

## **Anxiety and Neurofeedback**

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Generalized anxiety disorder affects 3% of the entire U.S. population. Perhaps one of the most overlooked mental illnesses, GAD is characterized by persistent and excessive worry about various things. Controlling one's worry is nearly impossible and expecting the worst out of an outcome seems to be a similarity across cases. Unfortunately, women tend to be twice as likely to be affected and although the exact cause of anxiety symptoms is unknown, there is evidence that family background, life experiences, and biological factors play a role. Although some patients can function socially and be employed successfully, certain social situations may be avoided due to more severe episodes. In the end, however, clinical anxiety has been linked to changes in the brain systems that are involved in the generation and regulation of normal emotion.

Oftentimes to control the regulation of normal emotion, doctors have turned to medication. Patients may get prescribed antidepressants, anxiolytics (anti-anxiety medications), or beta-blockers. Because anxiety disorders are associated with imbalances of neurotransmitters, antidepressants and anxiolytics play a role in altering the levels of these chemicals and thus help control some of the psychological symptoms. Medication can be extremely helpful in some cases but it may also have its drawbacks. Side effects can very much affect a person's life as well as the patient may become dependent on what's supposed to help and addiction is possible. These disadvantages have motivated scientists to come up with other potential treatments which has led them back to where it all begins; the brain.

Most anxiety disorders such as PTSD, social anxiety disorder (SAD), and phobias, all seem to stem from hyperactivation of the amygdala and insula. The amygdala is responsible for emotion control and survival instincts, which is why fear is in part a product of this region. The insula, on the other hand, has been connected to our brain's ability to perform interoception, which mediates the monitoring of arousal and aversive states. If a disruption is to occur in either of these areas, anxiety presents itself. But wouldn't it be ideal if we could somehow control these areas of our brain in order to decrease the level of arousal in certain situations? Guided by this question, scientists have looked to alternatives in the fight against anxiety disorders and it is evident that self-regulation is a promising method.

Self-regulation is the act of something, such as the brain, regulating itself without the intervention of an external body. Over the years, researchers have shown that a new brain self-regulation technique is effective and more inexpensive than medication in the long run. This may be the answer so many have been waiting for in terms of taking control of their lives once again and potentially freeing themselves from mental health abnormalities. This type of brain self-regulation can be achieved through a process called neurofeedback.

Neurofeedback is the direct training of brain function, which enables the brain to work more efficiently even in the most basic scenarios. It works on the idea that if a patient is shown how his brain works in real-time displays (EEG), he will then be able to act on systematically controlling it. After observing his own brain functioning and working on regulating its activity,

the concept of reward is introduced. Rewarding the brain for changing to more appropriate patterns reinforces long-term effects on both brain function and mood, which is the end goal. This type of self-regulation training improves the efficiency of the central nervous system, which is responsible for most functions of the body and mind including our thoughts, interpretation of our external environment, and communication between different areas of the brain. Training the brain to act differently may sound bizarre but thankfully adult brains, even those affected by mental illness, retain a high level of plasticity.

Recent research assures scientists that the effects of neurofeedback are worth the time and effort. Over the years, the brain has been mapped out by function and connectivity. The mapping of the brain has helped conduct more targeted approaches in the field of neurobiology tremendously. By using a targeted training approach towards the neuroscientifically informed defective circuitry, scientists are able to better observe the monitoring of neural activity. There's evidence that real-time fMRI neurofeedback can allow patients to voluntarily harmonize the amygdala and insula. The modulation of these areas in turn resulted in enhanced connectivity with the prefrontal cortex, which is involved in executive function and the emotion-processing biases related to anxiety disorders. Optimal connectivity between areas associated with lower anxiety levels is possible so long as the right treatment is executed.

Furthermore, it's important to note that certain types of brain wave activity can also have an impact on a person's mood and mental function. Specifically, beta and alpha waves have been linked to anxiety-related symptoms. Alpha waves are designed to bridge the gap between our conscious thinking and subconscious mind. These type of waves make it possible for us to calm down when necessary and promote feelings of deep relaxation. In cases of severe stress, a phenomenon called "alpha blocking" may occur in which very little alpha waves are present in addition to an excess of beta waves. Beta waves, by definition, help us focus and complete tasks as necessary. Too much beta, however, can lead to experiencing excessive stress and/or anxiety. Thus, higher beta frequencies are associated with high levels of arousal (i.e. inability to relax, high adrenaline, inability to fall asleep, etc.).

Several studies have observed the degree of anxiety-related symptoms to the brain wave activity in different areas of the brain. In a 2009 study consisting of 19 patients diagnosed with PTSD, neurofeedback turned out to be a major help. Each subject received a qEEG in order to observe brain activity as a baseline. These results were then compared to the Lifespan Normative database. Next, excessive high frequency beta was downtrained throughout the course of five to seven sessions for each site that presented excessive high beta wave. Alpha activity was also uptrained at the same sites. Pre-treatment self-related scores of anxiety ranged from 5/10 to 7/10. Participants who were involved in the NF training had a significant reduction in self-related anxiety in which their scores dropped to 0/10 to 2/10, and even after a month after NF training their scores seemed to stay between 0/10 to 2/10. Subjects who weren't exposed to NF training had little or no reduction in self-related anxiety 3 months after their initial qEEG.

In another 2009 study regarding alpha suppression and alpha symmetry training, scientists were able to prove that NF training can help reduce symptoms of anxiety in eight adults who presented anxious behaviors. A 5-minute baseline EEG was recorded with eyes open and with their eyes

closed for a secondary measurement. Post-baseline measurements were also recorded 1 week after the last NF training occurred. Between session 6 and 16, the goal was to explicitly decrease alpha magnitude by 10% in the anterior lobes for 30 or more minutes. When alpha was successfully suppressed, the procedure shifted to improvement of alpha symmetry by a 15% increment for 30 minutes or more during 8-32 sessions. These sessions were conducted on a biweekly basis, and continued assessment of participants' anxiety levels were conducted by the means of the State-Trait Anxiety Inventory (STAI). In the end, a significant improvement in subjects' scores seems to indicate that NF training indeed has a tremendous impact on those suffering from anxiety-related symptoms.

As noted, NF training may be a new and developing field of practice and research but it's been proven to have a significant effect on patients with anxiety. It uses a targeted training approach to aid sites of the brain that have been neglected by the brain itself, as well as it introduces a concept of brain wave monitoring that has been overlooked in the past. Luckily, research in this field is ongoing and promising. It's safe to say mental health professionals are turning to this alternative in order to provide subjects with the freedom they so deserve.

## References

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