Neurobiology of Trauma Reactions

Three of the most common symptoms of surviving a traumatic experience are constriction, hyperarousal and intrusion.

What is constriction?

Constriction, also referred to as “freeze mode”, occurs when an individual is unable to resist the trauma through either fight or flight. The individual therefore escapes the trauma by altering their state of consciousness and entering a state of surrender. Numbing allows for a state of calm where pain and terror are lessened. While the events register in ones awareness, they often become disconnected from time, reality and sensation. The individual may feel as though they are watching the event occur from outside their own body. While dissociation is adaptive at the time of the trauma, it prevents the integration needed for healing. It is important to understand that the fight-flight-freeze response happens automatically and is not a conscious choice by the individual.

What causes constriction?

Our limbic system, the center of survival functions, reacts to a threat by releasing hormones that prepare the body to defend itself. These actions take the form of flight, fight or freeze and are instinctive responses. Flight occurs when the limbic system perceives enough time, space and strength to flee (the body will break into a run). If there is not enough time or space to flee, but enough strength to fight, the body will defend itself. When there is not the option of fighting or fleeing, the body will freeze and create an out of body experience where time, pain and fear are distorted. These are normal adaptive responses that allow the body to protect the individual and facilitate survival.

What is hyperarousal?

Hyperarousal is explained as chronic arousal of the autonomic nervous system (ANS). Simply put, the ANS is responsible for the maintenance of normal bodily functions by ensuring that the body’s internal environment is in proper balance. Hyperarousal is best understood as a state of permanent alertness following a trauma. Oftentimes, the individual is easily startled, irritable and experiences poor sleep. One division of the ANS is the Sympathetic Nervous System (SNS), or the body’s emergency system, that prepares us for fight, flight or freezing when danger is detected. Chronic stimulation of the SNS, as seen with hyperarousal, causes constant physiological preparation for danger. Thus, the normal “baseline” level of alertness is altered so the individual is always alert for potential danger. As a result, both related and unrelated stimuli can provoke an extreme startle response. Increased arousal is also found during sleep and causes difficulty falling and staying asleep.

What causes hyperarousal?
In situations of non-traumatic danger, the body will release specific amounts of cortisol and other neurotransmitters (chemical messengers) to restore the body to its base state once the danger is over. Neurotransmitters allow cells to talk with each other and dictate to the body what needs to happen.

With post traumatic stress however, the system has gotten stuck. During the trauma, the brain is aroused and pours out neurotransmitters (chemicals that release signals) so the body can react appropriately and get to safety. Repeated trauma causes the brain to get stuck in an up-regulated state, meaning there are more receptors activated, and cells are therefore more sensitive to the neurotransmitters that are being released. As a result, the body produces a big fear response to the next trigger due to constant arousal. Furthermore, trauma affects cortisol levels and thus the ability to re-regulate.

What is intrusion?

After a traumatic event has passed, individuals often relive the experience as if it were presently occurring. The trauma interrupts the normal course of life and freezes time to the moment the trauma occurred. Intrusion is repetitive and is experienced with the same emotional intensity as the original trauma. Intrusion is oftentimes referred to as “re-experiencing”.

What causes intrusion?

Trauma memories are encoded in a different part of the brain and therefore are not processed like ordinary memories in a linear fashion. The hippocampus is responsible for long-term memory and thus provides context, time and space to an event. During trauma, the hippocampus is suppressed and causes trauma memories to lack autobiographical information. Instead, the events are encoded through sensations and images. This is why trauma memories are often visual/sensory experiences, fragmented, and occur as flashbacks and nightmares.

How can EMDR help?

Eye Movement Desensitization and Reprocessing (EMDR) is an evidence-based therapy that has been found effective for the treatment of trauma. EMDR has a direct effect on the way the brain processes information. As described above, trauma memories result in maladaptive encoding and are stored without linking to other experiences in a memory network which would offer more adaptive information. Unlike non-traumatic memories stored in the left-brain in a verbal and narrative fashion, trauma memories are encoded in the right subcortical regions of the brain associated with emotional states and autonomic arousal. EMDR allows for bi-lateral stimulation of the right and left-brain hemispheres in order to activate the trauma memory and restore it adaptively. With proper encoding of the memory, the brain and body will understand that the event occurred in the past and can then properly assess for current danger. EMDR addresses the past experience, current triggers and future potential challenges to reduce the experience of constriction, hyperarousal and intrusion.

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