THE BRIDGE BACK PROJECT: RESEARCH PROPOSAL (DRAFT)

TITLE
Counterstrain Manual Therapy and its impact on Post Traumatic Stress Disorder (PTSD) in First Responders and Veterans.

BACKGROUND
First responders and veterans often experience trauma while serving. Over 250,000 Vietnam theater veterans have Post Traumatic Stress Disorder (PTSD), 40 or more years after the war[1]. An estimated 10% of first responders world-wide experience PTSD[2]. They can experience recurring memories, insomnia, nightmares, apathy, emotional lability, physical pain, constant vigilance, and an inability to effectively and calmly deal with stress [3][4][5][6]. These symptoms can interfere with their activities of daily living (ADL's) and can surface months or even years after the traumatic event occurred.

People who have served and protected us frequently use coping mechanisms such as drug and alcohol abuse to help them cope[7]. They often pull away from others and isolate themselves. Unfortunately, the suicide rate in this population is high: In 2014, an average of 20 Veterans died by suicide each day, and 6 of the 20 were recent users of VHA services in 2013 or 2014[8].

Counterstrain Manual Therapy (CMT) has offered a substantive solution to this problem. CMT is an advanced manual therapy technique designed to relax the tension in the connective tissue surrounding every tissue in our bodies. To date, clinical data has demonstrated significant changes in the population we wish to study: CMT has measurably relieved the symptoms of PTSD. This study will attempt to validate the theories behind why CMT is so effective.

With CMT, we are able to effectively re-set the protective reflex spasms that occur in all fascial systems of the body: vascular, visceral, neural, musculoskeletal, thereby normalizing function. Fascia reflexively contracts around offended structures (e.g. epineurium, adventitia, dura, etc) and "re-routes" control of nearby muscles through the spinal cord, in essence splinting the offended tissue in response to mechanical, chemical or temperature dangers[9]. When reflexive guarding sets in, dysfunction occurs. This dysfunction can cause the structure that is being protected to become aberrant in its behavior.

Following CMT in patients with a diagnosis of PTSD, it has been clinically observed that these patients have improved mental function, emotional regulation, as well as diminished pain (migraines, headaches, peripheral pain) and more.

The observed changes in mental and emotional states include improvements in sleep, mood, and personal relationships. Patients with PTSD often attribute these changes to a feeling of "release" in the constant reminders of trauma. Patients have also reported, during and after treatments, that they experience flashbacks and even repressed memories, and once experienced, do not seem as "heavy" and constant in their day-to-day lives.

Of all the known tissue receptors found in muscle and connective tissue, only Type III and IV neurons are known to connect to the autonomic nervous system and have been shown experimentally to change heart rate, blood pressure and respiration[10] [11]. This explains the autonomic arousal associated with chronic somatic dysfunction and the observed viscerosomatic effects of CMT. These neurons connect in the spinal cord to motor neurons in

the ventral horn, and to preganglionic neurons of the autonomic nervous system, thus can trigger nocifensive and nociautonomic reflexes [8,12]. These primitive reflexes play a central role in PTSD, and are one of the main ways that CMT directly stops the reflex cycle of PTSD within the autonomic nervous system.

When a manual CMT release is performed, the involved fascial tissues which include the embedded Type III and IV neurons are slacked. Thoeretically, this “decompression” of the free nerve endings mechanically deactivates the local noci/mechanoreceptors, silencing the associated nociautonomic and nocifensive reflexes, thus calming a hyperactive response in the offended nerve. CMT also has an immediate impact on local inflammatory metabolites. As the involved tissues are decompressed, local venous and lymphatic vessels open and drain inflammation from the region. This eliminates the chemical irritation of the local type III and IV neurons which also silence the nociautonomic and nocifensive reflexes. This can occur in muscular, vascular, neural and visceral structures since they all have their own lymphatic / venous drainage systems (e.g. vasa vasorum, vasa nervorum). Normalization of nerve conductivity is theoretically restored following theses releases. In clinic, we see that patients with PTSD, the autonomic nerve normalization is associated with a significant relief in social, emotional and mental function.

PTSD may be understood as a deficit in autonomic adaptation that is often expressed as an incongruity between physiological state and environmental demands. Fore example, Heart rate variability (HRV) is a measure of the autonomic nervous system functioning and reflects an individual's ability to adaptively cope with stress. Patients with PTSD have decreased high-frequency heart rate variability, likely indicative of an autonomic state that would support the mobilization necessary for fight or flight behaviors and resulting in lower vagal tone to the heart, perhaps due to the perception of a threat condition manifesting as a combination of increased sympathetic drive and/or parasympathetic withdrawal[13]. Polyvagal theory argues that risk evaluation is not within our volitional control, but is instead a system of autonomic controls described as neuroception, which is defined as humans’ ability to engage in social interactions, or withdrawal from them, based upon the ability to assess threat properly[14]. Neuroception, although functioning outside of human awareness, may manifest reactions that are felt consciously, since they shift the autonomic state and create symptoms such as palpitations, elevation in heart rate, vasovagal syncope, and other psychophysiological measures. PTSD is linked with hyperactivity of the sympathetic branch of the autonomic nervous system, which causes the aforementioned symptoms[15]. Polyvagal theory provides a viable explanation for the reported covariation between atypical autonomic regulation (eg, reduced vagal and increased sympathetic influences to the heart) and psychiatric and behavioral disorders that involve difficulties in regulating appropriate social, emotional, and communication behaviors, as seen in those with PTSD[16].

With CMT, clinical data has shown that we are able to effectively dampen the hyperactivity of the sympathetic nervous system by slackening the tension in the perineureum of the affected nerves, and also stimulate the vagus nerve by improving blood flow to it through slackening the tension in the tunica adventitia of the posterior inferior cerebellar artery. Many other structures need to be cleared of dysfunction in order to normalize function in a subject with PTSD. We plan to demonstrate that cerebral blood flow irregularities can be restored with CMT to the structures affecting the amygdala, hippocampus and cortical regions, e.g., cerebral and cerebellar arteries, ventricles, brain sinuses, vertebral vein, cranial bones and other associated musculoskeletal structures.

Single photon emission computed tomography (SPECT) scans have shown irregularities in subjects with PTSD. SPECT is a functional neuroimaging technique that uses γ emitters to measure regional cerebral blood flow (rCBF) changes in the brain. Anterior cingulate, cerebellar, limbic and extrastriate rCBF was positively correlated with PTSD. PTSD was negatively correlated with rCBF in the superior frontal gyrus, parietal and temporal regions[17,18]. The main output center for the response to fearful stimuli is the central nucleus of the amygdala, which mediates responses (autonomic, behavioral, and endocrine) related to fear[19]. The dysregulation of the fear responsee in those with PTSD worsens subjective experiences by causing a disparate reaction to possible fear stimuli in the environment.

Other imaging has been used to study rCBF in subjects with PTSD. In one study, positron emission tomography (PET) of subjects with PTSD showed that symptom severity was positively related to rCBF in the right amygdala and negatively related to rCBF in medial frontal gyrus[20]. MRI studies in Vietnam veterans with PTSD have also shown a decrease in hippocampal volume[21]. The hippocampus is implicated in the control of stress responses, declarative memory, and contextual aspects of fear conditioning.

Clinician Administered PTSD Scale for DSM-5 past month version (CAPS-5) is the gold standard psychometrically sound measure of DSM-5 PTSD diagnosis and symptom severity[22]. Another way of assessing how subjects improve is to administer psychiatric outcome measures, which may include the following:

- BDI- Beck Depression Inventory for depression symptomology. The most trusted, tested, and reliable measure for depression
- PHQ-9 - Measure of depressive symptom severity.
- GAD-7 - Generalized Anxiety Disorder - measure for anxiety.
- PODS - Prescription Opioid Difficulty Scale. If there are patients on opiates, this measures the side effects of opiate medication.
- SWLS - Satisfaction With Life Scale.
- BPI - Brief Pain inventory - assesses how much pain is interfering with life tasks.
- PSEQ - Pain Self-Efficacy Questionnaire - assesses confidence in ability to do tasks and activities despite pain.
- PGIC - Patient Global Impression of Change assesses whether there was a perceived improvement with the treatment.
- Patient Health Questionnaire-15. The PHQ-15 assesses somatic symptom severity.

OBJECTIVE

To determine if CMT manual therapy has a positive impact on the quality of life, ADL's and regional cerebral blood flow in veterans and first responders with PTSD.

HYPOTHESIS

Based on our clinical data, patient reports, and previously demonstrated changes made with CMT, we project a statistically significant improvement in CAPS-5 scores, psychiatric outcome measures and brain imaging assessment of rCBF post-CMT therapy.

METHODS

Screening procedure

Subjects' trauma history will be assessed using the Life Events Checklist for DSM-5 (LEC-5), a 17-item self-report questionnaire developed to screen for lifetime trauma experiences[23]. The LEC-5 will be a self-administered checklist to identify the nature and extent of trauma experiences.

To determine the focus of the CAPS-5 interview, subjects must identify an index trauma, being a single or group of closely related events which will be the traumatic event (PTSD criterion A).

Each subject will complete a CAPS-5 interview and psychiatric outcome measures before as well as at 1, 3 and 6 months following CMT treatment to track the subjective improvements made post CMT therapy. Our first phase goal is to track the progress and improvement of patients using these tools.

In our second phase, should we have positive outcomes in phase one, will be to include functional neuroimaging to determine before and after improvements. Subjects will have functional neuroimaging before and at 3 and 6 month intervals following treatment with CMT. We have yet to determine if we will be using PET, SPECT or fMRI.

CMT treatment will include treatments to calm the sympathetic nervous system, optimize adrenal gland function, centrally stimulate the vagus nerve and treat targeted brain structures. The brain structures will have treatments to address dysfunction in the arterial supply, the sinus/venous drainage, neural structure (including dura, rami communicantes, pre and post ganglionic nerves) and musculoskeletal impact (including torsions in cranial bones, and structural/ligamentous dysfunction related to dural connections of C1, C2, T1 and T2, as well as peripheral impacts). We are theorizing that by deactivating the proprioceptive impact and metabolite drainage in tissues in the affected structures with CMT, we are effectively changing the dynamics of blood flow and function in the brain itself, which can potentially impact all other systems of the body.

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