Journal of Anxiety Disorders 25 (2011) 1–11

Contents lists available at ScienceDirect

Journal of Anxiety Disorders

The efficacy and psychophysiological correlates of dual-attention tasks in eye movement desensitization and reprocessing (EMDR)

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ARTICLE INFO

Article history:
Received 23 March 2010
Received in revised form 28 June 2010
Accepted 28 June 2010

Keywords:
EMDR
Eye movements
Autobiographical memory
Psychophysiology
Orienting response

ABSTRACT

This study aimed to investigate the psychophysiological correlates and the effectiveness of different dual-attention tasks used during eye movement desensitization and reprocessing (EMDR). Sixty-two non-clinical participants with negative autobiographical memories received a single session of EMDR without eye movements, or EMDR that included eye movements of either varied or fixed rate of speed. Subjective units of distress and vividness of the memory were recorded at pre-treatment, post-treatment, and 1 week follow-up. EMDR-with eye movements led to greater reduction in distress than EMDR-without eye movements. Heart rate decreased significantly when eye movements began; skin conductance decreased during eye movement sets; heart rate variability and respiration rate increased significantly as eye movements continued; and orienting responses were more frequent in the eye movement than no-eye movement condition at the start of exposure. Findings indicate that the eye movement component in EMDR is beneficial, and is coupled with distinct psychophysiological changes that may aid in processing negative memories.

1. Introduction

An extensive body of literature has demonstrated efficacy of eye movement desensitization and reprocessing (EMDR) for the treatment of posttraumatic stress disorder (PTSD). Meta-analyses that have examined efficacy of EMDR have concluded that it is as effective as traditional exposure therapy (Bisson et al., 2007; Bradley, Greene, Russ, Dutra, & Westen, 2005), and many international clinical practice guidelines recommend both therapies for the treatment of PTSD (Foa, Keane, Friedman, & Cohen, 2009; National Institute for Clinical Excellence, 2005). However, processes that operate in EMDR remain unclear. In particular, a longstanding debate continues in the literature about whether processes in EMDR are different from those of traditional exposure, and controversy still remains about the role of the eye movements in EMDR.

EMDR is a complex therapy with many elements (Solomon & Shapiro, 2008). Processes identified in EMDR include mindfulness, somatic awareness, free association, cognitive restructuring, and conditioning. These processes may interact to create the positive effects achieved through EMDR (Gunter & Bodner, 2009; Solomon & Shapiro, 2008). However, the mechanism of change in EMDR that has received most attention in the scientific literature is the eye movements (EMs) and other bilateral stimulation (i.e., tones and tapping) that are used as a dual-attention task within the procedure. To date, research that has examined the effect of the EMs in EMDR has resulted in mixed and inconsistent findings. It has been demonstrated that a single session of EMDR-with EMs leads to greater reductions in distress compared to EMDR-without EMs (Lee & Drummond, 2008; Wilson, Silver, Covi, & Foster, 1996). However, other researchers have reported that EMDR-with or -without EMs led to significant positive, but equivalent treatment effects (Pitman et al., 1996; Renfrey & Spates, 1994). Davidson and Parker (2001) employed meta-analysis to examine the impact of the EMs in EMDR, but found only marginally significant effects of the EMs in clinical populations. Thus, at present the contribution that EMs make to overall clinical effectiveness remains unclear.

A separate, expansive body of literature demonstrates that EMs have various effects on cognitive, neurological, and physiological processes that aid in memory processing. Laboratory research on non-clinical samples has demonstrated that when negative memories are recalled induced EMs decrease the emotionality and degree of vividness associated with them (Andrade, Kavanagh, & Baddeley, 1997; Barrowcliff, Gray, Freeman, & MacCulloch, 2004; Gunter & Bodner, 2008; Kavanagh, Freese, Andrade, & May, 2001; Maxfield, Melnyk, & Hayman, 2008; van den Hout, Muris, Salemink, & Kindt, 2001). Induced saccadic EMs have also been shown to affect cognitive processes such that they enhance episodic memory retrieval (Christman, Garvey, Propper, & Phaneuf, 2003; Christman, Propper,

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doi:10.1016/j.janxdis.2010.06.024

& Dion, 2004; Propper & Christman, 2008), increase the accuracy of memories recalled (Christman et al., 2004; Lyle, Logan, & Roediger, 2008; Parker, Relph, & Dagnall, 2008), induce cognitive and semantic flexibility, and facilitate attentional orienting (Kuiken et al., 2001–2002). Research investigating the neurological effects of EMs has demonstrated that saccadic EMs create changes in brain activation that enhance memory processing (Christman et al., 2003; Christman et al., 2004; Christman, Propper, & Brown, 2006).

While neurological changes created by EMs is a relatively new field of research, the physiological effects of induced EMs have been reported for many years, not only in laboratory studies but also more recently in treatment studies with PTSD patients (Elofsson, von Schèele, Theorell, & Söndergaard, 2008; Sack et al., 2008). EMs produce distinct psychophysiological effects, with most studies suggesting that they are associated with psychophysiological dearousal (for a review, see Söndergaard & Elofsson, 2008). For example, Barrowcliff et al. (2004) found that when participants brought-to-mind negative autobiographical memories EMs, compared to an eyes stationary condition, consistently reduced physiological arousal as indicated by significantly lower skin conductance. They concluded that their findings offer support for the orienting response theory of EMDR (MacCulloch and Feldman, 1996).

The orienting response (OR) was first described by Pavlov (1927) as "a "what-is-it" reflex which brings about the immediate response in man and animals to the slightest change in the world around them, so that they immediately orientate their appropriate receptor organ in accordance with the perceptible quality in the agent bringing about the change, making full investigation of it" (p. 12). Russian physiologist Eugene Sokolov (1963) proposed that the OR has two distinct phases: first, an alerting reaction in response to a novel stimulus in the environment; and second, habituation that leads to a reduction of the OR with repeated stimulus presentations in the face of no danger or threat. The OR is a well defined reflex and it is one of the most heavily investigated topics in psychophysiology (Sokolov & Cacioppo, 1997). The psychophysiological profile of the OR is characterized by an increase in parasympathetic tone (reflected by bradycardia and increased heart rate variability), decreases in respiration rate, and an increase in sympathetic tone (reflected by skin conductance increases and skin temperature reductions) (Öhman, Hamm, & Hugdahl, 2000). This reaction is a short-term (less than 10 s) response that habituates quickly. Shapiro (1995) has proposed that desensitization of trauma memories occurs in EMDR through possible mechanisms such as the orienting response, and other mechanisms such as disruptions in working memory and reciprocal inhibition.

The EM component in EMDR is thought to aid in the processing of memories by taxing working memory (Maxfield et al., 2008). Working memory theories of EMDR are based on Baddeley and Hitch's (1974) model that states that working memory is a capacity limited system that is responsible for consciously maintaining information in the face of ongoing information processing and/or distraction. Working memory theory proposes that targeted memories are held in working memory during EMDR. Concurrently engaging in EMs during EMDR overloads working memory capacity and, in turn, the memories held in mind become less vivid. Working memory theory predicts that the more complex the dual-attention task in EMDR, the greater the reductions in vividness and distress associated with negative memories.

A third account of EMDR proposes that counter-conditioning through reciprocal inhibition (Wolpe, 1991) is a mechanism underlying EMDR. The theory of reciprocal inhibition posits that two incongruent responses (relaxation and anxiety) cannot coexist. Research suggests that the EMs in EMDR, through inducing ORs that dissipate, create a state of physiological dearousal while patients simultaneously think about the traumatic memory (Wilson et al., 1996). Thus, a relaxation response is paired with the distress associated with the traumatic memory and, in turn, the association between the traumatic memory and the distress response weakens. Studies using EMDR have found that psychophysiological dearousal occurs from before to after successful treatment (Aubert-Khalfa, Roques, & Blin, 2008; Forbeset al., 1994; Sack, Lempa, & Lamprecht, 2007). Surprisingly, however, very little empirical research has examined psychophysiological changes *during* treatment sessions in patients with PTSD.

The first published study to have examined the mechanisms of EMDR by investigating the autonomic responses during EMDR was by Wilson et al. (1996). Eighteen subjects with distressing memories of traumatic events were treated with a single session of either EMDR-with EMs or two comparison treatments (EMDR-with tapping, or EMDR-with no EMs). EMDR-with EMs, but neither of the comparison conditions, led to significant physiological dearousal from before to after treatment. Onset of the EMs was associated with a relaxation response, suggesting that reciprocal inhibition is at least one of the mechanisms underlying EMDR.

More recently similar autonomic changes have been reported during EMDR intervention in naturalistic treatment settings with PTSD clients (Elofsson et al., 2008; Sack, Lempa, Steinmetz, Lamprecht, & Hofmann, 2008). Both studies provide support for a dearousal model of EMDR, as the authors demonstrated that EMDR resulted in significant physiological dearousal across the treatment session, reflected by a shift in autonomic balance as indicated by lowered heart rate (HR), respiration rate (RR), skin conductance (SC), and increased heart rate variability (HRV). Analysis of the within session physiological processes also indicated that the EM component in EMDR was associated with certain physiological changes. When the EMs began HR significantly decreased within the first 10 s, and HRV increased, together indicating decreased sympathetic and increased parasympathetic activity respectively. Although RR decreased across sessions, both Sack and Elofsson found that EM sets were associated with a significant increase in RR. Elofsson and colleagues also demonstrated that EMs were associated with a trend towards a decrease in SC. Sack and colleagues concluded that there was a clear association between the onset of redirecting the focus of awareness and following the therapist's moving hand with one's eyes and the elicitation an orienting response with psychophysiological de-arousal. A limitation of these findings was that neither study included a control group; therefore, the causal relationship between the onset of the EMs and the observed psychophysiological changes remains unclear.

The primary aim of this study was to investigate the psychophysiological correlates of the EM component in EMDR during a single treatment session by comparing findings to an EMDR condition with the eye movements omitted from the procedure. The study therefore also assessed the necessity of the EMs in EMDR. A further aim was to examine the effectiveness and psychophysiological correlates of two different types of eye movements commonly used in EMDR: fixed rate versus varied rate.

It was hypothesized that EM conditions would be more effective than the no-EM condition at reducing distress associated with negative memories. A further hypothesis was that the varied EM condition, assumed to be more taxing on working memory, would be more effective than the fixed EM condition and would generate more orienting responses. It was also hypothesized that physiological arousal would decrease within treatment sessions, and that different physiological responses would be noted for the EM conditions compared to the no-EM condition. Finally, it was expected that the physiological patterns of an orienting response would occur at the beginning of stimulation sets for the EM conditions.