From PTSD to dementia, can art therapy be useful for prevention and intervention?

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From PTSD to dementia, can art therapy be useful for prevention and intervention?

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Abstract

This review explores the possible link between post-traumatic stress disorder (PTSD) and the increased risk of developing dementia, particularly Alzheimer’s disease. Chronic stress and trauma alter the hypothalamic-pituitary-adrenal pathway resulting in increased exposure to glucocorticoids (GC). The hippocampus, a memory center of the brain, is highly vulnerable to the effect of the stress hormone GC because of the high density of GC receptors. Continuous exposure to stress causes reduced hippocampal volume resulting in memory problems, trouble in trauma processing and long term health consequences, possibly including Alzheimer’s disease. Trauma also results in reshaping the amygdala, the center of emotions, causing emotional outbursts among patients with PTSD. Service members and civilian adults with PTSD have higher risk of dementia at older age. Because trauma processing is often non-verbal, art therapy may be an effective treatment because it uses sensory information to transform images into trauma narrative. However, art therapy is more effective when combined with other psychotherapeutic modalities such as cognitive behavioral therapy. Hence, art therapy can be part of a treatment regimen that helps in the healing of trauma. That said, early treatment after exposure to trauma can prevent the long term consequences of stress on hippocampal reshaping, which may result in dementia. Evidence-based research for the effectiveness of art therapy in PTSD and the prevention of dementia is highly needed. This review provides a wide overview of the link between PTSD, dementia and the different treatment modalities that can be used for future research.
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Introduction

Convergent lines of evidence suggest that exposure to trauma and chronic stress have long term health consequences and increase the risk of dementia. Sleep disturbance, that is often seen in PTSD, is one of the factors that negatively affects recovery from PTSD and predisposes to dementia. Little is known as to whether psychotherapeutic intervention, including art therapy, during the early stages of PTSD would help in the prevention of dementia. This review provides a better understanding of the neuropathological consequences of PTSD that predispose to dementia as well as the different therapeutic modalities that can potentially be used for prevention.

PTSD is a mental health disorder with multiple comorbidities that affects service members exposed to war combat and has long term consequences. Patients suffering from PTSD have experienced or witnessed severe, often life-threatening, episodes of stress. PTSD’s hallmark symptoms are flashbacks, sleep problems and nightmares, emotional numbness or outbursts, anhedonia, exaggerated startle reflexes and problems with memory and concentration. These symptoms are associated with structural and functional changes in the brain (Bremner et al., 2008). The most important regions in the brain affected by chronic stress and PTSD are the hypothalamus, hippocampus, amygdala, nucleus accumbens, prefrontal and orbitofrontal cortex. These brain regions play a key role in modulating emotions and cognition, and are responsive to acute or chronic stress (Lucassen et al., 2014). Studies using animal models of stress have reported brain damage after prolonged periods of stress, mainly in the hippocampal area. The hippocampus is especially vulnerable to stress because it contains a large number of
glucocorticoid receptors; the continuous exposure to glucocorticoids has deleterious effect on memory and cognition (Swaab et al., 2005). Having said that, it’s not surprising that PTSD can be a risk factor for the development of Alzheimer’s disease or other forms of dementia, the neurodegenerative diseases that affect memory and cognition. Although there are many confounding factors in human studies, preclinical data in animal studies showed several plausible routes from stress to dementia. Indeed, PTSD has been shown to be associated with higher risk of dementia among war veterans (Qureshi et al., 2010). PTSD is also associated with an increased risk of dementia among civilian men and women. Older adults exposed to severe stress and PTSD have approximately 70% higher risk of dementia in men and 60% in women (Flatt et al., 2018).

There are many modalities of therapy that help in the healing process of such an intense stress as in PTSD. Healing is important because it can affect the brain structure and function as evidenced by neuroplasticity. Art therapy in trauma treatment can be very effective, however, further evidence-based research is needed. Mask making, an art therapy experiential, appears to help veterans suffering from PTSD by offering visual representations of the self-related to individual personhood, relationships, community, and society that can facilitate their recovery (Walker et al., 2017). Combat-related trauma-focused group therapy (TFGT) is another technique of therapy that combines aspects of prolonged exposure, cognitive processing therapy, and art therapy to reduce psychological suffering and enhance functioning (Levi et al., 2017).

The objective of this review is to explore the evidence-based research of the neuropathology of chronic stress, trauma and PTSD; and how trauma can be linked to the increased risk of dementia. This review will also display the different treatment modalities that
can facilitate the recovery from PTSD and, as a result, protect from development of stress-related dementia.

**Literature review**

**Neuropathology of stress**

Stress is perceived as an unpleasant, aversive or threatening experience. Stress can result from endogenous or environmental challenges that influence every aspect of individual’s body and brain. Stressors may be categorized depending on intensity, duration, novelty, and type. There is a great deal of variation in an individual’s response to a stressor that involves appraisal of danger, perceived predictability and controllability, and the potential development of psychopathology. Lucassen et al. (2014) reviewed the pathways and brain structures involved in stress response. The stress response is composed of two domains, a quick and a delayed one. The quick response involves the rapid activation of the autonomic nervous system (ANS) causing a release of epinephrine and norepinephrine from the adrenal medulla. The ANS activation is responsible for the “fight or flight” response where the basal metabolic rate is increased accompanied by an increase in blood pressure, heart rate and blood flow. This response is important for survival when the individual feels any threat or danger. The other component of the stress response is the hypothalamic–pituitary–adrenal (HPA) axis where activation is triggered by corticotropin-releasing hormone (CRH) in the paraventricular nucleus of the hypothalamus that induces adrenocorticotropic hormone (ACTH) release from the pituitary. ACTH in turn stimulates the release of glucocorticoid (GC) from the adrenal gland. GC enables individuals to engage in an adaptive response to a stressor. The brain, particularly the hippocampus, has a large
number of glucocorticoid receptors (GR) where GC bind to produce an effect. Short-term exposure to stress can be beneficial and adaptive, however, chronic stress can result in an alteration in the HPA axis leading to excessive brain exposure to GC (Lucassen et al., 2014).

Limbic (hippocampus, amygdala and prefrontal cortex) and hypothalamic brain structures play a key role in coordinating emotional, cognitive, neuroendocrine and autonomic inputs (Figures 1 and 2). These brain regions determine the magnitude and specificity of an individual’s behavioral, neural and hormonal responses to stress (Lucassen et al., 2014; Blausen, 2014; Cerqueira et al., 2008). The hippocampus plays an important role in declarative, spatial, and contextual memory and is vulnerable to chronic stress. Chronic stress and excessive GC exposure result in alteration of the number and morphology of synaptic structural elements leading to altered strength of excitatory synapses in the hippocampus (Liston et al., 2013). The damaging action of GC under the conditions of chronic stress has been termed “allostatic load”, referring to the cost to the body for adaptation to adverse conditions (McEwen, 2001).
Figure 1. Schematic representation of the cross-talk between the limbic system, the stress response and the immune system under normal conditions (left) and chronic stress conditions (right panel). Under normal conditions, the parasympathetic tone of the autonomic nervous system predominates and there is a balance between the ANS and HPA axis. Under chronic stress conditions, GC levels are increased and changes in the brain occur such as smaller hippocampus.
and enlarged amygdala. The dysfunctional HPA axis and activated sympathetic nervous system may induce immune dysregulation and contribute to behavioral dysfunction. The authors reproduced the figure from Cerqueira et al (2008) with permission (Lucassen et al, 2014).

**Figure 2.** Anatomical components of the limbic system (Blausen.com, 2014)

**Stress and PTSD**

**PTSD in adults.** The *Diagnostic and Statistical Manual of Mental Disorders* (*DSM-5*) revised the criteria of PTSD and included Trauma- and Stressor-Related Disorders. These conditions require exposure to a traumatic or stressful event (Criterion A) like being exposed to death or threatened death, actual or threatened serious injury, or actual or threatened sexual violence. The individual re-experiences the traumatic event (Criterion B) by having upsetting memories, nightmares, flashbacks, emotional distress or physical reactivity upon traumatic reminders. Additional required criteria for diagnosis are avoidance of trauma-related stimuli after
the trauma (Criterion C) and negative thoughts or feelings that begin or worsen after the trauma such as negative thoughts and affect, decreased interest in activities and feeling isolated (Criterion D). The symptoms should last for more than 1 month, create distress or functional impairment and are not due to medication, substance use, or other illness (American Psychiatric Association, 2013).

Not every traumatic experience results in PTSD. When stress is severe, it can result in PTSD in vulnerable individuals where the HPA axis displays low cortisol levels consistent with increased glucocorticoid sensitivity. Some studies reported that individuals vulnerable to the development of PTSD have smaller hippocampi prior to the stressful event (Gilbertson et al., 2002). Whether a smaller hippocampus represents a risk factor to develop PTSD or a result of the disorder is not yet established.

Animal models of PTSD showed that repeated psychosocial and restraint stress resulted in changes in volume of brain structures ranging from neuronal damage, glial cell loss, dendritic remodeling to reduced hippocampal dentate gyrus granule cell number. Consistent with data from animal studies, neuroimaging studies have found that individuals with PTSD have a smaller gray matter volume in the hippocampus, amygdala, and anterior cingulate gyrus; these are brain regions implicated in memory (Wang et al., 2010).

Veterans who were deployed to fight the war on global terrorism had higher risk of developing PTSD. Veterans were often exposed to tremendous amount of stress, trauma and traumatic brain injury (TBI) that resulted in altered or disrupted brain functioning caused by an external force. TBI results in memory loss, loss of consciousness, altered mental states, or neurological deficits (Bahraini et al., 2014; Wall, 2012). The major themes in the experience of
PTSD/TBI are trauma remembering, encountering death, hypervigilance in an unsafe world, dualistic psychological ideas and feeling alien to oneself and others, and feeling as if living in the dark (Kroch, 2009). Combat experiences and PTSD severity are the most salient risk factors for long term consequences and comorbid conditions, including injury/illness, somatic symptoms, and sleep problems. Separation from the military, sleeping less than 4 h per night, and lack of social support are also associated with persistence of PTSD (Armenta et al., 2018). These co-morbid conditions play a critical role in recovery and should, therefore, be addressed during a comprehensive and accessible treatment. PTSD is also a disorder frequently seen among victims of sexual, domestic and political violence as well as in refugee population fleeing war zones (Felitti et al., 1998; Malchiodi, 2008).

**PTSD in Children.** Children may also experience significant and prolonged psychological harm after stressful situations. Early childhood adversity such as physical and sexual abuse, emotional neglect, and parental loss predisposes individuals to a range of psychiatric disorders in adulthood, including PTSD. In the Adverse Childhood Experiences study, children exposed to repeated trauma experiences have increased likelihood of heart disease, cancer, lung disease, skeletal fractures, and liver disease in adult life (Felitti et al., 1998). Some studies in children replicated the findings seen in adults that smaller hippocampi are associated with PTSD thus providing evidence that stress may indeed damage the hippocampus (Carrion et al., 2007). Stressful experiences early in life and lack of maternal care, play an important role in determining patterns of lifelong reactivity of the systems that lead to atrophy of hippocampus and other brain structures (Felitti et al., 1998). Pediatric patients display a broader range of symptoms compared to adult counterparts. Symptoms in children may manifest as
repetitive play, avoidance of stimuli reminiscent of the trauma, temper tantrums, and difficulty sleeping (Langeland & Olff, 2008).

**Stress and Alzheimer’s disease**

Alzheimer’s disease (AD) is one form of dementia, a neurodegenerative disease that progresses with time until loss of all cognitive abilities. AD is characterized by the accumulation of amyloid β and neurofibrillary tangles in the brain (Johansson, 2014). Stress is involved in the pathology of AD where longstanding stressful life events can result in neural degeneration.

Psychological trauma and PTSD are psychosocial factors that affect the onset and course of AD states. Burnes & Burnette (2013) proposed two pathways that make a trauma lead to AD (Figure 3). The first pathway is that earlier life trauma is associated with later-life onset of AD. The second pathway is that trauma occurring during AD illness is associated with accelerated AD progression (Burnes & Burnette, 2013). Therefore, neuroanatomical changes in the brain found in AD could be partly precipitated by earlier-life PTSD.

*Figure 3. “Conceptual model relating psychological trauma, posttraumatic stress disorder (PTSD), and Alzheimer's disease (AD). Solid lines depict direct relationships between trauma and AD status. Dashed lines depict indirect, mediated relationships connecting trauma and AD status” (Burnes & Burnette, 2013).*
Many studies have reported that exposure to PTSD increases the risk of dementia among war veterans as well as traumatized civilian women and men (Qureshi et al., 2010; Flatt et al., 2018). Older adults exposed to severe stress and PTSD have approximately 70% higher risk of dementia in men and 60% in women (Flatt et al., 2018). Other studies reported that women are at higher risk of PTSD and clinical burnout syndrome (Norlund, 2010). Sex hormones seem to play a role as there are prominent sex differences in the activation of the HPA axis in response to stress (Wang et al., 2007).

Mechanistically, exposure to trauma and PTSD can drive AD pathogenesis by perturbing CRF signaling. Disrupted CRF homeostasis enhances chronic PTSD symptoms and increases the risk for AD-related dementia (Justice et al., 2015). Exposure to PTSD was shown to elevate cerebrospinal fluid amyloid β levels, which may also accelerate AD pathogenesis, leading to exacerbated amyloid plaque deposition. The increased amyloid β in response to trauma might also exacerbate chronic changes in behavior and GC regulation, resulting in a higher incidence of PTSD and accelerated loss of cognitive function. The stress-induced overproduction of amyloid β and subsequent stress exacerbation of later AD pathogenesis result in a vicious cycle that drives neuropathological progression of AD in the context of PTSD (Justice et al., 2015).

Studies have also shown that a considerable number of patients with AD have high levels of GC, which is correlated with cognitive impairment and neuronal remodeling. GC levels induce hippocampal damage and also potentiate amyloid β toxicity. Indeed, the brains of Holocaust survivors showed signs of atrophy as a result of elevated GC and severe traumatic stress (Sapolsky, 1992). Sperling et al. (2011) conducted a study on a sample of Holocaust survivors and found that dementia was diagnosed in 14% of participants; included among these
cases were vascular dementia (66%), Alzheimer’s dementia (23%) and other subtypes (11%) (Sperling et al., 2011).

Combat exposure during war has been shown to have deleterious effects on memory and cognitive processes (Nevarez et al., 2017). PTSD may cause deleterious effects on cognition by increasing the susceptibility to oxidative stress, such as increasing inflammation, increasing levels of C-reactive protein, and altering of homocysteine levels (Yaffe et al., 2010). GC exposure caused by chronic stress may have a cumulative effect on the onset and progression of AD pathology (Jeong et al., 2006).

**Stress, sleep and dementia**

Sleep disturbance is one of the main characteristics of PTSD. Trauma-related sleep disorders such as difficulty falling asleep, engaging in atypical sleep disruptive behavior, frequent awakenings, and nightmares, are frequent symptoms displayed by trauma survivors. Patients with PTSD are often afraid to sleep because of nightmares and distressing dreams produced by the high density of rapid eye movement (REM) sleep (Miller et al., 2017). Sleep loss immediately following a traumatic experience is being recognized as a contributor to the development and maintenance of PTSD (Spoomaker & Montgomery, 2008). About 70% of individuals diagnosed with PTSD report insomnia, which may be an antecedent rather than a consequence of PTSD (Ohayon & Shapiro, 2000). Soldiers suffering from insomnia predeployment have significantly greater risk of developing PTSD following deployment (Koffiel et al., 2013).
There are many speculations about the causes of immediate sleep loss following a trauma. One of the postulated theories is that transient sleep disturbances may be adaptive for survival because of the increased vulnerability to threat while the individual is asleep (Lima et al., 2005). In addition, the nightmares experienced after trauma exposure may be an attempt to assimilate the traumatic event into an individual’s experiences. However, when nightmares are chronically experienced the trauma processing becomes maladaptive (Hartmann, 1996). The enhanced neurobiological arousal causing sleep disruption such as decreased parasympathetic activity and reduced slow wave sleep, may impede the adaptive processing of emotional memories following trauma. Fear of sleep can, therefore, become a conditioned response that may contribute to longer sleep latency (Simor et al., 2012; Tanev et al., 2017).

Sleep disturbances among trauma survivors have significant negative effects on several domains of functioning, and may even provide a mechanism through which PTSD increases the risk for dementia (Miller et al., 2017). While there are no clear recommendations from the American Psychological Association and the Veterans Affairs/Department of Defense regarding pharmacological or psychotherapeutic treatment targeting nightmares, different therapeutic interventions have been adopted. Cognitive behavioral therapy (CBT) in the form of imagery rehearsal therapy following trauma has been the most widely studied treatment protocol for trauma-related nightmares. Because of the mixed results, however, imagery rehearsal therapy is still not currently considered an evidence-based treatment for PTSD-related traumatic nightmares. Another treatment protocol is exposure, relaxation, and rescripting therapy that shows some efficacy but it is also not considered an evidence-based treatment (APA, 2017; VA/DOD, 2017). Studies showed that combining components of CBT for insomnia and imagery
rehearsal therapy among survivors of violent crimes showed clinically significant improvement in sleep quality, nightmare frequency, and daytime PTSD symptoms (Germain et al., 2007; Germain et al., 2012). Pharmacologic treatment has been also tested but there are still no recommended pharmacotherapeutic options for trauma-related nightmares. Interventions that target sleep disturbances in PTSD are greatly needed and may have a great beneficial effect to reduce trauma-related symptoms and protect from long-term consequences on cognitive function.

**Psychological and art therapy interventions for PTSD**

In addition to the importance of sleep in recovery from PTSD and preventing the progression of PTSD to AD and dementia, identifying adaptive ways to cope with extreme stress is essential for promoting long-term health. The potential impact of stress and PTSD on the development of dementia may be influenced by different factors such as the individual, the stressor, and the stress response. People vary widely in their response to stress and ability to cope with stressful events. This is a quality referred to as resilience, which is influenced by cognitive endowment, developmental stage, substance use, mental and physical health, and access to social support as well as a host of putative genetic and physiological markers and cortisol secretion (Greenberg et al., 2014).

Neuroplasticity is a relatively new concept attracting lots of attention in the domain of neurodegenerative diseases. A novel form of neuroplasticity is called neurogenesis, which is the production of new neurons, phenomenon that may persist into adulthood. The hippocampus is one of only two neurogenic regions in that adult brain and dynamic changes in volume can occur in response to learning. Many factors influence neurogenesis in the hippocampus; exercise and
the use of antidepressants stimulate neurogenesis whereas stress and inflammation inhibit neurogenesis (Lucassen et al., 2010). Most of the cellular responses to stress can be normalized following appropriate recovery periods. Hence, psychotherapy and other forms of therapy such as expressive therapies may modulate the stress responses and protect the hippocampus by enhancing neurogenesis. In addition, early diagnosis and treatment may ameliorate the lasting emotional, mental, social, and educational consequences associated with PTSD (Makley & Falcone, 2010).

**DAT and neuroplasticity.** Del Giacco Neuro Art Therapy (DAT) works on the neuroplasticity potential of the brain and is designed to have direct effects on the primary brain regions that deal with emotion and cognition. Both the amygdala and the hippocampus are dependent on sensory processing and decoding information. The DAT method works on both brain regions because they are affected by stress and memory loss. DAT is an arts-based method of psychotherapy used for emotional and cognitive treatment in PTSD. DAT works by rebuilding brain pathways, relieving stress and providing cognitive rehabilitation. The regeneration and rehabilitation of hippocampal neurons by using sensory stimuli via color, visual, motor, spatial exercises and abstract designs for complex mental processing may help the brain generate new pathways that could contribute to the overall recovery process. The benefit of DAT is achieved with the repeated use of these sensorimotor and abstract stimuli (Del Giacco, 2010).

**Cognitive behavioral therapy.** CBT is an evidence-based treatment modality that is effective in both group and individual settings after exposure to different types of trauma. CBT has been shown to be consistently effective and superior to other interventions in both adults and children (Smith et al., 2007). CBT includes exposure techniques, stress management and
relaxation techniques, in addition to cognitive exploration with the goal of reframing debilitating reactions to traumatic experience. The goal of CBT is cognitive reframing, anxiety management and learning coping strategies. CBT helps decrease shame, improve trust and emotional strength, and decreases overall psychological harm after trauma in children as young as 2 years of age (Wethington et al., 2008).

**Play and art therapy.** Play therapy is another treatment modality used in children that links abstract thoughts and feelings to nonthreatening concrete play experiences. Art therapy is similarly used in traumatized children to allow processing and expressing stored images related to recent traumatic experiences. Healing through art is important for nonverbal communication, exploration of feelings, self-discovery, and catharsis. Art therapy process facilitates posttraumatic growth by helping children improve self-worth and increase resilience; children can explore memories and emotions subtly and symbolically in a safe space (Malchiodi, 2008; Malchiodi, 2011). However, there is no sufficient evidence to recommend the routine use of play and art therapies to treat pediatric PTSD (Task Force on Community Preventive Services, 2008).

**Art therapy combined with CBT.** Pifalo (2007) reported that the combination of both art therapy and CBT provided significant subjective improvement in symptoms and allowed sexually abused children with PTSD to communicate without relying strictly on words, in addition to setting clear goals for therapy as part of the CBT approach (Pifalo, 2007). Schouten et al. (2015) did a systematic review to identify and evaluate empirical evidence of the effectiveness of art therapy for trauma treatment. The authors found six controlled, comparative studies on art therapy in traumatized adult patients where half the studies reported a significant decrease in psychological trauma symptoms in the treatment groups. However, the significant
decrease in trauma symptom severity was found only in art therapy intervention combined with psychotherapy (Schouten et al, 2015). Art therapy combined with cognitive processing therapy also improved trauma processing among veterans suffering from PTSD and provided healthy distancing, enhanced trauma recall and increased access to emotions (Campbell et al., 2017). Campbell et al. (2017) reported that art therapy interventions helped with creating insight, safety, containment, nonverbal symbolic access to emotions, and visual trauma processing; the need for containment was seen in the artwork through the use of circles to provide compartmentalization for overwhelming feelings (Figure 4).

Figure 4. A method of containment: Encircling traumatic events and emotions

(Campbell et al, 2016)
**Art Therapy with combat veterans.** Service members suffering from PTSD and/or TBI experience range of physical and psychological symptoms that require a holistic therapeutic approach. A number of evidence-based treatment options for PTSD and TBI with service members and veterans have been used such as CBT, psychological debriefing and pharmacotherapy. Art therapy has been used with service members exposed to trauma and has been increasingly accepted as a form of complementary therapy (Nanda et al., 2010). The importance of art therapy use for traumatized service members stems from the findings that impairment in verbal memory may be more severe in PTSD caused by combat compared with other sources of trauma and that some traumatic memories are stored nonverbally; the trauma memory may be retrieved through recollections of sensory, affective, visual, olfactory, auditory, and kinesthetic elements (Johnsen & Asbjørnsen, 2008; Langer, 2011; Gantt & Tinnin, 2009). Indeed, art therapy helped clients recovering previously blocked memories and gaining insights and realizations crucial to their healing processes (Campbell et al., 2017).

Mask making is a commonly used method in art therapy and has historical significance that represent political issues, spirituality, fear, power and control. Mask making in art therapy clinical practice is used in different populations affected by trauma that allow psychological distancing for expression and externalization. Indeed, mask making has been recently used with PTSD-exposed service members. The creation and transformation of symbols of the military experience help achieve self-integration and mastery of trauma where image-making in art therapy helps pave the way for the integration of memories and development of a coherent narrative (Figures 5-7) (Malchiodi, 2012; Golub, 1985; Pachalska et al., 2013; Walker et al., 2017; Chandler, 2016).
Figure 5. Some of the themes include pain, both physical and emotional, as well as community, cultural metaphors, a conflicted sense of self and death. (Chandler, 2016).

Figure 6. Client’s work on mask at Walter Reed (Chandler, 2016).
Figure 7. “The masks above represent some of the service members’ frustrations and existential reflections with military experiences: (1 and 2) these represent sadness (tears) and the conflict between the suffering experienced and the desire to perform their patriotic duties as represented by shredded and colorless flags; (3) represents an exterior of honor and passion when serving in the military (i.e., a glittering US flag and Bronze Star Medal he earned for heroic actions in combat). The mask opens up to reveal a bloody skull which symbolizes war and the underlying injuries and exposure to death/evil” (Walker et al, 2017).

Walker et al. (2017) reported that the mask making visual representations followed a pattern of representations of the self as an individual, in relationships, in communities, as well as self-representing societal and philosophical value systems, and self in/over time (Figure 8). The masks representations reflected emotional struggles around managing overwhelming emotions of anger and sadness by frequently using darker shades of colors as well as explosive emotions in the form of fire, lightning, or explosions. The masks also reflected feelings of pride and patriotism as well as being broken and fragmented (Walker et al, 2017).
Figure 8. Framework of representations of self as seen in mask imagery (Walker et al, 2017).

The benefit of art therapy is manifested by uncovering unconscious material through art-making; this process helps in cognitively and verbally decoding the traumatic experience, which ultimately results in reducing some of the symptoms associated with psychological injury and improving insight and tolerance of trauma-related emotions (Lobban, 2014). Hence, art therapy interventions have been shown to offer a great expressive relief and important psychosocial support by providing a safe way to approach traumatic memories through the use of symbols. The art therapy process facilitates consolidation of experiences by converting the artistic expression, representative of emotions and reactions to trauma, into linguistic communication (Gantt & Tinnin, 2007). The complete processing and storage of traumatic experiences in long-term memory involve bilateral stimulation and integration between the left and right hemispheres of the brain as well as engaging the integrating and planning functions of the prefrontal cortex.
into sequence narratives using left brain functions (Talwar, 2007). Furthermore, art therapy helps the trauma survivors describe psychological states and behaviors before and after the traumatic event and creating a visual trauma narrative that facilitate new insights of the “self”, “others” and the “world” (Gantt & Tinnin, 2007).

**Art therapy and refugees.** Art therapy can also be very effective with vulnerable populations like refugees who have experienced severe trauma of war and relocation due to its ability to circumvent language barriers and focus on positivity and growth (Malchiodi, 2008). The refugee population is especially vulnerable because of the uniqueness of their experiences such as stressors at home country and post-migration difficulties. Refugee children and adolescents are highly vulnerable and have high prevalence of mental health issues such as depression, anxiety, hyperactivity, PTSD and difficulties in peer relationships (Hodes, 2000). Upon arrival to the hosting country, refugees’ mental health needs are often met with logistical, cultural, and language barriers where art therapy may ease this difficult transition (Crosby, 2013; Malchiodi, 2008).

Kalmanowitz and Ho (2017) conducted a study about trauma among refugees and victims of political violence. The Inhabited Studio is a project that combined art therapy and mindfulness for survivors of political violence, focusing on the worldview of refugees exposed to trauma. The study appealed to participants because it emphasized each individual’s worldview, culture, religion, and coping style. Art, mindfulness and recorded instances in which art making or mindfulness contributed to calming, emotional regulation, catharsis, gaining emotional distance, and clarity of thought were the main goals of this treatment modality. The responses to this treatment modality were organized into 7 thematic clusters. Five themes were categorized into 2
broad categories composed of personal elements (memory, identity) and mediating aspects (emotional/self-regulation, communication, and imagination). Two themes were categorized into resilience and worldview (Figures 9-11). Participants found the Inhabited Studio culturally compatible; some of the skills they learned were helpful in times of stress (Kalmanowitz & Ho, 2017).

The combination of therapy (art therapy and mindfulness) can contribute to building resilience. Individuals frequently attempt to banish trauma memories when they surface, to cope. This conflict can lead to rigidity of thought and action. Common to all survivors is the struggle between remembering and forgetting. In addition, symptoms are not only psychological, but frequently somatic. Therapists using this method emphasized creating a sense of psychological safety, regulating emotions, working on coping, and enhancing resilience. In summary, Art therapy combined with mindfulness provided a process oriented approach and helped clients engage in the present and express themselves as whole individuals (Kalmanowitz & Ho, 2017).
Figure 9. “This is me ... I am sitting on the chair ... in my head there are a lot of problems, my stomach is burning with pain ... and the colors around me are pain.” (Kalmanowitz & Ho, 2017).

Figure 10. “Just imagining was really very good... what I can get out of this, and then you start shaping. Suddenly I saw something I did not know. Out of the scribble. Just imagining starts forming something that looks like something.” (Kalmanowitz & Ho, 2017).
Figure 11. “Worldview The theme of worldview refers to the way in which culture, religion, politics, family, community, and personality affected participants’ perceptions and coping methods.” (Kalmanowitz & Ho, 2017).

**Discussion**

There are many links among chronic stress, trauma, sleep disturbances and dementia. PTSD is a disorder that results from combat experiences among veterans as well as among victims of sexual, domestic and political violence (Armental et al., 2018; Felitti et al., 1998; Malchiodi, 2008). This review emphasized the neuropathological consequences of PTSD that predispose to dementia, which is exacerbated by sleep disturbances. Sleep disturbances in PTSD negatively affect several domains of functioning, and may even provide a mechanism through which PTSD increases the risk for dementia (Miller et al., 2017). The most important regions in
the brain affected by chronic stress and PTSD are the hypothalamus and limbic system where the hippocampus is especially vulnerable to stress because it contains a large number of glucocorticoid receptors causing a deleterious effect on memory and cognition (Lucassen et al., 2014; Swaab et al., 2005). Studies showed that the neuroanatomical changes in the brain found in AD could be partly precipitated by earlier-life PTSD that results from perturbed CRF signaling, and hence, potentiating amyloid β toxicity (Burnes & Burnette, 2013). Chronic stress and trauma alter the HPA axis and reduce the volume of the hippocampus leading to an inability to process the trauma memory. Trauma also results in hyperarousal and emotional reactivity as a result of increased volume of the amygdala. All these changes may predispose the individual to Alzheimer’s disease or other forms of dementia. The co-morbid conditions observed in PTSD patients, including sleep disturbances, play a critical role in recovery and should, therefore, be addressed during a comprehensive and accessible treatment.

Early intervention after trauma exposure is important to prevent the negative consequences of chronic stress on the limbic system of the brain as well as sleep homeostasis. Psychotherapeutic interventions during the early stages of PTSD may modulate the stress responses and protect the hippocampus by preventing degeneration and enhancing neurogenesis. Therefore, identifying adaptive ways to cope with extreme stress and target sleep disturbances is essential for promoting long-term health and ameliorating the lasting emotional, mental, social, and educational burden in PTSD. This review discussed the different treatment modalities used in PTSD, however, the emphasis was on the usefulness of art therapy alone or combined with other psychotherapeutic interventions. Using the arts, as in DAT and art therapy, works by rebuilding brain pathways, relieving stress and providing cognitive rehabilitation. CBT, on the
other hand, is mainly a verbal therapy that includes exposure techniques, stress management, relaxation techniques and cognitive exploration with the goal of reframing debilitating reactions to the traumatic experience and improving sleep (Wethington et al., 2008). The impairment in verbal memory in severe PTSD caused by war combat and the nonverbal storage of traumatic memories are factors that prompt the use of art therapy where trauma memory may be retrieved through recollections of sensory, affective, visual, olfactory, auditory, and kinesthetic elements (Johnsen & Asbjørnsen, 2008; Langer, 2011; Gantt & Tinnin, 2009). However, the effectiveness of art therapy alone has not been confirmed by evidence-based research. Only few studies showed some evidence that art therapy improves the post-traumatic symptoms among veterans (Schouten et al., 2015; Walker et al., 2017). On the other hand, combination of art therapy with other forms of psychotherapy such as CBT and mindfulness have more evidence-base research on its effectiveness in combat-related trauma (Levi et al., 2017, Kalmanowitz & Ho, 2017).

Hence, treatment of PTSD should be holistic, i.e. targeting the verbal and nonverbal memories, the individual, relationships, community and social aspects of the disorder.

In conclusion, future research is needed to prove the effectiveness of art therapy as an intervention in PTSD as well as in the prevention of the long term consequences of stress on brain modulation that predisposes to dementia. Research is also needed to determine which aspect of art therapy is most effective in the treatment PTSD, and which population would benefit the most. Conducting animal studies to explore neurogenesis in response to art therapy may seem not feasible. Nevertheless, advances in neuroimaging techniques, such as regular or functional magnetic resonance imaging, can be great tools to understand the structural and functional changes in the brain in response to art therapy in human participants. Another
important factor to consider for future studies about the healing process of PTSD is timing of art therapy sessions. Although it is beyond the scope of this review, circadian rhythm, which is the biological clock of the brain and body, affect the timing of GC release; GC is involved in learning and memory. Specific timing of art therapy sessions during the day may affect the healing process and ameliorate long term consequences of PTSD.


THESIS APPROVAL FORM

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Type of Project: Thesis

Title: From PTSD to dementia, can art therapy be useful for prevention and intervention?

Date of Graduation: May 19, 2018

In the judgment of the following signatory this thesis meets the academic standards that have been established for the above degree.

Thesis Advisor: Raquel Stephenson