Improving Trauma Treatment: Examining the Effects of Different Levels of Activation in Online EMDR

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Abstract

Background: Eye Movement Desensitization and Reprocessing (EMDR) is used to reduce the emotionality and vividness of traumatic memories in post-traumatic stress disorder (PTSD). The effects of extra activation during EMDR and whether it leads to positive outcomes by taxing the working memory more is still unclear.

Objective: This study investigated the effectiveness of different levels of activation and desensitization (recall only, dual task only, recall + dual task, recall + dual task + activation). It was hypothesized that the conditions involving dual task would result in a larger decrease in emotionality and vividness compared to the conditions without the dual task. The second hypothesis was that more decrease in emotionality and vividness would be seen in conditions where participants recalled the negative memories during intervention compared to the 'dual task only' condition. We examined the effects of the different conditions on avoidance behavior about the negative memory in the week following the intervention.

Method: Non-clinical participants (N = 64) were randomly allocated to 4 conditions. The negative memory was induced by using a film clip. Emotionality and vividness of the memory were measured pre- and post-intervention, and at 1-week follow up. Avoidance behavior was measured post-intervention and at 1-week follow-up.

Results: There was a significant decrease in the emotionality and vividness both at post- and follow-up assessments. There was no significant difference between the conditions in reducing emotionality and vividness, nor for avoidance behavior.

Conclusions: No significant difference in the decrease in the emotionality and vividness scores was found between different conditions. The effects of different experimental conditions warrant more research. Studies with clinical samples are needed.

Keywords: PTSD, EMDR, working memory, dual task, emotionality and vividness, avoidance.

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Post-traumatic stress disorder (PTSD) is diagnosed in 8% of people who experience a traumatic event in their lives (Kilpatrick et al., 2013). One symptom of PTSD, re-experiencing the event, can occur in forms of intrusive thoughts, memories, and images (Sareen, 2014). Cognitive Behavioral Therapy (CBT), Exposure Therapy and Eye Movement Desensitization and Reprocessing (EMDR) were found to be effective in the treatment of PTSD symptoms (Foa & Rothbaum, 1998; Zoellner et al., 2003; Kar, 2011). Additionally, pharmacological treatments (selective serotonin reuptake inhibitors, sertraline, and paroxetine) are also used in treatment (Brady et al., 2000; Zoellner et al., 2003). Meta-analyses show that therapeutic interventions are more effective in reducing PTSD symptoms compared to pharmacological treatments (van Etten & Taylor, 1998; Zoellner et al., 2003). International guidelines suggest the use of EMDR and CBT as a first line treatment of PTSD for trauma survivors (Ursano et al., 2004; Capezzani et al., 2013).

Eye Movement Desensitization and Reprocessing (EMDR) consists of saccadic eye movements (EM) and the recalling of the traumatic memory simultaneously (Shapiro, 1989; van Schie et al., 2019). According to Shapiro (1989), this procedure results in reduced anxiety, flashbacks, intrusive thoughts, avoidance, and sleep-related problems as well as changes in the interpretation of the memory of the traumatic event. The working memory theory (Baddeley, 1992) suggests that this dual task taxes the limited capacity of the working memory (WM). The dual task in EMDR consists of saccadic eye movements. Patients are instructed to follow the therapist's fingers which are moving horizontally in front of them. Previous research shows that EMDR is significantly more effective than CBT for survivors of life-threatening medical conditions and chronic pain (Schneider et al., 2008; Arabia et al., 2011; Capezzani et al., 2011) and sexual assault survivors (Edmond et al., 2004; Jaberghaderi

et al., 2004). A recent study (van den Berg et al., in press) found a 60% decrease in PTSD symptoms in patients with PTSD and a psychotic disorder.

The term WM, as introduced by Baddeley (1992), introduces a memory system that simultaneously and temporarily stores and interprets information for cognitive tasks. EMDR task creates a competition for resources between WM task and hotspot recall (Gunter & Bodner, 2008; van den Hout & Engelhard, 2012). Voluntary EM makes the hotspot recall more difficult; consequently, the distress and emotionality caused by the memory reduces and the memory gets stored as less unpleasant in the long-term memory (Maxfield et al., 2008; van den Hout et al., 2012; Leer et al., 2014). Even though the exact ways through which EMDR changes emotionality of the traumatic memory is not completely known, the WM theory is most supported by previous experimental literature (Gunter & Bodner, 2009; Lee & Cuijpers, 2013).

Previous experimental research on EMDR and PTSD consists often of studies done with patients who experienced a traumatic event. On the other hand, aversive film clips are also commonly used in experimental studies to create emotional distress in participants (Lee et al., 2008; El Khoury-Malhame et al., 2017). In the *trauma film paradigm*, videos containing unpleasant and aversive material are shown to participants creating short-term stress reactions, both psychological and physiological (Holmes & Bourne, 2008; James et al., 2016).

With the aim to compare the effectiveness of EMDR and an addition of the screenshot element to EMDR, Cuperus and colleagues (2019) compared three conditions: A control group who viewed the screenshots only, a condition in which they recalled the memory while doing the dual-task, and the experimental condition performed the dual-task with the screenshot as a background. Results suggested that the two conditions where individuals performed the dual task combined with memory activation, either recall or a screenshot, were

more effective in reducing the emotionality and vividness of the memory compared to the screenshot only condition (Cuperus et al., 2019). Furthermore, the conditions where the dual task was done were more effective in reducing vividness. The screenshot only condition resulted in more decrease in emotionality compared to the other conditions. It's concluded that screenshot exposure can be an applicable method to induce negative memories while completing the dual task (Cuperus et al., 2016, 2019). The emotionality and vividness scores were only assessed shortly after the completion of conditions and permanence of the effects of the different conditions are hence not known. Consequently, Cuperus and colleagues' (2019) study didn't examine how avoidance behavior is affected after different interventions.

On another note, PTSD patients can portray avoidance behavior towards the memory of the traumatic event during the EMDR intervention which can have adverse effects on the efficacy of the treatment. It is shown by Lee and Cuijpers (2013), that the recall of the memory during EM (i.e., not engaging in avoidance) results in higher decrease in the emotionality and the vividness of the memory. A previous study (van Veen et al., 2016) examined the effects of different levels of recall and EM on the WM using three conditions: (1) recall of a relevant memory with EM, (2) recall of a relevant memory without EM and (3) recall of an irrelevant memory with EM. Researchers concluded that the recall relevant memory with EM condition showed more decrease in vividness and emotionality of the memory compared to the other two conditions. In conclusion, although recalling an aversive memory with EM loads the WM, EM do not instantly reduce the cognitive load created by the recall (van Veen et al., 2016). The study (van Veen et al., 2016) portrayed the importance of recall of the relevant memory during EM intervention yet lacked in assessing permanent changes in the vividness and emotionality of the memory. The key element in treatment of PTSD is exposure to the memories of the traumatic event and the inhibitory learning approach (Craske et al., 2014). It targets expectancy violation and stimulus discrimination

(Craske et al., 2014). Through this understanding, recall and the activation of the relevant memory is a necessary element of EMDR.

This study aims to investigate the effects of different levels of activation and desensitization on the emotionality and vividness of the negative memories. Negative memories were induced using a trauma film (Arnaudova & Hagenaars, 2017). Two-dimensional screenshots of the film clip were used for the screenshot condition as a background to the dual task. The present study compares the effects of two experimental conditions ('recall + dual task + screenshot' condition and 'recall + dual task' condition) with two control conditions ('recall only' and 'dual task only'). It adds to the current literature by investigating and assessing vividness and emotionality scores multiple times. Before (pre), immediately after (post-intervention) and one week after (follow-up) the intervention, participants rated the emotionality and vividness of the memory they have of the most disturbing images of the video. The follow-up assessment is especially critical in investigating the permanence of the outcomes. Furthermore, participants completed an avoidance questionnaire where they rated their avoidance behaviors about negative memories both at post-intervention and follow-up. Significantly, this study adds an extra activation condition that uses a screenshot which is compared to the 'recall + dual task' condition to assess the effects of the extra activation of the memory.

Bearing in mind the WM theory, it was expected that the conditions in which the dual task was performed will show a higher decrease in post-intervention emotion and vividness scores compared to the 'recall only' condition (**H1**). Furthermore, it was hypothesized that due to the burden on the WM capacity, a significantly higher decrease in post-treatment emotion and vividness scores was expected in 'recall + dual task' and 'recall + dual task + activation' conditions compared to 'dual task only' (**H2**; Andrade et al., 1997). The decrease in post-treatment emotion and vividness scores for 'recall + dual task' and 'recall + dual task

+ activation' conditions were exploratively analyzed and compared. Lastly, the effect of different conditions on follow-up avoidance scores was examined.

H1. dual task only = recall + dual task = recall + dual task + screenshot > recall only

H2. recall + dual task = recall + dual task + activation > dual task only

Methods

Participants

Participants were recruited via social media and flyers. 97 participants signed up for the study. Inclusion criteria for the study were: 18 years or older; not receiving treatment for any psychiatric condition; not taking any psychiatric medication; not having auditory or visual impairments. Moreover, inclusion in the study depended on having a Subjective Unit of Disturbance (SUD) score of 6 or higher at pre-measurement . 12 of the participants were eliminated from the study due to SUD scores lower than 6. 2 participants dropped out of the study because of extreme distress. 7 participants were excluded because of technical problems and 5 didn't show up to their appointments.

The final sample consisted of 64 participants of which 31 were women and 33 were men (See Table 1 for Demographic Characteristics of Participants). The ages of the participants varied between 18 and 47 (M = 25, SD = 4.81).

Materials

Emotionality. The Emotionality scale (SUD) was used to assess the level of disturbance and distress induced by the memories and recall of the film clip (Wolpe, 1969). This was measured by a 10-point Likert scale (see Appendix A for the questionnaire). The Emotionality scale is a standard procedure in the application of EMDR. It is used to assess the effectiveness of EMDR in decreasing the emotional intensity of negative memories (Shapiro, 2018).

Table 1
Demographic Characteristics of Participants

Characteristic	Recall Only		Dual Task Only		Recall + Dual Task		Recall + Dual Task + Screenshot	
	n	%	*n*	%	*n*	%	*n*	%
Gender								
Female	8	53.3	8	42.1	9	60	6	40
Male	7	46.6	11	57.9	6	40	9	60
Nationality								
Indian	7	46.6	7	36.8	8	53.3	3	20
German	1	6.6	2	10.5	0	0	2	13.3
Turkish	0	0	1	5.2	0	0	1	6.6
Italian	0	0	1	5.2	0	0	1	6.6
Dutch	2	13.3	2	10.5	1	6.6	4	26.6
English	0	0	0	0	0	0	1	6.6
Ghanaian	0	0	0	0	1	6.6	0	0
French	3	20	2	10.5	2	13.3	0	0
Greek	0	0	1	5.2	0	0	1	6.6
Swiss	0	0	1	5.2	1	6.6	0	0
Philipino	0	0	1	5.2	0	0	0	0
Canadian	1	6.6	0	0	0	0	0	0
Algerian	0	0	0	0	2	13.3	0	0
Japanese	0	0	0	0	0	0	1	6.6
Irish	0	0	0	0	1	6.6	0	0
Mongolian	1	6.6	0	0	0	0	0	0
Bulgarian	0	0	0	0	0	0	0	0
Romanian	0	0	0	0	0	0	1	6.6
Spanish	1	6.6	0	0	0	0	0	0
Highest completed educational level								
High school	6	40	4	21.1	3	20	4	26.7
Bachelor’s degree	4	26.7	9	47.4	6	40	3	20
Master’s degree	4	26.7	5	26.3	5	33.3	8	53.3
Doctorate	1	6.6	1	5.2	1	6.7	0	0

Vividness. Participants were asked by the researcher to rate the vividness of the memory of the film clip on a 10-point Likert scale (see Appendix A for the questionnaire). Measurement of vividness is mostly used in EMDR research (van den Hout et al., 2011).

Film clip. The film clip used to induce a negative memory consisted of physical and sexual violence in a crowded and loud environment where people were screaming. The clip was 2 minutes 40 seconds long. The effectiveness of the film clip used in this study was established by Arnaudova & Hagenaars (2017) and their results show participants reporting strong levels of involvement in and more intrusive memories of the negative film.

Avoidance questionnaire. This questionnaire consisted of 4 100-point Likert scale questions (see Appendix B for the questionnaire) and assessed the participants' experiences in the past week and whether they engaged in any avoidance behavior towards the memories and feelings the film clip evoked. The final score of the questionnaire was calculated as the means of participants' ratings of items.

Conditions

Participants were randomly assigned to four conditions : 'Recall only' condition (n = 15), 'dual task only' condition (n = 19), 'recall + dual task' condition (n = 15), and the 'recall + dual task + activation' condition (n = 15).

Recall Only Condition. Participants were instructed to choose an image from the video which they found most distressing and focus on that. They were told to look at the screen while focusing on the image and distress. They looked at the screen in 24-second intervals for 12 times, in-between these intervals where they were asked what was coming to their mind and were instructed to keep focusing on the distress in between tasks.

Dual Task Only Condition. During the intervention, participants conducted a ball-task in 24-second intervals for 12 times. The ball-task consists of the horizontal movement of a ball on the screen which changed into a cylinder at random intervals. The participants

followed the ball and pressed a key on their keyboard every time it changed into a cylinder. The speed of the ball was automatically adjusted to the right and wrong responses of the participants. There was also a distracting sound which resembled a clicking sound in the background of the task. Participants were instructed not to think about the film clip.

Recall + Dual Task Condition. The procedure of this condition was the same as dual task only procedure. Additionally, in recall + dual task condition, participants were instructed to concentrate on the distress and tension evoked by the most disturbing scene of the video during the task.

Recall + Dual Task + Activation Condition. The procedure of this condition was the same as recall + dual task condition. Additionally, participants were shown the screenshot of the scene which they found most disturbing as the background of the ball-task.

Procedure

The study consisted of a screening call and 2 online appointments. The screening call consisted of questions determining whether the individual meets the criteria for participation. Then, appointments were scheduled for the participants who fit the criteria. The online appointments were conducted using video call and the online application SilVrmind (2021).

The first appointment starts with the participant signing the information letter to give their written consent. After the instructions were given to the participant, a 60-second ball-task practice session was started. Them, the film clip was shown. During the video, the camera of the researcher is shut down and the camera of the participant stayed turned on. Then, the pre-measurement of emotionality (Subjective Unit of Disturbance) and vividness was conducted by the researcher. Participants received the intervention according to their condition. Following the intervention, the post-measurement of Emotionality (SUD) and Vividness of the memory was assessed again. Then, participants completed the avoidance questionnaire and the adapted TAAS.

The follow-up measurement takes place in an online video-call where the researcher conducts a follow-up Emotionality (SUD) and Vividness survey, and the participant completes the Avoidance questionnaire. After the follow-up measurements, participants were provided with a debriefing.

Data Analyses

To examine whether the gender distribution was different between conditions a chi-square analysis was used. To investigate differences in age between conditions a one-way ANOVA was conducted. Differences in pre-measurement of Emotionality (SUD) and Vividness between conditions were analyzed with a one-way ANOVA.

To examine which of the 4 conditions is most effective in reducing the emotionality and vividness of the aversive memory of the video, two mixed ANOVAs were conducted with emotionality and vividness as dependent variables and Condition (4 levels: recall only, dual task only, recall + dual task, recall + dual task + activation) as the between-subjects factor and Time (3 levels: pre, post, follow up) as the within-subject factor. To examine whether the conditions in which the dual task was performed would show a higher decrease in post-assessment scores compared to the 'recall only' condition, a contrast was performed: 'Recall + activation + dual task' & 'recall + dual task' & 'dual task' vs. 'recall only', Contrast 2: 'Recall + dual task' & 'recall + activation + dual task' vs. 'dual task only', Contrast 3: 'Recall + dual task' vs. 'recall + activation + dual task. The within-subjects factor Time was investigated with the following contrasts: Contrast 1: pre vs. post, Contrast 2: post vs. follow up. To control for Type-I error for conducting 2 contrasts, a Bonferroni correction was done to correct the alpha-value as 0.025.

Secondly, to explore whether there is a significant difference between conditions in avoidance behavior regarding the thoughts and memories of the film clip in the week after the

intervention session , a one-way ANOVA is conducted with 4 levels of conditions as independent variable and avoidance scores as dependent variable.

A post-hoc power analysis was conducted using G*power (Faul et al., 2007) for a mixed ANOVA. Results showed that with a sample of 64 with 4 number of groups, an effect size of 0.70 was calculated.

Results

Preparatory Analyses

A chi-square analysis and a one-way ANOVA were conducted to check whether there were differences between conditions regarding their age and gender (see Table 1 for demographic information of the sample). The results showed that there was no significant difference in gender distributions between conditions, $X^2(2, N = 64) = 1.68$, $p = .642$. Additionally, there was no significant difference between conditions in terms of age, $F_{3, 60} = 1.30$, $p = .076$. A one-way ANOVA revealed that there was no significant difference in SUD, ($F_{3, 60} = 2.41$, $p = .283$), or vividness, ($F_{3, 60} = 1.114$, $p = .351$). between the conditions at pre-assessment.

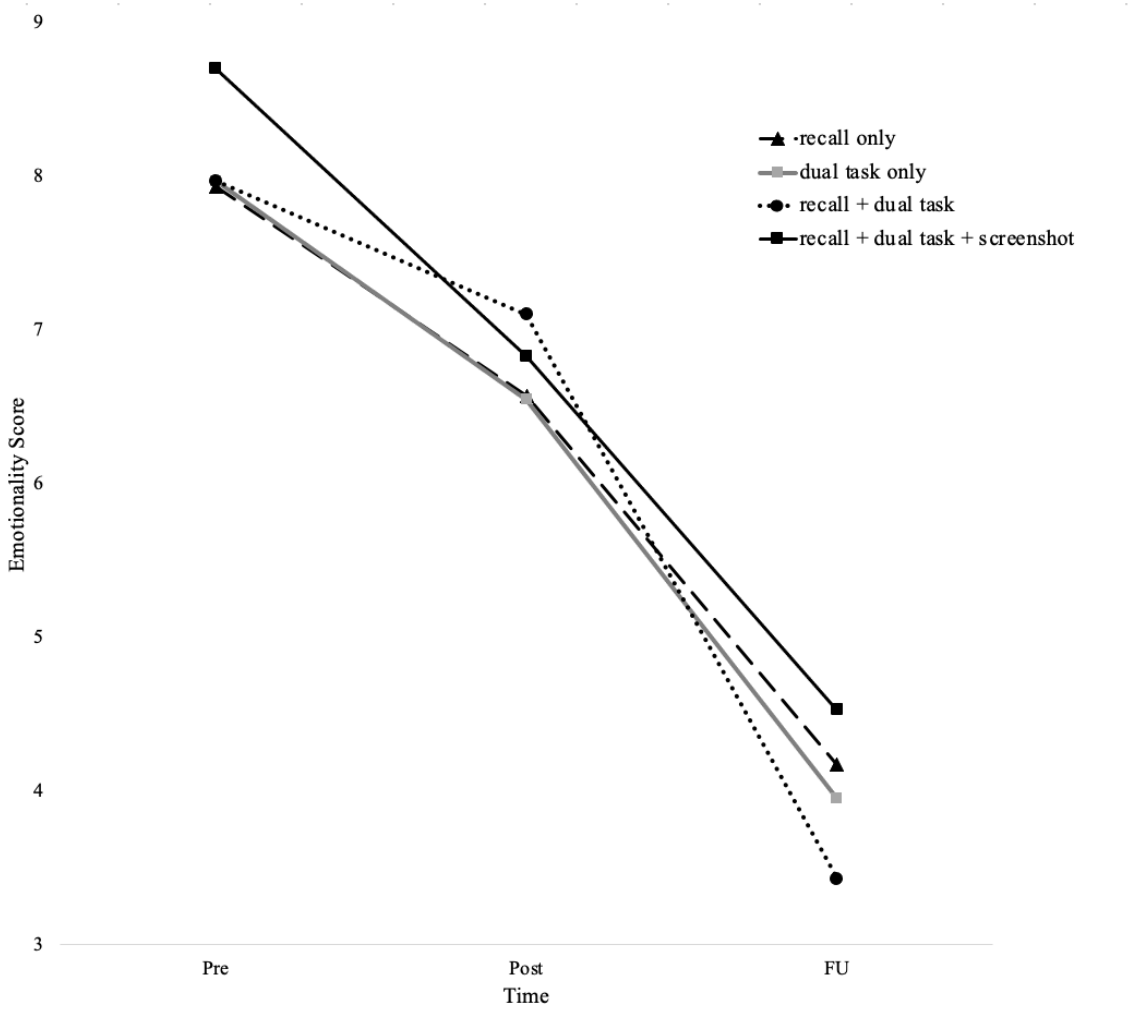
Main Results

Emotionality. To examine the effectiveness of different conditions on emotionality and vividness in time, two mixed ANOVAs were conducted. Assumptions for mixed ANOVA were met. A Bonferroni correction was done to control for Type-I error by dividing the α-value by 2 because of the two contrasts ($\alpha = 0.025$). Results show a significant main effect of Time on emotionality scores, $F(2,120) = 174.46$, $p < .001$. The pre-assessment emotionality scores were significantly higher ($M = 8.13$, $SD = 1.28$) than post- ($M = 6.75$, $SD = 1.95$) and follow-up-assessments ($M = 4.02$, $SD = 2.29$). The interaction effect between Time and Condition on emotionality scores was not significant, $F(6,120) = 1.04$, $p = .05$.

Figure 1

Raw means of emotionality scores for all time points specified per conditions. Pre = pre-assessment, Post = post-assessment, FU = follow-up assessment.

Vividness. The Mauchly's Test of Sphericity revealed that the sphericity assumption was violated ($p < .001$) so the Greenhouse-Geisser correction was used. Results show a significant main effect of Time on vividness scores , $F(1.62,97.05) = 68.08$, $p < .001$.

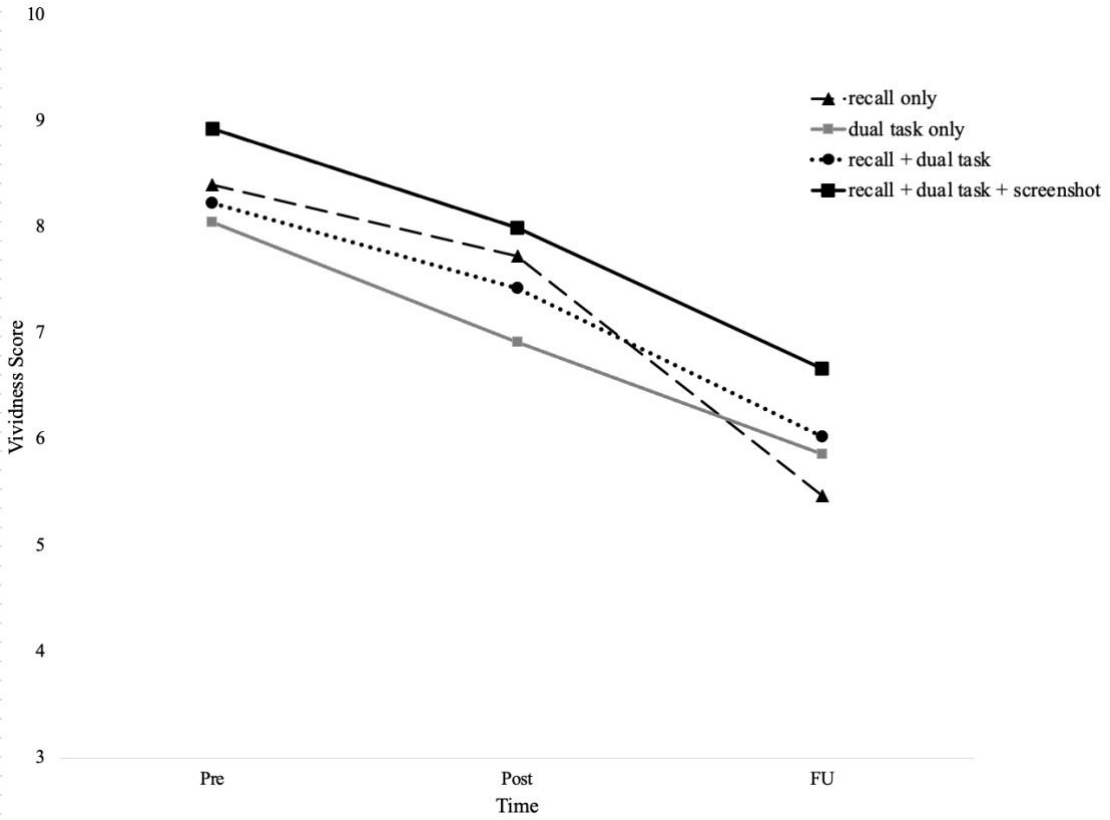


Vividness scores at the pre-assessment ($M = 8.38$, $SD = 1.45$) were significantly higher than both post- ($M = 7.48$, $SD = 1.77$) and follow-up-assessment ($M = 6.00$, $SD = 2.01$). However, the interaction effect between Time and Condition on vividness scores was not significant, $F(4.85,97.05) = .861$, $p = .05$.

Figure 2

Raw means of vividness scores for all time points specified per conditions. Pre = pre-assessment, Post = post-assessment, FU = follow-up assessment.

Planned Contrasts for Condition Factor. Planned contrasts revealed that the



conditions in which the the dual task is performed (dual task only, recall + duall task, recall + dual task + screenshot) did not show a higher decrease from pre- to post-assessment in emotionality scores compared to the 'recall only' condition, $t(60) = .16$, $p = .87$. The decrease from pre- to post-assessment emotionality scores was not significantly higher in 'recall + dual task' and 'recall + duall task + screenshot'conditions compared to 'dual task only', $t(60) = -.71$, $p = .48$.

Furthermore, no significant higher decrease in post-treatment vividness scores was seen between the conditions in which the the dual task is performed compared to the 'recall only' condition, $t(60) = 1.22$, $p = .23$. The decrease in post-treatment vividness scores was not significantly higher in 'recall + duall task'and 'recall + duall task + screenshot' compared to 'dual task only', $t(60) = -.54$, $p = .13$.

Secondary Analysis of Avoidance

To examine whether conditions differed in terms of avoidance behavior during the week after the interventions, a one-way ANOVA was conducted with Condition as the independent variable and avoidance scores as the dependent variable. The results showed that the avoidance scores did not differ between the conditions at follow-up-assessment, $F(3,60) = .513$, $p = .675$.

Discussion

The purpose of the present study was to investigate the effectiveness of an online EMDR treatment by comparing the effects of different levels of activation and desensitization on emotionality and vividness of the memory of a traumatic film clip. The findings provide insight into 3 hypotheses: the effects of the cognitive load created by the dual task on reducing emotionality and vividness, the effect of extra activation using a screenshot on emotionality and vividness and the effect of different levels of activation and desensitization on avoidance behavior during the week after the intervention. The results of the study showed that the emotionality and vividness of the negative memory decreased significantly when comparing pre- to post-assessment and pre- to follow-up-assessments in respective order. This confirms that the shortened and simplified online EMDR procedure used in this study proved to be effective in reducing the emotionality and vividness of the negative memory. However, no one condition outperformed the others in decreasing the emotionality and vividness of the negative memory. An interaction effect of time and different conditions was not found, suggesting that the effect of time on the difference of the decrease in emotionality and vividness was constant between all conditions. Hence, time did not moderate the effect of different activation and desensitization levels. The results of the study did not support the first hypothesis that the conditions in which the dual task was performed would lead to a higher decrease in emotionality and vividness scores compared to

the ‘recall only’ condition. Contrary to Cuperus and colleagues (2019) where they observed a decrease in emotionality and vividness in the condition where participants only engaged in recall without the dual task compared to the dual task condition. Additionally, the second hypothesis investigating the effects of the ‘recall + dual task’ and ‘recall + dual task + activation’ conditions showed no significant difference in emotionality and vividness scores. Meanwhile, a decrease in avoidance behavior was seen from post- to follow-up assessment. However, the secondary analysis testing the influence of different conditions on avoidance behavior at 1-week follow-up also revealed no significant difference between conditions.

A probable explanation to the discrepancy between this study and Cuperus and colleagues’ (2019) can be, that the dual task used in this study is less taxing than the one used in theirs. The less taxing dual task might not have created a significant difference to the ‘recall only’ condition. As the effectiveness of EMDR is explained by the WM theory (Baddeley, 1992), an adequate level of taxation using recall and the dual task is essential in decreasing the adversities of the negative memory.

The conclusions of this study were partly in line with the WM theory (Baddeley, 1992) since a significant decrease in the emotionality and vividness of the negative memory was seen across time for the conditions where recall and dual task were performed. This reinforces previous findings supporting the effectiveness of simultaneous recall and EM in reducing the adversities of the negative memory. However, this study found no significant difference between the ‘recall only’ and other conditions, or between the ‘dual task only’ and other conditions. This can be interpretated as both recall and dual task only are as effective as recall and activation, contrasting the WM theory. An explanation to this can come from the experimental observation of the researchers. Although participants were told that there were no right or wrong answers to the emotionality and vividness questions, we observed a

common willingness to answer in a way that supports the effectiveness of the intervention (i.e., showing a reduction in emotionality and vividness in response to the intervention).

The fact that there was no significant difference between the 'dual task only' condition and other conditions is in line with previous research which showed that EM only do not reduce the cognitive load of the memory (van Veen et al., 2016). Contrary to Lee and Cuijpers (2013), there was also no significant difference between the conditions in which the participant recalled the memory compared to where they didn't. This might have resulted from the habituation to the memory during the interventions which lasted longer compared to previous research.

Although the hypotheses were not confirmed, the present study was successful in adding to the existing literature. The current study investigated emotionality and vividness at two different timepoints after the treatment adding to the previous literature (Cuperus et al., 2016, 2019): post-assessment, which took place immediately after the intervention, and follow-up assessment, which took place 1-week after the intervention. The follow-up assessment proves the lasting effects of the shortened and simplified version of an online EMDR protocol, for the four different conditions it examined. Furthermore, in addition to previous literature, this study involved a self-report questionnaire for avoidance behavior.

The current study has several limitations. First, the sample consisted of non-clinical individuals. In future research, it would be most beneficial and more generalizable if a clinical, and larger sample is used. Second, since the traumatic memory and disturbing images were created using a film instead of a real traumatic event, this could have eliminated the 'avoidance of the traumatic memory' often seen in PTSD patients (APA, 2013). Third, to what extent participants kept the disturbing image in their minds while completing the dual task was not assessed and remains unknown. Since in order for EMDR to be effective it is important that the individuals hold the memory of the traumatic event for it to be processed

(Van Veen et al., 2016), this might have reduced the effects of the interventions which included an activation of the memory. To understand the effects of level of recall, future research can investigate the self-report avoidance questionnaire in an item-specific manner to assess to what level the participants held the memory in their mind during intervention.

In conclusion, the online EMDR protocol used in this study was found to be effective in reducing the emotionality and vividness of traumatic memories both immediately after and 1-week after the intervention. This remains an important finding in today's rapidly digitalizing world as psychotherapy and mental healthcare are also moving to the online environment (Feijt et al., 2020). The addition of the screenshot activation needs further investigation as it may assist patients who show avoidance behavior during therapy (Cuperus et al., 2019). Another improvement can be sustained by assessing the level to which participants hold the memory in their minds while doing the dual task. Future research needs to focus on larger and more generalizable clinical samples while implementing the novelties of this study to understand the effects of different levels of activation and desensitization on the decrease of emotionality and vividness of traumatic memories.

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Appendices

Appendix A: Emotionality and Vividness Questionnaire

You have just seen a film clip. I would like to ask you to recall the memory you have of the film clip:

Thinking about the film clip, how unpleasant does it feel or how much distressed do you feel, estimated on a scale from 0, no distress at all, to 10, maximum distress?

How vividly can you picture the film clip, estimated on a scale from 0 "not vivid at all," to 10, "very vivid"?

Appendix B: Avoidance Questionnaire

Last week you participated in our study entitled ‘Improving (online) trauma treatment’.

As part of this study, you watched a film clip and then performed a task under supervision of a research assistant.

We would like to ask you some questions about your experiences after the experiment, more specifically your experiences in the last week.

1. In the last week, what percentage of the time did you think of unpleasant fragments of the film clip?

   Scale: not at all = 0, the whole time = 100
2. In the last week, what percentage of the time did you avoid thinking about unpleasant fragments of the film clip?

   Scale: not at all = 0, the whole time = 100
3. In the last week, what percentage of the time did you avoid negative emotions related to the film clip?

   Scale: not at all = 0, the whole time = 100

4. In the last week, what percentage of the time did you try to suppress/avoid physical sensations (e.g., sweating, trembling, stomachache, palpitations, tendency to hyperventilate) related to the film clip?