

CLINICAL TRIAL SHOWS NEUROFEEDBACK TRAINING CAN HELP RESET BRAINWAVES AND WITH EMOTION REGULATION IN PEOPLE WITH PTSD

WHAT WAS THIS CLINICAL TRIAL AIMING TO UNDERSTAND?

The aim of this clinical trial was to assess the effectiveness of electroencephalogram (EEG) neurofeedback as a treatment tool to help individuals with PTSD to reset brain waves that may over- or under-function in the aftermath of traumatic experiences.

WHAT DID THE CLINICAL TRIAL STUDIES TELL US ABOUT THE EFFECTIVENESS OF EEG NEUROFEEDBACK AS A TREATMENT FOR PTSD?

There were two distinct studies that outlined findings from this clinical trial. Together, they showed:

- Study participants receiving neurofeedback had **significantly decreased PTSD severity scores after treatment, with a remission rate of over 60%** at the three-month follow-up.
- There were **no participants who dropped out of the study, suggesting that neurofeedback therapy is both accessible and well tolerated.**
- Findings from the EEG portion of the study reported that neurofeedback brain training resulted in a “rebound” of alpha waves within the same areas of the brain that showed decreased alpha before the intervention. Increasing alpha waves is important because it has been repeatedly shown that decreased alpha waves are highly associated with PTSD symptoms ([from Nicholson et al., 2023](#)).
- Findings from the functional magnetic resonance imaging (fMRI) portion of the study show that neurofeedback brain training improves the engagement of cognitive (i.e., processing thoughts and making decisions) and emotional control of brain areas when a person is completing memory tasks that trigger emotion because of trauma. ([Shaw et al., 2023](#)).

Neurofeedback is a non-invasive therapy that doesn't hurt or involve medication. It helps people learn how to self-control brain activity so that they can think more clearly, balance their emotional responses and control triggered behaviours like avoidance, anxiety or panic.



Alpha brain waves are what the brain produces when in a resting, relaxed state. People with PTSD can have disrupted brain activity where alpha waves are decreased because, either consciously or unconsciously, they may not feel that it is safe to relax in the aftermath of trauma. This can lead to difficulties with emotional control and other PTSD-related symptoms.



WHY IS THIS STUDY SIGNIFICANT?

- Although neurofeedback and other forms of biofeedback (i.e., heart rate feedback) have been around for decades, our recently published study is the **first clinical trial in Canada on neurofeedback for the treatment of PTSD**.
- **Results suggest that this treatment may be a highly promising new option for the treatment of PTSD that is non-invasive and well tolerated by participants.**
- This is a recent milestone in the team's 10-year neurofeedback research program that aims to build the evidence base and best-practice understandings about the effectiveness of neurofeedback therapy.

WHO PARTICIPATED IN THE TRIAL?

- This was a **double-blind randomized, sham-controlled trial**. This means some participants received active neurofeedback treatment and some did not receive active treatment. Those who did not receive active treatment were not aware of this.
- Clinical trial participants were recruited over a four-year period between 2014 and 2018 from referrals from physicians, mental healthcare providers, psychiatry clinics and community advertisements in London, Ontario, Canada.
- There were **40 participants with a primary diagnosis of PTSD**.
- Participants were **aged 21-59**. There were 25 females and 10 males who completed the study.

- Participants were provided financial compensation and were not engaged in other trauma-focused psychotherapy treatments at the time of the study. They also had no previous experience with neuro- or biofeedback.
- Participants were screened for problematic substance use in the three months before the trial, as well as for diagnoses of bipolar or psychotic disorders and suicidal ideation or self-injurious behaviour that needed attention in the three-month period before the trial started.

HOW WERE TRIAL RESULTS MEASURED?

- Before the start of neurofeedback therapy, the study team did a **comprehensive mental health baseline assessment** using a Clinician Administered PTSD Scale and the *Structured Clinical Interview for DSM-5*. This assessment was then repeated after the neurofeedback trial, and again at the three-month follow-up.
- Before and after the neurofeedback therapy protocol, the team did a **brain scan on participants using an fMRI machine and an EEG device**. This allowed them to compare and measure changes in the brain and in PTSD responses of participants that resulted from the neurofeedback therapy.

DSM-5 is short for the *Diagnostic Statistical Manual (Fifth Edition)*. It's published by the American Psychiatric Association and is used by mental health professionals for reference, and to diagnose psychiatric and mental health disorders.



WHAT WAS THE NEUROFEEDBACK THERAPY PROTOCOL USED IN THIS TRIAL?

- Clinical trial participants attended weekly **20-minute neurofeedback therapy sessions over a 20-week period. All participants completed at least 17 sessions.**
- During neurofeedback sessions, participants were shown visual cues that corresponded to brain activity.
- The EEG/neurofeedback machine gave feedback – in the form of auditory and visual signals – when brainwaves responded in dysregulated or traumatized ways. This allowed participants to regulate or calm their brain response using a variety of strategies.
 - Most participants reported that they tried to “quiet their mind” by decreasing mind-wandering thoughts and increasing visual attention to the neurofeedback screen as a way to gain control over their feedback signal.
- Feedback being given targeted the desynchronization of alpha rhythms or resting state brain waves (which are 8-12Hz).

HOW STRONG IS THE EVIDENCE FOR NEUROFEEDBACK THERAPY AS A TREATMENT FOR PTSD?

- Participants receiving neurofeedback demonstrated significantly decreased symptoms of PTSD.
- In addition, over **60% of trial participants receiving neurofeedback no longer met diagnostic criteria for PTSD** by the end of the trial.
- No study participants left the trial, **suggesting that neurofeedback therapy is easy to tolerate and effective** for patients.
- Brain imaging of participants before and after treatment, showed that disrupted brain networks that cause symptoms of PTSD were normalized after the trial. **This supports evidence of neurofeedback’s ability to heal the brain in the aftermath of trauma.**

- Another recent study, [A Randomized Control Study of Neurofeedback for Chronic PTSD](#), showed that EEG-neurofeedback led to significant improvements in both PTSD symptoms and patients’ capacity for emotion regulation. Participants in this study consisted of individuals with exposure to multiple traumas who had not responded to (i.e. had improved symptoms) to at least six months of trauma-focused psychotherapy.
- Another recent pilot study, [The impact of neurofeedback training on children with developmental trauma: A randomized controlled study](#), also demonstrates reductions of PTSD symptoms and improved executive functioning among patients with severe histories of abuse and neglect.

HOW CAN NEUROFEEDBACK THERAPY BE INTEGRATED INTO EXISTING STANDARDS OF CARE (i.e., USED IN CONJUNCTION WITH OTHER TREATMENTS OR AS A FRONTLINE TREATMENT)?

- Neurofeedback is an **extremely flexible second-line treatment for PTSD**. It can be used in combination with other frontline treatments such as exposure and talk therapy, and also be tailored to fit the individual needs of patients.
- **Our recent clinical trial examined the effectiveness of neurofeedback** as a treatment on its own. However, we are currently conducting new research where patients are using a portable form of neurofeedback at home for 30 minutes before group-based talk therapy.
- Patients can also train to regulate brain activity with neurofeedback during exposure to trauma triggers (i.e., similar to the presentation of trauma reminders that happens during exposure therapy).
- More research is currently needed to fully uncover the benefits of neurofeedback, particularly how it can be used in combination with other frontline treatments to improve outcomes.

WHAT ARE THE BARRIERS TO ACCESSING TO NEUROFEEDBACK THERAPY FOR VETERANS WITH PTSD?

- Barriers to the widespread use of neurofeedback therapy include finding a healthcare provider trained in neurofeedback delivery for trauma-related disorders, and accessing neurofeedback technology.
- We are **currently conducting an internet-based clinical trial using low-cost, wearable neurofeedback technology in which patients are learning to train their brain at home**. Several other studies have also shown that low-cost, portable neurofeedback devices are effective in reducing PTSD symptoms.

Note: A service provider who is covered through Veterans Affairs Canada (VAC)/Medavie Blue, will need to be certified by the [Biofeedback Certification International Alliance](#), which offers a searchable database of clinicians.

WHAT ARE THE OUTCOMES WHEN NEUROFEEDBACK THERAPY IS SUCCESSFUL AND HOW MUCH CAN IT IMPROVE THE QUALITY OF LIFE FOR VETERANS LIVING WITH PTSD?

- In our clinical trial, we showed that **reductions of PTSD symptoms continued three months after treatment**.
- We also found that **brain networks that are disrupted among patients and cause PTSD symptoms were “reset” after neurofeedback treatment**. As such, this treatment option has the capacity to heal dysregulated brain activity that can cause distressing symptoms after experiencing a traumatic event.
- **Neurofeedback has also been shown to be effective in treatment resistant cases** (i.e., among individuals who have not responded to psychotherapy) and who may be too dysregulated, anxious or dissociative to tolerate exposure-based treatments. This can provide a lot of hope for people who are struggling with persistent symptoms of PTSD.

Frontline treatment or therapy refers to the primary treatment a person is receiving. For example, a person may be accessing talk therapy as a main part of their treatment plan, but also have other “second-line” treatments that complement or support the work they do with that clinician or service provider.



[Learn more about neurofeedback therapy and the Atlas Institute’s clinical research in this area.](#)

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