found this approach to be productive. We have had great success using intake evaluation methods (my clinical interview, psychosocial history, patient presentation and symptoms, Qiktest data, and decades of experience) and monitoring and tracking to achieve reliably effective results.

Why isn't neurofeedback more mainstream?

A pertinent question. Neurofeedback is becoming more widespread. Its popularity is increasing mostly from the groundswell of people dissatisfied with the mainstream medical approach of throwing drugs at patients. Word is spreading that neurofeedback helps a lot without medications. And many enlightened physicians are taking note. Some recommend it and a few offer it. But as my learned colleague, Dr. Siegfried Othmer, says, "The field of Medicine is not interested in the brain that heals itself."

A plethora of research supports the efficacy of neurofeedback. One has only to look at the scientific literature. The American Academy of Pediatrics has included and endorsed neurofeedback for the treatment for ADD. Though scientific studies attest to its efficacy in treating seizures, migraines, and even addictions, we have a long way to go to overcome *ignorance*, plain and simple. Conventional medicine is not yet willing to confront, absorb, and admit the substantial evidence. Interestingly, this scenario alters when a physician's family member has a crisis problem that is not successfully addressed by meds. (I have treated many such patients.)

The treatment is robust, and the human brain is very capable of relevant tuning when shown its own activity in real time.

How do I get started?

Many neurotherapists (like me) have specialized experience in allied fields: psychology, family counseling nursing, social services, etc. Try to find a practitioner with more and diverse clinical experience. Of course, working with someone who "gets" you is important. Comfort and therapeutic alliance help. Don't be shy about asking any questions. Hopefully, the information herein has acquainted you with the process and allows you to ask relevant questions.

I recommend looking for someone who uses the *Othmer Method*, as we do in my practice. Visit EEGinfo.com for more information.

— Mark Steinberg, PhD

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