Trauma Releasing Exercises – A Potential Treatment for Co-Occurring Post-Traumatic Stress Disorder and Non-Specific Chronic Low-Back Pain: A Systematic Review

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Abstract

**Objective:** This systematic literature review presents the relevant research supporting the potential use of Trauma Releasing Exercises (TRE), a somatic modality for releasing chronic muscle tension, to treat adults with co-occurring post-traumatic stress disorder (PTSD) and non-specific chronic low-back pain (nsCLBP). Both conditions share symptoms of hyperarousal and chronic muscle tension, which may be reduced by the use of TRE.

**Data Sources:** Electronic databases: Cochrane Library; EBSCOHost; GoogleScholar; MaryAnn Liebert, Publishers – Alternative and Complementary Therapies; MaryAnn Liebert, Publishers – Ecopsychology; MaryAnn Liebert, Publishers – Journal of Alternative and Complementary Medicine: Research on Paradigm, Practice, and Policy; ProQuest; Pubmed; Sage Journals Online; Sage Research Methods and Cases; Science Direct Health Sciences Journal Collection; Science Direct Life Sciences Journal Collection. Additional sources found by reviewing reference lists and on the TRE website (www.traumaprevention.com).

**Study Selection:** Two separate analyses were conducted. Studies for the first analysis were selected for their relevance to PTSD or nsCLBP and connections to muscle tension (n = 8). A second analysis on TRE and related interventions (n = 8) was also conducted. An additional informal survey was conducted of known studies on the use of TRE that are currently underway but not published (n = 19).

**Data Extraction:** Two separate data extraction sheets were used, one for muscle tension related articles, and one for TRE and related intervention articles.

**Data Synthesis:** A narrative synthesis for muscle tension showed connections between negative emotions and increased muscle tension, particularly in low-back and hip flexor muscles. A direct link between PTSD and low-back muscle tension was found in rats. Various body-based
interventions were found to release muscle tension with positive impacts on symptoms of PTSD or nsCLBP.

Conclusions: Preliminary evidence links muscle tension to co-occurring PTSD and nsCLBP. There is also preliminary evidence that interventions which are designed to release muscle tension have positive impacts on the symptoms of PTSD and nsCLBP.

Limitations: There is a general lack of research on the use and effectiveness of TRE. All of the studies on muscle tension focused on tension in the moment rather than chronic tension. Many of the included studies lacked controls as well as long-term effects. Finally, all of the research related to PTSD used criteria from the DSM-IV-TR, which is now outdated.

Keywords: Trauma Releasing Exercises (TRE), post-traumatic stress disorder (PTSD), non-specific chronic low-back pain (nsCLBP), muscle tension
Trauma Releasing Exercises – A Potential Treatment for Co-Occurring Post-Traumatic Stress Disorder and Non-Specific Chronic Low-Back Pain: A Systematic Review

There is significant co-occurrence of post-traumatic stress disorder (PTSD) and non-specific chronic low-back pain (nsCLBP) in adults, ranging from 16.0% (Dunn, Passmore, Burke, & Chicoine, 2009) to 25.1% (Loncar, Curic, Mestrovic, Mickovic, & Bilic, 2013) of people being treated for either of the conditions. Very little is known about effective treatment for people with both conditions. Additionally, multiple factors affect traditional treatment, and multiple barriers prevent people from seeking or receiving treatment (Kempson, 2007; Lewis, Roberts, Vick, & Bisson, 2013; Sayer et al., 2009; Slade, Molloy, & Keating, 2009).

A promising intervention for both conditions is Trauma Releasing Exercises (TRE), a self-help technique developed to release chronic muscle tension and reduce anxiety (Berceli, 2005, 2008). To date, the only peer-reviewed research on TRE is a pilot study (Berceli, Salmon, Bonifas, & Ndefo, 2014), leaving a large gap in the literature regarding the use and effectiveness of TRE. Psychological theories and treatments featuring muscle tension as a primary cause of pathology date back to Freud and Janet (Atarodi & Hosier, 2011; Ruden, 2008). They provide a basis for proposing the use of TRE as a treatment for PTSD and nsCLBP.

Rationale

Figure 1 depicts relationships between symptoms of and theories about co-occurring PTSD and nsCLBP; chronic muscle tension and the release of chronic muscle tension; TRE; and two modalities which are similar to TRE in including the release of tension as part of healing: Somatic Experiencing and Rosen Method Bodywork. Connections supported by research are represented with a solid line and those proposed by theory with a dashed line.
To understand whether TRE might be an effective treatment for co-occurring PTSD and nsCLBP, it is important to explore what is known about how the mechanisms of the two disorders connect to the fundamental purpose of TRE. It is a technique designed primarily to release chronic muscle tension. This literature review focused first on evidence which links muscle tension to either PTSD symptoms or nsCLBP symptoms. A second focus on the TRE technique itself includes both published and unpublished research on TRE to present what is currently known or theorized about this intervention.

**Objectives**

The objective of this literature review was to find existing research to help answer the following research question, “Will a four-week, 3 times per week practice of Tension and Trauma Releasing Exercises (TRE) significantly reduce symptoms of co-occurring non-specific chronic low-back pain (nsCLBP) and post-traumatic stress disorder (PTSD) among selected adults?” The main link between TRE and the two conditions is muscle tension, so the first objective was to locate and summarize relevant literature regarding muscle tension and either PTSD or nsCLBP. The second objective was to summarize available literature about TRE itself.
Background

The rationale for proposing TRE as a treatment for co-occurring PTSD and nsCLBP draws on several concepts: (a) TRE itself; (b) key terms and definitions; (c) PTSD and nsCLBP; (c) treatment considerations when both conditions are present; (e) current barriers to treatment; and (f) theories related to one or both conditions.

Tension and Trauma Releasing Exercises (TRE)

Tension and Trauma Releasing Exercises (Berceli, 2005, 2008) was developed to invoke self-induced therapeutic tremoring (SITT), which is thought to release chronically held muscle tension. It can be used as a self-help tool or with a facilitator, either individually or in groups, and once learned it requires no special equipment or travel to a facility.

Berceli (2008) spent many years providing humanitarian aid in war-torn countries. He became curious about two reactions to traumatic experience which seemed to be present regardless of culture or class. First, he noticed that people always curled their bodies inward when bombs exploded. Second, he noticed that children shook when bombs exploded, but adults did not. He asked the adults about this, and they responded that they did not want the children to know they were scared (Berceli, 2005, 2008).

From these observations, Berceli (2005, 2008) theorized that curling the body required muscle contraction, particularly of the psoas muscles, and that the shaking, or tremoring, was the way the body released muscle contraction. He also theorized that adults learned to suppress tremors to avoid appearing scared or weak, and suppressed tremoring led to chronic muscle contraction or tension (Berceli, 2005, 2008).

Using seven sequential exercises to progressively stress and relax muscles gently and safely, TRE specifically targets the psoas and other hip flexor muscles as the location of chronic
The psoas muscles attach to the mid-spine and the tops of the legs, making them the only muscles which connect the upper and lower body (Koch, 2012; Staugaard-Jones, 2012). They are key in curling the body inward, and chronic tension in the psoas muscles is linked to both nsCLBP and PTSD (Andersen, Andersen, Vakkala, & Elklit, 2012; Flor, Turk, & Birbaumer, 1985; Iglesias-González, Muñoz-García, Rodrigues-de-Souza, Alburquerque-Sendín, & Fernández-de-las-Peñas, 2013; Nelson, DeMartini, & Heinrichs, 2010).

The goal of TRE is to allow the body to tremor naturally. These tremors are currently known as self-induced therapeutic tremors (SITT), but have also been called neurogenic tremor and self-induced unclassified tremor in previous work by Berceli (2005, 2009, 2014). The tremors can vary widely from person to person, session to session, and even within a session. According to Berceli (personal communication, June 26, 2015), frequency and velocity of tremors are irrelevant to the therapeutic benefit. Following the body's urge to move the tremor through to completion is what is thought to release muscle tension (Berceli, 2008).

**Interventions Related to TRE**

As with most complementary and alternative medicine interventions, research on TRE is in its infancy. There is some literature available on other interventions which are based on similar concepts of stored tension and release. Three of these other interventions are: Somatic Experiencing (SE), Rosen Method Bodywork (RMB), and Bioenergetics (BE).

Somatic Experiencing is a form of somatic psychotherapy which was developed based on observations of animals in the wild. The creator, Peter Levine, observed predator and prey animals and noticed that prey animals always shook after reaching safety (Levine, 1997). He developed a psychotherapy based on building self-awareness of body sensations and releasing stored tension related to trauma. Berceli connected his theory to Levine’s work, among others.
Bioenergetics is also a somatic psychotherapy, based on the work of Alexander Lowen (Lowen, 1995). It is a combination of talk therapy and physical exercises which target releasing stored tension in the body, depending on individual needs. Rosen Method Bodywork is not psychotherapy; rather, it is adapted from massage therapy but includes verbal techniques to help clients increase self-awareness (Fogel, 2013). It is purported to result in relaxation and decreased muscle tension (Fogel, 2013; Hoffren-Larsson, Gustafsson, & Falkenberg, 2009).

A difference between TRE and these related interventions is that they are all services delivered by trained professionals, whereas TRE can be performed by anyone once a brief initial training is completed. While some comparisons can be made, TRE is unique in that it was designed to be a self-help tool for people without access to professionals (Berceli, 2005).

**Key Terms**

Terms from multiple disciplines are used throughout this review. Some terms have historically been used in different ways, and some do not have consistent, accepted meanings. To assist the reader, definitions for key terms as they are used in this review are found in Table 1.

**Post-Traumatic Stress Disorder (PTSD)**

Post-traumatic stress disorder is defined in the *Diagnostic Statistical Manual of Mental Disorders, Fifth Edition* (DSM-5) as a condition which develops after an individual has experienced one or more traumatic events, with a lifetime prevalence of 8.7% in the US (American Psychiatric Association, 2013a). Traumatic events occur whenever a person feels endangered or that someone close to them is in danger, and may include car accidents, experiences of violence or sexual abuse, and participation in combat or first responder duties. Multiple symptoms lasting more than one month include intrusive thoughts or memories, dissociation, avoidance of triggers, negative moods, and hyperarousal.
Table 1

*Key Terms and Definitions*

<table>
<thead>
<tr>
<th>Term</th>
<th>Acronym</th>
<th>Definition</th>
</tr>
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<tbody>
<tr>
<td>Hyperarousal</td>
<td>--</td>
<td>A physiological state of high alert where the body is prepared to deal with danger (Weston, 2014). It is associated with a symptom cluster of PTSD, including sleep problems, irritability, reckless or self-harming behavior, concentration problems, hypervigilance, and exaggerated startle response (American Psychiatric Association, 2013a; Weston, 2014).</td>
</tr>
<tr>
<td>Non-specific chronic low-back pain</td>
<td>nsCLBP</td>
<td>Uncomfortable sensation, stiffness, or muscle tension centered at the lower end of the spine which is not related to injury or disease and lasts at least three months (Koes, Van Tulder, &amp; Thomas, 2006).</td>
</tr>
<tr>
<td>Post-traumatic stress disorder</td>
<td>PTSD</td>
<td>A psychological diagnosis characterized by both physical and psychological symptoms including hypervigilance, exaggerated startle response, nightmares, insomnia, and flashbacks (American Psychiatric Association, 2013a).</td>
</tr>
<tr>
<td>Self-induced therapeutic tremor</td>
<td>SITT</td>
<td>A shaking or trembling process that is thought to release chronically held muscle tension (N. Ndefo, personal communication, May 16, 2015). SITT is formerly known as neurogenic tremor (Berceli, 2008) or self-induced unclassified therapeutic tremor (SUTT; Berceli et al., 2014).</td>
</tr>
<tr>
<td>Somatic psychotherapy</td>
<td>--</td>
<td>A general term for many forms of psychotherapy that feature body-oriented concepts.</td>
</tr>
<tr>
<td>Tension and Trauma Releasing Exercises</td>
<td>TRE</td>
<td>A body-based self-help technique which invokes self-induced therapeutic tremoring to release chronic muscle tension and reduce anxiety (Berceli, 2008).</td>
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</table>

Hyperarousal is of particular interest in this review. Symptoms related to hyperarousal are: (a) irritability and aggressive behavior; (b) out of control or self-injurious behavior; (c) hypervigilance; (d) exaggerated startle response; (e) concentration problems; and (f) sleep problems (American Psychiatric Association, 2013a). Hyperarousal is closely related to fight-or-
flight responses through activation of the sympathetic nervous system (SNS), which regulates muscles and other body parts to be alert and active in response to perceived danger (Porges, 2011; Siegel, 1999).

Weston (2014) made an argument for studying the hyperarousal subtype of PTSD separately from other symptoms because of the role hyperarousal plays in increasing other symptoms of PTSD. He theorized that in PTSD the amygdala, a part of the brain responsible for processing incoming messages and deciding whether there is danger, misinterprets incoming stimuli and sends out the message to multiple systems to continue being alert when there is no actual danger (Weston, 2014). The SNS is one of those systems, and it signals muscles to stay alert. Hyperarousal symptoms may be the most appropriate to target with a treatment such as TRE, which purports to relax the body, including the SNS.

**Non-Specific Chronic Low-Back Pain (nsCLBP)**

Several different terms are used to discuss nsCLBP: low-back pain (LBP), lower-back pain, chronic low-back pain (CLBP), and lumbar pain. The pain may be acute, with sudden onset and lasting a few days, or it may be chronic and lasting three or more months (Balagué, Mannion, Pellisé, & Cedraschi, 2012; Koes et al., 2006). About 5% of low-back pain becomes chronic (Koes et al., 2006).

Non-specific chronic low-back pain refers to the condition when it is not directly attributable to a specific illness or injury. About 90% of reported low-back pain is non-specific, and it is difficult to diagnose and treat with traditional medical interventions (Koes et al., 2006). An estimated 84% of US adults will experience low-back pain during their lifetime and 23% will have nsCLBP. Where possible, this review has focused on nsCLBP, but the available literature has not always separated out different types of low-back pain. Non-specific pain was chosen for
this review because it is the most common type and because it may be most closely linked to chronic muscle tension (Koes et al., 2006; Scaer, 2007).

Co-Occurring Post-Traumatic Stress Disorder and Non-Specific Chronic Low-Back Pain

Co-occurring PTSD and back pain have been studied from different angles. In some studies, participants with PTSD were surveyed for pain disorders or low-back pain. In others, patients at pain clinics were assessed for PTSD symptoms. In general, the two conditions occur together enough to consider treatment that addresses both (Gibson, 2012; Otis, Keane, & Kerns, 2003; Sharp & Harvey, 2001). The mutual maintenance theory suggests that the two conditions work together to make either one difficult to treat separately (Sharp & Harvey, 2001).

In a study of 304 patients at pain clinics in Denmark and Finland, 70 people (23.0%) met the criteria for PTSD, with CLBP ranking as the most prevalent type of pain (Andersen et al., 2012). Similarly, of 130 veterans being treated for either neck or back pain in western New York, 21 (16.2%) met the criteria for PTSD, with low-back pain being the most prevalent type of pain (Dunn et al., 2009). A retrospective chart review of 85 veterans in Atlanta with PTSD showed that 66% of the participants had a chronic pain condition, with 18.8% having co-occurring PTSD and CLBP (Shipherd et al., 2007). At the high end of the range, women who had been in intimate partner violence relationships showed a 70% prevalence of co-occurring PTSD and chronic pain, though the study did not separate out low-back pain (Kim & Yu, 2015).

There are several reasons to study effective treatments for these co-occurring conditions. Interactions between the two conditions may negatively impact each other (Otis, Keane, Kerns, Monson, & Scioli, 2009), and traditional treatments for either condition are often less effective or are sometimes ineffective for people with both conditions (Gibson, 2012; Otis et al., 2009). For example, chronic pain may be perceived as traumatic and add to symptoms of pre-existing
PTSD. With the number of wounded and traumatized veterans returning from Iraq and Afghanistan, more effective and accessible treatments are being called for (Gibson, 2012). Treatment barriers for each of the conditions become compounded when both are present, making self-help interventions desirable alternatives (Lewis et al., 2013).

**Treatment Barriers**

There are many reasons why people may not receive treatment for either PTSD, nsCLBP, or co-occurring PTSD and nsCLBP. A qualitative study using focus groups with 18 adults with nsCLBP found that people often feel that professionals do not listen to them or actively engage them in care decisions (Slade et al., 2009). People with pain conditions often suffer from depression, anxiety, and substance abuse issues, which may reduce motivation to seek treatment (Gibson, 2012; Humphreys, Cooper, & Miaskowski, 2010; Morasco et al., 2013).

People with PTSD often suffer the same co-occurring conditions. Additionally, people with PTSD may fear being judged by others for having a mental disorder and may not seek treatment (Sayer et al., 2009). Other reasons cited for avoiding treatment include frustration with administrative procedures, particularly for veterans (Sayer et al., 2009); difficulty accessing treatment in rural areas (Lewis et al., 2013); and dissatisfaction with traditional medications and other treatments (Gibson, 2012). Many of these issues might be reduced or eliminated with the use of TRE, as it is non-invasive, can be done privately, and does not require a medical professional or travel to a facility once the technique is learned.

**Theoretical Models**

Four theoretical models are discussed to support the rationale for researching TRE as an intervention for co-occurring PTSD and nsCLBP: Mutual Maintenance Theory, Complex Psychogenic Pain Theory, Fear Avoidance Model, and Hyperarousal Subtype Model.
**Mutual Maintenance Theory.** This theory tied together similar physical and psychological aspects of both PTSD and chronic pain and summarized them into seven factors which interact and lead to mutual maintenance of the co-occurring disorders (Sharp & Harvey, 2001). The seven factors are: “attentional and reasoning biases, anxiety sensitivity, reminders of the trauma, avoidance, depression and reduced activity levels, anxiety and pain perception, and cognitive demand from symptoms limiting use of adaptive strategies” (Sharp & Harvey, 2001, p. 870). These complex interactions make successful treatment difficult. The experience of developing a felt sense of safety in one’s body that is cultivated through the practice of TRE may reduce the attentional biases, the anxiety, and the avoidance factors, which would then reduce overall symptom levels for both disorders.

**Complex Psychogenic Pain Theory.** This theory provided a psychophysiological explanation for non-specific or *psychogenic pain* as well as for PTSD symptoms. Psychogenic pain has been theoretically linked to traumatic experience (Atarodi & Hosier, 2011). Pain is believed to be stored in memory as a result of suppressed fear or anger from a traumatic experience (Ruden, 2008). An example of anger or fear that cannot be acted on during trauma might be the experience of being held hostage, where the person experiences fear and anger but is powerless to do anything. Since the person cannot act on these emotions, the need to act becomes trapped in memory and reappears as pain in the affected body areas or as the hyperarousal symptoms of PTSD (Ruden, 2008). Practicing TRE is thought to allow this kind of stored tension to move through to completion so that it is no longer held in the body.

**Fear Avoidance Model.** This model related to back pain proposed that people with back pain are afraid of exercise and movement because of a belief that it will cause more pain or injury. This belief causes them to avoid physical activity (Pincus, Smeets, Simmonds, &
Sullivan, 2010). Since movement and exercise are an integral part of treatment for back pain, this avoidance leads to increased pain and disability as the person moves less and muscles become stiff from disuse. Sedentary people who are in pain may pay more attention to their pain and body sensations, increasing awareness and hypervigilance. It can become a vicious cycle of increasing hypervigilance, which leads to increased anxiety and tension, which then leads to increased pain (Pincus et al., 2010). This cycle could potentially be broken by the use of TRE. The training for TRE includes a focus on safety and gentle, painless movement. It also includes many modifications for people with pain or mobility issues. The experience of being able to do TRE without pain might then lead to more confidence in being able to move, as well as to reductions in the sensations that are setting off the cycle.

**Hyperarousal Subtype Model.** In this model about PTSD symptoms, the amygdala plays a primary role. It is a central processor of incoming messages about sensations and internal states, which include physiological arousal, amount of stress hormones, and pain levels. It is also a sender of outgoing messages about danger or safety to many body systems (Weston, 2014). When these states are sensed as extreme, the amygdala can misinterpret them as a threat and send out messages that the body is in danger. The person then reacts as if a traumatic event is occurring, even when there is no immediate danger, with increased heart and respiratory rates, increased muscle tone, and other actions to support fight or flight (Weston, 2014). Over time, these over-reactions can become neurological patterns and can be generalized to similar sensations or states, a process known as kindling (Scaer, 2005). The result is the symptoms associated with the hyperarousal subtype for PTSD (Weston, 2014). When the amygdala is over-reactive, it is also likely to increase the other symptoms of PTSD, making hyperarousal symptoms a catalyst for other symptoms (Weston, 2014). If TRE can reduce hyperarousal
through calming a hyperactive amygdala, then it is likely to decrease all other symptoms of PTSD as well as muscle tension that may be causing or exacerbating nsCLBP.

**Methods**

**Protocol and Registration**

A formal protocol and registration were not used for this review.

**Eligibility and Criteria**

For Searches 1 and 2, all peer-reviewed literature was included without other limitations. No limitations were applied to Search 3, due to the scarcity of literature.

**Information Sources**

Electronic databases were searched using relevant key terms with no limits: Cochrane Library; EBSCOHost; GoogleScholar; MaryAnn Liebert, Publishers–Alternative and Complementary Therapies; MaryAnn Liebert, Publishers–Ecopsychology; MaryAnn Liebert, Publishers–Journal of Alternative and Complementary Medicine: Research on Paradigm, Practice, and Policy; ProQuest; PubMed; Sage Journals Online; Sage Research Methods and Cases; Science Direct Health Sciences Journal Collection; Science Direct Life Sciences Journal Collection. All searches were run on April 3, 2016.

Additional articles were located from reference lists of review articles and from the research website for TRE (“TRE research,” 2016). Supplemental information about ongoing and unpublished TRE research was obtained from an international group of TRE researchers (Current TRE Research Worksheet, personal communication, April 26, 2016).

**Database Search**

Three main topics were the subject of the literature review: PTSD and muscle tension, nsCLBP and muscle tension, and TRE and similar interventions. To increase the likelihood of
finding information on muscle tension, the terms *psoas* and *iliopsoas* were added. Iliopsoas is the medical term for the group of muscles more commonly known as psoas. These are the muscles that TRE was originally developed to target. The search strings for the three searches were:

**Search 1.** all("post traumatic stress disorder" or PTSD) AND all("muscle tension" OR psoas or iliopsoas)

**Search 2.** all("chronic low back pain") AND all("muscle tension" OR psoas or iliopsoas)

**Search 3.** all("Trauma Releasing Exercises") OR (all("Somatic Experiencing" OR "Rosen Method") AND all("muscle tension" OR psoas or iliopsoas))

**Study Selection**

After eliminating duplicate results (*n* = 10), 696 titles and abstracts were reviewed for appropriate content. Many studies related to Searches 1 and 2 were excluded (*n* = 651) because they pertained to pathology of muscles rather than muscle tension. One study was excluded because it was listed as a retraction.

A full text assessment was then performed on 47 articles. For Searches 1 and 2, the studies selected for more comprehensive review (*n* = 8) were limited to primary research and were selected based on their applicability to the three main topics. For Search 3, all results were included (*n* = 8) except for three articles published in foreign languages and one article that was not primary research.

**Study Inclusion Criteria.** Studies were included if they represented primary research and had as a primary focus one of the following subject areas: muscle tension and PTSD or nsCLBP; TRE; muscle tension and Somatic Experiencing (SE), Rosen Method Bodywork (RMB), or Bioenergetics (BE).
Study Exclusion Criteria. Studies that were helpful in developing the background for this review but were excluded from the analysis (n = 31) included 22 articles where the primary focus was not one of the above subject areas, three articles written in languages other than English, two theory articles, two review articles, one study that was descriptive and had no intervention, and one document that was an unpublished manuscript describing a study in a dissertation that was already included in the analysis.

Data Collection Process

Separate data extraction sheets were developed for each of the two subject areas.

Data Items

Key items extracted for the muscle tension analysis were: study name, method, condition addressed (PTSD or nsCLB), number of participants, age, gender, intervention and comparator (if any), relevant outcome measures, and relevant outcomes. For the TRE and related interventions analysis, data items of study type and intervention used were added. Items related to bias assessment were also collected.

Risk of Bias in Studies

An analysis of the risk of bias within studies was constructed using an adaptation from the Cochrane Handbook for Systematic Reviews of Interventions (The Cochrane Collaboration, 2011) for both topic area analyses.

Summary Measures

The study types, methods, conditions, interventions, and data analyses were so heterogeneous across the selected articles that no summary measures were identified as appropriate. Most articles provided means of demographic variables such as age, but in general
this information did not significantly add to this discussion of research on the use of TRE in co-occurring PTSD and nsCLBP.

**Synthesis of Results**

With the heterogeneity of the selected studies, no formalized synthesis of studies appeared appropriate. Instead, individual study characteristics, limitations, and relationship to the research question were noted as studies were reviewed. These notes were then formulated into a narrative review of the selected studies.

**Risk of Bias Across Studies**

No formal assessment of bias across studies was undertaken. General observations from the detailed article reviews were consolidated into a narrative analysis.

**Results**

**Study Selection**

Figure 2 illustrates the data flow for study selection. Searches of electronic databases yielded 651 potentially relevant citations. An additional 55 articles were obtained from other sources such as references from review articles and the TRE website (“TRE research,” 2016). Ten duplicates were removed, leaving 696 articles to be screened for relevant content. After reviewing titles and abstracts, 651 articles were excluded. Common reasons for exclusion were topics out of scope for this paper such as other medical diagnoses, articles published in foreign languages without English translation, and articles not pertaining to primary research. An exception was made to this last exclusion reason for any articles related to TRE.

The remaining 47 articles were examined in detail for eligibility. Review articles and reports from government organizations were excluded from the final analysis but proved useful
in preparing the background information for this review. A final selection of 16 articles was chosen for this review. Of these, eight met the criteria for analysis of research on muscle tension and how it connects to PTSD or nsCLBP. Another eight articles were selected for the analysis of TRE and related interventions. Finally, 19 unpublished research studies on TRE were reviewed and relevant data items were summarized.
Study Characteristics

Table 2 presents a summary of the information from the eight studies regarding muscle tension and either PTSD or nsCLBP (searches 1 and 2). All used quantitative methods, with three using one-group pretest posttest designs (Glombiewski et al., 2015; Harvey, Thorne, & McPhetridge, 2012; Lundberg et al., 1999), two using mixed-between subjects trials (Burns, 2006; Burns et al., 2012), two using randomized-controlled trials (Kim & Yu, 2015; Nelson et al., 2010); and one using a descriptive cross-sectional method (Iglesias-González et al., 2013). Overall, the studies included 500 human adult participants and 28 rats. Of the human participants, 279 were female (55.8%) and 209 were male (41.8%), with the gender of 12 participants not stated (Harvey et al., 2012). All of the rats were adult males.

Interventions across studies varied widely, and six of the studies were carried out in classroom or laboratory environments. The Kim and Yu (2015) study included an eight week trial of complex manual therapy and was the only study of a treatment intervention. Nelson et al. (2010) was the only study to utilize a physiological measurement of muscle tension, using electrodes implanted in the muscles of rats. The rest of the studies used either self-report of muscle tension or the presence of trigger points detected by trained massage therapists (Iglesias-González et al., 2013). Finally, three of the studies related to CLBP, one to nsCLBP, one to PTSD, one to general pain, and one to co-occurring CLBP and PTSD. The Harvey et al. (2012) did not related to either condition.

Table 3 presents a similar summary of the eight studies using TRE and related interventions. Three of the studies investigated the use of TRE with varied pretest posttest methods. Three studies investigated the use of SE; two utilized pretest posttest methods and one used a qualitative phenomenological/hermeneutic approach. Of the remaining two studies, one
### Table 2

**Summary of Characteristics of Studies Included in Muscle Tension and PTSD/nsCLBP Analysis**

<table>
<thead>
<tr>
<th>Study</th>
<th>Study Method</th>
<th>Condition/ (n= )</th>
<th>Age/ Gender</th>
<th>Intervention/Comparator</th>
<th>Outcome Measures*</th>
<th>Relevant Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burns, 2006</td>
<td>Mixed-Between Subjects Trial</td>
<td>CLBP (n=173)</td>
<td>18+/ M=77</td>
<td>Anger and sadness recall interviews/ Participants with CLBP compared to healthy controls</td>
<td>EMG; PSS; Self-report of pain and negative affect (0-5)</td>
<td>Increase in low-back muscle tension and longer recovery time for CLBP group as compared to healthy controls</td>
</tr>
<tr>
<td>Burns et al., 2012</td>
<td>Mixed-Between Subjects Trial</td>
<td>CLBP (n=58)</td>
<td>18+/ F=30 M=28</td>
<td>Frustrating maze task/ Anger Suppression group compared to No Suppression</td>
<td>EMG; NRS</td>
<td>Increases in low-back muscle tension for both groups after intervention, but Suppression group had significantly more</td>
</tr>
<tr>
<td>Glombiewski et al., 2015</td>
<td>One group pretest-posttest</td>
<td>CLBP (n=71)</td>
<td>18-65/ F=39 M=32</td>
<td>Fear of movement induction/ Clusters based on fear and anxiety (FA) identified during study: Cluster 1 = High FA (n=41) and Cluster 2 = Low FA (n=30)</td>
<td>EMG; NRS; PASS; PCS; PDI; TSK</td>
<td>Significant increase in low-back muscle tension after intervention; Cluster 1 showed greater pain catastrophizing and pain anxiety</td>
</tr>
<tr>
<td>Harvey et al, 2012</td>
<td>One-group, pretest-multiple observations-posttest</td>
<td>None/ (n=12)</td>
<td>19-31/ Not stated</td>
<td>Muscle tension recorded while performing simple movements, and again after muscle tension awareness training</td>
<td>sEMG</td>
<td>All participants unconsciously increased muscle tension unnecessarily during intervention, but decreased muscle tension after awareness training</td>
</tr>
</tbody>
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<th>Study Method</th>
<th>Condition/Gender (n=)</th>
<th>Age/Gender</th>
<th>Intervention/Comparator</th>
<th>Outcome Measures</th>
<th>Relevant Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iglesias-Gonzalez et al., 2013</td>
<td>Descriptive cross-sectional/Purposive sample age- and sex-matched with healthy controls</td>
<td>nsCLBP/n=84</td>
<td>23-55/F=42 M=42</td>
<td>None/Comparison of active and latent trigger points between two groups</td>
<td>PSQI; Roland-Morris Activity Scale; TrP exam</td>
<td>Latent trigger points in the psoas muscles were the most common trigger points in both pain and control groups</td>
</tr>
<tr>
<td>Kim and Yu, 2015</td>
<td>RCT two-group pretest posttest</td>
<td>CLBP &amp; PTSD/n=30</td>
<td>18+/M=30</td>
<td>Experimental group received 8 weeks, 2x week complex manual therapy/Education in self-exercise</td>
<td>KODI; PDS-K; VAS</td>
<td>Experimental group improved in both pain and PTSD symptoms compared to control group</td>
</tr>
<tr>
<td>Lundberg et al, 1999</td>
<td>One-group, pretest multiple observations-posttest</td>
<td>Pain/n=72</td>
<td>20-58/F=72</td>
<td>Normal work as a cashier/Compared to experience when not at work</td>
<td>EMG; Self-reports of pain</td>
<td>Increased muscle tension at work correlated with increased pain</td>
</tr>
<tr>
<td>Nelson et al., 2010</td>
<td>Two related RCT pretest posttest studies with rats</td>
<td>PTSD/n=28</td>
<td>3-5 months/M=28</td>
<td>Ex. 1 – Social defeat by other rat paired with odor cue/Control group with no intervention Ex. 2 - Introduction of odor cue 4 weeks later/Control group with no intervention</td>
<td>Transponder implants in gastrocnemius muscles; Observation of behaviors</td>
<td>Ex. 1 - Defeated rats displayed anxious behaviors along with increased muscle tension; Ex. 2 – Odor cue reactivated anxious behaviors and increased muscle tension</td>
</tr>
</tbody>
</table>
### Table 2

**Summary of Characteristics of Studies Included in Muscle Tension and PTSD/nsCLBP Analysis**

<table>
<thead>
<tr>
<th>Study Method</th>
<th>Condition/ (n= )</th>
<th>Age/ Gender</th>
<th>Intervention/Comparator</th>
<th>Outcome Measures</th>
<th>Relevant Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complex manual therapy consists of myofascial release, muscle energy technique, and exercises to release muscle tension</td>
<td>Pain in this study was in neck and shoulders rather than low-back</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

Abbreviations: CLBP = Chronic low-back pain, including conditions attributable to medical pathology; EMG = Electromyography, used to measure muscle tension; KODI = Korean Oswestry Disability Index; NRS = Numeric Rating Scale for pain intensity; PASS = Pain Anxiety Symptom Scale; PCS = Pain Catastrophizing Scale; PDI = Pain Disability Index; PDS-K = Post-traumatic Diagnostic Scale; PSQI = Pittsburgh Sleep Quality Index; PSS = Pain Severity Scale of the Multidimensional Pain Inventory; PTSD = Post-traumatic Stress Disorder; sEMG = Surface electromyography; TrP exam = Examination by qualified massage therapists to identify trigger points; TSK = Tampa Scale of Kinesiophobia; VAS = Visual Analog Scale
### Table 3

**Summary of Characteristics of Studies Included in Trauma Releasing Exercises and Related Interventions Analysis**

<table>
<thead>
<tr>
<th>Study</th>
<th>Study Type/Method</th>
<th>Intervention/Comparator</th>
<th>Outcome Measures</th>
<th>Relevant Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Berceli, 2007</td>
<td>Dissertation/ RCT 2</td>
<td>TRE for 2 weeks, 2x week allowing tremors/Control group told to stop TRE when tremors start</td>
<td>STAI Form X-1 AD-ACL HRV</td>
<td>Decrease in anxiety-present, increase in anxiety-absent</td>
</tr>
<tr>
<td>Berceli et al., 2014</td>
<td>Peer-rvw/ one-group pretest posttest feasibility study</td>
<td>TRE introductory training, then 10 weeks of practice, 2-3x week/No comparison</td>
<td>HWQoL</td>
<td>91.3% completed study. Perceived quality of life improved, but actual changes not significant</td>
</tr>
<tr>
<td>McCann, 2011</td>
<td>Masters thesis/ 1 group pretest posttest</td>
<td>TRE 4 day introductory training, then 4 weeks of practice, 2-3x week/No comparison</td>
<td>SF-36 PGWBI STAI Form Y-1</td>
<td>Improvement in trait anxiety and sense of well-being</td>
</tr>
<tr>
<td>Ellegaard et al., 2012</td>
<td>Peer-rvw/ Phenomenological/ Hermeneutic</td>
<td>Gestalt Therapy and SE with written narrative by therapist/No comparison</td>
<td>None</td>
<td>No relevant outcomes for intervention, but themes of feeling restricted by CLBP and using inner resources to cope</td>
</tr>
</tbody>
</table>
### Table 3

**Summary of Characteristics of Studies Included in Trauma Releasing Exercises and Related Interventions Analysis***

<table>
<thead>
<tr>
<th>Study</th>
<th>Study Type/Method</th>
<th>Interv/Condition/ (n=)</th>
<th>Age/Gender</th>
<th>Intervention/Comparator</th>
<th>Outcome Measures*</th>
<th>Relevant Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fogel 2013</td>
<td>Peer-rvw/ Pretest posttest case series</td>
<td>RMB/ CLBP/ (n=5)</td>
<td>31-56 F=5</td>
<td>5 months of RMB/No comparison</td>
<td>Self-report scales of pain, fatigue, and mood</td>
<td>Improvement on all measures after intervention</td>
</tr>
<tr>
<td>Leitch et al., 2009</td>
<td>Peer-rvw/ two-group pretest posttest</td>
<td>SE/ PTSD/ (n=132)</td>
<td>22-60 F=113 M=19</td>
<td>Brief intervention group therapy of SE/TRM for 2 weeks, 1-2x week/ Matched control group; Follow-up after 3-4 months</td>
<td>SCL-90-R PCL-C</td>
<td>No significant change for physical symptoms, but improvement in psychological symptoms and resiliency</td>
</tr>
<tr>
<td>Nickel et al., 2006</td>
<td>Peer-rvw/ RCT two-group pretest posttest</td>
<td>BE/ Pain/ (n=128)</td>
<td>Adult F=90 M=38</td>
<td>Bioenergetics therapy for 6 weeks/ Control group did gymnastics</td>
<td>SCL-90-R STAXI</td>
<td>Treatment group had improvements in pain and mood compared to control</td>
</tr>
<tr>
<td>Parker et al., 2008</td>
<td>Peer-rvw/ one-group pretest posttest</td>
<td>SE/ PTSD/ (n=150)</td>
<td>18+ F=110 M=40</td>
<td>1 75-minute session of TRE/No treatment; Follow-ups at 4 weeks and 8 months</td>
<td>Post-Tsunami Checklist IES-R-A SUD</td>
<td>At 8 months, more than half still showed improvement and 27% completely well</td>
</tr>
</tbody>
</table>
### Summary of Characteristics of Studies Included in Trauma Releasing Exercises and Related Interventions Analysis

<table>
<thead>
<tr>
<th>Study Type/Method</th>
<th>Condition/Intervention/Comparator</th>
<th>Outcome Measures</th>
<th>Relevant Outcomes</th>
</tr>
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<tbody>
<tr>
<td>AD-ACL</td>
<td>Activation-Deactivation Adjective Checklist</td>
<td>Health, Wellness and Quality of Life Questionnaire</td>
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<tr>
<td>BE</td>
<td>Bioenergetics</td>
<td>Heart Rate Variability</td>
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<tr>
<td>CLBP</td>
<td>Chronic low-back pain, including conditions attributable to medical pathology</td>
<td>Impact of Events Scale-Revised-Abbreviated</td>
<td></td>
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<tr>
<td>HWQoL</td>
<td>Health, Wellness and Quality of Life Questionnaire</td>
<td>PTSD Checklist-Civilian</td>
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<tr>
<td>HRV</td>
<td>Heart Rate Variability</td>
<td>Psychological General Well-Being Index</td>
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</tr>
<tr>
<td>IES-R-A</td>
<td>Impact of Events Scale-Revised-Abbreviated</td>
<td>Rosen Method Bodywork</td>
<td></td>
</tr>
<tr>
<td>PCL-C</td>
<td>PTSD Checklist-Civilian</td>
<td>Symptom Checklist-90-Revised</td>
<td></td>
</tr>
<tr>
<td>PGWBI</td>
<td>Psychological General Well-Being Index</td>
<td>Somatic Experiencing</td>
<td></td>
</tr>
<tr>
<td>RMB</td>
<td>Rosen Method Bodywork</td>
<td>Somatic Experiencing/Trauma Resiliency Model</td>
<td></td>
</tr>
<tr>
<td>SF36</td>
<td>Short Form Health Survey</td>
<td>Subjective Units of Disturbance</td>
<td></td>
</tr>
<tr>
<td>STAI Form X-1</td>
<td>State Trait Anxiety Inventory, Trait Version</td>
<td>Trauma Releasing Exercises</td>
<td></td>
</tr>
<tr>
<td>STAI Form Y-1</td>
<td>State Trait Anxiety Inventory, State Version</td>
<td>SE/TRM</td>
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</tr>
<tr>
<td>STAXI</td>
<td>State-Trait Anger Expression Inventory</td>
<td>SUD</td>
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</table>

Abbreviations: AD-ACL = Activation-Deactivation Adjective Checklist; BE = Bioenergetics; CLBP = Chronic low-back pain, including conditions attributable to medical pathology; HWQoL = Health, Wellness and Quality of Life Questionnaire; HRV = Heart Rate Variability; IES-R-A = Impact of Events Scale-Revised-Abbreviated; PCL-C = PTSD Checklist-Civilian; PGWBI = Psychological General Well-Being Index; RMB = Rosen Method Bodywork; SCL 90-R = Symptom Checklist-90-Revised; SE = Somatic Experiencing; SE/TRM = Somatic Experiencing/Trauma Resiliency Model; SF36 = Short Form Health Survey; STAI Form X-1 = State Trait Anxiety Inventory, Trait Version; STAI Form Y-1 = State Trait Anxiety Inventory, State Version; STAXI = State-Trait Anger Expression Inventory; SUD = Subjective Units of Disturbance; TRE = Trauma Releasing Exercises
examined RMB with a pretest posttest case series, and one utilized a randomized-controlled design with BE. A total of 553 adult participants across studies included 419 females (75.8%) and 134 males (24.2%). Five of the studies were conducted on-site in areas where either acute or chronic traumatic events were present. Berceli et al. (2014) involved staff at a facility in South Africa, an area torn by civil unrest for years. McCann (2011) was also conducted in South Africa. Leitch et al. (2009) and Parker et al. (2008) both studied victims of natural disasters. The Nickel et al. (2006) study participants were all Turkish refugees living in Germany. Studies of interventions conducted in the field provide valuable information about real-world results, but also introduce more risk of bias within the studies.

Risk of Bias Within Studies

Muscle Tension and PTSD or nsCLBP. See Table 4 for a detailed assessment of the risk of bias within studies. Of the eight studies related to muscle tension and either PTSD or nsCLBP, two used a randomized-controlled design (Kim & Yu, 2015; Nelson et al., 2010) and only three used a control group. Given the nature of the interventions, which involved identifiable movement and physical treatments, blinding would have been difficult with the exception of one study using rats as subjects (Nelson et al., 2010). In that study, the rats were likely not aware of what was happening to the other rats. Lack of blinding was considered to be a more serious risk in Harvey et al. (2012) because the researcher was a university professor and the participants were his students, introducing a likelihood that participants would be aware of the hypothesis of the study and the results the researcher desired. Lack of blinding was also deemed a strong risk in Kim and Yu (2005) because of the biased language used in the article. The authors obviously wanted favorable results for their intervention, and this could likely have been communicated to the relatively small number of participants.
Table 4

Risk of Bias Within Studies for Muscle Tension Analysis

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</tbody>
</table>

⊨ = Some identifiable bias that is unlikely to significantly impact results
⊗ = Identifiable bias that is likely to significantly impact results
★ = Identifiable bias that may be of concern for results

Table adapted Cochrane Handbook for Systematic Reviews of Interventions (The Cochrane Collaboration, 2011)
Table 5

*Risk of Bias Within Studies for Trauma Releasing Exercises and Related Interventions Analysis*<sup>a</sup>

<table>
<thead>
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<td><strong>Randomized study design?</strong></td>
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<td>✔</td>
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<tr>
<td><strong>Well described study intervention and population?</strong></td>
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<td><strong>Selection of study population well described?</strong></td>
<td>✘</td>
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<td><strong>Outcome variables reliable measures of outcome interest?</strong></td>
<td>✘</td>
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<td>✔</td>
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<tr>
<td><strong>Comparison groups?</strong></td>
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<td>✔</td>
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<td>✔</td>
<td>✔</td>
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<td><strong>Participants blinded?</strong></td>
<td>✘</td>
<td>✘</td>
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<td>✘</td>
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<td><strong>Researchers blinded?</strong></td>
<td>✘</td>
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<td><strong>Data collectors blinded?</strong></td>
<td>✘</td>
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<td><strong>Outcome assessors blinded?</strong></td>
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<td><strong>Limitations?</strong></td>
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</tr>
</tbody>
</table>

✔ = Some identifiable bias that is unlikely to significantly impact results  
✘ = Identifiable bias that is likely to significantly impact results  
✶ = Identifiable bias that may be of concern for results  
N/A = Not applicable to this type of study (phenomenological/hermeneutic)

<sup>a</sup>TRE studies listed first, followed by related intervention studies in alphabetical order by author

Table adapted *Cochrane Handbook for Systematic Reviews of Interventions* (The Cochrane Collaboration, 2011)
Of all the studies, the smallest risk of bias was found in Nelson et al. (2010). This randomized-controlled study of trauma and muscle tension in rats was conducted under laboratory conditions and followed well-structured protocols, thus reducing much of the risk of bias. However, the data is difficult to generalize because we do not know if it is applicable to humans or outside of such a structured environment.

**TRE and Related Interventions.** See Table 5 for a detailed assessment of the risk of bias within studies. All three TRE studies included adequate descriptions of study methods. For these studies, only one used a randomized design (McCann, 2011). For the remaining two, the lack of a randomized design adds a strong risk of bias because both studies were conducted within distinct communities and during in-person trainings by Berceli (Berceli et al., 2014; Berceli, 2007). There is a possibility that participants wanted to please Berceli based on the amount of time they spent with him, and on his enthusiasm for the intervention he developed.

Given that TRE is a movement intervention taught by a certified trainer, it is difficult to have blinding on the part of participants or researchers. Lack of blinding in all three studies is a strong concern, because Berceli led the interventions. The 2007 Berceli study was also his dissertation for his doctoral degree, and it is likely he held personal bias as to the results of his study. Selection of the study populations in the two Berceli studies (2007, 2014) was not described sufficiently to fully assess the risk of bias. Both of these were convenience samples within well-defined communities. It is unknown how much this may have affected the outcomes.

In the five studies using related interventions, there are similar issues with blinding. This was not considered to present as high a risk of bias because the interventions were not delivered by the creators of the interventions. Two of these studies utilized control groups (Leitch, Vanslyke, & Allen, 2009; Nickel et al., 2015), further mitigating risk of bias. Lack of
randomized study design was a concern in three of these studies (Fogel, 2013; Leitch et al., 2009; Parker, Doctor, & Selvam, 2008), but it appeared of most concern in Fogel (2013) because of the small sample size (n = 5), length of study, and lack of demographic information about participants. It seems likely that, with a hands-on intervention like Rosen Method Bodywork, participants would become very familiar with the bodyworker over the course of five months and might want to show positive results for the researcher.

**Results of Individual Studies**

See Table 2 for results from studies regarding muscle tension and PTSD or nsCLBP. See Table 3 for results from studies regarding TRE and related interventions. Confidence intervals are not presented due to the heterogeneity of the interventions and the data available.

**Synthesis of Results**

**Muscle Tension and PTSD or nsCLBP.** Eight studies linking muscle tension to PTSD or nsCLBP were analyzed. Four studies focused on CLBP or nsCLBP (Burns, 2006; Burns et al., 2012; Glombiewski et al., 2015; Iglesias-González et al., 2013), one focused on general pain (Lundberg et al., 1999), and one included both PTSD and CLBP (Kim & Yu, 2015). The final study explored dysponesis, a chiropractic term meaning inappropriate use of muscle to do specific tasks (Harvey et al., 2012). Dysponesis may either cause or be a result of chronically held muscle tension, and is often associated with low-back pain (Harvey et al., 2012).

In Burns (2006) and Burns et al. (2012), the effects of anger on muscle tension in the low-back and hip flexors among people with CLBP was explored. Participants experiencing negative emotions such as anger and sadness showed significant increases in low-back muscle tension as compared to control groups. They also took longer to return to baseline than participants in the healthy control group (Burns, 2006). Similarly, fear was linked to significant
increases in low-back muscle tension as well as increases in pain levels and anxiety (Glombiewski et al., 2015). The complex psychogenic pain theory (Atarodi & Hosier, 2011) proposed that pain not attributable to medical causes may be related to suppressed emotions, particularly negative emotions. These studies provide a link between negative emotion, which may be present in both PTSD and nsCLBP, and muscle tension. This is applicable to TRE in that tremoring is thought to release anything chronically stored or suppressed in the body.

The most direct connection between PTSD and muscle tension was found by Nelson et al. (2010). In a two-part experiment, rats first had sensors implanted in hip flexor muscles and were exposed to traumatizing experiences after a recovery period. They displayed anxious behavior and increased muscle tension as compared to control rats. Four weeks later, they were exposed to reminders of the traumatic experience, and muscle tension and anxious behavior again increased compared to the control rats. The hyperarousal subtype model (Weston, 2014) suggested the amygdala is responsible for interpreting the reminders as a new traumatic experience and sending out messages about danger to the body, including the hip flexor muscles.

The one study connecting muscle tension to both PTSD and CLBP involved 30 Korean former prisoners of war who all had PTSD and CLBP (Kim & Yu, 2015). Participants were randomized to either a treatment group, which received multiple therapies designed to release muscle tension (complex manual therapy), or a control group which did self-directed exercise. People in the experimental group showed significant improvement in both pain and PTSD symptoms as compared to the control group. The results suggested that releasing muscle tension is an effective way to treat co-occurring PTSD and nsCLBP. An advantage of using TRE to release the muscle tension, as opposed to complex manual therapy, is that TRE does not require physical therapists to administer, making it more accessible.
**TRE and Related Interventions.** Of the eight articles examined, three were conducted with TRE as an intervention (Berceli et al., 2014; Berceli, 2007; McCann, 2011), three used some form of SE (Ellegaard & Pedersen, 2012; Leitch et al., 2009; Parker et al., 2008), one used RMB (Fogel, 2013), and one used BE (Nickel et al., 2015). None of the TRE studies related directly to PTSD or nsCLBP, limiting their applicability to the research question, but they did offer some information about the effectiveness and feasibility of TRE as an intervention. The Berceli et al. (2014) study was primarily intended as a feasibility study to determine if people would be use TRE consistently. Results showed that 91.3% of the participants did complete the study, but the two week time period was fairly short and most of the TRE sessions were facilitated. Participants (n = 21) were all staff at an orphanage in Cape Town, South Africa, and may have had a high motivation to complete the sessions. Within those limitations, there was a very high rate of participation and some perceived improvement in quality of life.

In his dissertation on TRE and anxiety, Berceli (2007) used a control group, but the sham intervention he used was questionable. The sham had participants perform the TRE exercises with the instruction to stop as soon as they felt tremors. Performing the exercises often invokes tremors differently in people and at different times (D. Berceli, personal communication, June 13, 2015), and participants new to TRE might not even notice the tremors initially or might have difficulty stopping them. The use of this sham as a comparison likely contributed to the relatively weak results of the study. Small but significant changes in anxiety measures were found, but no significant differences occurred for heart rate variability or activation levels (Berceli, 2007).

Of the studies using related interventions, two focused on PTSD (Leitch et al., 2009; Parker et al., 2008), two on CLBP (Ellegaard & Pedersen, 2012; Fogel, 2013), and one focused on pain in general (Nickel et al., 2015). Ellegard and Pedersen (2012) was a qualitative study that
identified two relevant themes in the treatment of CLBP: feelings of restriction in activity due to CLBP and a desire to use inner resources to cope. The feelings of restriction correlate with the fear avoidance model concepts that over time, people with nsCLBP restrict movement more and more out of fear of pain or further injury (Pincus et al., 2010). Wanting to have inner resources for coping ties to the mutual maintenance theory (Sharp & Harvey, 2001), in that factors of anxiety sensitivity and pain perception affect both PTSD and chronic pain, and people can mitigate this with inner resources. This study provided a link between theory and treatment of the co-occurring conditions and SE, an intervention that has similar foundations to TRE.

In regards to CLBP and pain treatment, Fogel (2013) and Nickel et al. (2006) both showed significant improvement of pain levels and mood using RMB and BE respectively. Regarding PTSD, Leitch et al. (2009) and Parker et al. (2008) both used very brief SE interventions with participants who had been victims of natural disasters. Both also used control groups and conducted follow-ups later on. Significant improvement occurred for psychological symptoms of PTSD for the intervention group compared to the control group in both studies, and significant improvement lasted four months (Leitch et al., 2009) and eight months (Parker et al., 2008). There are limitations to these results due to the diversity of locations, participants, types of conditions, and quality of studies, but together, they provide preliminary evidence that body-based interventions similar to TRE can be effective for either PTSD or nsCLBP.

There are currently an additional 19 studies worldwide, either in progress or unpublished, on the use of TRE (Current TRE Research, personal communication, April 26, 2016). Many are qualitative or mixed-methods in design (n = 11) which will provide information about the experience of TRE but will not yield much in the way of data about effectiveness. Only five of these prospective studies focused on trauma or PTSD, and none focused on nsCLBP or pain in
general. One study is focused on chronic pelvic pain and another on fibromyalgia, possibly providing a link between TRE and pain treatment. No significant results pertaining to this literature review have been reported to date, but there appears to be interest in TRE as an intervention for many conditions.

Risk of Bias Across Studies

**Muscle Tension and PTSD or nsCLBP.** Publication bias is always a concern. In this systematic review, no studies were found that did not show a relationship between pain, emotion, trauma, and muscle tension. In half of the selected studies, population recruitment and selection information was missing or incomplete, making it difficult to assess selection bias. Additionally, most of the studies used convenience samples in the form of hospital or clinic patients, potentially providing bias.

**TRE and Related Interventions.** All of the interventions investigated in this review are considered complementary and alternative medicine and are not mainstream interventions. Researchers in these areas are all likely to want to prove that their intervention works, introducing a great amount of bias. Much of the research was conducted by the creator of the intervention or by a close associate. As opposed to the publication bias for the muscle tension studies, for TRE and related interventions an opposite bias may be occurring. Because these are new and unproven techniques, journals may avoid publishing positive results or any studies at all. It is difficult to know how much this impacts available peer-reviewed literature at this time.

Discussion

**Summary of Evidence**

The research directly linking muscle tension to either PTSD or nsCLBP is preliminary, but there is enough evidence to warrant further investigation. The primary link appears to be
between negative emotions such as fear and anger and muscle tension in the lower-back and hip flexor muscles (Burns, 2006; Burns et al., 2012; Glombiewski et al., 2015). The criteria for PTSD includes several negative emotions, further implying a possible role of muscle tension. The one study that linked muscle tension with co-occurring PTSD and CLBP (Kim & Yu, 2015) had some strong risk of bias, indicating a need for more clinical trials.

Regarding TRE and related interventions, the eight studies analyzed varied widely in populations, research methods, conditions, and outcome measures. A common theme in the results, however, was that the use of these body-oriented methods for releasing muscle tension provided relief of symptoms. The one published study on the use of TRE measured perceived quality of life rather than symptoms of PTSD or nsCLBP (Berceli et al., 2014). The results showed that TRE had an impact on the participants, but falls short of providing a strong argument for the use of TRE with PTSD or nsCLBP. Research being conducted currently which measures PTSD and pain symptoms may be more helpful as it is concluded and published.

The overall picture from the two separate analyses is that there is some correlation between muscle tension and co-occurring PTSD and nsCLBP, but no research was found that addressed chronic muscle tension in the body. The complex psychogenic pain model is based on chronically-held muscle tension, and much of Berceli’s (2005, 2008) theory is also based on chronic tension. Both PTSD and nsCLBP are chronic conditions. More research is needed to understand the differences between muscle tension as a reaction and as a chronic effect. The second connection is whether releasing muscle tension provides relief from PTSD and/or nsCLBP. Some preliminary evidence on TRE and related interventions suggests this is true, but again it is unknown whether this applies to temporary relief or true healing. In general, there appears to be enough evidence to warrant more research in all of these areas.
Limitations

The results presented here have some common limitations. The issue cited above about the potential differences in muscle tension in the moment and chronically-held muscle tension has not been addressed. There is a lack of research in general on the use and effectiveness of TRE, particularly in the areas of PTSD and nsCLBP. Most of the research on TRE and related interventions lacked appropriate controls and comparison groups. While the available research is promising, it is also limited in generalizability.

When discussing PTSD, an important limitation relates to the diagnosis of PTSD. In 2013, the American Psychiatric Association released the first revision to the Diagnostic and Statistical Manual of Mental Disorders since 2000. This manual is considered the primary source for describing and diagnosing mental disorders. The newest edition is known as the DSM-5 (American Psychiatric Association, 2013a), and the previous edition was known as the DSM-IV-TR (American Psychiatric Association, 2000). All of the research on PTSD reviewed here, as well as the measurement instruments, was based on criteria from the DSM-IV-TR. While criteria for the PTSD diagnosis changed significantly between the two versions, very little change occurred in the symptom cluster of hyperarousal (American Psychiatric Association, 2013b), which has been the focus for PTSD in this review. The differences between the two versions of the manual are important to note for future research, but do not significantly impact the topic of this literature review.

Conclusions

This literature review attempted to link together several concept areas that have not been extensively researched. An overall picture of the reviewed literature suggests that there are connections between muscle tension and co-occurring PTSD and nsCLBP. It also suggests a
connections between body-based interventions which are designed to release muscle tension and symptom relief for PTSD, nsCLBP, or other types of back pain. Tying these all together, it appears that research investigating TRE for the treatment of co-occurring PTSD and nsCLBP is an appropriate next step.

Ideally, multiple studies on the use of TRE for each condition as well as for the co-occurring conditions could help to identify the factors involved in treatment. Studies using wait-listed control groups would be very helpful, particularly because both of these conditions are chronic and some may resolve on their own over time. Other variables that may affect symptom improvement, like concurrent medical or psychological treatment, needs to be factored in to understand whether TRE is actually effective. It may be that other risk factors, such as type of work, age, amount of other exercise, and levels of outside stressors, will have an impact on outcomes. All of these variables need to be included in future research.

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References


TRAUMA RELEASING EXERCISES – A POTENTIAL


