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# How to Promote Neuroplasticity Following Trauma

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How to Promote Neuroplasticity Following Trauma

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Abstract

Trauma has been a key topic within the mental health field in recent years. Practitioners have been dedicated to researching and learning new treatment modalities to treat trauma. In the quest to better treat trauma survivors, we have taken a closer look at how exactly trauma affects our clients. We have found that it not only causes clinically significant impairment in functioning, but it can also alter the structure of the brain. Thus, the goal of treatment is to treat more than the symptoms and behaviors. In order to do so, we must take a closer look at how we can heal the brain itself. We must learn all we can about neuroplasticity; how it works, and how to promote it in our clients.

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# Introduction

## Can the Brain be Repaired Following Trauma?

Most people will experience something traumatic in their lifetime, yet only a quarter to a third of them will meet criteria for a diagnosis of posttraumatic stress disorder (Lupien, Juster, Raymond, & Marin, 2018). In order to meet criteria for posttraumatic stress disorder there needs to be evidence or report of functional impairment in an individual (American Psychiatric Association, 2013). Those are the individuals we will be discussing because the impairments they exhibit are not only due to their trauma; they are also due to how their brains were wired as a result.

Recent advancements in the use of brain-imagery technologies (Nowack & Radecki, 2018) are making way for neuroimaging studies which have revealed varied abnormalities in the brain structure and function of patients diagnosed with posttraumatic stress disorder. These abnormalities are most often found in the hippocampus, amygdala, and prefrontal cortex (Jung, Chang, & Kim, 2016). We will discuss what these areas of the brain are responsible for and how the damage done to them can influence external behaviors.

Tabibnia and Radecki (2018) identified 15 different strategies that can increase resilience and change in the brain including exercising, social support, cognitive therapy, mindfulness, and cognitive reappraisal. Many of these strategies are found embedded in the treatment modalities used by counselors to treat clients with trauma histories. We will examine some treatment modalities and their effectiveness in repairing the damage done to the brain by emotional trauma.

## Review of Literature

### What is Neuroplasticity?

The concept of neuroplasticity was just developed over the past 20 years of research. It used to be thought that the brain could not change once it had been damaged. As new treatment modalities surfaced, so did new results. The results created the concept of neuroplasticity. Eichinger (2018) defines neuroplasticity as "the capacity of the brain to develop and change throughout life" (p.90). Emerging research suggests that brain cells can modify their structure and function when exposed to a variety of internal and external stimuli, including counseling. As such, neuroplasticity means changes made at the neural level. Research is showing that behavioral rehearsal and practice can promote neuroplasticity. It was previously thought that these interventions only worked by increasing client's ability to access skills that led to helpful behavioral changes. (Nowack & Radecki, 2018). In order to understand how neuroplasticity is possible, one must first understand how the brain functions before and after trauma.

#### Typical brain function.

When the brain is functioning typically there is a working balance between the reflexive system, consisting of the amygdala and striatum; and the reflective system, consisting of the prefrontal cortex. The reflective system, which consists of intentional functions like problem solving and self-control, can exert control over the reflexive system which is responsible for less voluntary functions, such as cravings and emotions. When an individual feels an emotion, their reflexive system is being engaged because the initial feeling of an emotion is automatic; when the reflective system is engaged, the individual is choosing how to process and respond to that

emotion. When the balance between the two occurs, it is possible for the brain to produce impulse control and emotional regulation behaviors (Tabibnia & Radecki, 2018).

The prefrontal cortex also holds most of our working memory. When functioning properly, this area can hold, process, and manipulate information. This is different than the memory function found in the hippocampus which is part of the emotional brain. This means that this portion of the brain records the feelings associated with memories (Eichinger, 2018).

The amygdala is also part of the emotional brain. Cisler et al. (2016) used neuroimaging to look at the amygdala in adolescent girls diagnosed with posttraumatic stress disorder. Their images showed functional connectivity as it happened in the amygdala when the girls viewed negative images. Increased functional connectivity in the amygdala represented emotional hyperreactivity. When the amygdala is working properly, images should show no abnormal functional connectivity because the individual is practicing emotional regulation effectively.

**Brain function following trauma.**

When the brain experiences a traumatic event, our working memory, which is housed in the prefrontal cortex, is radically compromised. Flashbacks to the traumatic event, and prolonged stress continue to wear down the prefrontal cortex, resulting in long-term damage to prefrontal neurons (Tabibnia & Radecki, 2018). Neuroimaging has shown that people with posttraumatic stress disorder have problematic activity in the mid-prefrontal cortex, which is involved in fear conditioning and extinction learning. The anterior cingulate cortex, orbitofrontal cortex, thalamus, insula, Broca's area, parietal lobe and hippocampus also show problematic activity in those with posttraumatic stress disorder. These areas all work to process and integrate

sensory information as well as form structured memories and narratives (Zantvoord, Diehle, & Lindauer, 2013).

When a traumatic event takes place, the body activates the fight or flight physiological response so that one can defend themselves if needed. This response is activated by stress hormones in the body, commonly known as cortisol. Continual exposure to cortisol in the brain during a traumatic event or trauma reminders, can result in abnormal cell growth in the amygdala, and neural damage in the hippocampus and prefrontal cortex (Lupien et al., 2018).

The stage of life an individual is in at the time they experience a traumatic event may influence which part of the brain is affected. This depends on which part of the brain is developing at that life stage. As such, trauma experienced in the prenatal stage can affect the hippocampus, prefrontal cortex, and amygdala; whereas trauma experienced in adolescence may affect the developing amygdala and frontal lobe as it is maturing (Lupien et al., 2018).

Although emotional trauma has shown negative effects in the brain, there is an "ideal" amount of trauma that stimulates resilience in the brain. Researchers found that people with some traumatic experiences fared better when faced with future stressors as compared to people who have experienced no trauma or chronic trauma in their lives (Tabibnia & Radecki, 2018). Similarly, Farber et al. (2019) found that adolescents raised by parents who often appropriately model their own emotions are more likely to exhibit amygdala hyperreactivity when faced with interpersonal conflict because they have been sheltered from it. Conversely, those adolescents whose families do not appropriately process emotions may be desensitized to interpersonal conflict, and therefore show lower amygdala reactivity in those situations.

## What is Trauma

Santarnecchi et al. (2019) state "It is estimated that, during lifetime, 60.7% of men and 51.2% of women experience at least one potentially traumatic event" (p.2). Emotional trauma can be described as a time in which a person was directly exposed to, or witness to a stressful event. A stressful event is something involving death, serious injury, or sexual violence; or the threat of death, serious injury, or sexual violence. Emotional trauma can also be a result of learning that a family member or close friend experienced a stressful event, or indirectly experiencing a stressful event (American Psychiatric Association, 2013). Stressful events range from near death experiences, to abuse, to natural disasters, and beyond. The defining factor of a traumatic event is not necessarily what the event was, but how the person involved felt about the event. A person's perception of a situation dictates how they will feel about and respond to that situation. If the perception is that they are in danger and unable to control the outcome, their brain will store this memory as a traumatic event and respond as such.

### Adverse childhood experiences.

Adverse childhood experiences **(**ACEs) are found to be extremely common among the general public, and the term has become synonymous with the definition of emotional trauma in the mental health field (Lanier, Maguire-Jack, Lombardi, Frey, & Rose, 2018). Sciaraffa, P.D. Zeanah, & C.H. Zeanah (2018) define ACEs as "a term used to describe types of abuse, neglect, and other traumatic childhood experiences that impact later health and well-being" (p.343). This term came about as a result of the first ACEs study which sought to correlate ACEs with medical and public health issues that are the leading causes of death in adults (Felitti et al., 1998).

The screener that was used in the original ACEs study is still used today. It includes 17 questions that fall under three different themes which are: childhood abuse, exposure to household dysfunction, and criminal behavior. Within those three themes are seven categories of childhood trauma. If a participant answers "yes" to any of the questions within those seven categories, they earn one point. The possible scores range from zero to seven. The higher the score, the more at risk the individual is to have a problematic health status (Felitti et al., 1998).

**Behavioral effects.**

Trauma experiences and reminders can cause prolonged stress. This stress influences how working memory functions because focus and concentration are diminished during that stress. In turn, that stress prevents quality thinking, problem solving, and decision making; which leads to indecisiveness and being unable to proceed with a decision at all (Eichinger, 2018). Furthermore, damage done to the prefrontal cortex as a result of trauma changes the efficacy of the working memory which is where memories are stored in some semblance of an order, where the individual can call upon them when needed. If the area of the brain that controls working memory is damaged, the individual will be more difficult to track in conversation during session when the counselor is attempting to gather information.

Nikulina & Spatz-Widom (2013) looked at executive functioning specifically and found that experiencing neglect in childhood related to a deficit in the ability to perform executive functioning tasks in adulthood. Executive function is responsible for planning, inhibition, organization, and monitoring of more complicated functions like working memory, cognitive flexibility, sustained attention, nonverbal problem solving, and relational reasoning.

The behavioral effects of trauma in children may appear more severe because they do not have the same ability as adults to regulate their emotions. Behavioral effects include aggression, anger, irritability, withdrawal, over or under reaction to external stimuli, difficulty with authority, new phobias, confusion, regression in learned skills, poor concentration, changes in sleep or feeding, self-harm, and acting out sexually (Sciaraffa et al., 2018).

## Promoting Neuroplasticity

As counselors, our job is to help our clients improve their functioning. We do this by using therapeutic techniques, varied interventions, micro skills, strict ethical guidelines, and evidence-based practices. Until recently, we thought the only way to improve functioning was to illicit behavior change. Now research is suggesting that functioning can also be improved when integral parts of the brain are rewired. We will discuss treatment modalities and interventions that can be used to promote neuroplasticity.

### Treatment modalities.

Psychotherapy is considered standard treatment for posttraumatic stress disorder (PTSD). Some of the most widely used approaches being eye movement desensitization and reprocessing (EMDR), trauma-focused cognitive behavioral therapy (TF-CBT), and mindfulness-based interventions. Multiple studies have used neuroimaging to show the impact TF-CBT and EMDR on the brain (Santarnecchi et al.2019). Neurobiological studies are also indicating that mindfulness training has a positive impact on the plasticity of the brain and how it functions (Guendelman, Medeiros, & Rampes, 2017).

### *Eye movement desensitization and reprocessing.*

EMDR works by having clients focus on a trauma memory for a short amount of time while the therapist initiates bilateral stimulation of the brain through eye movements (Santarnecchi et al., 2019). EMDR can be effective in just a few sessions, however, the more complex or repetitive the trauma, the more sessions of EMDR treatment an individual may need in order to see symptom elimination. Francine Shapiro developed the treatment after noticing how much better she felt following an emotional upset when she processed the emotions while on a walk where her eyes were moving back and forth (Shapiro & Brown, 2019). EMDR is now a recommended treatment for trauma (Jung, Chang, & Kim, 2016), following extensive research. It was widely stigmatized at first due to its unorthodox development by an independent scholar. Shapiro happened upon a technique that she had a hunch could work for others. It took resolve to continue to develop the method amid skepticism to create the effective treatment used today (Shapiro & Brown, 2019).

Boukezzi et al., (2017) conducted a study with participants who underwent EMDR to see if their gray matter density changed in correlation with PTSD symptom improvement. They found evidence that gray matter significantly increased in the areas of the prefrontal cortex that control the regulation of negative emotions and subsequent behaviors, suggesting possible reversibility of the stress induced effect trauma has on the brain. Santranecchi et al., 2019 found that EMDR and TF-CBT produced similar results at the clinical and neuroimaging level, although EMDR included half the number of treatment sessions to elicit the same result.

### *Trauma-focused cognitive behavioral therapy.*

TF-CBT is an evidence-based practice often used in the treatment of PTSD. The practice involves psychoeducation, helping identify trauma triggers, teaching coping skills, and creating a trauma narrative. When successfully combined, these stages result in helping clients to modify dysfunctional trauma-associated cognitions. By confronting trauma reminders, clients face trauma memories and triggers, which leads them to reprocess the unfavorable memories as normalized memories (Sarntarnecchi et al., 2019). Verbally recounting a past traumatic event actually works by rerouting the memory from living in the amygdala where it is connecting to fear circuits, to living in the declarative memory space of the brain where it can be intentionally accessed, thus more easily regulated when remembered (Tabibnia & Radecki, 2018).

Neuroimaging technology used in several different studies has uncovered that TF-CBT is able to correct or decrease problematic activity in the mid-prefrontal cortex, the amygdala, and the dorsolateral prefrontal cortex (Zantvoord et al., 2013). Cisler et al., (2016) looked at the functional connectivity in the amygdala of adolescent girls diagnosed with PTSD. They found that the girls with the most PTSD symptom reduction also had the most reduction in functional connectivity within the amygdala. They also found that girls with the least symptom reduction also had the least reduction in functional connectivity within the amygdala. This suggests that successful TF-CBT treatment may promote a reduction of hyperactivity within the amygdala; an area of the brain responsible for emotion.

### *Mindfulness-based interventions.*

Gotink, Meijboom, Vernooij, Smits, & Hunink, (2016) define mindfulness as “a mental state characterized by full attention to internal and external experiences as they occur in the

present moment" (p.32). Practice in mindfulness has shown to enhance the part of the brain responsible for executive functioning. It does so by lowering levels of inflammation that usually increase when a person experiences stress. When inflammation is low the brain can operate more efficiently, resulting in the improvement in areas of attention, planning, and decision-making (Nowack & Radecki, 2018).

Gotink et al., (2016) suggest that an eight-week mindfulness-based stress reduction training showed the same benefits in the brain as traditional long-term meditation styles. The study found that the same positive changes in the prefrontal cortex, the hippocampus, insula, and cingulate cortex appeared in neuroimaging after the eight-week training as happened when clients engaged in long-term meditation. These areas of the brain account for attention regulation, self-referential processing, and perspective taking.

**Conclusion**

There is research available to explain how the brain changes as a result of emotional trauma. We are just beginning to understand how those changes can be lessened or reversed. As clinicians, it is our responsibility to remain abreast of current research and treatment modalities to enhance treatment for all our clients. Neuroplasticity may be a new concept; however, we have been promoting it since counseling began. We have been promoting it through our use of micro skills, rapport building, skills training, caring confrontations, and repetitive practice. The use of these techniques is what sets us apart from a friend giving advice. To hear advice does not initiate a new neural pathway but reflecting effectively and allowing the client to solve their own dilemma can change the brain for the better.

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