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THE TRAUMATIZED BRAIN:
How Abuse Changes Children and How Music Can Help

The Central Nervous System

- The brain is a dynamic organism constantly reflecting and adjusting to the environment being experienced.
- *Plasticity:* Neurons are designed to respond, change, and re-organize in response to experiences. This allows neurons to "store" information. The more a group of neurons are activated, the stronger the information is internalized.

Neurodevelopment

- Development occurs in a predictable and hierarchical fashion. It begins in our more primitive structures (e.g. the brainstem) and ends with the more complex structures (e.g. the cortex).
- There are *Critical Periods* and *Sensitive Periods* during development, windows of time during which parts of the brain either require or are more sensitive to certain stimulation needed to develop appropriately.
- *Pruning:* Neurons and synapses not stimulated appropriately are eliminated. If stimulation is absent or abnormal, developmental opportunities may be lost.
- The most important developmental opportunities occur in the fetal and first 2 years of life.

Attachment

- A caregiver's nurturance provides a source of external regulation for an infant. With repetition, the infant's brain internalizes these feelings and behaviors and thus learns how to self-regulate.
- A secure attachment relationship provides the ability to: 1) learn empathy, trust, and emotional connectedness with others; 2) learn how to regulate emotions and stress; and 3) develop capacities for higher level cognitive processing.
- In a disorganized attachment behavior, the infant desperately seeks closeness, but in disorganized and distorted ways (e.g. yelling, hitting, throwing, self-harm, running, etc.). They feel extreme stress responses and learn they cannot rely on others.
- The structural and chemical processes that should support relief and connectedness instead handle stressful and erratic responses, which are internalized by 12 months. The infant becomes vulnerable without the experience and practice in coping with stress. This affects mental health and results in maladaptive behaviors (e.g. aggressions, disorganized self-soothing, hypervigilance, compromised learning, lack of variability responding to stress, poor ability to initiate in play, etc.)

The Classic Stress Response

- The stress response is a cascade of biological and chemical events that perceive and mobilize the body in response to internal or external threats.
- The stress response begins in primitive brain areas (e.g. the spinal cord), then travel up to more complex systems (e.g. the neocortex). Each level matches information to previously stored information. Lower-level systems may act upon the information if deemed threatening. More complex interpretations occur at each level.
- When experiencing stress outside one's window of tolerance, a person is in a state of *dysregulation*. When calm and relaxed, a person is *regulated.* When dysregulated, there is no higher level cortical involvement.
- The stress response is optimally *self-regulating*, moving a person from a state of dysregulation to one of regulation.
- With chronic stress, even the *thought* of the stressor can initiate the stress response. These are not verbal memories and the person may not even know why they feel inattentive or anxious.

About Trauma

- "Trauma is in the nervous system – not in the event!" (Levine 2007)
- There are different types of trauma (abuse, neglect, removal from caregivers, parental depression, et al.).
- Different types of traumatic events have different effects. Isolated events (e.g. a school shooting) may produce a conditioned behavioral response where chronic events have a more pervasive effect on neurodevelopment. A person's natural resilience (e.g. inherent intelligence, access to support networks, positive coping skills) will effect how the trauma impacts them.
- The classic stress response is not practical for infants and children. They tend to have a hyperarousal response (like a "fight or flight" response) or a dissociative response (like a "freeze" response). These two types of responses have different chemical events and manifest differently.

Trauma and Neurodevelopment

- Chronic traumatization has a profound effect on developing brain structures, systems, and neurobiology. For example the fear center, the amygdala, is enlarged, causing the person to live in a constant state of fear. The hippocampus is decreased, affecting learning and memory.

Clinical Implications

- Symptoms will include poor self-regulation (e.g. difficulty sleeping, frequent daydreaming, poor impulse control, running behaviors), social problems (e.g. poor peer relationships, difficulty empathizing, withdrawn, aggressive), learning and memory difficulties (e.g. poor attention span, hyper-vigilance, poor impulse control), and motor-vestibular challenges (e.g. difficulty writing, poor coordination).
- The therapist first needs to regulate the child. Cognition is not functioning when in a dysregulated state; therefore therapeutic work cannot occur until a person is

regulated. Useful techniques include: remain regulated and calm; focus on the relationship by providing nurturance; allow time for responses; validate the feelings; and provide a physical sense of safety and predictability.

- Part of the therapeutic process is to also for the person to be able to tolerate the body sensations and emotional states they feel. These will not go away, so the person needs to know how to handle (e.g. cope) with them.
- The ability to regulate emotions can be taught even though the fundamental patterns were learned in the first year.
- The victim had 1000s of times to learn and practice the maladaptive behaviors; they will need 1000s more to learn and practice the new ones.
- It is important to provide a safe, predictable environment through boundaries, rules, and predictable transitions and structures.
- Goals include: helping to overcome the habitual stress response; improve cortical functioning; promote the ability to be in charge of their bodies and themselves; and to express, process and understand their emotions.

Trauma and Music Therapy

- Researchers have behaviorally noticed music's effectiveness for years, but the question is unanswered as to *why* it is effective.
- Theory: There is a biological and evolutionary (e.g. adaptive) basis for music. We are hard-wired to produce and perceive music. Music may facilitate social bonding and may be involved in the initial infant-caregiver secure attachment relationship.
- Theory: Listening to music produces physiologic and emotional responses (e.g. changes in respiration, laughing, heart rate changes, etc.)
- Theory: Music coordinates and enhances motor movement, which can be used to entrain rhythmic rocking.
- Theory: Attention functions can be improved. Music affects arousal and attention even in infants.
- Theory: Creating music uses executive functioning skills.

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