2022

EYE MOVEMENT DESENSITIZATION AND REPROCESSING: STANDARD VERSUS PAIN-FOCUSED TREATMENT PROTOCOLS

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by

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SUBMITTED TO SCRIPPS COLLEGE IN PARTIAL FULFILLMENT OF THE DEGREE OF BACHELOR OF ARTS

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DECEMBER 9TH, 2022

Abstract

Typically used as a trauma therapy, Eye Movement Desensitization and Reprocessing (EMDR) may be a promising intervention for chronic pain, given the relationship (and rates of comorbidity) between chronic pain and post-traumatic stress (PTS). The purpose of the proposed study is to investigate how EMDR therapy might best be implemented as an integrated treatment for chronic pain among individuals with post-traumatic stress symptoms. This study will be the first of its kind to directly compare the standard trauma-focused (TF) EMDR treatment to a popular emerging pain-focused (PF) EMDR treatment modification (Grant, 2000). This study will utilize a matched-participants design and random assignment to one of three experimental conditions (standard TF-EMDR, PF-EMDR, treatment-as-usual [TAU] waitlist control) to compare outcomes on pain severity and PTS symptom severity among patients across three time points (baseline, post-test, 6-month follow up). Although both EMDR interventions are expected to produce a reduction in pain severity and PTS symptom severity, PF-EMDR is expected to be more effective at reducing pain severity than both TF-EMDR and TAU, while TF-EMDR is expected to be slightly more effective at reducing PTS symptom severity. In addressing an understudied subject, the findings of this study might allow academics and care providers alike to better understand and/or implement the version of EMDR that will best serve individuals given their positionalities and needs, leading to increasingly effective treatment of chronic pain in the future.

Eye Movement Desensitization and Reprocessing: Standard versus pain-focused treatment protocols

Chronic pain is a widespread public health problem (Sessle, 2011). Approximately 100 million Americans and an estimated 20% of the world's adult population report suffering from chronic pain (Gaskin & Richard, 2012; IASP, 2012). Chronic pain has far-reaching impacts, with the potential to influence the physical, social, psychological, and financial domains of one's life (Smith et al., 2001). Chronic pain has been reported to significantly impair quality of life and inhibit many aspects of everyday functioning, including ability to exercise, drive, maintain or perform duties at a job, and obtain adequate sleep (IASP, 2012; Sessle, 2011). Chronic pain has also been associated with increased rates of suicide, depression, and social isolation (Tompkins et al., 2017) as well as increased risk for and rates of addiction (López-Martínez, 2019; Tompkins et al., 2017). In the financial domain, chronic pain can have high healthcare costs and additional expenses associated with lower work productivity, resulting in an estimated national cost ranging from $560 to $635 billion, which is larger than the national cost of heart disease, cancer, and diabetes (Gaskin & Richard, 2012). Despite the steep national costs of chronic pain care, current treatment outcomes are typically lacking. For a notable number of individuals, pain remains even once the underlying disease has been treated, making pain treatment unsatisfactory and challenging (Tesarz et al., 2019). This phenomenon is especially common among individuals with comorbid mental disorders or among those where psychological factors play a role in the maintenance of pain. The immense impacts of chronic pain, coupled with the relative ineffectiveness of current treatment options, paint a strong argument for the exploration of more fruitful interventions that address both the somatic and psychological aspects together. Subsequently, the purpose of this study is to explore how EMDR therapy might best be

implemented as an integrated treatment for chronic pain among individuals with post-traumatic stress (PTS) symptoms.

Conceptualizing pain

As of 2020, the International Association for the Study of Pain (IASP) defines pain as "an unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage" (Raja et al., 2020, p. 2). Given this definition, pain can be understood as a subjective experience; it does not necessarily require actual tissue damage, but rather hinges on the individual's cognitive and emotional interpretations of the pain. Acute pain, involving actual or potential tissue damage, inflammation, or disease, generally serves a protective function, drawing one's attention to the body to encourage appropriate behavior and care during the healing process (Hanson & Gerber, 1990). Acute pain typically lasts for a short time, subsiding as the body heals. However, when pain persists and surpasses the point of being considered adaptive, it can be classified as chronic. This threshold is often identified as the 3-to-6-month mark (Hanson & Gerber, 1990; Turk & Melzack, 2001). As referenced in IASP's definition, chronic pain is not simply a sensory experience, but also contains an emotional dimension. Arguably, biological, psychological, and social components all interact to perpetuate the experience of pain, and thus all must be considered when determining effective treatment (Engel, 1981; Turk & Monarch, 2002).

Etiology of chronic pain

It is difficult to pinpoint a single cause of chronic pain. Common causes of pain include diseases, physical injury, or secondary to traumatic events (Kind & Otis, 2019). The development of acute pain into chronic pain may be due to nerve fibers continuing to fire despite the physical trauma having healed (Hanson & Gerber, 1990). However, this explanation does not

sufficiently address why certain individuals are more likely than others to develop chronic pain, nor does it account for pain not caused by actual tissue damage. Thus, the biopsychosocial model (Engel, 1981) becomes crucial in understanding the causes of chronic pain. As argued by Linton and colleagues, chronic pain is a "developmental process over time" in which "contextual factors set the stage for this development, underlying transdiagnostic psychological factors fuel this development, and the principles of learning steer the development of pain behaviors" (2018, p. 315).

Turning now to these contextual factors, researchers have documented ways in which adverse life experiences and other life stressors may relate to the development of chronic pain (Coppens et al., 2017). Burke et al. (2017) argue that psychological traumas and/or stressors are predisposing factors for the development of chronic pain. Additionally, Feletti et al. (2019) suggested that adverse childhood experiences (ACEs) increase the occurrence of physical health conditions later in life, revealing a strong relationship between childhood exposure to abuse or household dysfunction and risk factors for several leading causes of death. Utilizing Linton et al.'s framework, such contextual experiences must be considered in both understanding the development of pain and subsequently treating it.

Also notable are findings that highlight the psychological factors associated with chronic pain. For instance, several researchers have reported high rates of comorbidity between chronic pain and PTSD, suggesting that the rate of PTSD among chronic patients (9-10%) is higher than the rate of PTSD in the general population (~3.5-4.7%; Fishbain et al., 2017; Siqveland et al., 2017). This comorbidity is particularly significant because individuals with both PTSD and chronic pain report greater PTSD symptoms, pain, anxiety, depression, disability, and opioid use than individuals with only one of these conditions. (Kind & Otis, 2019; López-Martínez, 2019).

Most noteworthy within this subject, however, is the role that emotional processing may play in both the maintenance (i.e., chronification) of pain and in the development of PTSD (Tesarz et al., 2019). In their study of childhood adversity and chronic pain, Coppens et al. (2017) emphasized that the *impact* of childhood adversity was the most important factor in chronic pain development: subsequent development of PTSD symptoms following childhood adversity was more directly linked to chronic pain than the mere *presence* of childhood adversity (although there was a link in both groups). In essence, an individual's subsequent reaction to trauma can be formative—not everyone who experiences trauma manifests a disordered response (Bedard-Gilligan & Zoellner, 2008). This is further supported by research finding that daily stressors (rather than traumatic events) can also generate PTSD symptoms for certain individuals (Mol et al., 2005), emphasizing that an individual's subjective interpretation plays a significant role in the manifestation or lack thereof of trauma symptoms. Given the central role of emotional processing in the development of disorder, these findings reflect the importance of treating chronic pain and its psychological comorbidities as combined conditions through EMDR rather than focusing on them separately as most treatments have.

Scholars have addressed models of pain such as the fear-avoidance model of pain (Vlaeyen & Linton, 2000) as well as other possible mechanisms underlying the relationship between chronic pain and psychological comorbidities (Barlow, 2000; Burke et al., 2017). As touched on already, Tesarz et al. (2019) posit that maladaptive emotional processing may be central to determining whether acute pain subsides or transitions into chronic pain. This assertion can be understood through Vlaeyen & Linton's (2000) *cognitive-behavioral-fear-avoidance* model of pain, which highlights the roles of fear, avoidance, and catastrophizing in the chronification of pain. *Catastrophizing*—the interpretation of pain as overly threatening—may

lead an individual to demonstrate bracing behaviors, hypervigilance to body sensations, and avoidance of activities believed to cause pain. Subsequently, avoidance of activities may lead to increased disability and depressive symptoms. Depression and inactivity can then increase perception of pain intensity, which further exacerbates this cycle (Vlaeyen & Linton, 2000).

Additionally, first utilized to explain anxiety, Barlow's (2000) *triple vulnerability model* also provides a framework through which to understand the development of both chronic pain and psychological disorders. Barlow pinpoints three vulnerabilities that contribute to the development of such disorders: (1) *biological vulnerabilities* (i.e., genetically inherited anxious response tendencies), (2) *general psychological vulnerabilities* (i.e., life experiences that produced a threatened sense of safety or lack of control), (3) *specific psychological vulnerabilities* (i.e., the focus of anxious thoughts on specific traumatic or painful situations (Barlow, 2000). Utilizing this model, chronic pain and PTSD may be expected to emerge if an individual has an anxious affect and maintains distressing thoughts about their painful or traumatic experiences. Although this model indicates that there are biological and circumstantial influences on the development of chronic pain and psychological issues, it also suggests that such disorders can be somewhat managed by attending to these vulnerabilities, helping an individual gain a sense of control, manage catastrophic thinking, and develop more effective coping strategies (Kind & Otis, 2019). Psychotherapeutic interventions may have the potential to address both pain and psychological issues by managing such vulnerabilities. Thus, drawing upon Engel's (1981) biopsychosocial model, chronic pain treatment can be understood not solely as a medical process, but rather as possibly more effective if it includes a psychotherapeutic component.

Current chronic pain treatments

The fact that chronic pain is closely linked to (and exacerbated by) maladaptive emotional processing supports the need for psychotherapy in the treatment of chronic pain (Barlow, 2000; Burke et al., 2017; Tesarz et al., 2019). In addition to pharmacological and physical treatments, recommended psychological treatments for chronic pain currently include Acceptance and Commitment Therapy (ACT; Lin et al., 2019), Behavioral Therapy (BT), and Cognitive and Behavioral Therapy (CBT; Williams et al., 2020). CBT is currently recommended as a first-line treatment of trauma (Martin et al., 2021), and evidence also points to its potential efficacy as a chronic pain treatment (Williams et al., 2020). CBT addresses the interconnection between thoughts, emotions, and actions (World Health Organization, 2013). A pain-focused CBT protocol typically includes identifying and changing unhelpful pain-related thought or behavior patterns, and reframing a patient's conceptualization of their pain to develop more adaptive beliefs and behaviors. Although it has a larger evidence base than BT or ACT, even CBT appears to only result in small beneficial effects for the management of chronic pain, including pain intensity, disability, and distress (Williams et al., 2020). Shortcomings of CBT as a chronic pain treatment include the long length of treatment (Thieme & Gracely, 2009) and low tolerability leading to patient dropout (Glombiewski et al., 2010). These aspects may be especially salient for patients whose chronic pain severely impacts their daily functioning.

Arguably, Eye Movement Desensitization and Reprocessing (EMDR) may be a promising alternative treatment for the subgroup of individuals with chronic pain who also demonstrate post traumatic stress symptoms. Given its somatic focus (Shapiro, 2001) and demonstrated effectiveness for trauma (e.g., Martin et al., 2021; Shapiro, 2014; Shapiro &

Solomon, 2010), EMDR may offer the benefits of an integrated model without the length and tolerability limitations of CBT.

Eye Movement Desensitization and Reprocessing (EMDR)

Developed by Francine Shapiro (1989), Eye Movement Desensitization and Reprocessing (EMDR) is a psychotherapy treatment initially intended to reduce distress associated with traumatic memories. Shapiro's (2001) *adaptive information processing* (AIP) model provides the theoretical basis for this intervention, positing that certain mental health problems arise from past experiences that have been maladaptively stored in the brain as unprocessed memories. According to this model, the brain's information processing system integrates incoming stimuli into pre-existing neural networks during the processing of new experiences. These networks are the foundation for an individual's perceptions and behaviors. Typically, the brain processes incoming information to *adaptive resolution*, meaning that the information from an experience is integrated constructively into emotional and cognitive schema. However, during particularly distressing experiences, incoming stimuli may become stored in isolation, remaining in the form of overwhelming perceptions, emotions, and sensations experienced at the time of the event, rather than merging into the more adaptive pre-existing networks. In such cases, the perceptions, emotions, and sensations from the unprocessed memory can emerge again automatically if a current situation triggers the memory network of dysfunctionally stored information (Shapiro & Maxfield, 2002). EMDR treatment works to access and thoroughly integrate these isolated memories into wider, more adaptive networks (Shapiro, 2001).

To achieve adaptive resolution, EMDR employs a standardized trauma-focused (TF) protocol and bilateral dual attention stimulation (BLS; Shapiro & Solomon, 2010). BLS is accomplished by prompting a patient to internally focus on a targeted traumatic memory while

simultaneously attending to an external stimulus such as horizontal sets of eye movements, alternating taps, or auditory tones alternating from ear to ear (Shapiro & Solomon, 2010). The current literature lacks a unanimous understanding of the precise neurological mechanism through which BLS accesses the AIP system, although scholars have proposed different theories. Shapiro (2014), for example, has pointed to a possible psychophysiological factor underlying the efficacy of BLS, suggesting that BLS promotes relaxation through activating the parasympathetic nervous system. Additionally, Bergmann (2008) has proposed that BLS increases hemispheric communication in the brain by activating the thalamus. Given that the thalamus plays a role in cognitive processes and is involved in the processing of bodily senses, it is hypothesized that this activation may contribute to the repair of hemispheric connections that are often disrupted in PTSD (Bergmann, 2008). Furthermore, Pearson (2009) posits that BLS may promote neural plasticity by activating a neural network in the parietal cortex of the brain. The parietal lobes' associations with working memory, eye movements, and pain processing combined with its influence on one's *sense of self* may facilitate integration of the traumatized version of oneself with one's current sense of self, as frequently seen in the outcomes of EMDR (Teneycke). Subsequently, updating the internal representations of the body could also influence chronic pain.

Multiple scholars have also pointed to a theory regarding sleep-dependent memory processing to explain the role of BLS in promoting adaptive resolution (Lee & Cuijpers, 2013; Stickgold, 2008). Eye movements may connect to the same processes that occur during rapid eye movement (REM) sleep (Lee & Cuijpers, 2013). This may be facilitated through EMDR's potential stimulation of acetylcholine, a neurotransmitter known for activating REM sleep states (Stickgold, 2008). It is possible that this expedites the processing of negative or traumatic

memories into more adaptive networks, given that REM activation reduces episodic memories and the negative affect of PTSD (Stickgold, 2008). Related to sleep is the prospect that BLS triggers an *orienting response* (i.e. "the attentional adjustment to unexpected stimuli," Kuiken et al., 2002), facilitating positive changes in an individual's narrative representation of a painful or traumatic memory (Shapiro, 2014). The orienting response has been associated with changes in dream content during REM sleep, and thus Kuiken et al. posit that, similarly, EMDR's activation of the orienting response may aid in content changes of traumatic memories (2002, p. 3).

Although these theories are currently seen as somewhat independent from one another, Gunter and Bodner (2009) suggest that these factors will most likely eventually be understood as interrelated (i.e., forming an integrated mechanism of action). EMDR has faced past criticism regarding the fact that the mechanism of action was not entirely understood prior to its clinical use (Lilienfeld et al., 2003) and has endured questioning as to whether the BLS component is indeed necessary. However, meta-analytic research has since confirmed significant effects (in both clinical and laboratory settings) for the eye movement component of EMDR, with positive effects also demonstrated when substituting eye movements with tones or taps (Lee & Cuijpers, 2013).

EMDR: Intervention overview

The standard trauma-focused (TF) EMDR protocol utilizes a three-pronged approach, addressing (1) past experiences contributing to present cognitive, emotional, and somatic distress, (2) present-day triggers, and (3) development and installation of positive beliefs to increase future adaptive functioning (Shapiro, 2001). According to Shapiro's (2001) protocol, TF-EMDR consists of eight stages. The first phase, *client history*, involves obtaining the client's background information, assessing client stability and availability of positive memory networks,

and developing a treatment plan. This phase also includes identifying memory targets (i.e., the most disturbing aspects of previous traumas) for processing. During the second phase, *preparation,* the client is prepared to process the targeted memory. The clinician's goals during preparation are to establish the therapeutic alliance (i.e., supportive therapist-client relationship), explain the EMDR process and its effects, and to teach the client techniques for emotional regulation. Third, in the *assessment* phase, the targeted memory is evaluated by identifying: a mental image of the memory, the current negative belief associated with it, a desired positive belief to ideally replace the current negative belief, and the client's current emotions and physical sensations. Baseline measurements of the level of current distress are measured using the Subjective Units of Distress (SUD) scale (Wolpe, 1969). The believability of the desired positive belief is assessed using the Validity of Cognition (VOC) scale (Shapiro, 2001).

Desensitization occurs in the fourth phase, during which the memory target is reprocessed. BLS is used to activate the information processing system, and the client maintains a dual awareness of their internal experience (mental picture of the negative memory and the related emotions, physical sensations, and negative beliefs) and their external experience (BLS). Shifts in cognition, emotion, and physical sensation associated with the memory are tracked and assessed using the SUDs and VOC scales. Fifth, throughout the *installation* phase, the client's desired positive self-belief is strengthened using BLS, and the connection with pre-existing positive cognitive networks is increased. The positive belief is associated with the target event until it feels true (using VOC scale). The sixth phase, *body scan,* focuses entirely on the body. The client pinpoints and processes any remaining negative body sensations until they disappear. Processing isn't considered complete until all negative somatic sensations have resolved. If comfort or positive sensation is identified, BLS is used to strengthen this. The seventh phase,

closure, returns clients to a state of calm in the present moment. This occurs either after the successful resolution of a target memory, or part way through processing if the session must end due to time constraints. The clinician should brief the client about what to expect between sessions, and instruct them to pay attention to their state of mind between sessions. *Reevaluation* takes place in the eighth and final phase. This occurs at the beginning of every new session, at which point the clinician and client explore any emotions or beliefs that have emerged since the previous session. Additionally, the previous session's memory target is assessed to determine the extent to which it has integrated into the larger network, and lasting effects of the treatment are evaluated.

Empirical support for EMDR

Currently, EMDR is well established as an effective treatment for trauma, with 20+ randomized trials supporting its usage (Martin et al., 2021; Shapiro, 2014, Shapiro & Solomon, 2010). EMDR has been found to be equally as efficacious as CBT and other accepted PTSD treatments (Bisson et al., 2007; Bradley et al., 2005), or even slightly superior (Chen et al., 2015). Eight of the 14 psychological guidelines reviewed by Martin et al. (2021) recommend EMDR as a first-line psychological treatment for trauma. EMDR is also effective at reducing post-traumatic stress symptoms in participants who have had adverse life experiences that don't fully meet the traumatic event criteria for PTSD diagnosis (Cvetek, 2008; Shapiro & Solomon, 2010). This finding may be particularly relevant for chronic pain patients whose distress has arisen primarily from the disturbance of the pain itself, and is significant in that non-diagnostic post-traumatic stress can still significantly impair life functioning (Coppens et al., 2017; Kind & Otis, 2019).

EMDR as chronic pain treatment: Arguments for use

The strong empirical support for EMDR as a trauma treatment has promising implications for its subsequent use for chronic pain intervention, given that trauma is a primary risk factor for chronic pain. Additionally, the daily difficulties related to chronic pain may be conceptualized by the individual as "little t" traumas in and of themselves (e.g., loss of autonomy, social isolation, financial stress; Grant & Threlfo, 2002). Given that emotion and perception of resilience play a role in the subjective experience of pain, EMDR may be a beneficial intervention because it addresses the underlying issue of maladaptive emotional processing (Shapiro & Solomon, 2010). Finally, a standard element of the EMDR's theoretical background and trauma protocol is addressing the somatic components of experiences and other emerging physical sensations (*Phase 6*). It follows that this integration of psychological and somatic issues may benefit chronic pain patients more significantly than treatments that employ a solely cognitive approach (Shapiro & Solomon, 2010). Furthermore, the AIP model can be utilized to support EMDR's treatment of chronic pain. Using the AIP model as a framework, certain expressions of chronic pain may be understood as resulting from unprocessed memories which contain the physical sensations experienced at the time of the event. This is reflected most clearly in physical traumas, such as in the case of phantom limb pain (Rostaminejad et al., 2017). This relevant theoretical background and its dual psychological-somatic focus make EMDR a promising intervention for individuals dealing with comorbid chronic pain and post-traumatic stress symptoms.

Arguably, EMDR is a viable alternative to CBT and other existing psychotherapeutic approaches for chronic pain. Within the context of trauma treatment, both CBT and EMDR interventions aim to reduce distress and strengthen adaptive cognitions. Although both

interventions are similarly effective for trauma treatment, they have notably different procedures. EMDR's procedural differences may be more congruent with the needs of chronic pain patients: *"Unlike CBT with a trauma focus, EMDR does not involve a) detailed descriptions of the event, b) direct challenging of beliefs, c) extended exposure, or d) homework.*" (World Health Organization, 2013, p. 1). EMDR's aforementioned integrative approach, coupled with its increased efficiency, patient-centered approach, and accessibility for patients with functional limitations, paint a strong argument for clinical use amongst chronic pain populations.

Although emerging literature positions EMDR as a promising intervention (Tesarz et al., 2014), not enough high-quality studies exist to definitively recommend it as a chronic pain treatment. As of 2019, six randomized controlled trials have been conducted, all of which demonstrated reductions in pain severity with overall medium or high effect sizes (Tesarz et al., 2019). Populations of interest included unspecified chronic pain (Estergard, 2008), chronic back pain (Gerhardt et al., 2016), severe migraine (Marcus, 2008), acute (post-surgery) pain (Maroufi et al., 2016), rheumatoid arthritis musculoskeletal pain (Nia et al., 2018), and phantom limb pain (Rostaminejad et al., 2017). However, methodological limitations must be considered in the interpretation of such results, including unclear specifics regarding patient population pain type (Estergard, 2008), vague procedural details of intervention (Estergard, 2008; Rostaminejad et al., 2017), clear divergence from the standard TF-EMDR protocol (Gerhardt et al., 2016; Marcus, 2008), small sample sizes leading to insufficient power (Gerhardt et al., 2016), poor control group (Maroufi et al., 2016), and acute rather than chronic pain population (Maroufi et al., 2016). The limitations of these studies make it difficult to generalize their findings, and thus necessitate further contributions to the field of EMDR and chronic pain research.

The limitation most relevant to this particular study proposal is the aforementioned divergence from the standard TF-EMDR protocol. A variety of pain-focused (PF) protocol modifications are emerging (e.g., Gerhardt et al., 2016; Grant & Threlfo, 2002; Marcus, 2008) despite the fact that EMDR is typically implemented through a standardized trauma-focused protocol. Although modifications have the potential to be better attuned to the needs of pain patients and thus possibly more effective, they must be empirically tested before being considered viable alternatives to the standard protocol. Most recently, through a series of interviews, von Baeyer (2020) identified and documented the most common EMDR protocol modifications being used by practitioners to treat chronic pain symptoms, including: creative visualization, additional resource development installation, the flash technique, Grant's (2000) pain protocol, and others. Von Baeyer (2020) reported that the majority of clinicians (75%) are modifying the standard EMDR protocol to treat pain but aren't doing it in a consistent/universal way. Crucially, no research has determined whether these modified protocols work more effectively than the standard TF-protocol in the treatment of chronic pain. These modifications have emerged at a time where the effectiveness of the standard protocol in treating chronic pain still has not been concretely established. Because of this, the need for departure from the standard protocol has also not been established. To develop more consistent and fruitful treatment of comorbid chronic pain and post-traumatic stress, it is necessary to build upon von Baeyer's work and pinpoint whether these EMDR modifications are effective, and in what contexts.

To date, the most popular modification is Mark Grant's (2000) pain-focused (PF) EMDR protocol (Gerhardt et al., 2016; Grant & Threlfo, 2002; von Baeyer, 2020). Grant's protocol addresses pain associated directly with a traumatic event as well as non-traumatic pain. Grant's

PF-EMDR protocol follows the same eight phases of Shapiro's standard TF-EMDR protocol but includes changes and additions to better meet the needs of chronic pain patients. In Grant's protocol, patients undergo a pain assessment and review of their diagnosis prior to beginning the first standard EMDR stage (*preparation*; Grant, 2010). Throughout the intervention, greater attention is given to pain sensations and developing psychological pain management strategies. Body scans, a hallmark of TF-EMDR's sixth phase, are used throughout desensitization as a whole (phases 4-6). Grant's approach also includes a practice of antidote imagery, psychoeducation related to pain management, and homework in the form of take-home audio recordings to help patients continue processing (Grant, 2010; Teneycke, 2012).

Although Grant's protocol is a promising intervention for pain, current research on the subject is limited. Grant's protocol has only been utilized in two small multiple case studies (Grant, 2000; Grant & Threlfo, 2002), one quasi-experimental study (Mazzola et al., 2009) and one randomized controlled trial (Gerhardt et al., 2016), none of which compared the PF-protocol directly to standard TF-EMDR. Arguably, utilization of Grant's protocol might be considered preemptive given how much is still unknown about the role of standard EMDR protocol in treating chronic pain. It remains unclear, for instance, how EMDR effectiveness might vary across different types of chronic pain (Tesarz et al., 2019) or which initial targets should be selected for pain patients (e.g., pain-related targets or trauma-related targets). Additionally, given EMDR's quality of memory network association, it is worth exploring whether it is even necessary to use pain-specific modifications; the standard protocol may be sufficient enough in revealing and treating interconnectedness between psychological and physical symptoms (Shapiro, 2014). Examination of these nuances is the aim of the proposed study.

Study overview

The purpose of the proposed study is to explore how EMDR therapy might best be implemented as an integrated treatment for chronic pain among individuals with post-traumatic stress (PTS) symptoms. This study will utilize a matched-participants design to compare outcomes of the standard TF-EMDR and Grant's (2000) PF-EMDR interventions on the pain severity and PTS symptom severity of patients at outpatient tertiary care pain centers. The use of random assignment to one of three experimental conditions (TF-EMDR, PF-EMDR, waitlist control) will allow for a direct comparison of these interventions in a way that previous studies have lacked.

By conducting baseline, outcome, and follow-up measurements of pain severity and PTS symptom severity, this study will examine the necessity and effectiveness of the pain-specific EMDR protocol modification on both of these variables. This study will also address two associative hypotheses to identify comorbidity rates and possibly further support the use of integrated treatments: participants who report higher baseline levels of PTS symptoms will also report higher baseline levels of pain (Hypothesis 1), and participants who report lower pain levels following treatment will also report lower levels of PTS symptoms (Hypothesis 2). Furthermore, several hypotheses will be tested to assess the overall effects of the treatment type on pain severity and post-traumatic stress severity across the three time points (baseline, post-intervention, and 6-month follow up). First, this study will assess whether there is a difference in baseline pain and PTS symptom severity between the TF-EMDR and PF-EMDR intervention groups, hoping to find no difference (Hypothesis 3). It will then assess whether both interventions produce a reduction in pain and PTS symptoms from baseline to post-testing (Hypothesis 4), as well as whether this reduction is maintained over time between post- and 6-

month follow up (Hypothesis 5). Furthermore, this study will test the hypothesis that PF-EMDR will produce a greater reduction in pain severity than TF-EMDR (Hypothesis 6). It will also explore whether TF-EMDR will produce a greater reduction in post-traumatic stress symptom severity than Grant's PF-EMDR protocol (Hypothesis 7). Finally, it will assess if the PF-EMDR protocol will more significantly reduce somatic preoccupation severity than it will reduce affective severity, with affective severity being calculated as a composite of the anxious arousal, depression, and anger TSI-2 subscales (Hypothesis 8).

Proposed Method

Participants

Participants for this study will be recruited from a range of tertiary care pain clinics in Southern California through a convenience sampling method, in collaboration with the centers. This sampling method will entail contacting and cooperating with clinic staff to advertise the study to patients. Given this recruitment method, it is likely that individuals in this sample will have more severe chronic pain than the general pain population because their pain is significant enough to incentivize them to seek treatment. Although this sampling method limits the generalizability of this study's findings to patients with significant enough chronic pain to be in a care center, this study is particularly focused on this population given that they represent a group that is in particular need of more effective treatment. Based on demographic data available at somewhat comparable tertiary care pain clinics (Kerr et al., 2004; Lakha et al., 2021; Mailis-Gagnon et al., 2007), it is likely that the most prevalent pain types among participants will be low back pain, musculoskeletal problems in the joints, and/or neuropathic disorders. The most affected age group is expected to be between 35 and 65, and there is expected to be a slightly greater population of women than men (Kerr et al., 2004; Lakha et al., 2021; Mailis-Gagnon et

al., 2007). Overall, participants are expected to maintain lower employment rates than the general public (Kerr et al., 2004; Mailis-Gagnon et al., 2007).

Clinic patients at least 18 years of age who report suffering from chronic pain and demonstrate PTS symptoms will be considered potential participants. Potential participants will be asked to volunteer for a multiple-session study in which they will engage in an intervention to address their chronic pain (primarily) and possibly their post-traumatic stress symptoms (secondarily). Participants will not be financially compensated.

To determine an appropriate sample size, a power analysis was conducted using G*Power (Faul et al., 2007), assuming the medium effect sizes found in previous studies (Gerhardt et al., 2016; Tersarz et al., 2019). Although a mixed model analysis of covariance (ANCOVA) will be used for this study's data analysis, a mixed model ANOVA will be used for the purposes of the power analyses. The proposed study utilizes difference scores to account for measurement at multiple time points (thus controlling for participants' individual characteristics), making the ANOVA an appropriate statistical alternative due to its examination of between-participants factors. For a desired statistical power of 0.80 and significance level of 0.05, a G*Power calculation indicates that 108 participants are needed. Assuming an attrition rate of roughly 20% based on the findings of previous studies (Gardoki-Souto et al., 2021; Gerhardt et al., 2016), the estimated sample size increases to 135. Finally, given the matched participant aspect of this study, the target recruitment number will be doubled (for a total of 270 participants) to ensure that participants are able to be adequately matched by pain type, pain severity, and PTS severity. Because participants need to be matched, some potential participants may not end up being included in the study if participants with comparable characteristics cannot be identified.

Materials

Materials will include a pain-related health information questionnaire, EMDR-specific measures, and measures to assess dimensions of chronic pain and post-traumatic stress. The pain-related health information questionnaire will cover questions regarding age, gender, type of chronic pain, duration of chronic pain, and previous and/or current pain treatments attempted. On the questionnaire, type of chronic pain will be assessed through qualitative fixed format response options listing the most commonly occurring types of chronic pain as well as an 'other' category for pain types that are not encapsulated by the response options. Chronic pain type options will include: migraine, back pain, arthritis/joint pain, musculoskeletal pain, phantom limb pain, cancer pain, scar tissue pain, and neurogenic pain. These response options will subsequently be used to match participants based on pain type similarity. Duration of pain will be assessed through fixed format response options based on time frame. Time frame response options will include less than 1 year, 1-2 years, 2-3 years, 3-4 years, and 5 years or above. Current and/or previous pain treatments will be assessed using qualitative fixed format response options listing the most common treatments as well as an 'other' category. The treatment response options will include surgical treatments; injection therapies; pharmacological methods such as topical agents, antidepressants, anticonvulsants, and/or opioids; behavioral treatments such as behavioral therapy, biofeedback therapy, and/or cognitive behavioral therapy; coping skills; physical and occupational therapy; and complementary and alternative medicines such as hypnosis, massage, acupuncture, meditation, and relaxation.

Process Measures

In alignment with the standard EMDR protocol, the Subjective Units of Distress scale (SUDS; Wolpe, 1969) will be used to evaluate changes in emotion during each EMDR session.

The SUDS is a single-item self-report measure designed to determine the subjective severity of distress experienced by the individual at the time of measurement. The scale ranges from 0 (*no disturbance or neutral*) to 10 (*the highest disturbance one can imagine*). The SUDS is first used in the assessment phase of EMDR (phase three), and then again throughout the treatment process to evaluate treatment outcomes. Research supports the use of SUDS as a measure for physical and emotional discomfort (Tanner, 2012) as well as its use specifically in the EMDR protocol (Kim, et al., 2008; Shapiro, 2001). The SUDS has demonstrated high concurrent validity, high convergent validity, and high discriminant validity (Kim et al., 2008).

The Validity of Cognition scale (VOC), another standard measure used in EMDR therapy, will be used to evaluate changes in cognition during the assessment, desensitization, and installation phases of EMDR (Shapiro, 2001). The VOC scale is a single-item self-report measure that determines how strongly a patient believes in a cognition that they hold. The scale ranges from 0 (*completely false*) to 7 (*completely true*). The VOC scale was primarily based on face validity (Shapiro, 2001), but its use is also arguably supported by research (Emmerson & Neely, 1988) highlighting the effectiveness of semantic differentials in counseling psychology to evaluate treatment outcomes.

Dependent Measures

To ensure that participants meet inclusion criteria of having both pain and PTS symptoms, participants will be evaluated using measures that assess these aspects prior to beginning the study. Pain severity will be measured using the Short-form McGill Pain Questionnaire (SF-MPQ-2; Dworkin et al., 2009). The SF-MPQ-2 is a 22-item measure that evaluates and describes pain across four different subscales (continuous pain, intermittent pain, neuropathic pain, and affective descriptors). Each item (representing a quality of pain or related

symptoms) is rated on an 11-point rating scale ranging from 0 (*none*) to 10 (*worst possible*). A total score is calculated through averaging the 22 individual scores, with higher scores indicating higher pain severity. Overall, the SF-MPQ-2 has robust psychometric properties in its use in pain studies, demonstrating strong reliability and validity (Dworkin et al., 2009). Additional pain studies indicate its solid convergent validity (Dworkin et al., 2015), good test-retest reliability, and high internal reliability (Cronbach's α scores ranging from 0.83 to 0.95; Jumbo et al., 2020).

Post-traumatic stress symptom severity and related psychological symptoms will be measured using elements of the Trauma Symptom Inventory-2 (TSI-2; Briere, 2011). The TSI-2 is a 136-item self-report measure used to assess PTSD as well as a wide range of broader psychological outcomes related to stressful events. Respondents rate how often each listed symptom has occurred during the past six months. Items are rated on a 4-point scale ranging from 0 (*never*) to 3 (*often*). The TSI-2 score report generates a total score alongside a multitude of subscale scores, with higher scores indicating higher symptom severity. For the purposes of this study, a post-traumatic stress (PTS) score will be calculated using only certain clinical subscales of the TSI-2 rather than using all 136 items. The subscales to be used are as follows: anxious arousal, depression, anger, dissociation, somatic preoccupations. This will serve to reduce information irrelevant to the study and decrease measure length to reduce participant fatigue. Furthermore, an affective severity score will be calculated as a composite of the anxious arousal, depression, and anger subscale scores. The TSI-2 also produces a reliable change score for repeated measurement, which will be used in re-testing post-intervention and during the 6-month follow-up. The TSI-2 is one of the most commonly used measures to assess PTSD and related symptoms. It has been tested across many studies and has shown good internal reliability (Cronbach's α scores ranging from 0.73 to 0.91; Snyder et al., 2009) and strong test-retest

reliability (Nilsson et al., 2018), as well as reasonable convergent and construct validity (Snyder et al., 2009).

Procedure

Written informed consent will be obtained from all participants prior to beginning the study. To ensure that participants meet inclusion criteria of having both (1) pain and (2) post-traumatic stress symptoms, participants will complete measures that assess their baseline levels of these elements prior to beginning the intervention. Participants will then complete the questionnaire to document their age, gender, type of chronic pain, duration of chronic pain, and previous and/or current pain treatments attempted. This study will utilize a matched participants three-group design, in which participants will be matched based on their baseline pain severity, type of pain, and post-traumatic stress symptom severity to control for these factors.

Once matched, participants will be randomly assigned to one of three treatment conditions: TF-EMDR, PF-EMDR, or the treatment-as-usual (TAU) waitlist control group. Participants in the TF-EMDR and PF-EMDR conditions will receive EMDR treatment provided by EMDR-trained practitioners over a secure Telehealth platform. Prior to the beginning of the study, practitioners will undergo EMDR training review to guarantee standardized treatment, as well as undergo training in Grant's (2000) protocol modifications to ensure that they carry out the modifications accurately. The same practitioners will be used across both conditions to avoid potential confounds that could result from possible differences in the practitioners.

The study will take place over 10 weeks, with participants completing one 90-minute session per week. All participants in the study will receive TAU, facilitated by practitioners at the pain clinics. Participants allocated to the waitlist condition will thus follow their usual treatment without receiving any other additional therapy. Participants assigned to the TF-EMDR

intervention will receive (in addition to TAU) the standardized outpatient EMDR intervention. Participants assigned to the PF-EMDR intervention will receive (in addition to TAU) Grant's modified pain-focused EMDR intervention.

Following the last treatment session, participants will once again complete the measures of pain severity and post-traumatic stress symptom severity. They will then be debriefed about the purposes of the study and provided with psychological resources if needed. Given the sensitive nature of pain and trauma, participants will also be monitored throughout the study for signs of distress beyond their typical threshold. The study will include a follow-up six months after the end of the initial intervention period, at which point participants will once again complete the measures and then be debriefed about the purpose of the follow up (i.e., determining if intervention effects have been maintained). After the study has completed, the TAU control group will be provided with the option to receive 10 sessions of whichever EMDR intervention indicates the greatest efficacy across pain and post-traumatic stress symptom reduction.

Ethical considerations

The physical, social, psychological, and financial impacts of chronic pain, alongside the limitations of current treatment options, position this study as part of a necessary exploration of more effective interventions. This study has the potential to provide direct benefits to participants through possible reduction in pain severity and PTS symptoms. In addition to participant benefit, this research may provide benefits on the scholarly and societal levels alike; understanding to what extent TF-EMDR and PF-EMDR can serve chronic pain patients with PTS symptoms is important to the field of academic research and has implications for clinical work.

Alongside benefits, it is important to consider possible risks of the study and vulnerabilities of the population at hand. This study's population may be considered vulnerable given that it is a clinical population of individuals suffering from (possibly severe) physical and/or psychological stressors. This study may be considered higher than minimal risk because it may necessitate that vulnerable individuals confront their (pre-existing) distressing somatic sensations and/or emotional states. Although this EMDR intervention could instead be implemented using a less vulnerable population, doing so would not provide insight into how it may specifically help those with comorbid chronic pain and PTS. The necessity of testing this intervention directly on this population supports its usage despite the risks.

Due to the sensitive nature of this study, safeguards will be put in place to minimize risks to participants and protect participants' well-being to the extent possible. Prior to agreeing to participate, participants will undergo an informed consent process, in which they will be provided with adequate information about the study so that they have a full understanding of the benefits and risks involved with participation. Participants will be provided with a clear explanation of the EMDR stages and process, ensuring they are aware that distressing thoughts, images, or sensations may be addressed during the session. They will also be informed that their identities and medical details will be kept confidential and that they may withdraw from the study at any point. Following the last session of the study, participants will be debriefed about the purposes of the study and provided with psychological resources as needed. Patients will also be monitored throughout the study for signs of distress (that exceed their baseline level of distress from PTS and/or pain). Any participant exhibiting increased distress will be followed up with immediately. These distressed participants will be provided resources, and if necessary, participants may terminate participation in the study.

To supplement the aforementioned safeguards, this study will also be intentional about encouraging voluntary (rather than coerced) participation. Admittedly, possible pain relief may be an incentive for patients. To reduce any potential pressures to participate despite this incentive, the researcher will (1) specify during informed consent that patients are not obligated to participate, (2) educate patients about alternative treatments available to them outside of the study, and (3) will not provide financial compensation. Given that chronic pain care often has financial impacts, the choice to not provide financial compensation will serve to reduce the likelihood that especially vulnerable or disenfranchised pain patients feel the need to participate. Additionally, given that patients who are experiencing a flare-up in their pain may be more compelled to participate, potential participants will be asked to rate their pain intensity in the current moment before consenting to the study. Potential participants who report significantly high pain will be contacted at a later time and asked for consent only when they report less significant distress.

Finally, regarding confidentiality, participants will need to provide possibly sensitive health information in the pain-related health information questionnaire. This is necessary for facilitating the matched participants design (i.e., matching pain types), and may be beneficial for observing if pain type appears to interact with intervention effectiveness. To protect this information, data will be collected through a secure telehealth platform that automatically encrypts. Unique ID numbers will be assigned to participants after they consent to participate in the study, so no names or identifiable characteristics will be privy to the researcher. Additionally, to ensure an added level of privacy, therapists providing the EMDR interventions will be subject to therapist-client confidentiality requirements, in which therapists agree to keep all information

they learn about the participants during the study confidential. Overall, with these safeguards in place, the potential benefits gained from this study outweigh the possible risks.

Anticipated Results

Data analysis strategy

Two simple correlations will be conducted to establish the relationship between pain severity and post-traumatic stress symptom severity. The first correlation will explore if participants who report higher baseline levels of post-traumatic stress symptoms will also report higher baseline levels of pain (Hypothesis 1). The second correlation will address whether participants who report lower pain levels following treatment will also report lower levels of post-traumatic stress symptoms (Hypothesis 2). A series of mixed model analyses of covariance (ANCOVAs) will be conducted to determine the effects of the treatment type predictor variable on pain severity and post-traumatic stress severity across the three time points (baseline, post-intervention, and 6-month follow up), addressing Hypotheses 3-8. The covariates for this study will be type of pain, duration of pain, pain symptom severity, PTS symptom severity, and existence of previous and/or current pain treatments.

Hypothesized results

Consistent with aforementioned findings (Fishbain et al., 2017; Kind & Otis, 2019; Siqveland et al., 2017), there is expected to be a moderate or strong positive correlation between baseline post-traumatic stress severity and pain severity (Hypothesis 1). This makes sense given the high comorbidity rates between these conditions as well as theories (Barlow, 2002; Burke et al., 2017; Coppens et al., 2017; Tesarz et al., 2019; Vlaeyen & Linton, 2000) that the two conditions share underlying maladaptive cognitive mechanisms. This same logic may be extended to support the hypothesis that participants who report lower pain levels following

treatment will also report lower levels of post-traumatic stress symptoms (Hypothesis 2). Once an individual's dysfunctional emotional processing has been attended to via EMDR's adaptive resolution (Shapiro, 2001), one might expect both pain and post-traumatic stress severity to subside.

Regarding baseline testing, it is hypothesized that there will be no significant difference in baseline pain and PTS symptoms between the PF-EMDR, TF-EMDR, and waitlist condition groups, given the usage of the matched participants design and intervention group randomization (Hypothesis 3). Additionally, in alignment with literature denoting both TF-EMDR's (Tesarz et al., 2019) and PF-EMDR's (Grant & Threlfo, 2002) preliminary efficacy in pain treatment, it is expected that both TF- and PF-EMDR will produce at least moderate reduction in pain and PTS symptoms from baseline to post-testing (Hypothesis 4). Furthermore, this reduction in symptom severity for both dependent variables is expected to be maintained over time between post-treatment and the 6-month follow up (Hypothesis 5), in line with literature reporting that the pain-alleviating effects of EMDR are sustained or even show further improvements over time (Tesarz et al., 2019).

With regard to intervention modification comparison, Grant's (2000) PF-EMDR protocol modification is expected to produce a greater reduction in pain severity than the standard TF-EMDR protocol and the standard TAU (Hypothesis 6). PF-EMDR's increased somatic focus serves as the basis for this prediction, given that the modified protocol incorporates pain management education, body scans, antidote imagery, and other elements that have appeared to be particularly effective in the treatment of pain (Grant, 2000). It follows that these pain-specific aspects might facilitate more improvement for pain patients than the more general standardized protocol, which only integrates a bodily focus into the sixth phase (Shapiro, 2001). Although PF-

EMDR's efficacy is still being established, it is most likely at the very least comparable to TF-EMDR, as existing studies of either intervention have reported significant decreases in pain severity (Gerhardt et al., 2016; Nia et al., 2018; Mazzola et al., 2009; Rostaminejad et al., 2017).

Furthermore, the standard TF-EMDR protocol is hypothesized to produce a greater reduction in post-traumatic stress symptom severity than both Grant's (2000) PF-EMDR protocol and the standard TAU. (Hypothesis 7). This prediction is in line with a substantial body of research supporting the use of TF-EMDR for PTSD and related psychological stress symptoms (Martin et al., 2021, Shapiro, 2014, Shapiro & Solomon, 2010). In contrast to TF-EMDR, PF-EMDR so far lacks similar empirical support for efficacy related to post-traumatic stress symptoms, as it has been primarily studied in relation to pain. Given that this modified intervention prioritizes a pain focus over a trauma focus (Grant, 2000), it is possible that the psychological dimensions will not be addressed as sufficiently as they would be by the standard TF-EMDR protocol. However, it is expected that PF-EMDR will at least have at least somewhat of a positive impact on post-traumatic stress symptom reduction. This is supported by the rationale that post-traumatic stress severity may subside alongside pain as maladaptive emotional processing is corrected via EMDR's adaptive resolution process (Shapiro, 2001), which should be expected to occur in both intervention groups.

Combining the rationale supporting Hypotheses 6 and 7, it is also predicted that Grant's (2000) PF-EMDR protocol will more significantly reduce somatic preoccupation severity than it will reduce affective severity (Hypothesis 8). In essence, PF-EMDR's increased somatic focus may be expected to influence somatic preoccupation more significantly than it will to the affective dimensions, although both are expected to show positive changes.

Scholarly Merit and Broader Impacts

This study's significance is multifaceted. Understanding in what contexts and to what extent EMDR can serve chronic pain patients with post-traumatic stress is beneficial in both the academic and clinical domains. Regarding academia, current literature addressing EMDR as a chronic pain treatment is still in its relative infancy. Few high-quality studies have been conducted in the field, and the methodological limitations of the existing studies reveal a need for additional research that is more sufficiently generalizable (Tesarz et al., 2019). By comparing the effects of Grant's (2000) pain protocol and the standard trauma-focused protocol, this study may add to the existing TF-EMDR literature as well as contribute to the growing literature regarding pain-related EMDR protocol modifications. The focus on PF-EMDR is also significant in that it is currently unknown whether modified EMDR protocols are a viable alternative to TF-EMDR, or whether such modifications are simply unnecessary. As the first study to compare the PF-protocol directly to TF-EMDR, this study will further academic understanding of how precisely EMDR might best be used or modified for individuals with chronic pain and post-traumatic stress. Furthermore, in examining a modified EMDR protocol, this study may encourage broader scholarly exploration of EMDR modifications for other conditions in the future, perhaps even beyond the scope of trauma and/or pain.

Clinically speaking, EMDR's integrated somatic and psychological focus make it a promising intervention for individuals dealing with comorbid chronic pain and post-traumatic stress symptoms. Fine-tuning the efficacy of EMDR amongst chronic pain patients has important implications for alleviating not only chronic pain, but its associated physical, social, psychological, and financial impacts. Effective EMDR treatment has the potential to enhance quality of life and many aspects of everyday functioning, as well as decrease rates of depression

and social isolation (Tompkins et al., 2017). Relief from high healthcare costs and additional expenses associated with lower work productivity is significant on both the personal and wider economic levels. More broadly, given that this study departs from both EMDR's standard protocol *and* standard purpose (i.e., trauma treatment), this study may support the overall expansion of EMDR's clinical usage. For instance, its findings may be informative for clinicians interested in utilizing different forms of EMDR for a range of conditions. Overall, by more clearly distinguishing between the effectiveness of TF- and PF-EMDR, the findings of this study might allow academics and care providers alike to better understand and/or implement the interventions that will best serve individuals given their positionalities and needs, leading to increasingly effective treatment in the future.

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