Eye Movement Desensitization and Reprocessing (EMDR) Therapy as a Treatment for

Depression

by

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Abstract

This study examined the efficacy of EMDR therapy as a treatment for unipolar depression. Results provide preliminary evidence for the efficacy of EMDR therapy. Of the 12 participants that received 10 sessions of EMDR therapy, four met the criteria for "Recovered," six "Improved" and two reported no change in severity of depressive symptoms. Results further indicated that participants who experienced decline in depressive symptoms within the first six sessions of treatment had a higher probability to be meet the criteria for "Recovered." A small sample comparison between EMDR therapy ($n = 4$) and CBT ($n = 4$) did not find any significant difference in terms of treatment outcome. In phase 2, participants in both groups either improved or recovered after 10 sessions of treatment. Sudden gains analysis indicated that 5 out of 12 EMDR therapy participants had sudden gains. Participants in sudden gains group were more likely to meet "Recovered" criteria than participants in no-gains group. Examination of attention bias found that depression was positively related to negative affect fixation duration and negatively related to positive affect fixation duration when only using female affect images. These findings support previous research that used attention bias to differentiate depressed and non-depressed persons. Clinical implication and further research are discussed.

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Dedication

This paper is dedicated to my parents Xianggui Chen and Yonghui Su.

Chapter 1 - Introduction

The World Health Organization (WHO, 2017) estimated in 2015 that more than 300 million people (4% of the world's population) suffered from depression globally. In the United States (U.S.), more than 17 million people (5.9% of the population or 1 in every 20 persons) were affected by depression in 2015 (WHO, 2017). It is predicted that depression would become the leading cause of global burden of disease by 2030 (WHO, 2012).

Depression is a disorder that is characterized by persistently depressed mood and significant loss of interest or pleasure in activities, along with significant unintended weight loss/gain, insomnia or hypersomnia, psychomotor retardation or agitation, fatigue, feelings of worthlessness, reduced ability to concentrate, and recurrent suicidal thoughts that impair functioning (APA, 2013). In 2016, about 64% of adults in the U.S. with a major depressive episode reported severe impairment in level of functioning (Bose et al., 2016). Such functional impairment is a burden to the overall economy. The economic burden of persons with depression in the U.S. increased by 21.5% from 2005 to 2010 at $210.5 billion a year accounting for all depression-related costs (Greenberg et al., 2015). The three major components of the financial burden include workplace 50%, direct cost 45%, and suicide-related costs 5% (Greenberg et al., 2015). It was estimated that there was close to 800,000 depression-related death per year globally (WHO, 2017). The prevalence of depression permeates every group regardless of age, gender, and region. Depression is prevalent among older adults (55 to 74 years old), women (5.1% of women compared to 3.6% of men), and South-East Asian and Western Pacific regions (including India and China; WHO, 2017). Some of the major risk factors that are believed to contribute to depression include poverty, unemployment, life events such as the loss of a significant other, physical illness, and substance use problems (WHO, 2017).

Unfortunately, not every person affected by depression seeks or receives treatments. Of the 16.2 million adults in the U.S. with a major depressive episode, only 10.6 million (65.3%) received some forms of treatment in 2016 (Bose et al., 2016). It was estimated that 44% of persons with a major depressive episode received both mental health service and medication treatments, 6% received treatment of medication alone, and 13% received mental health services alone (NIMH, 2017). The two main treatment modalities for depression are antidepressant medication and psychotherapy. For a few decades, Cognitive Behavioral Therapy (CBT) has been historically one of the most extensively researched and supported treatments for depression (Hofmann et al., 2012). However, Weissman and Cuijpers (2017) who recently reviewed all existing randomized trials of psychotherapy for depression pointed out that all therapies (including psychotherapy and antidepressant medication) seem to be equally effective or about equally effective with no significant differences between treatment efficacy. A meta-analysis of 115 randomized controlled trials of depression treatment (predominately CBT) concluded that the effects of psychotherapy for adult depression had been over-estimated, and the effect sizes were much smaller than were assumed (Cuijpers et al., 2010). The mean effect size found for high-quality studies was only .22, comparing to the mean effect size of .68 for all included studies. The overestimation is believed to be attributed to the unpublished negative studies (Weissman & Cuijpers, 2017). Given the results, the efficacy of psychotherapies for depression is unclear and there is a need for more clinical research examining treatment efficacy of different treatments for depression.

Eye Movement and Desensitization and Reprocessing (EMDR; Shapiro, 2009) therapy was first introduced as a treatment for posttraumatic stress disorder (PTSD; Shapiro, 1989). EMDR therapy is a type of psychotherapy that use eye movements that help processing

distressed memories and images. EMDR therapy is conceptualized through the adaptive information processing (AIP) theory which explains how one's memories are processed and stored through a network that contains thoughts, images, emotions, and sensations (Shapiro, 2001). Using eye movements to target maladaptive information (memories or beliefs) is believed to alter maladaptive emotional and physical responses. Depression as an emotional disorder is characterized by inappropriate orientation of negative information (including memories and perceptions). Evidence has shown a decrease in depressive symptoms when treating PTSD with EMDR therapy (Arabia, Manca, & Solomon, 2011; van der Kolket al., 2007).

Purpose of this Study

The purpose of this study is to address the need for more clinical research examining treatment efficacy of depression psychotherapy treatments. Previous studies had found that EMDR therapy effectively treats the comorbidity of PTSD and depression. This study extends current research on EMDR therapy by examining its efficacy to treat unipolar depression as a primary diagnosis. The process of EMDR therapy was examined by exploring a phenomenon known as "sudden gains." Sudden gains, a marked improvement in symptoms in treatment, has been found to relate to positive treatment outcome in CBT treatment for depression, but has not been studied in EMDR therapy. Further, the treatment outcomes of EMDR therapy was compared to CBT using a small sample of participants. Finally, changes in attentional bias, found to differentiate depressed and non-depressed persons were examined to provide additional evidence that EMDR therapy can influence depressive emotions.

Chapter 2 - Literature Review

Effectiveness of EMDR Therapy and CBT for Depression

The cognitive model of treatment for depression was first pioneered by Beck (1970) and Ellis (1962). After over 40 years of empirical research, CBT has become one of the standard depression treatments (Hofmann et al., 2012). CBT became popular in treatment for mental illness in the late 20th century. Rooted in cognitive and behavioral theories, CBT postulates a treatment model for changing cognitions, behaviors, and emotion regulations (Beck, 1970). In addition to depression, CBT has been applied in treatment for other mental health problems, predominately anxiety-related disorders (Hofmann et al., 2012). A meta-analysis conducted in 2012 examined the efficacy of CBT and concluded that CBT as a treatment for depression was effective in decreasing depressive symptoms in comparison with control conditions such as waiting list or no treatment, with a medium effect size (Hofmann et al., 2012). In the same meta-analysis, it was found that when compared with other psychological treatments, CBT showed either equal or higher effectiveness.

EMDR therapy as a treatment for depression is a relatively new clinical and research topic. In 1989, Shapiro conducted a case study and a controlled study. She found that Eye Movement Desensitization (EMD) therapy as it was known then, was effective in desensitizing anxiety related to PTSD (Shapiro, 1989). In 1991, EMD therapy was changed to EMDR therapy to highlight the insights and cognitive changes with the treatment (Shapiro, 1991). At the same time, the adaptive information processing (AIP) was used to explain how eye movements could help with processing information and altering emotional and physical responses (Shapiro, 1995). Negative feelings such as depression is conceptualized as related to maladaptive information processing, particularly related to negative life experience and

memories (Shapiro, 2009). It is claimed that EMDR therapy could heal trauma-based (either PTSD or smaller relational trauma) depression and facilitate the healing and management of biologically based depression (Shapiro, 2009). Trauma-based depression can be viewed as reactive depression (with external stressors), as opposed to endogenous depression (without external stressors). EMDR therapy is conceptualized to be effective in treating reactive depression. Even so, there is a lack of research evidence for the efficacy of using EMDR therapy with depression as a primary diagnosis. In most studies, the level of depression reduces only when depression was a comorbid disorder with PTSD (Rothbaum et al., 2005). In a recent meta-analysis of randomized controlled trials (RCTs) comparing EMDR therapy to other forms of psychotherapy for PTSD, 20 of the 26 studies included depression as an outcome variable (Chen at al., 2014). The results revealed that the overall reduction in depression following EMDR therapy was significant, with a moderate effect size.

Four randomized controlled trails (RCTs) had been conducted internationally (China, Iran, Germany, and Pakistan). Although these RCTs found positive outcome of using EMDR therapy for depression, the results were limited by the lack of information about EMDR therapy treatment and the controlled group treatment (Behnammoghadam, Alamdari, Behnammoghadam, & Darban, 2015; Gauhar, 2016; Hase et al., 2015; Song & Wang, 2007). Therefore, there is a lack of evidence supporting EMDR therapy as an efficacious treatment for depressive disorders as the primary diagnosis. Despite these findings, Wood and Ricketts (2013) who completed a review of studies on EMDR and depression, concluded that it remains unclear if EMDR therapy directly reduces depression or if the improvements observed are a by-product of treating PTSD. Therefore, there is a need for more empirical studies to provide evidence for using EMDR therapy for depression as a primary diagnosis.

Sudden Gains in Depression Treatment

"Sudden gains" is an observed phenomenon that was coined by Tang and DeRubeis (1999). The authors discovered a significant decrease (seven points on the BDI scale) in depression scores between two consecutive sessions for about 39% of patients (24 out of 61 patients) treated for depression using CBT. They concluded that these gains were not mood fluctuations but rather caused by cognitive modifications. Patients who experienced sudden gains reported significantly lower level of depression than those who did not at six months and 18 months follow-ups (Tang, & DeRubeis, 1999). Since then, multiple studies have replicated and found supportive evidence for sudden gains and its associations with positive treatment outcome in cognitive therapy (Hardy et al., 2005), interpersonal therapy (Kelly, Cyranowski, & Frank, 2007), and behavioral activation therapy (Masterson et al., 2014).

Originally, sudden gains was hypothesized to be caused by cognitive changes that were observed in the pre-gain session (the session before the sudden changes; Tang & DeRubeis, 1999). However, there is a lack of evidence to support this hypothesis. The mechanisms of sudden gains remains unknown. Other studies have proposed potential contributing factors such as life events, therapeutic alliance, treatment adherence, and level of self-esteem that might explain the sudden gains found in treatment (Doane, Feeny, & Zoellner, 2010; Hardy et al., 2005; Kelly et al., 2005). None of these factors have been supported with substantial research evidence. Another factor that garnered researchers' attention is the timing of the sudden gains that tend to be detected in the early part of treatment. The majority of studies detected sudden gains between the second and the fifth session (Hardy et al., 2005; Masterson et al., 2014; Tange & DeRubeis, 1999).

In addition to depression, sudden gains has been found in studies for other mental illnesses, such as social anxiety disorder (Hofmann, Schulz, Meuret, Moscovitch, & Suvak, 2006), generalized anxiety disorder (Present et al., 2008), and posttraumatic stress disorder (Doane, Feeny, & Zoellner, 2010). In all these studies, sudden gains was related to reducing mental illness symptoms at the end of treatment (Aderka et al., 2012). Researchers proposed that the relationship between sudden gains and treatment outcome may vary across different treatment modalities (Kelly et al., 2007). However, there has not been any literature focusing on the change mechanism or sudden gains in EMDR therapy. The meta-analysis conducted by Aderka et al., (2012) noted that CBT is the only treatment where sudden gains appears to be significantly correlated with outcomes in post-treatment. This same finding was not apparent with non-CBT interventions. Given the current literature on the occurrence of sudden gains and its potential to predict treatment outcome, this study will examine if sudden gains exist in EMDR therapy.

Attentional Bias and Depression

In addition to increased negative emotions and negative thoughts, depression is characterized by biases in attention, interpretation, and memory, which is supported by cognitive experimental tasks (Mathews & MacLeod 2005). Earlier studies on cognitive biases found that depressed persons spent significantly more time looking at images featuring sadness and loss than did non-depressed controls (Eizenman et al., 2003). More recent studies provide evidence that persons with depressive disorders experience more difficulties disengaging from negative information when other positive/neutral stimuli are present (Caseras, Garner, Bradley, & Mogg, 2007; Gotlib, & Joormann, 2010; Kellough et al., 2008; Sanchez et al., 2013). Early research on attentional biases on anxiety and depression postulated that for anxious persons, their attentional

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biases facilitated picking up mood-congruent, and emotionally threatening information; while

persons with depression had bias towards recalling and retrieving mood-congruent, emotionally

negative information (MacLeod, Mathews, & Tata, 1986). Three mechanisms have been

proposed by cognitive science researchers to describe the biased cognitive processing and the

dysregulation of emotion in depression: 1) inhibitory processes and deficits in working memory;

2) ruminative responses to negative mood states and negative life events; and 3) the inability to

use positive and rewarding stimuli to regulate negative mood (Gotlib & Joormann, 2010). In

some studies, researchers suggested that the cognitive biases we see in depressed persons may

contribute to the sustained negative affect and the maintenance of the disorder (Beck, 1976;

Kellough et al., 2008; Sanchez et al., 2013).

Although it makes intuitive sense that depressed persons would spend more time

dwelling on negative materials (images, memories, word) and such bias is seemingly related to

sustained depressive symptoms, the causal relationship is undetermined and the biological

underpinning mechanism is undiscovered. Earlier studies on depression and attention biases used

response latency tasks, which indirectly assesses attentional biases and it suffered from the

inability to differentiate different components of attention (orienting versus maintaining

attention), and to account for the influence of psychomotor retardation in depressed persons

(Duque & Vázquez, 2015). More recent attentional bias studies favor the eye-tracking techniques

with eye movement tasks as it provides a more direct measurement of eye attention (Duque &

Vázquez, 2015). In 2012, a meta-analysis was conducted to review the use of eye-tracking in

depression and anxiety research (Armstrong & Olatunji, 2012). Out of the nine studies included

in the meta-analysis, only two studies had clinically depressed patients. Their findings indicated

that clinically depressed people spent significant more time dwelling on negative information.

In two more recent studies that used a clinically depressed population, participants were given facial images with different affects to free view (Duque & Vázquez, 2015; Sanchez et al., 2013). Both studies found that clinically depressed persons indicated a tendency to maintain their attention on mood-congruent sad faces, compared to the non-depressed population. To extend the current literature and provide more concrete evidence for the efficacy of EMDR therapy as a treatment for depression, this study will examine the change of attentional bias throughout the treatment for depression using eye-tracking technology.

This study will examine the following hypotheses and research question:

H1: Depression scores will progressively reduce from clinically depressed levels to non-clinically depressed levels as participants receive more sessions of EMDR therapy.

R1: What sudden gains, if any, are evident in EMDR therapy?

H2: Both EMDR therapy and CBT will decrease level of depression.

H3: Depression will be positively correlated with negative affect fixation duration (FD) and negatively correlated with positive affect fixation duration.

Chapter 3 - Method

A quasi-experiment was utilized to study the efficacy of EMDR therapy to treat depression. The study included two phases. In phase 1, eight participants with depression were recruited and received a 10-session EMDR therapy treatment. In phase 2, an eye-tracking experiment was designed and implemented. Eight more participants with depression were recruited and were randomly assigned to either EMDR therapy or CBT treatment.

Recruitment

Participants were recruited from a Midwestern town of 50,000 residents plus its large state university of 24,000 students. Recruitment efforts included mailings to mental health providers in the area to inform them of the study and encourage them to refer potential participants, and monthly advertisements in the university's online news release. Potential participants were directed to contact a designated research team member via electronic mail.

The inclusion criteria for this study included a diagnosis of depressive disorder which was not medically or substance induced, not currently receiving psychotherapy, and not consuming any psychotropic medication during the participation in the study. The exclusion criteria included having a positive diagnosis of post-traumatic stress, attention deficit, psychotic, dissociative, bipolar, substance use and personality disorders and having conditions that could counter-indicate EMDR therapy (e.g., pregnancy, cardiac issues).

Screening

Potential participants who contacted the designated research team member were directed to an online survey (See Appendix A). The survey included measurement instruments for personality traits (Standardized Assessment of Personality Abbreviated Scale; Moran, Leese, Lee, Walters, & Thornicroft, 2003), depression, anxiety and stress (DASS-21; Henry &

Crawford, 2005), attention deficit and hyperactivity (Adult ADHD Self-Report Scale (Kessler et al., 2005), dissociation (Dissociative Experiences Scale, Carlson & Putnam, 1992) and mania and trauma symptoms (adapted from the respective sub-scales from the Mini International Neuropsychiatric Interview, MINI 5.0, Sheehan et al., 1998).

Based on the results of the online survey, persons who did not meet the criteria for the study were referred to services at the university clinic and in the community. Persons who met the criteria were invited to campus for a face-to-face assessment with a research team member. This assessment utilized the MINI 5.0 (Sheehan et al., 1998) to diagnose depression, suicidality, bipolar, posttraumatic stress, substance abuse, psychosis and anxiety. Fact-to-face assessment was conducted by master's or Ph.D. students who received training in MINI 5.0 assessment by a doctoral couple and marriage therapist.

Based on this second assessment, persons who met the study criteria were offered a place in the study and received 10 therapy sessions. In phase 1, participants were randomized into either EMDR therapy or waitlist group. However, because the dropout rate of the waitlist group was high (2 out of 4) at the beginning of phase 1, immediate treatment was deemed necessary to maintain participants. Two participants from waitlist group who completed phase 1 study were not included in this paper. From this need evolved the second phase of the study that replaced the waitlist group with Cognitive Behavioral Therapy (CBT).

A cash incentive ($30) for participation was provided at the one-month follow-up session. At follow-up, participants were given the option to continue treatment at the university clinic or community mental health agencies in the community. This study was approved by the Institutional Review Board of Kansas State University and funded by the EMDR Foundation as well as Kansas State University.

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Participants

In Phase 1, 34 persons completed the online assessment, of which 25 met the study criteria and were invited to complete the in-person assessment. Eighteen persons completed the in-person assessment and seven either no showed for their appointments or did not respond when contacted (see figure 1). Of the 18 that completed the in-person assessment, six did not meet the study criteria. Persons who met the study criteria were randomized using simple randomization into either the EMDR therapy or waitlist group (the first qualified participant was placed in EMDR therapy group; the second qualified participant was placed in the waitlist group and it continued). Because of high attrition in the waitlist group, this group was discontinued midway through the study. Four participants (a 21-year-old man and 3 women with a mean age of 29.00; $SD = 9.02$) dropped-out of the study, leaving eight to complete the study. The eight participants (two mixed race and six White) were three men (M age 44.33, $SD = 9.61$) and five women (M age 40.00, $SD = 9.28$). Data were collected at 11 time points.

In Phase 2, 40 persons completed the online assessment, of which 25 met the study criteria and 15 did not. Of the 25 that met the study criteria, 17 completed the in-person assessment, two decided not to join the study hence declined the in-person assessment and eight either no showed for their appointments or did not respond when contacted. Of those who completed the in-person assessment, seven did not meet the study criteria while eight did. These participants were randomized using simple randomization to either the EMDR therapy or CBT group (the first qualified participant was assigned to EMDR therapy group and the second qualified participant was assigned to CBT group and so on). Participants in the EMDR therapy group were three women (M age 34.00, $SD = 10.00$) who identified as White and one 27-year-old White man. Participants in the CBT group were two women who identified as White (M age

33.50, *SD* = 14.50) and two men, one identified as Hispanic and one as White (*M* age 23.00, *SD* = 4.00). Eye-tracking data were collected at four time points.

Treatment protocol

EMDR therapy and CBT were administrated by master's or Ph.D. Couple and Family Therapy students. Treatment was supervised by a trained doctoral level EMDR therapist. EMDR therapy's protocol was adapted from the standard EMDR therapy eight phase protocol included history taking and treatment planning, preparation, assessment, desensitization, installation, body scan, closure, and reevaluation (Shapiro, 1995). Modification was made to fit into 10 therapy session. The targets of the desensitization were depression-related memories, core beliefs about self, and physical reactions to memories. The CBT treatment protocol was adopted from Cully and Teten's (2008) Brief CBT eight-session treatment. CBT focused on identifying negative cognition, challenging maladaptive thoughts, and modifying behavior. Modification was made in this study to fit into 10 therapy sessions. Treatment fidelity was assessed using the EMDR Therapy Fidelity Rating Scale (Korn et al., 2004) and a CBT fidelity checklist (unscored), which were completed by research team members who observed the sessions live. These team members who completed fidelity check included trained master therapists and undergraduate students. Adherence to EMDR treatment protocol were rated from 0 (no adherence) to 3 (adherence very good). Fidelity scores for the EMDR therapy averaged 2.94, indicating very good adherence to the treatment protocol. All four CBT fidelity checklists indicated that CBT protocol was adhered by the therapists. All therapists received trainings in EMDR therapy or CBT by a trained doctoral Couple and Family Therapy professor and a doctoral candidate student before seeing a participant. Ongoing supervision was provided by the doctoral therapist.

Both EMDR therapy and CBT were administered twice a week over a five-week period. All sessions were conducted during the weekday (Monday through Friday). Two consecutive sessions within a week are scheduled at least two days apart (if they came in on Monday, the next session would be Wednesday of the same week as earliest). The preference was three days apart within a week (Monday and Thursday or Tuesday and Friday). When a session was cancelled due to unexpected situations such as family crisis or change of schedule, a new session would be scheduled as soon as possible and within a week from the last session. All participants completed all 10-session of treatment and one session of follow-up.

Data Collection

When participants arrived for treatment at the Family Center, they first completed a set of assessments before meeting with the therapist. The assessments took approximately five minutes to complete. Participants in phase 2, were brought to a computer lab to complete an eye-tracking experiment before commencing treatment at sessions 1, 5, 10 and at follow-up. After the experiment that took approximately 10 minutes, participants adjourned to the lab for treatment.

Measurement

The Patient Health Questionnaire (PHQ-9; See Appendix A; Kroenke & Spitzer, 2002), a 9-item scale was used to assess depression and track effectiveness of treatment over time. Participants were asked if they were currently bothered by problems such as, "Feeling down, depressed or hopeless" and "Little pleasure or interest in doing things" using a 4-point scale from 0 (did not apply to me at all) to 3 (applied to me most of the time). Scores of 5, 10, 15 and 20 represent cutoff points for mild, moderate, moderately severe and severe depression respectfully. PHQ-9 has shown good validity (criterion validity and construct) and reliability (internal consistency and test-rest reliability) in previous study (Kroenke & Spitzer, 2002; Gilbody,

Richards, Brealey, & Hewitt, 2007). Using 16 participants from 11 time points, Cronbach's alpha in this study was .82 ($n = 175$), indicating a high internal consistency.

Stress sub-scale. This 7-item scale from the DASS-21 (See Appendix B; Henry & Craford, 2005) was used to assess level of stress as a confound variable over the course of the treatment. Participants were asked if they identified with the statements such as, "I found it hard to wind down," and "I tended to over-react to situation" using a 4-point scale from 0 (did not apply to me at all) to 3 (applied to me very much, or most of the time). Cronbach's alpha for this study was .92 ($n = 175$).

Eye-tracking. The EyeLink 1000 Plus (SR Research Ltd., 2005-2009) was used to administer an eye-tracking experiment that consisted of 12 sets of facial images (six men and six women). Each set consisted of a pair of positive (happy) and negative (sad) facial images (see Appendix C). All images were of persons of European descent. Images were obtained from the Karolinska Directed Emotional Faces (KDEF) database (Lundqvist, Flykt, & Öhman, 1998) that is publicly available. All participants in Phase 2 completed the eye-tracking experiment at four time points: sessions 1, 5, 10, and one-month follow-up. In this free viewing task, participants were instructed to look at the images naturally, with no further requirements. Participants had 8000ms to view each set of image. Total fixation duration (FD; the total time spent on each type of facial expression – sad and happy) was detected and collated by the eye-tracker system. The total fixation duration reflect participants' dwell time on each image.

Data Analysis

The following analysis were conducted to test the three hypotheses and one research question in this study. Data was analyzed using SPSS Version 24 (IBM Corp., 2016).

H1: Depression scores will progressively reduce from clinically depressed levels to non-clinically depressed levels as participants receive more sessions of EMDR therapy.

To test this hypothesis, data from EMDR therapy participants from phase 1 (eight persons) and phase 2 (four persons) were analyzed. First, changes in depression scores from T1 to T11 were used to determine the degree of change in depression levels. For PHQ-9, scores of 10 and more reflected clinical levels of depression (McMillan, Richards, & Gilbody 2010). Scores of 5, 10, 15 and 20 represented cutoff points for mild, moderate, moderately severe and severe depression respectfully.

Next, a paired sample *t*-test was conducted to examine the differences in depression scores at T1 and T11. This was followed by a linear mixed model (LMM), to examine the fixed effects of time, stress, age and gender, and the random effects of between participant variances. LMM is recommended for repeated measures as it controls for non-independence among the repeated observations for each participant and prevents pairwise deletion due to missing data. Stress level was included as a covariate to account for its impact on depression. Age and gender were included as control variables. The strength of each model was determined by the difference in Akaike's Information Criteria (AIC) and Schwarz'z Bayesian Criterion (BIC) values between each model. A smaller AIC and BIC values and a difference of at least two indicates a better fitting model (Müller, Scealy, & Welsh, 2013).

Next, reliable change index (RCI) proposed by Jacobson and Truax (1991) will be used to calculate clinical significant change and determine if the change reflect recovery, improvement, no change or deterioration. RCI assesses the magnitude of change occurring during the course of therapy using the following formulas (Jacobson & Truax, 1991).

$$RCI = \frac{x_{post} - x_{pre}}{S_{diff}} \qquad S_{diff} = \sqrt{2(S_E)^2} \qquad S_E = SD\sqrt{1-r}$$

where x_{post} and x_{pre} represents scores for post-test and pre-test, S_{diff} represents the standard error of difference between the pre and post test scores, S_E represents the standard error of measurement, SD represents the standard deviation of the measure, and r represents the reliability of the measure. RCI greater than 1.96 (the cutoff value for RCI) reflected reliable differences (Jacobson & Truax, 1991).

For measuring depression using PHQ-9, the midpoint between the general population mean = 3.3 (SD = 3.8) and clinical population mean = 17.1 (SD = 6.1) (Kroenke et al., 2001) were used to calculate the cutoff as recommended by Jacobson & Truax (1991):

$$\text{cutoff} = \frac{s_0 M_1 + s_1 M_0}{s_0 + s_1}$$

where s_0 and s_1 represents the standard deviation of the general population and the clinical depressed population, and M_0 and M_1 represents their mean scores. The result of the above calculation was 8.60. Participants whose depression change scores > 8.60 and RCI > 1.96 were considered Recovered; scores < 8.60 but RCI > 1.96: Improved; scores < 8.60 and RCI between -1.96 and 1.96: Unchanged; and scores < 8.60 and RCI < -1.96: Deteriorated.

Last, benchmarking, a statistical advanced tool to assess effect size of clinical treatments (Weersing & Weisz, 2002) was utilized. Benchmarking involves three steps. Step 1 constructs the pre-post benchmarks by aggregating results from clinical trials. In 2014, a meta-analysis was conducted by Delgadillo et al., to calculate the benchmark for the PHQ-9 depression scale. Based on clinical trials using CBT, brief guided self-help, and psycho-education groups, the following performance benchmarks were proposed: low (.46), average (.73), and high (.91).

Step 2 estimates the effect size of clinical treatment using the following formula:

$$d_D = \left(1 - \frac{3}{4N - 5}\right) \frac{M_{D,post} - M_{D,pre}}{SD_{D,pre}}$$

where d_D represents the effect size of the clinical setting, N represents the sample size, $M_{D,post}$ and $M_{D,pre}$ represents the post-treatment mean and the pre-treatment mean respectively, and $SD_{D,pre}$ represents the pre-treatment standard deviation. Step 3 contrasts the calculated effect size against the constructed benchmark. Using Cohen's (1998) measure of effect size where a change of .20 is considered small, Minami et al., (2012) noted differences between the benchmark and the data under .20 to be clinically trivial while differences above .20 were considered as having a clinical effect.

R1: What sudden gains, if any, are evident in EMDR therapy?

The changes of depression scores between two consecutive sessions were compared to the reliable change criterion to study the occurrence of sudden gains in the treatment process. There are three criteria to define sudden gains. First, the gain has to be large itself. This study used the reliable change criterion of PHQ-9 ≥ 5 points. Second, the gain has to be large compare to the pre-gain session. This study used the criterion from Tang and DeBubeis (1990). The gain has to be at least 25% of the score in the pre-gain session. Third, the average depression score for the 3 (2 if the sudden gains happened between session 2 and 3) preceding time points and 3 following time points differed in terms of an independent sample *t*-test. The *t*-test result needs to be greater than or equal to 2.5 when defining sudden gains. To assess sudden gains that happen between time 1 and 2, the gain must be at least 1.5 standard deviation of the mean of the person's session-by-session scores (Kelly, Roberts, & Ciesla, 2005). A fisher's exact test was conducted to test if the treatment outcome ("Recovered." "Improved," "Non-responsive," and "Deteriorated") were different for participants who did and did not experience sudden gains.

H2: Both EMDR therapy and CBT will decrease level of depression.

To test this hypothesis, eight participants from phase 2 (4 EMDR therapy and 4 CBT) were analyzed. First, correlation analyzes and *t*-tests were performed to examine relationship between study variables and differences between treatments respectively. Next, RCI and benchmarking were utilized to examine clinical significant changes in depression and effect size of treatments.

H3: Depression will be positively correlated with negative affect fixation duration (FD) and negatively correlated with positive affect fixation duration.

Data form participants in phase 2, including eye-tracking data from four time points (T1, T5, T10, and T11) were used to test this hypothesis. First, correlation analyses were conducted on depression and all 12 positive and negative affect FD. Next, *t*-tests were used to detect differences in positive and negative affect FD across treatment groups. Last, correlation analysis were conducted to differentiate FD on female and male images.

Chapter 4 - Results

H1: Depression scores will progressively reduce from clinically depressed levels to non-clinically depressed levels as participants receive more sessions of EMDR therapy.

H1 was supported. Preliminary analysis indicated a significant correlation between study variables (presented in Table 1). Depression scores were related to stress ($r = .70$, $p < .001$), age ($r = -.19$, $p = .03$), gender ($r = .36$, $p < .001$), and stress levels were related to age ($r = -.47$, $p < .001$). Depression scores of participants progressively reduced from prior to the first treatment session T1 ($M = 14.50$, $SD = 3.03$; Range = 10 to 20) to a month after the tenth treatment session, T11 ($M = 6.25$, $SD = 3.89$; Range = 2 to 14). Change in average depression scores for all participants overtime are presented in Figure 2. Paired sample *t*-test indicated a significant difference between T1 and T11 self-report depression scores ($t(11) = 8.72$, $p < .001$). Results indicated that participants' range of depression scores reduced from moderate (10-14), moderately severe (15-19), and severe (20) at T1 to no depression (<5), mild (6-8) and moderate (13-14) at T11 (refer to Table 2).

In order to take into account of the effects of repeated measures, a linear mixed model (LMM) that examined the fixed effects of treatment on depression after controlling for the stress, gender and age was first performed. A first-order autoregressive (AR1) covariance structure was utilized to account for the effects of repeated measures. AR1 accounts for the fact that the measures at the different time points are related and the strength of the correlation with each adjacent time point gets weaker overtime. The LMM model fit was AIC = 649.32 and BIC = 695.08. Fixed effects were indicated on depression for time ($F(10, 79.42) = 3.22$, $p = .002$), stress ($F(1, 95.94) = 45.76$, $p < .001$), and gender ($F(1, 27.14) = 12.38$, $p = .002$), but not age.

Estimates of covariance parameters indicated a significant AR1 variance (Wald $Z = 4.71$, $p <$ .001) indicating that AR1 describes the covariance structure.

A second model was run to account for the random effects of participants and time. This second model yielded an AIC of 634.78 and a BIC of 683.40. The difference in AIC and BIC between the first and second models were 14.54 and 14.68 respectively, indicating that the second model with lower AIC and BIC better described the data. The second model indicated fixed effects on depression for time ($F(10, 83.49) = 5.27$, $p < .001$), and stress ($F(1, 116.56) = 39.76$, $p < .001$), but not age or gender. Estimates of covariance parameters indicated a significant AR1 variance (Wald $Z = 5.39$, $p < .001$) and that 59.7% of variance in the predictor was attributed to differences between participants.

Estimates of fixed effects (presented in Table 3) indicated that one unit increase in stress corresponded to .24 increase in depression ($p < .001$). Average depression scores at T1 and T2 were higher than at T11. At T1, the mean depression score was 5.46 higher than at T11 ($t(84.32) = 5.00$, $p < .001$, 95% CI: 3.30, 7.64). At T2, the mean depression score was 3.23 higher than at T11 ($t(88.93) = 3.00$, $p < .01$, 95% CI: 1.09, 5.38). The mean depression scores from T4 to T10 were not significantly different from T11 at the 95% significance level.

Results of participants' Reliable Change Index (RCI) (presented in Table 2) indicate if participants had recovered, improved, not responded or deteriorated in their depression. Four out of 12 participants whose change in depression scores from T1 to T11 exceeded 8.60 and had RCI > 1.96 were classified as having "Recovered" from depression. Six out of 12 participants reported change in depression scores of less than 8.60 from T1 to T11 had RCI > 1.96 and were classified as having "Improved" in their depression. Two out of 12 participants reported change in depression scores of less than 8.60 from T1 to T11 and RCI between -1.96 and 1.96, hence

were classified as being "Non-responsive to treatment" or having had "Unchanged" depression. No participants met the criteria of deteriorated depression, i.e., less than 8.60 change in depression scores from T1 to T11 and RCI < -1.96. Change in mean depression scores for the three groups (recovered, improved, and non-responsive) overtime are presented in Figure 3.

Based on benchmarking analysis and using T1 and T11 depression scores as pre-test and post-test, the calculated absolute effect size of this study was 2.65. According to Delgadillo et al. (2014), this effect size was large (more than .91) and clinically significant (more than .20 higher than .91). Results suggest that EMDR therapy may be an efficacious treatment for unipolar depression.

R1: What sudden gains, if any, are evident in EMDR therapy?

Based on the three criteria for sudden gains, 5 of the 12 participants experienced one sudden gain (see Table 4). No participant experienced more than one sudden gain. Of the five participants who had a sudden gain, two experienced sudden gain reversal (i.e., when depression score increased by 50% or more of amount of preceding sudden gain). Two participants experienced sudden gain between sessions 2 and 3 while one participant each experienced sudden gain between sessions 1 and 2, 3 and 4, and 5 and 6. The mean sudden gain in depression was 6.2 ($SD = 1.1$). The mean overall improvement in depression for the five participants that experienced sudden gain was 9.2 ($SD = 4.1$) or 67.4% of the mean overall improvement in depression scores.

In comparing the characteristics of the sudden gain ($N = 5$) and no sudden gain ($N = 7$) groups, no significant differences in age, gender or improvement in depression were found (see Table 5). Differences however, were evident for treatment outcomes. The change of depression scores for participants with and without sudden gains are depicted in line graphs (Figures 4 and

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5). The mean age of the sudden gain group ($M = 43.00$, $SD = 21.64$) was not significantly different from that of the no sudden gain group ($M = 34.86$, $SD = 14.26$; $t(10) = .79$, $p = .45$). All five participants in the sudden gain group were women, and 3 out of 7 participants in the no sudden gain group were women. The proportion women however was not significantly different between groups (sudden gain group = 100% female; no sudden gain group = 42.9%; Fisher's Exact, $p = .08$). There was no significant difference in the overall improvement in depression from T1 to T11 (sudden gain group: $M = 9.20$, $SD = 4.09$; no sudden gain group: $M = 7.57$, $SD = 2.70$; $t(10) = .84$, $p = .42$). There is a higher tendency for participants with sudden gains to recover from depression than participants without sudden gains (Fisher's Exact, $p < .05$). Results suggested that participants who received EMDR therapy and experienced sudden gain were more likely to recover from depression.

H2: Both EMDR therapy and CBT will decrease level of depression.

H2 was supported. Eight participants from phase two (4 EMDR therapy and 4 CBT) were used to test H2. Preliminary analysis indicated significant relationships between study variables (presented in Table 6). In this correlation analysis, depression and stress scores from all 11 time points were used. For the EMDR therapy group, time was related to depression ($r = -.33$, $p = .03$) and stress ($r = -.48$, $p < .001$), and depression was related to stress ($r = .54$, $p < .001$) and gender ($r = .45$, $p = .002$). For the CBT group, time was related to depression ($r = -.68$, $p < .001$) and stress ($r = -.46$, $p = .002$), depression was related to stress ($r = .74$, $p < .001$), and age was related to gender ($r = .96$, $p < .001$). These results indicated that for both treatment groups, the more treatment sessions received, the lower their levels of depression and stress, and the higher the stress, the higher were the levels of depression.

Table 7 summarizes the characteristics of the EMDR therapy ($N = 4$) and CBT ($N = 4$)

groups. There were no significant differences between the two groups in terms of age ($t(6) = .43$,

$p = .68$). For gender, 3 out of 4 EMDR therapy participants were female, and 1 out of 4

participants in the CBT group was female. The proportion female in both groups were not

significantly different (Fisher's Exact, $p = .49$). As for depression levels, no significant difference

in depression was found for both groups at T1 ($t(6) = .54$, $p = .61$) or T11 ($t(6) = 1.22$, $p = .27$).

The change in depression levels from T1 to T11 for the EMDR therapy group was 8.75 and for

the CBT group was 9.75. This magnitude of change did no differ between groups ($t(6) = -.45$, p

$= .67$). These results indicate that both groups did not significantly differ.

Paired sample t-test indicated a significant difference between T1 and T11 depression

score for both the EMDR therapy group ($t(3) = 6.09$, $p = .009$) and the CBT group ($t(3) = 7.28$, p

$= .005$). This suggested that for both groups, participants' depression scores were significantly

lower at one-month follow-up than at the first treatment session for both groups. RCI analysis

found one participants in EMDR therapy group had "Recovered" from depression (see Table 8)

while three had "Improved". In the CBT group, two participants had "Recovered" from

depression and two had "Improved." Change in average depression scores for the participant in

both groups over 11 time points are presented in Figures 6 and 7. On these two graphs, the x-axis

depicts the 11 time points and the y-axis the average depression scores. Although there were

fluctuations in depression all participants in both groups over time, the depression scores for all

participants were lower at both T10 and T11 than the beginning of treatment at T1.

Based on benchmarking analysis and using T1 and T11 depression scores as pre-test and

post-test, the calculated absolute effect size for four EMDR participants was 2.37. And the effect

size for four CBT participants was 3.91. According to Delgadillo et al. (2014), both effect sizes were large (more than .91) and clinically significant (more than .20 higher than .91).

H3: Depression will be positively correlated with negative affect fixation duration (FD) and negatively correlated with positive affect fixation duration.

H3 was supported only for female affect images but not male affect images. Correlation analysis indicated that there was no significant relationship between the FD on either positive affect or negative affect with depression (see Table 9). This correlation analysis included all 12 pairs of images. Paired sample *t*-test was conducted to test the differences in FD on positive and negative affect images from T1 to T11 (see Table 10). Results did not indicated significant differences between T1 and T11 FD on either positive or negative affect images.

Additional analysis was conducted separately for male and female images. As seen in Figure 8, a steeper slope is seen between depression and FD for female images compared to male images. For female images, positive affect FD decreased and negative affect FD increased as depression scores increased. Results indicated significantly correlation between depression and positive affect FD ($r = -.44$, $p = .02$) and negative affect FD ($r = .44$, $p = .01$) for female images, but not for male images (see Table 11). To further illustrate these relationships, line graphs plotted separately for female and male images are presented in Figures 9 and 10. Only negative images are illustrated, as graphs for positive images will essentially be the reverse given that the magnitude of the correlations between FD of the images and depression are the same other than the direction of the relationship. In both figures, x-axis is the time (T1, T5, T10, and T11), and y-axis is the z-scores for depression and the negative affect FD. The correlation between FD and negative female affect images was higher than male affect images for both groups.

Chapter 5 - Discussion

The goal of this study was to explore the efficacy of using EMDR therapy as a treatment for unipolar depression. EDMR therapy is an evidenced-based treatment for PTSD (Shapiro, 1989). Studies examining the effectiveness of EMDR therapy to treat PTSD found improvement in co-current depression (Chen at al., 2014). The efficacy of using EMDR therapy for unipolar depression as a primary diagnosis is still at its infancy.

The results from this preliminary study indicate that EMDR therapy may be efficacious in reducing depressive symptoms. All participants reported clinical level of depression (moderate, moderately severe, or severe) prior to commencing treatment and after 10 sessions of EMDR therapy, 10 participants reported clinically significantly change in their levels of depression. These 10 participants met the criteria for either "Improved" or "Recovered" from depression. The positive outcome of this clinical study adds to a growing body of current literature that shows potential efficacy of EMDR as a treatment for depression as a primary diagnosis (Bae et al., 2008; Hofmann et al., 2014).

EMDR therapy's effectiveness in treating PTSD that stem from negative life events may explain its suitability to treat depressive symptoms, particularly reactive depression. While some negative life events (current or past) may be sufficiently traumatic to trigger post-traumatic responses, many are not. However, these events can have profound negative effects on emotions, behaviors, and perceptions that culminate into depressive symptoms (Shapiro, 2001). The same mechanism that explains the treatment for PTSD may apply to the treatment for depression. Specifically, the adaptive information processing (AIP) system can be used to explain how EMDR therapy desensitizes the physical and emotional responses to negative memories and

images related to negative life events, and reconstructs the AIP network, allowing more positive emotional responses to be generated (Shapiro, 2001).

Depression is essentially a negative emotional state conjured by negative life events. EMDR therapy targets the memories related to negative live events, including images and physical arousal evoked by these memories by desensitizing emotional, perceptive and physical responses to target memories by changing maladaptive responses to adaptive responses (Shapiro, 2009). The reprocessing function of EMDR therapy involves installing more adaptive forms of responses to target memories such that when target memories are triggered, responses are more adaptive than maladaptive.

To understand the trajectory of treatment progress, identifying sudden gains in treatment (sharp decline in symptoms) may be predictive of treatment outcome (Tang & DeRubeis, 1999). Sudden gains are often evident in the early stages of treatment for those who respond well to treatment. Of the five participants who experienced sudden gains during, three met the criteria for "Recovered" from depression and two met the criteria for "Improved" after 10 sessions of treatment. These results suggest that decline in severity of symptoms in the early phases of treatment, may serve as a good indicator of treatment outcome. Such findings are consistent with current studies on sudden gains (Hardy et al., 2005; Hopko et al., 2009; Masterson et al., 2014). This is the first known study that examines the phenomenon of sudden gains in EMDR therapy.

In this study, sudden gains were experienced within the first 6 sessions. The focus in these sessions is mainly the desensitization of negative childhood memories linked to depressive mood and the desensitization of negative emotional responses evoked by these memories. Significant decrease in depression in the early stages of EMDR therapy consequently appears to relate to the desensitization phase of treatment. Because the goal of EMDR therapy is to help

desensitize and reprocess negative memories, these findings on the timing of sudden gains imply that positive response to desensitization may be key to positive treatment outcomes. Thus, experiencing sudden gains during the desensitization phase of EMDR therapy may serve as a good indicator of response to treatment.

When looking at participants' outcome from EMDR therapy and CBT, results suggest that both treatments are efficacious depression. Participants in both groups met the criteria for either "Recovered" or "Improved" after completing 10 sessions of treatment. The degree of improvement in depressive symptoms was also not significantly different between groups. Although EMDR therapy has not been widely studied as a treatment for depression, its focus on modifying emotions, perceptions and behaviors through the AIP system appears to work as CBT's focus on modifying cognitive distortions and corresponding behaviors. Both these treatments may be similarly efficacious because they both conceptualize depression as a part of an internal system -- thought-feeling-behavior system for CBT (Beck, 1970) and the AIP system for EMDR therapy (Shapiro, 2001) as oppose to depression as externally derived (i.e., systems theory; Winek, 2009). It is important to note that the comparison of treatment efficacy was limited by the small sample size hence there might be potential differences in treatment efficacy that could not be detected in this study.

In order to further understand the change of depression overtime across the EMDR therapy and CBT treatment groups, attentional bias was examined. Attentional bias, which is the amount of time spent focused on emotional images, is related to the level of depression (Caseras, Garner, Bradley, & Mogg, 2007; Gotlib, & Joormann, 2010; Kellough et al., 2008; Sanchez et al., 2013). Previous studies indicate that persons with depression display attentional bias towards images with negative affect (sadness) compared to positive affect (happiness). This means that

persons with depression spend more focusing on sad images and less time focusing on happy images (Duque, & Vázquez, 2015; Sanchez et al., 2013). The time spent focusing on an object is known as fixation duration (FD). Eye-tracking results in this clinical study did not find significant correlation between depression and attentional bias when all negative and positive affect images were combined. However, when images were separated by gender, FD on negative female images but not male images were related with depression such that higher levels of depression was related to longer durations of looking at negative affect images of women. The difference between male and female images could be related to the general expectation that women are emotionally expressive. Hence, participants may be more comfortable focusing on female expressions of emotions, especially negative emotions such as sadness. Therefore, FD on female affect might have a better correlation with participants' level of depression than male affect. These results are consistent with current literature on depression and attentional bias. There appears to be a descending trend in FD on negative female affect images as depression scores decrease and an ascending trend in FD on positive female affect images as depression scores decrease. These results provide preliminary evidence that suggests EMDR therapy and CBT may potentially change mood that can in turn change attentional bias, hence, providing some concrete evidence for treatment outcome.

Limitations and Further Research

There were a few limitations to this study. Because of the preliminary nature of the study and the small sample size, these results need to be interpreted with caution and not generalized to a larger population. The study provides opportunities for further research on the same topic with larger samples. Although it is common for clinical studies to have smaller sample sizes, this may

have been ameliorated to some extent if an alternative treatment was offered to the control group instead of waitlisting the controls.

Because of the regional diversity of the study, the sample size was not ethnically diverse. There is a need for research with more diverse groups. It is important to consider that assessment for progress monitoring were conducted before the beginning of treatment session. Changes in depression between two consecutive sessions could be explained by the treatment as well as by everyday life events that cannot be controlled in an experiment. Furthermore, it is natural that personal reflection and processing memories and emotions continue post-session. These life events that were not quantified could explained the fluctuations in the depression scores between treatments.

Clinical Implications

Based on the results of this preliminary study, EMDR therapy shows potential efficacy in treating depression. Differ from using EMDR therapy to treat PTSD, EMDR therapy for depression targets memories and self-images that related to depressive symptoms. Clinicians with a background of EMDR therapy training can easily adapt the EMDR therapy treatment protocol to target depression as a primary presenting problem. Clinicians treating unipolar depression without EMDR therapy training could also expand their treatment repertoire by acquiring training in EMDR therapy. This treatment would be particularly suitable for clients who can trace their current depressive symptoms to earlier life events. It is believed that EMDR therapy is more suitable for reactive depression than endogenous depression. And for clients who cannot trace depression-related memories or information from specific life events, EMDR therapy can still target depression-related self-image (being unsuccessful, unlovable, incapable, etc.) and physical symptoms (chest pain, headache, tension in body, etc.). AIP system theory

allows EMDR therapy to intervene with different parts of the processing network including memories, perception, sensation, and images. As discussed above, CBT and EMDR therapy share similarity in viewing depression as interconnecting with cognitive functions and bodily sensations. The result from this study did not find difference in improvement of depression between CBT and EMDR therapy. And both treatments were efficacious in reducing depression over 10 sessions of treatment. Given the preliminary result of the current study, clinicians are encouraged to acquire different psychotherapy models and provide optimal care that meets clients' needs.

Knowing that sudden gains as a treatment phenomenon, which might correlate with the successful treatment outcome, it is encouraged for clinicians to carefully monitor clients' depression level through session-by-session assessment. Although the reasons for sudden gains remain unspecified, the potential use of sudden gains as an indicator for successful outcome is evidenced. As previous research has provided evidence supporting sudden gains as an outcome indicator for CBT, interpersonal therapy, and behavioral therapy, the current study adds to the lack of sudden gains research for EMDR therapy. Therefore, clinicians are suggested to examine treatment outcome by studying sudden gains with their psychotherapy of choice. This study emphasizes the importance to monitor treatment progress and study the trajectory of change of the clients' recovery in order to help provide optimal care.

Another clinical implication of the current study is for clinicians to detect depression using attentional bias strategies. Knowing that persons with depression have a tendency to fixate on negatively charged information (sad face images in this study), clinicians can use visual task (having clients to view images with different affects) in early stage of therapy to detect potential depression in addition to self-reported symptomology. Our study finds significant correlation

between female affect images and depression but not male affect. It suggests female affect might

act as a better indicator to identify persons with depression than male affect. At the same time,

the change of attentional bias along the EMDR therapy and CBT treatments suggest changes in

perception as a by-product when treatment itself focuses mainly on cognitions and sensations.

This finding supported the holistic change of individual functioning when depression improves.

Clinicians working with depressive persons can use attentional bias not only as an indicator for

change of depression but to understand how a psychotherapy could impact one's perceptions and

attentions and better conceptualize change mechanism.
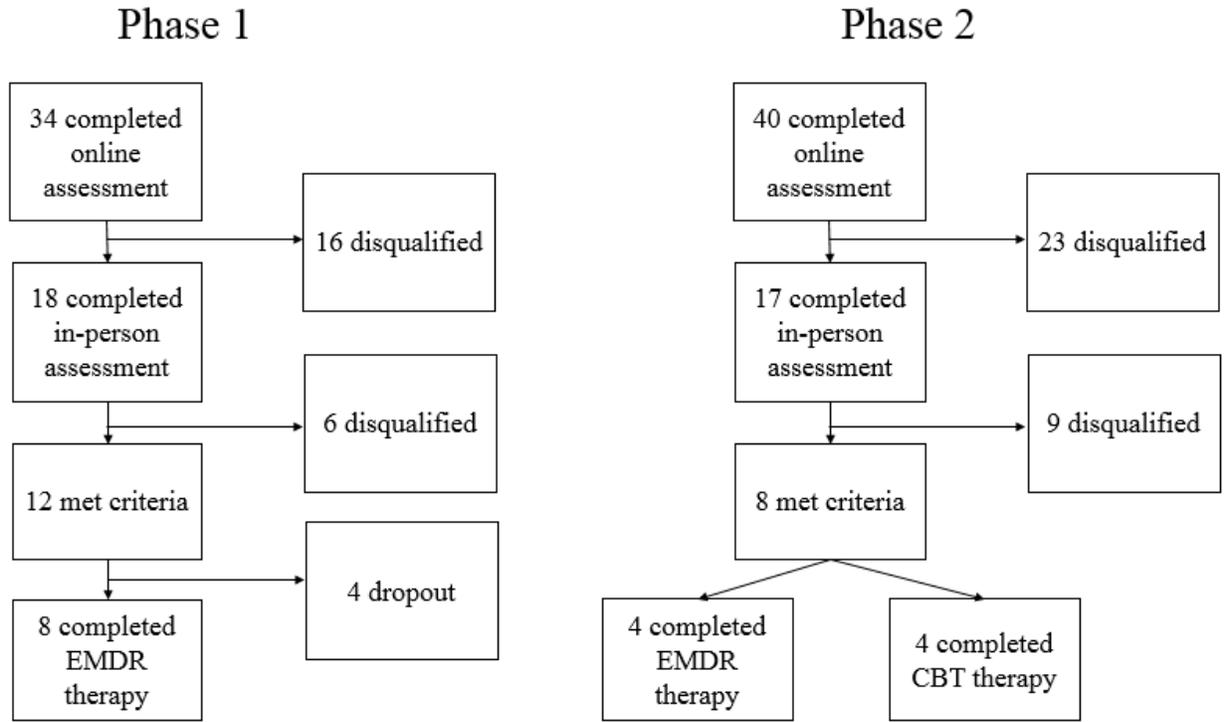
Figure 1 Participant recruitment from phase 1 and phase 2

Simple Line Mean of Depression by Time
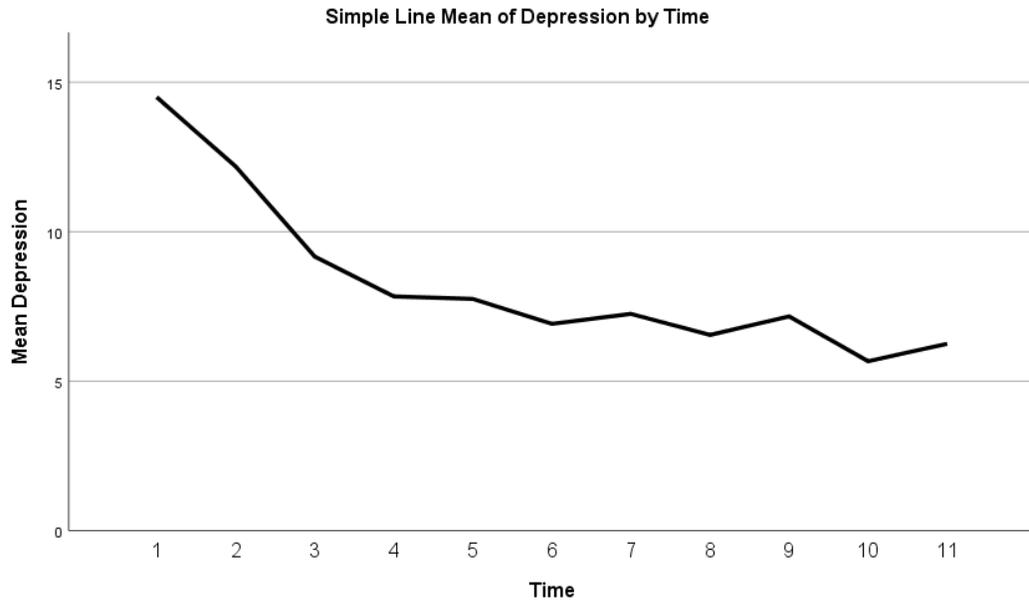
Figure 2 Change of mean depression score from T1 to T11 (*N* = 12)

Multiple Line Mean of Depression by Time by Group
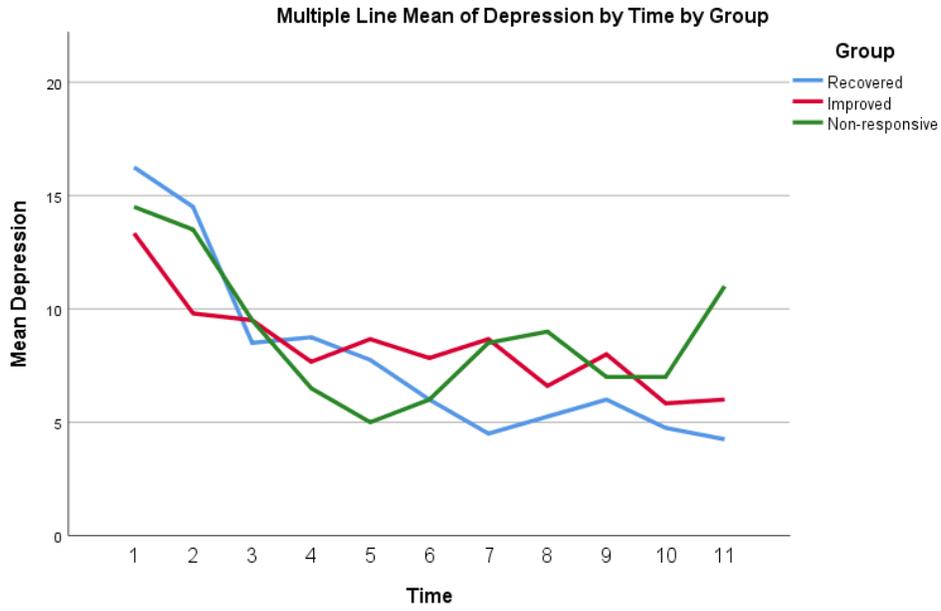
Figure 3 Change of mean depression score from T1 to T11 for recovered, improved and non-responsive groups ($N = 12$)
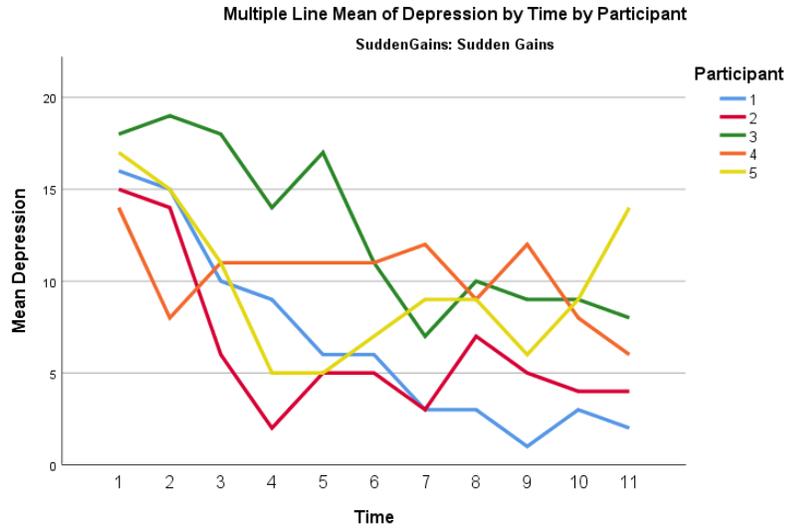
Figure 4 Change of average depression score from T1 to T11 for sudden gain group (*N* = 5)

Multiple Line Mean of Depression by Time by Participant

SuddenGains: No Gains
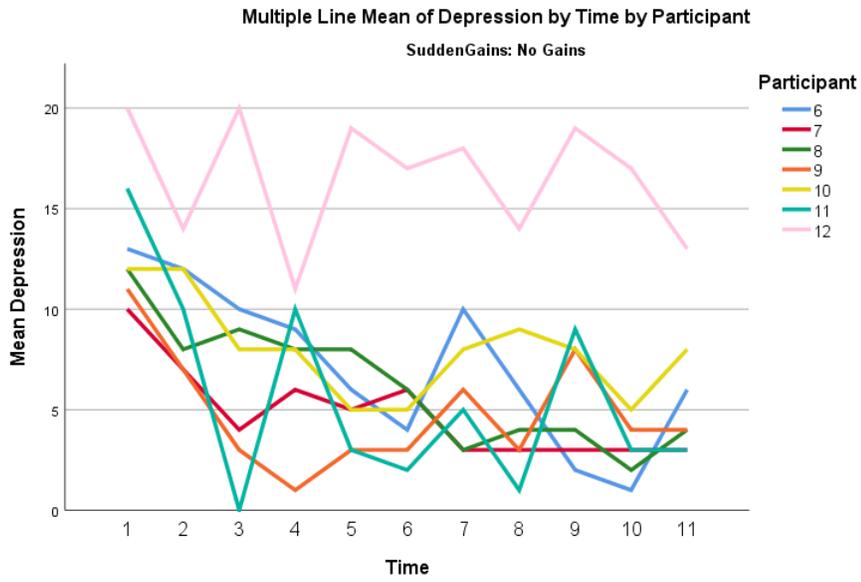
Figure 5 Change of average depression score from T1 to T11 for no sudden gain group (*N* = 7)
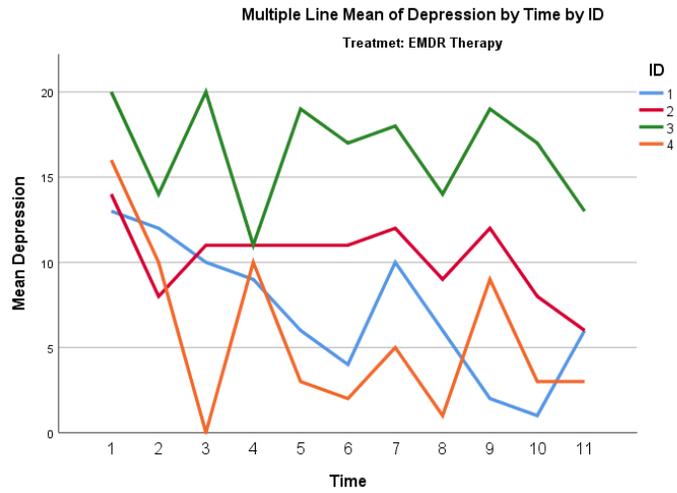
Figure 6 Change of average depression scores from T1 to T11 for EMDR therapy group (*N* = 4)
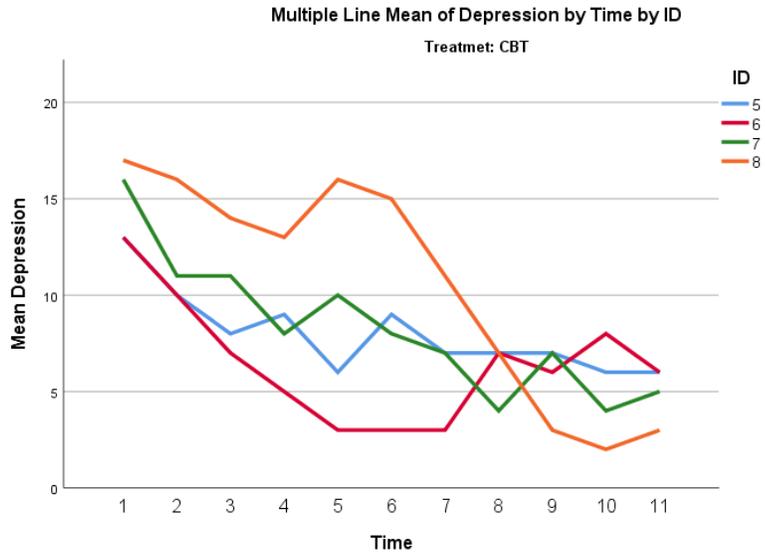
Figure 7 Change in average depression scores from T1 to T11 for CBT group (*N* = 4)
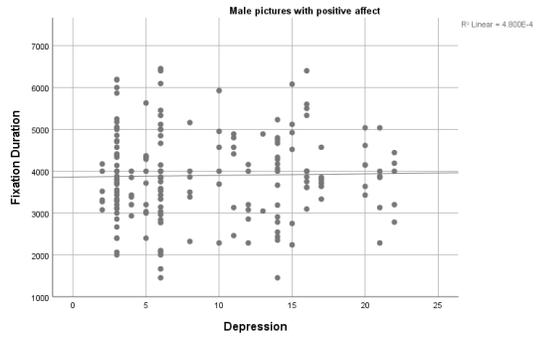
(a)
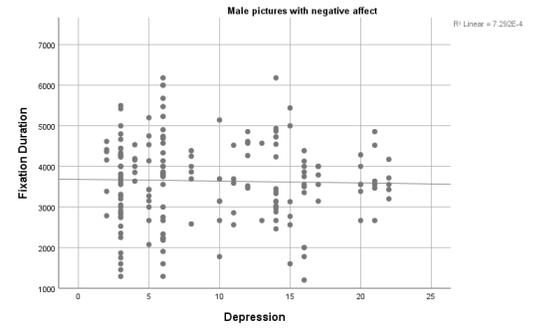
(b)
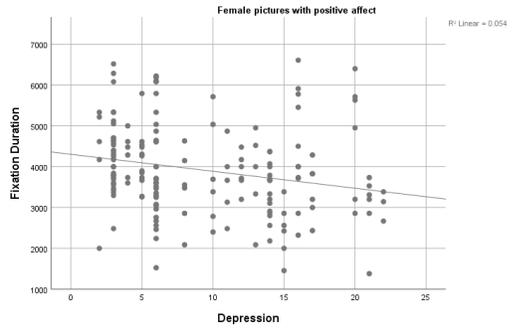
(c)
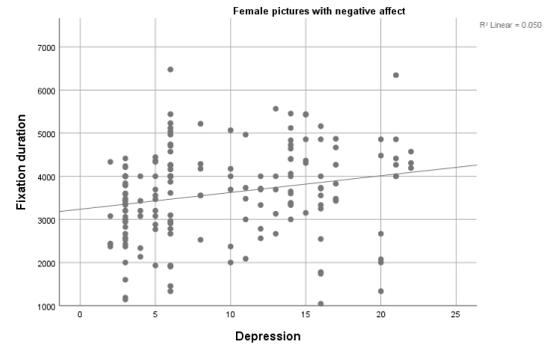
(d)

Figure 8 Scatter plot of depression and fixation duration (FD) for male (a & b)/female (c & d) pictures with negative/positive affects
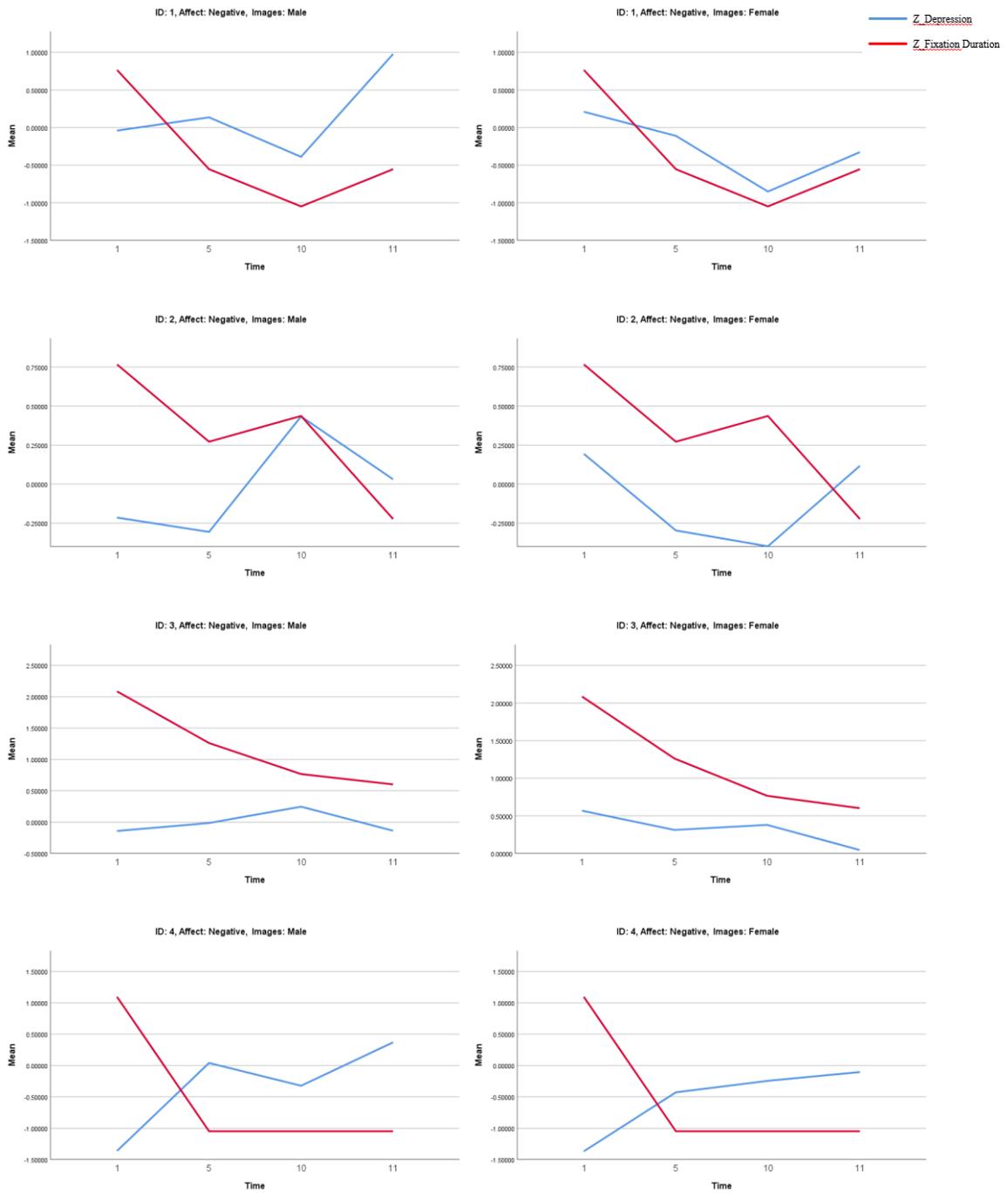
Figure 9 Change in average depression scores and fixation duration (FD) in z-scores on negative affect images (left: male images; right: female images) at four time points for 4 EMDR therapy participants
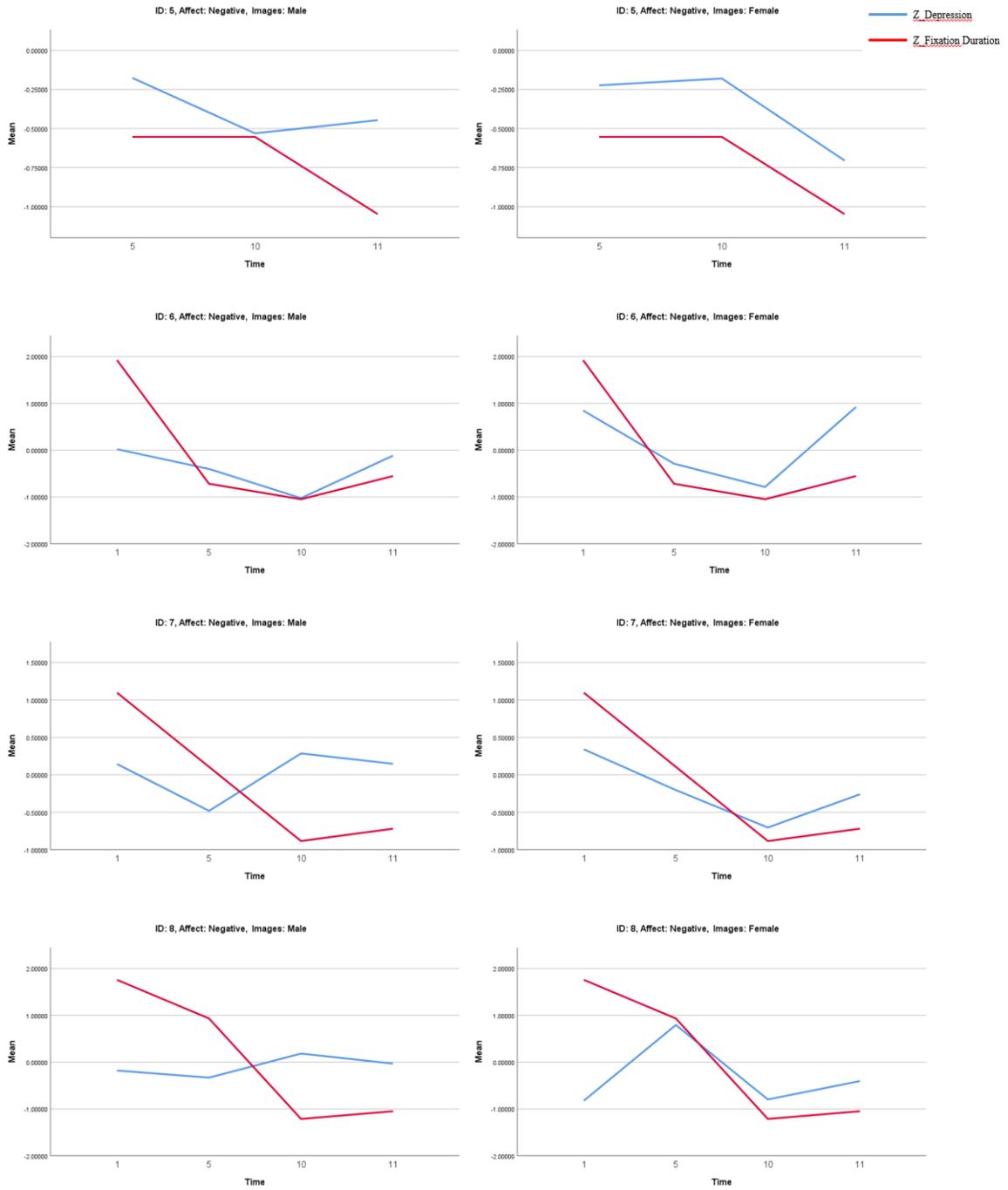
Figure 10 Change in average depression scores and fixation duration (FD) in z-scores on negative affect images (left: male images; right: female images) at four time points for 4 CBT therapy participants

Table 1 Correlation and descriptive statistics of study variables

	1	2	3	4
1. Depression	-			
2. Stress	.70***	-		
3. Age	-.19*	-.47***	-	
4. Gender	.36**	.15	-.06	-
M (*SD*)	8.28 (4.95)	13.32 (9.75)	38.58 (16.28)	

Note. $N = 130$. Gender: $1 = male$, $2 = female$.

* $p < .05$. ** $p < .01$. *** $p < .001$. (two-tailed test).

Table 2 The change in depression scores and RCI from T1 to T11

Participant	1	2	3	4	5	6	7	8	9	10	11	12
Depression at T1	16	15	18	16	10	12	11	13	14	20	12	17
Depression at T11	2	4	8	3	3	4	4	6	6	13	8	14
Change in depression	14	11	10	13	7	8	7	7	8	7	4	3
RCI	5.23	4.11	3.74	4.86	2.62	2.99	2.62	2.62	2.99	2.62	1.50	1.12
Treatment outcome		Recovered					Improved				Non-responsive	

Table 3 Results of linear mixed modeling of fixed effects on depression

	Beta	SE	95% CI
Intercept	-9.37**	3.12	-15.68, -3.06
Time 1	5.46***	1.09	3.30, 7.64
Time 2	3.23**	1.08	1.09, 5.38
Time 3	1.33	1.02	-.69, 3.36
Time 4	-.08	1.02	-2.1, 1.94
Time 5	.23	.99	-1.74, 2.21
Time 6	-.20	.97	-2.13, 1.73
Time 7	.22	.96	-1.68, 2.11
Time 8	-.38	.96	-2.28, 1.51
Time 9	.41	.91	-1.40, 2.22
Time 10	-.44	.88	-2.19, 1.30
Time 11	0	0	
Stress	.24***	.04	.16, .32
Gender	2.79	1.42	-.10, 5.68
Age	.02	.04	-.07, .10

* $p < .05$. ** $p < .01$. *** $p < .001$. (two-tailed test).

Table 4 Sudden gain characteristics of 12 EMDR therapy participants

Sudden gain characteristic	Result
One sudden gain	5/12
Sudden gain between session 1 and 2	1/5
Sudden gain between session 2 and 3	2/5
Sudden gain between session 3 and 4	1/5
Sudden gain between session 5 and 6	1/5
Sudden gain reversed	2/5
Mean (*SD*) sudden gain improvement in depression	6.2 (1.1)
Mean (*SD*) overall improvement in depression	9.2 (4.1)
Sudden gain as a % of overall improvement	67.4%

Table 5 Characteristics of the sudden gain and no-gain groups

Characteristic	Sudden gain group ($N = 5$)	No-gain group ($N = 7$)	Statistic
Age	$M = 43.0$, $SD= 21.64$	$M = 34.9$, $SD = 14.26$	$t(10) = .79$, $p = .45$
Gender	% female = 100% (5/5)	% female = 42.9% (3/7)	Fisher' Exact, $p = .08$
Improvement in depression	$M = 9.2$, SD = 4.09	$M = 8$, SD = 2.70	$t(10) = .84$, $p = .42$
Treatment outcome	% recovered = 60% (3/5)	% recovered = 0% (0/7)	Fisher' Exact, $p < .05$

Table 6 Correlation of study variables for EMDR therapy and CBT treatment groups

		Time	Depression	Stress	Age
EMDR	Time	-			
therapy	Depression	-.33*	-		
($N = 44$)	Stress	-.48***	.54***	-	
	Age	0	.02	-.28	-
	Gender	0	.45**	-.15	.26
CBT ($N = 44$)	Time	-			
	Depression	-.68***	-		
	Stress	-.46**	.74***	-	
	Age	0	-.12	-.28	-
	Gender	0	-.05	-.09	.96***

* $p < .05$. ** $p < .01$. *** $p < .001$ (two-tailed test).

Gender: 1 = *male*, 2 = *female*.

Table 7 Differences across EMDR therapy and CBT treatment groups

	EMDR therapy ($N = 4$)	CBT ($N = 4$)	Group differences
Age	$M = 32.50, SD = 14.39$	$M = 25.25, SD = 13.70$	$t(6) = .43, \ p = .68$
Sex	% female = 75	% female = 25	Fisher' Exact, $p = .49$
Depression at T1	$M = 15.75, SD = 3.10$	$M = 14.75, SD = 2.06$	$t(6) = .54, p = .61$
Depression at T11	$M = 7.00, SD = 4.24$	$M = 4.25, SD = 3.10$	$t(6) = 1.22, p = .27$
Change of depression from T1 to T11	$M = 8.75, SD = 2.87$	$M = 9.75, SD = 3.40$	$t(6) = -.45, p = .67$

Table 8 RCI of depression from T1 to T11 for EMDR therapy and CBT treatment groups

	EMDR Therapy				CBT			
Participant	1	2	3	4	5	6	7	8
Depression at T1	13	14	20	16	13	13	16	17
Depression at T11	6	6	13	3	6	6	5	3
Change in depression	7	8	7	13	7	7	11	14
RCI	2.89	3.30	2.89	5.36	2.89	2.89	4.54	5.78
Treatment outcome	Improved			Recovered	Improved		Recovered	

Table 9 Correlation of fixation duration (FD) on positive and negative affect for participants

		Time	Depression	Positive FD
All	Time	-		
participants	Depression	-.72***	-	
($N = 32$)	Positive FD	-.02	-.56	-
	Negative FD	.02	.25	-.93***
EMDR	Time	-		
therapy	Depression	-.58*	-	
($N = 16$)	Positive FD	-.22	-.16	-
	Negative FD	.30	.03	-.95***
CBT	Time	-		
($N = 15$)	Depression	-.88***	-	
	Positive FD	.18	-.32	-
	Negative FD	-.31	.47	-.91***

* $p < .05$. ** $p < .01$. *** $p < .001$ (two-tailed test).

Negative FD = negative affect fixation duration; Positive FD = positive affect fixation duration.

Table 10 Paired t-test of fixation duration (in millisecond) on positive and negative affect from T1 to T11

	Positive FD at T1	Positive FD at T11	Statistics	Negative FD at T1	Negative FD at T11	Statistics
Both groups	$M =$ 368210, SD = 744.79	$M =$ 3588.25, $SD =$ 951.78	t (73) = .69, $p = .49$	$M =$ 3828.32, $SD =$ 722.10	$M =$ 3886.66, $SD =$ 957.94	t (73) = -.44, $p = .66$
EMDR therapy	$M =$ 3736.55, $SD =$ 710.75	$M =$ 3607.84, $SD =$ 899.41	t (40) = .71, $p = .48$	$M =$ 3684.43, $SD =$ 660.47	$M =$ 3900.10, $SD =$ 849.10	t (40) = -1.24, $p = .22$
CBT	$M =$ 3614.45, $SD =$ 790.86	$M =$ 3561.90, $SD =$ 1026.78	t (32) = .24, $p = .81$	$M =$ 4007.10, $SD =$ 764.69	$M =$ 3869.96, $SD =$ 1091.62	t(32) = .70, $p = .49$

Negative FD = negative affect fixation duration; Positive FD = positive affect fixation duration.

Table 11 Correlation of fixation duration (FD) on positive and negative affect for male and female pictures

		Depression	Positive FD
Male Pictures	Depression	-	
	Positive FD	.05	-
	Negative FD	-.06	-.92***
Female Pictures	Depression	-	
	Positive FD	-.44*	-
	Negative FD	.44*	-.94***

N = 31 * *p* < .05. ** *p* < .01. *** *p* < .001 (two-tailed test).

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Appendix A - Online Survey

The following scales were included in the online survey completed by all potential participants who enquired about the study:

A. **Standardized Assessment of Personality Abbreviated Scale, (Moran, Leese, Lee, Walters, & Thornicroft, 2003)**

   Please indicate 'Yes' or 'No' according to when you think the following descriptions apply to you most of the time and in most situations.

   1. In general, do you have difficulty making and keeping friends?
   2. Would you normally describe yourself as a loner?
   3. In general, do you trust other people?
   4. Do you normally lose your temper easily?
   5. Are you normally an impulsive sort of person?
   6. Are you normally a worrier?
   7. In general, do you depend on others a lot?
   8. In general, are you a perfectionist?

B. **Depression, Anxiety and Stress Scale (Henry & Crawford, 2005)**

   Please indicate how much each statement below applied to you over the past week.

(0) Did not apply to me at all	(1) Applied to me to some degree, or some of the time	(2) Applied to me to a considerable degree, or a good part of time	(3) Applied to me very much, or most of the time

   1. I found it hard to wind down
   2. I was aware of dryness of my mouth
   3. I couldn't seem to experience and positive feeling at all
   4. I experienced breathing difficulty (e.g., excessively rapid breathing, breathlessness in the absence of physical exertion)
   5. I found it difficult to work up the initiative to do things
   6. I tended to over-react to situations
   7. I experienced trembling (e.g., in the hands)
   8. I felt that I was using a lot of nervous energy

9. I was worried about situations in which I might panic and make a fool of myself

10. I felt that I had nothing to look forward to

11. I found myself getting agitated

12. I found it difficult to relax

13. I felt down-hearted and blue

14. I was intolerant of anything that kept me from getting on with what I was doing

15. I felt I was close to panic

16. I was unable to become enthusiastic about anything

17. I felt I wasn't worth much as a person

18. I felt that I was rather touchy

19. I was aware of the action of my heart in the absence of physical exertion (e.g., sense of heart rate increase, heart missing a beat)

20. I felt scared without any good reason

21. I felt that life was meaningless

C. Adult Attention Deficit and Hyperactivity Disorder Self-Report Scale (Kessler et al., 2005)

Please rate yourself on each of the criteria below using the scale 'never, rarely, sometimes, often and very often' to best describe how you have felt and conducted yourself over the past 6 months.

1. How often do you have trouble wrapping up the final details of a project, once the challenging parts have been done?

2. How often do you have difficulty getting things in order when you have to do a task that requires organization?

3. How often do you have problems remembering appointments or obligations?

4. When you have a task that requires a lot of thought, how often do you avid or delay getting started?

5. How often do you fidget or squirm with your hands or feet when you have to sit down for a long time?

6. How often do you feel overly active and compelled to do things, like you were driven by a motor?

D. Dissociative Experiences Scale (Carlson & Putnam, 1992)

To answer the following questions, please determine to what degree the experience described in the statement below applies to you and indicate what percentage of the time you have the experience from 0%, 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90% to 100%.

1. Some people have the experience of driving a car and suddenly realizing that they don't remember what has happened during all or part of the trip.

2. Some people find that sometimes they are listening to someone talk and they suddenly realize that they did not hear part of all of what was said.

3. Some people have the experience of finding themselves in a place and having no idea how they got there.

4. Some people have the experience of finding themselves dressed in clothes that they don't remember putting on.

5. Some people have the experience of finding new things among their belongings that they do not remember buying.

6. Some people sometimes find that they are approached by people that they do not know who call them by another name or insist that they have met them before.

7. Some people sometimes have the experience of feeling as though they are standing next to themselves or watching themselves do something and they actually see themselves as if they were looking at another person.

8. Some people are told that they sometimes do not recognize friends or family members.

9. Some people find that they have no memory for some important events in their lives (for example, a wedding or graduation).

10. Some people have the experience of being accused of lying when they do not think that they have lied.

11. Some people have the experience of looking in the mirror and not recognizing themselves.

12. Some people have the experience of feeling that other people, objects, and the world around them are not real.

13. Some people have the experience of feeling that their body does not seem to belong to them.

14. Some people have the experience of sometimes remembering a past event so vividly that they feel as if they are reliving the event.

15. Some people have the experience not being sure whether things that they remember happening really did happen or whether they just dreamed them.

16. Some people have the experience being in a familiar place but finding it strange and unfamiliar.

17. Some people find that when they are watching television or a movie they become so absorbed in the   story that they are unaware of the other events happening around them.

18. Some people find that they become so involved in a fantasy or daydream that it feels as though it were really happening to them.

19. Some people find that they are sometimes able to ignore pain.

20. Some people find that they sometimes sit staring off into space, thinking of nothing, and are not aware of the passage of time.

21. Some people sometimes find that when they are alone they talk out loud to themselves.

22. Some people find that in one situation they may act so differently compared with another situations that they feel almost as if they were two different people.

23. Some people sometimes find that in certain situations they are able to do things with amazing ease and spontaneity that would usually be difficult for them (for example, sports, work, social situations, etc.).

24. Some people sometimes find that they cannot remember whether they have done something or have just thought about doing it (for example, not knowing whether they have just mailed a letter or have just thought about mailing it).

25. Some people find evidence that they have done things that they do not remember doing.

26. Some people sometimes find writings, drawing, or notes among their belongings that they must have done but cannot remember doing.

27. Some people sometimes find that they hear voices inside their head that tell them to do things or comment on things that they are doing.

28. Some people sometimes feel as if they are looking at the world through a fog so that people and objects appear far away or unclear.

Appendix B - Stress Subscale

Stress Subscale from the DASS-21

Please read each statement and circle a number 0, 1, 2 or 3 that indicates how much the statement applies to you. There are no right or wrong answers. Do not spend too much time on any statement.

The rating scale is as follows:

0 - Does not apply to me at all

1 - Applies to me to some degree, or some of the time

2 - Applies to me to a considerable degree, or a good part of time

3 - Applies to me very much, or most of the time

1. I find it hard to wind down	0	1	2	3
2. I tend to over-react to situations	0	1	2	3
3. I feel that I am using a lot of nervous energy	0	1	2	3
4. I find myself getting agitated	0	1	2	3
5. I find it difficult to relax	0	1	2	3
6. I find it difficult to tolerate interruptions to what I am doing	0	1	2	3
7. I feel that I am rather touchy	0	1	2	3

Appendix C - Facial Images