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Review Paper

Brain-Based Changes and Therapeutic Effectiveness of the Eye Movement Desensitisation and Reprocessing Approach: A Mini Review

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ABSTRACT

The Eye Movement Desensitisation and Reprocessing or the EMDR approach, developed by F. Shapiro has been considered one of the most effective treatment options for PTSD. This mini review conceptualises the theoretical underpinnings of the effectiveness of EMDR with respect to PTSD as well for Substance Use Disorders (SUD), while looking into the neural correlates of the both these conditions. The Adaptive Information Processing (AIP) theory proposed by Shapiro herself views pathology as a product of maladaptive processing of information leading to its storage in a maladaptive form, which manifests outwardly as reliving a traumatic experience. Another theory that explains process of EMDR is the REM hypothesis, which posits that the bilateral stimulation arising out of the eye movements triggers the process of memory consolidation that is very much similar to the memory consolidation that occurs during REM sleep. Additionally, there is evidence showing promising findings for EMDR as a approach to treat SUDs. However, EMDR as a therapeutic approach works most efficiently when there are underlying traumatic reasons, such as intrusive memories, for the substance use.

Keywords: *EMDR, Adaptive Information Processing, REM hypothesis PTSD, Substance Use Disorders*

A relatively newer approach in the field of psychotherapy, the Eye Movement Desensitisation and Reprocessing or the EMDR approach, developed by Francine Shapiro, first came to fruition as a response to the daunting symptoms of Post-Traumatic Stress Disorder (PTSD) (Mayfield & Solomon, 2017). In her first publication on this approach, Shapiro conceptualises the technique as a product of multi-saccadic and rhythmic eye movements made while one consciously focuses on the traumatic memory, with the aim of desensitising the said memory (Shapiro, 1989). Figure 1 illustrates the various phases of EMDR theory.

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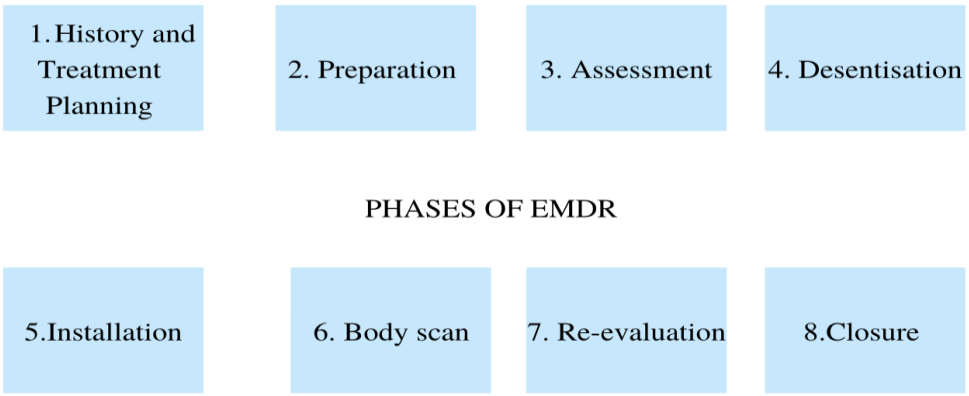
Figure 1 The eight phases of EMDR therapy

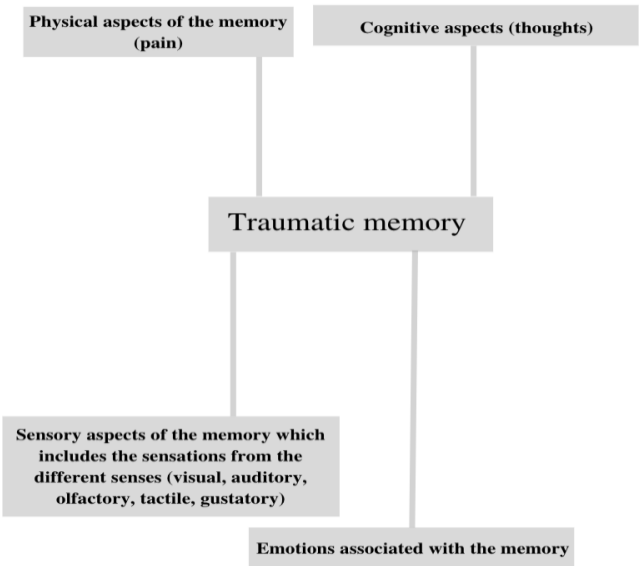


Note. The different phases of EMDR therapy. Adapted from the paper, The Role of Eye Movement Desensitization and Reprocessing (EMDR) Therapy in Medicine: Addressing the Psychological and Physical Symptoms Stemming from Adverse Life Experiences by F.Shapiro, 2014,*The Permanente Journal*, *18*(1): 71–77. Copyright by © 2014 The Permanente Journal.

Theoretical Underpinnings of the Neural Correlates of EMDR

The effectiveness of EMDR and the neural correlates of the same hasn't been without controversies. Multiple theories attempt to explain the approach, the most accepted one being the Adaptive Information Processing (AIP) theory proposed by Shapiro herself. This theory views pathology as a product of maladaptive processing of information leading to its storage in a maladaptive form, which manifests outwardly as reliving a traumatic experience (Pagani et al., 2017). Hence, according to AIP, when one is bombarded with information that causes an extremely high arousal state, the said information will be stored with all the sensations and perceptions that one experiences at the time of the event, which inevitably leads to an overwhelming negative arousal state at the recollection of that event (Adler-Tapia & Settle, 2017). A closely overlapping concept is that of the theory of pathogenic memories, which is believed to be the cause of many psychopathologies (Hase et al., 2017).

Figure 2 Different facets of a traumatic memory

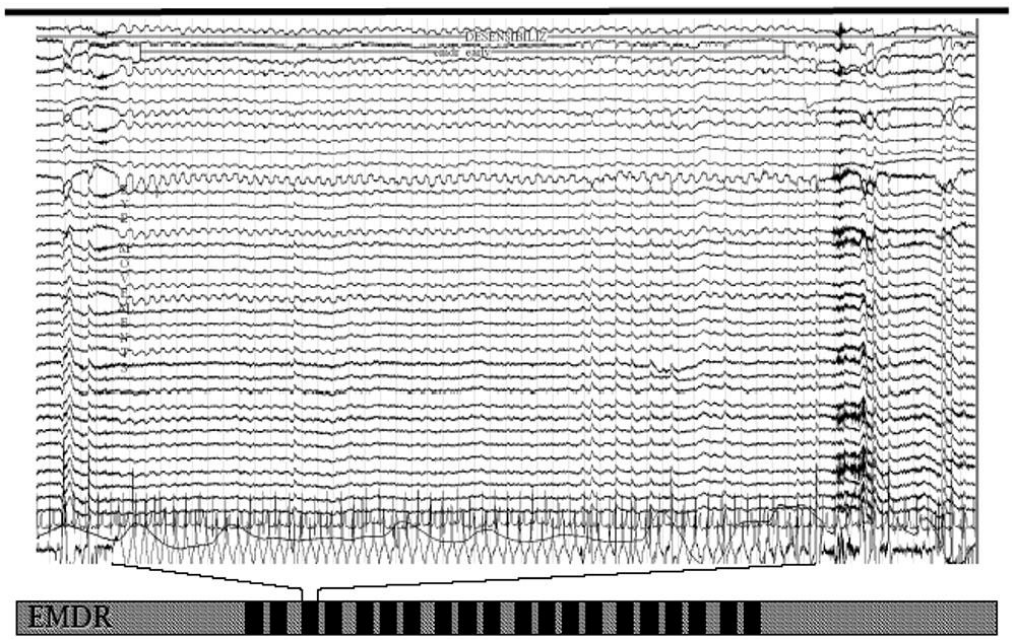


Note. These aspects are associated with the domain of memory but is amplified in the case of traumatic memory

A more neurological perspective that attempts to explain the effectiveness of EMDR is the thalamic binding model, which states that the bilateral stimulation that arises out of the rhythmic eye movements causes an integration of hemispheric functions, in addition to the emotional, cognitive, memory and somatosensory ones, as a result of the activation of the central and ventrolateral thalamic nuclei (Pagani et al., 2017).

The REM hypothesis places emphasis on the physicality of the eye movements and likens it to the process that occurs during the Rapid Eye Movement (REM) sleep of the sleep cycle. According to this perspective, the bilateral stimulation arising out of the eye movements triggers the process of memory consolidation that is very much similar to the memory consolidation that occurs during REM sleep (Pagani et al., 2017). During REM sleep, the neural representation of all the events from the day gets shifted from the amygdala-hippocampal complex so as to get processed by the rest of the brain. However, the highly arousing traumatic memories are said to be stuck in this amygdala-hippocampal complex, thus preventing its adequate processing. EMDR as an approach is an effective method, which is hypothesised to target this process, by mimicking the process of REM sleep, hoping to properly consolidate and process the traumatic memory (Des, 2020). During the administration of EMDR, the expert triggers bilateral stimulation of the brain, which triggers slow sleep waves, similar to the waves recorded during REM sleep, which in turn leads to the depotentiation of the AMPA synapses in the amygdala, thus facilitating the processing of the memory by shifting it to other areas of the brain (Pagani et al., 2017).

Figure 3 Elicited slow waves during an EMDR session*Note.* Slow waves elicited during an



EMDR session. Reprinted from the paper, Eye Movement Desensitization and Reprocessing and Slow Wave Sleep: A Putative Mechanism of Action, M. Pagani et al., 2014, *Front. Psychol.* 8:1935, Copyright © 2017 Pagani, Amann, Landin-Romero and Carletto.

The EMDR approach is becoming widely popular, with attempts being made to extend its scope from treating PTSD into other areas of psychopathology such as Substance Use Disorders (SUD), somatoform disorders, eating disorders and the like (Scelles & Bulnes, 2021). The rest of the essay will talk about the effect of EMDR therapy on PTSD and SUDs by understanding the neural mechanism of the same.

Neural Correlates of Post-Traumatic Stress Disorder

Post-Traumatic Stress Disorder (PTSD) is a debilitating mental health disorder that arises out of being exposed to threatening life events such as death, sexual assault and the like (Bisson et al., 2015). PTSD is a distressing disorder that causes significant impairment in both cognitive and functional aspects of life, thus requiring proper and effective intervention (Mann & Marwaha, 2022). However, PTSD can also be seen as a memory disorder, with the major dysfunction being in the process of memory consolidation, due to which the traumatic memory trace remains in the subcortical and the primary areas associated with perception thereby preventing its integration into the existing cortical memory circuits (van Marle, 2015). Furthermore, various functional imaging studies have observed higher activation in the amygdala while seeing a decreased activation in the prefrontal cortex in patients suffering from PTSD (Malejko et al., 2017). Other brain regions that appear to be implicated in the symptomatology of PTSD are the anterior cingulate gyrus, thalamus and prefrontal regions such as the Broca's area and the left inferior prefrontal cortex (Lanius et al., 2001).

How EMDR Changes the Brain and Alleviates the Symptoms of PTSD

Prior studies have demonstrated the effectiveness of EMDR when it comes to treating the haunting symptoms of PTSD. A significant reduction in activity in brain areas such as the amygdala, thalamus, precuneus, caudate nucleus, ventromedial and dorsolateral PFC has been noticed post the therapeutic sessions through this approach. This reduction in activity can be correlated to a decrease in the functional aspects of these brain regions, namely attention, sleep, fear, self-perception, memory and fear extinction (Rousseau et al., 2019). This thus can represent an adequately functioning top down process as opposed to the previously dysfunctional bottom-up process. Thus, EMDR is considered one of the most effective treatment strategies to alleviate the symptoms of PTSD (Wilson et al., 2018).

Neural Correlates of Substance Use Disorders

SUD is a serious mental health disorder characterised by a person's inability to control the use of legal or illegal substances, often leading to significant impairment in the occupational, social and academic fields (Jahan & Burgess, 2022). Impaired neural circuity leading to impairment in habit-formation, reward processing, cognitive and behavioural control are implicated in these disorders. Specific areas such as the anterior cingulate cortex, the dorsal striatum and the nucleus accumbens are associated with SUDs (Motzkin et al., 2014). Addiction memory as a concept refers to the recall of an event that is related to alcohol or drug use, by the person suffering from a substance abuse disorder and is closely related to the reason why EMDR is an effective therapeutic option for substance use disorders (Pilz et al., 2017). Figure 4 shows the three major brain areas that are implicated in SUDs.

Effectiveness of EMDR as an Approach for SUD

EMDR has proved itself to be effective for the treatment of SUDs and does show alleviation of symptoms such as fear, intense cravings and other comorbid conditions such as depression and anxiety (Pilz et al., 2017). This approach, in the context of SUDs, works by mainly targeting the underlying traumatic memories associated with substance take and

retake and alleviates the symptoms by helping the person integrate and process the memory efficiently (Pistoia, 2022). However, EMDR as a therapeutic approach works most efficiently when there are underlying traumatic reasons, such as intrusive memories, for the substance use. Prior literature in this area has shown the effectiveness of EMDR in reducing the cravings associated with alcohol withdrawal along with a significant reduction in the depressive symptoms associated with SUDs (Perez-Dandieu & Tapia, 2014). Specific memories associated with the effects of drugs and the associated loss of control form the addiction memory, which reduced significantly post-EMDR sessions (Hase et al., 2008).

CONCLUSION

In conclusion, the EMDR approach as a therapeutic tool has shown promising findings in various domains of psychopathology. Even though this method is best effective when it comes to treating and addressing the symptoms of PTSD, it also acts an effective method to treat the symptoms of other conditions as well, by helping the person to reintegrate and reprocess the faultily consolidated memory.

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Conflict of Interest

The author(s) declared no conflict of interest.

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