

# TREATING PTSD WITH BRAIN TRAINING: EXPLORING THE OPTIMAL APPROACH

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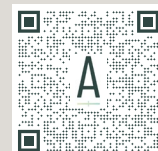
## Highlights

**One of the most challenging decisions service providers and researchers have to make when using neurofeedback to treat people with posttraumatic stress disorder (PTSD) is choosing the right brain region to work with to reduce symptoms. This preliminary clinical research study begins to shed some light on this question.**

- This study investigated how brain training through functional MRI (fMRI)-neurofeedback could help individuals with PTSD stabilize hyperactivity in specific brain areas associated with trauma.
- A preliminary trial comparing the response of targeted neurofeedback therapy on the amygdala versus the posterior cingulate cortex (PCC) found that:
  - Targeting the PCC **led to unique decreases** in brain activity in other PTSD-related brain regions. This was associated with improvements in PTSD symptoms, including reduced reliving of traumatic memories and less emotional distress during neurofeedback training.
  - Targeting the amygdala **led to comparatively no unique decreases** in other PTSD-related brain regions. It was also not associated with significantly improved PTSD symptoms.
- These findings will help service providers begin to understand the best brain region to work with to reduce symptoms.

**The Atlas Institute for Veterans and Families is currently undertaking a broader multi-session, sham-controlled, double-blind randomized control trial with a larger participant group to further explore these findings. Learn more about this study or how you can participate in the trial: [bit.ly/mri-biofeedback-study-ptsd-form](https://bit.ly/mri-biofeedback-study-ptsd-form)**

Find out more about neurofeedback therapy and ongoing research in this area: [atlasveterans.ca/neurofeedback](https://atlasveterans.ca/neurofeedback)



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## What are Study Notes?

**Study Notes** provide a plain-language summary of a research project led or supported by the Atlas Institute for Veterans and Families. The aim is to ensure that Veterans and Families can better access and understand emerging research and key findings.

A **single** research study cannot give us all the answers, but every well-conducted study gives us a piece of the puzzle.



## Why is the study important?

This preliminary research study begins to shed light on areas of the brain that can be targeted to decrease PTSD-related hyperactivity and reduce reliving and distress symptoms. Changes in the brain caused by PTSD can be complex, making it difficult to choose a specific target region for neurofeedback therapeutic intervention.

Though the amygdala has long been linked with PTSD symptoms, emerging research suggests that responses in this part of the brain don't account for the full range of symptoms associated with PTSD<sup>1,2,3</sup>. For example, the posterior cingulate cortex or PCC has been shown to be hyperactive during trauma triggers in brain imaging in people with PTSD and contributes to symptoms such as reliving of trauma memories<sup>4,5,6,7</sup>.

For this reason, the Atlas Institute Clinical Research team wanted to better understand these two targets by comparing clinical and neural outcomes for amygdala- versus PCC-targeted neurofeedback.



## What did the study aim to find out?

This study aimed to explore how two brain areas linked to PTSD symptoms, the amygdala and PCC, respond to a type of brain training called fMRI-neurofeedback. The training helps reduce hyperactivity in these regions, which is often triggered by trauma cues in people with PTSD. By comparing these two brain areas, the researchers hoped to understand which one is a better target for therapy, with the ultimate goal of improving treatments for PTSD.

### fMRI-neurofeedback

is a technique that shows real-time brain activity, allowing individuals to learn how to reduce hyperactivity in specific brain regions.

### Amygdala

A region of the brain involved in the “emotional alarm system,” the amygdala is responsible for detecting threats and triggering fear or anxiety responses. In PTSD, the amygdala tends to be overactive, making individuals feel constantly on edge or easily triggered by trauma-related cues.

### PCC

A region of the brain involved in reflecting on oneself, recalling memories and processing emotions. In PTSD, this area becomes overactive during trauma-related thoughts, contributing to symptoms such as vivid reliving of traumatic memories and emotional distress.



## What did the study discover?

- Targeting the PCC reduced activity in several brain areas involved in trauma processing, such as those related to emotional and visual responses.
  - This was associated with improvements in PTSD symptoms, including reduced reliving of traumatic memories and less emotional distress during a single neurofeedback session.
- Targeting the amygdala showed no unique reductions in brain activity linked to trauma processing (i.e. no reductions over and above those seen in the PCC group).
  - This was not associated with significant improvements in PTSD symptoms.

Learn more about what these findings mean in the [Implications section](#).

### Clinician-Administered PTSD Scale for *DSM-5* (CAPS score)

is the gold standard in PTSD assessment. It is a structured interview where questions are asked about the onset and duration of symptoms, subjective distress, impact of symptoms on social and occupational functioning and improvement of symptoms since previous CAPS administration.



## How was this study conducted?

This study compared brain activity and changes in PTSD symptoms in two groups of study participants using fMRI-neurofeedback. In one group the amygdala brain region was targeted, in the other the PCC brain region was targeted.

Both groups followed the same experimental protocol where participants used strategies such as mindfulness, positive self-talk and visual imagery to regulate their brains during neurofeedback sessions.

### Group characteristics

- 28 participants
- Amygdala group: 14 (10 females/4 males)
- PCC group: 14 (6 females/8 males)

There were no significant differences between groups in age, use of psychotropic medications or other clinical measures (e.g. childhood trauma, depression scores, dissociation symptoms).

There were differences in biological sex and baseline PTSD severity (based on Clinician-Administered PTSD Scale for *DSM-5* scores) between the two groups, so these factors were controlled for in all analyses. This approach ensured that any observed differences in brain activity or symptoms could be attributed to the neurofeedback target (PCC or amygdala) rather than unrelated factors.



## What are some strengths and limitations of the study?

- **All participants were able to self-select strategies to successfully regulate brain activity during the neurofeedback session within both regions of the brain.**
  - This means that participants were able to learn from the neurofeedback to figure out strategies that work well for regulating the target areas to better manage their PTSD symptoms.
- **Data was collected from the two groups one at a time and they were not randomized.**
  - This means that the findings could be influenced by differences between the groups that are unrelated to the intervention being studied. For example, differences in demographics, baseline characteristics or external factors occurring during data collection could impact the results.
- **The sample was small, making it harder to detect subtle effects.**
  - The ability to detect significant differences between groups in PTSD symptoms is therefore limited.
  - Creates challenges for generalizing findings to the broader population.

For more information about the strengths and limitations of this study, read the published study: [atlasveterans.ca/tale-of-two-targets](https://atlasveterans.ca/tale-of-two-targets)



## What are the implications of this study?

### FOR VETERANS AND FAMILY MEMBERS

This study can help Veterans and Family members build self-awareness about the complex symptoms and responses associated with PTSD.

It can also begin to shift thinking that informs treatments Veterans and Family members may wish to explore with their service provider.

### FOR SERVICE PROVIDERS

One of the most challenging decisions service providers and researchers have to make when using neurofeedback to treat people with PTSD is choosing the best brain region/response to work with to reduce symptoms. The study findings suggest that fear- and anxiety-based treatment responses may not be as effective on their own as previously thought.

PTSD symptoms and their treatment have long been linked with amygdala activation and fear- and anxiety-based models. However, this preliminary clinical research study suggests alternative targets and/or treatments that may address the full range of symptoms and responses associated with PTSD.

### FOR RESEARCHERS

This preliminary research study allowed the authors to begin a broader multi-session, sham-controlled, double-blind randomized control trial with a larger participant group to further explore these findings. This study (NCT05456958) is ongoing.

Researchers interested in the details of these preliminary study findings can access the published study at [atlasveterans.ca/tale-of-two-targets](https://atlasveterans.ca/tale-of-two-targets).

See the [Future directions section](#) to learn more about this clinical trial and other directions future research may explore based on the preliminary study findings.

#### Sham-controlled

A type of control condition designed to resemble the intervention being tested but that does not include the active components believed to produce the therapeutic effects.

#### Double-blind randomized trial

A study where neither the participants nor the researchers know who is receiving the actual treatment or the sham intervention.

Using a **sham-controlled, double-blind randomized trial** design helps ensure reliable results by reducing bias, such as the effects that can occur when people know they are receiving an active treatment.

## Future directions

The Clinical Research team at the Atlas Institute is currently undertaking a broader multi-session, sham-controlled, double-blind randomized control trial with a larger participant group. This can help to further test the findings in this research and address the study limitations.

The larger clinical trial will:

- Compare neurofeedback to a sham-controlled group in a randomized, double-blind trial design
- Compare multiple clinically relevant brain targets (PCC vs amygdala) to each other in a single clinical trial
- Evaluate the effect of multiple sessions of fMRI-neurofeedback on clinical and neural outcomes
- Evaluate the effect of fMRI-neurofeedback on sleep and physical activity using biometric data collection
- Assess the effects of regulation strategies (e.g. mindfulness-based techniques, positive self-talk, visual imagery) on neurofeedback training success via qualitative semi-structured interviews with participants

Learn more about this clinical trial or how to participate: [bit.ly/mri-biofeedback-study-ptsd-form](https://bit.ly/mri-biofeedback-study-ptsd-form)





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