The Potential for Computerized Eye Tracking Technology to Improve Bilateral Stimulation Methodology and Assessment

Commentary

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Abstract

Bilateral stimulation is also called Eye Movement Desensitization and Reprocessing (EMDR) and is a psychotherapeutic technique for treating PTSD and other mental health issues. Trauma affects brain activity, and EMDR may help rewire that activity through use of bilateral stimulation (BLS) during memory processing. BLS typically involves eye movements; tracking a stimulus back and forth. However, the effectiveness of EMDR is debated due to limited research on its neurological mechanisms and methodological inconsistencies in the literature. Inconsistencies include lack of concrete methodology and inconclusive meta-analyses. The traditional EMDR eight-phase protocol involves history, assessment, desensitization, and more. A major appeal of EMDR for clients includes the low requirement for verbalizing traumatic memories in session, but effectiveness assessment relies on self-report. Eye tracking technology could address the standardization issues with EMDR while also enhancing protocols and research. Standardized EMDR, online or in-person, could improve outcomes and expand its applications.

Commentary

Bilateral stimulation, also called Eye movement desensitization and reprocessing (EMDR) is a clinical technique in the field of psychotherapy that was originally developed to improve symptoms of posttraumatic stress disorder (PTSD). It is generally believed that traumatic events that go unprocessed (i.e., no therapeutic intervention) can lead to decreased hippocampus and prefrontal cortex activity as well as increased amygdala response[1]. This pattern of brain activity response, referred to as neurofunctions, as a result of unprocessed trauma demonstrate brain activity modifications in those who suffer from PTSD. An underactive hippocampus and prefrontal cortex are unable to combat the warnings from an overactive amygdala, and reactions to threats, real or perceived, are exacerbated[2]. This demonstrates the neurological underpinning of a clinical diagnosis of PTSD in which the subject exhibits symptoms including recurrent flashbacks, persistent avoidance of the stimuli associated with the traumatic event, negative alterations in cognitions and mood associated with the traumatic event, and marked alterations in arousal and reactivity associated with the traumatic event[3].

EMDR has long been utilized to decrease the symptoms associated with PTSD and has also been found to enhance clinical outcomes for other mental health diagnoses including depression, bipolar, psychosis, panic disorder, anxiety disorder, OCD, substance abuse disorder, and pain[4]. The essence of the technique is that a client/patient engages in

bilateral stimulation (BLS) while processing (thinking, talking) a traumatic memory. Bilateral stimulation can involve any motion that crosses the midpoint of the body, but the earliest, and most common method, is eye movements. This process involves the head maintaining a stationary position while the subject moves their eyes back and forth while tracking a stimulus. For example, envision a client using their eyes to follow the hand motions of the clinician or tracking the motion of a light on an apparatus called a "light bar." In the past few years, EMDR therapy has been taken online as a result of the pandemic, so these eye movements can also include following a visual stimulus on a screen during virtual EMDR therapy. Most importantly, the eye movements need to move from left to right in a smooth motion, ensuring passage across the midpoint of the body[5]. The traditional EMDR protocol involves therapists taking clients through a total of eight stages: history and treatment planning, preparation, assessment, desensitization, installation, body scan, closure, and reevaluation[6]. BLS most often occurs in the desensitization and installation phases of the protocol.

While EMDR has support as an efficacious technique for treating PTSD, it is not universally accepted as the gold standard for treatment of that diagnosis. Both the American Psychological Association (APA) and UK National Institute for Health and Care Excellence (NICE) only conditionally recommend EMDR for the clinical treatment of PTSD[4]. The technique draws criticism due to the fact that the specific mechanism of change has yet to be identified[7]. According to Balkin's meta-analysis (inclusion criteria required neurophysiological measures), there have been no studies that can directly link EMDR to favorable neurophysiologic function changes, and the idea that it improves the aforementioned effects of trauma on the brain is based on basic neurologic ideals [8]. This lack of research on the neurophysiologic changes in the brain means that the R part of EMDR (reprocessing) has little scientific evidence to support the claim. Controversy over use of EMDR and its effectiveness likely comes from a dearth of solid research as well as a lack of concrete methodology. Research for EMDR tends to have lower quality studies with literature in this area consistently derived of small sample sizes, potential bias, or unreliable methods[8,9]. Meta-analysis of EMDR is also complicated as there is an abundance of articles on the topic of EMDR, but in most EMDR meta-analyses the majority of articles meet exclusion criteria. The remaining articles tend to give a wide variety of results ranging from more effective compared to other clinical methods to ineffective completely[8].

Part of the reason EMDR is so appealing for PTSD patients is that there is less talking in sessions than in typical talk therapy sessions. While in clinic this might be valuable for treatment outcomes, it adds a bit of difficulty when attempting to determine effectiveness of the treatment, since all measures are self-report and subjective. As a result, research tends to follow the same pattern, focusing on perceived symptom improvement rather exploring both subjective and objective improvement. Balkin also noted in his meta-analysis that none of the included studies tracked neurophysiological responses to corroborate self-report[8]. Furthermore, the vast majority of studies, sixty-two percent[9], solely focus on PTSD and the studies that do focus on other mental health issues are even shakier in methodology. Cuijpers's meta-analysis reported similar issues as Balkin: it is hard to draw meaningful conclusions due to unsatisfactory quality research with potential for bias in several studies. Methodological issues in EMDR research appears to be the strongest contributor when it comes to unsatisfactory conclusions drawn regarding EMDR's effectiveness.

Because this treatment technique was developed before adequate mechanistic research was conducted, it is not surprising that there is also a lack of information available relating to the specifics of how this treatment should be applied in the clinical setting. Although the eight-phase standard EMDR protocol is outlined in detail and endorsed by EMDRIA, the international association for EMDR practice, the specificity of BLS has yet to be defined with scientific rigor. Specifically, the eye movements, which is the basis of the technique and are purportedly responsible for the change in severity of PTSD symptoms, are vastly under researched. For example, to these authors' knowledge, there is no pre-determined speed for eye movements (e.g., how quickly the eyes move from left to right while processing the memory) nor specific width (e.g., how far to one's periphery the eyes move from left to right while processing the memory). Generally, there are recommendations for when to do "fast" or "slow" eye movements, but these metrics are not defined[10]. This lack of specificity may contribute to the myriad methodological issues with studying EMDR. Additionally, with the advent of online EMDR emerging, the specificity of BLS is even more important to get "right." Several virtual EMDR platforms have been developed in the past few years, with the COVID-19 pandemic creating a need for delivering services to clients from a distance. Virtual, or distance, EMDR, is achieved by conducting BLS in a variety of ways. One platform (remotEMDR) allows clients to choose their form of BLS: visual stimulus delivered via customizable options on the screen, auditory stimulus delivered via headphones, or tactile stimulus delivered via Bluetooth tappers. An early study on distance EMDR for PTSD symptoms related to the global pandemic yielded results similar to other EMDR studies- mixed results[11]. All subjects demonstrated

decreases in symptoms from pre-test to post-test, with one subgroup in the sample demonstrating significant decrease for the health care providers[11]. Results indicated stress reduction and positive mood production in self-reports, but seeing as the participants were generally in good mental shape the change in physiological data from pre to post intervention, that would substantiate the self-report, wasn't strong enough to corroborate[12]. This isn't to say that the intervention isn't effective, but rather that the methods of this study weren't satisfactory to confirm the research question. Virtual EMDR is very new and as such the present research reflects that in unreliable findings.

Eye tracking technology is potentially extremely helpful in the field of EMDR. As highlighted in this commentary already, the BLS for EMDR is not standardized. Technology can be used to track eye movement speed, width, and also customize variables like color of the on screen BLS simulator. Research has shown that variables like the aforementioned can make a difference in clinical outcomes. For example, both fast and slow eye-movements resulted in desired effects to working memory and the fast eye movements produced even better outcomes[13]. Technology that can standardize and differentiate what constitutes as fast vs slow is paramount, not only for research methodology, but also clinical application. Not relying solely on the subjective perception of fast vs slow from the clinician potentially could improve the outcomes for those being treated via EMDR. Additionally, this technology acts as a confirmation that the eyes are moving at the speed of the prompt which they are tracking. Online EMDR, while shown to be effective, could be improved as the on-screen eye tracking of a hand can look substantially different depending on dimension of the screen, distance from the camera of both the clinician and the patient, and then couple that with the other inconsistencies associated with in person EMDR therapy methodology, eye tracking technology likely could be a game changer for EMDR outcomes in treatment as well as improving methodologies with quantitative measures. Last, it is imperative to maintain a research focus on objective measures to support the subjective improvement in symptoms associated with PTSD and other diagnoses that benefit from the use of EMDR. Standardization of eye tracking along with improvements in neurofunction would provide a robust foundation for the how and the why for symptom improvement due to reprocessing during BLS.

One study notes EMDR as the first psychotherapy that is proven to alter the neurobiological effects of PTSD in the brain[14]. In his research, Pagini found that EMDR is correlated with functional changes to the region of the brain activated by autographic script confirming; the changes were consistent among a variety of severities of PTSD and types of trauma[14]. This study also suggests that the occipital lobe, which is responsible for visual perception, is one of the regions indicated as undergoing changes as it related to EMDR therapy[14]. Technology that can detect and record changes in eye movements is necessary in EMDR methodologies, in relation to visual perception speed, color, width, path, shape, etc., to potentially have the best neurobiological outcomes and results. Another meta-analysis by Lenferink and collaborators showed promising results with online EMDR therapy with PTSD symptoms during the Covid-19 pandemic, but also failed to show any standardized methods[15]. As per Maxfield's study, developing eye tracking technology for online EMDR to have more standard protocol would result in more compelling outcomes[13]. Effective online EMDR would allow for this treatment to be much more accessible to patients resulting in better health care for those suffering from PTSD. Recording eye movements during an EMDR session would also enhance research as scientists and clinicians can have measurable variables as far as the actual eye movements and other visual perceptions to have their results duplicated and corroborated. Standard protocol(s) for EMDR both online and in person would allow for quantitative clinical conclusions, potentially expanding EMDR to other areas of mental health like performance or treatment of other mental health afflictions.

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References

1 McEwen Bruce S. Protective and damaging effects of stress mediators: central role of the brain *Dialogues in clinical neuroscience.* 2022.
2 Shin Lisa M, Rauch Scott L, Pitman Roger K. Amygdala, medial prefrontal cortex, and hippocampal function in PTSD *Annals of the New York Academy of Sciences.* 2006;1071:67–79.
3 Barrowcliff Alastair L, Gray Nicola S, Freeman Tom CA, MacCulloch Malcolm J. Eye-movements reduce the vividness, emotional valence and electrodermal arousal associated with negative autobiographical memories *Journal of Forensic Psychiatry & Psychology.* 2004;15:325–345.
4 Maxfield Louise. A clinician's guide to the efficacy of EMDR therapy 2019.
5 Shapiro Francine. Eye movement desensitization: A new treatment for posttraumatic stress disorder *Journal of behavior therapy and experimental psychiatry.* 1989;20:211–217.

6 Hase Michael. The structure of EMDR therapy: A guide for the therapist *Frontiers in Psychology*. 2021;12:660753.
7 Patel Gauranga Jeram, McDowall John. The role of eye movements in EMDR: Conducting eye movements while concentrating on negative autobiographical memories results in fewer intrusions *Journal of EMDR Practice and Research*. 2016;10:13–22.
8 Balkin Richard S, Lenz A Stephen, Russo G Michael, Powell Brent W, Gregory Halie M. Effectiveness of EMDR for decreasing symptoms of over-arousal: A meta-analysis *Journal of Counseling & Development*. 2022;100:115–122.
9 Cuijpers Pim, Veen Suzanne C van, Sijbrandij Marit, Yoder Whitney, Cristea Ioana A. Eye movement desensitization and reprocessing for mental health problems: A systematic review and meta-analysis *Cognitive Behaviour Therapy*. 2020;49:165–180.
10 Schie Kevin, Veen Suzanne C, Engelhard Iris M, Klugkist Irene, Hout Marcel A. Blurring emotional memories using eye movements: Individual differences and speed of eye movements *European Journal of Psychotraumatology*. 2016;7:29476.
11 Yurtsever Asena, Bakalim Orkide, Karaman S¸enel, Kaya Sefa, Konuk Emre. The effect of the online eye movement desensitization and reprocessing early intervention protocol (EMDR R-TEP) for the risk groups with post-traumatic stress symptoms during the COVID-19 pandemic *Frontiers in Psychology*. 2022;13.
12 Kamin´ska Dorota, Sm´o lka Krzysztof, Zwolin´ski Grzegorz, Wiak Sl awomir, Merecz-Kot Dorota, Anbarjafari Gholamreza. Stress reduction using bilateral stimulation in virtual reality *IEEE Access*. 2020;8:200351–200366.
13 Maxfield Louise, Melnyk William T, Hayman Gordon CA. A working memory explanation for the effects of eye movements in EMDR *Journal of EMDR Practice and Research*. 2008;2:247–261.
14 Pagani Marco, H¨ogberg G¨oran, Fernandez Isabel, Siracusano Alberto. Correlates of EMDR therapy in functional and structural neuroimaging: A critical summary of recent findings *Journal of EMDR Practice and Research*. 2013;7:29–38.
15 Lenferink LIM, Meyerbr¨oker K, Boelen PA. PTSD treatment in times of COVID-19: A systematic review of the effects of online EMDR *Psychiatry research*. 2020;293:113438.