The Effects of Eye Movement Desensitization and Reprocessing (EMDR) Therapy on Posttraumatic Stress Disorder in Survivors of the 1999 Marmara, Turkey, Earthquake

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As part of a program of response to the 1999 Marmara, Turkey, earthquake, an estimated 1,500 trauma victims with posttraumatic stress disorder (PTSD) symptoms were treated in tent cities with eye movement desensitization and reprocessing (EMDR). A field study evaluating a representative group of 41 participants with diagnosed PTSD indicated that a mean of five 90-minute sessions was sufficient to eliminate symptoms in 92.7% of those treated, with reduction in symptoms in the remaining participants. Significant reductions occurred between the pre and posttreatment PTSD Symptom Scale Self-

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Thanks to members of the research team, Ceyda Eke, Leyla Tanogolu, and to Erkan Kalem and Steven Silver for assistance with statistical analyses.

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International Journal of Stress Management
2006, Vol. 13, No. 3, 291–308

1072-5245/06/$12.00 DOI: 10.1037/1072-5245.13.3.291

Report version (PSS-SR) total scores and all subscales. These gains were maintained at 6-month follow-up. The same pattern of recovery was observed regardless of the use or nonuse of psychotropic medication at the time of intake.

Keywords: Posttraumatic Stress Disorder, EMDR, developing countries, disaster response

In August 1999, an earthquake struck populated areas along the Sea of Marmara in Turkey, resulting in the deaths of over 25,000 people and the displacement of 750,000 more. A disaster of this magnitude is likely to result in widespread mental health consequences (National Institute of Mental Health [NIMH], 2002). Two days following this earthquake, members of the Turkish Psychologists' Association (TPA) met to plan a program of psychotherapy services in response to the situation. It was immediately clear that many people would be suffering from posttraumatic stress. A retrospective study in May 2000, conducted by TPA-Istanbul Branch (TPA-IB), of 240 randomly selected households (i.e., family units living together) in the earthquake zone found 70% suffering from posttraumatic stress disorder (PTSD; Konuk, 2000). The degree of loss experienced in these earthquake areas was extreme; for example, in the International Transportation Foundation (UND) tent city in Izmet, each household surveyed had at least one member killed in the earthquake.

In response to this situation, members of the TPA established clinics in seven tent cities, and these clinics eventually provided pro bono psychotherapeutic services to approximately 4,000 individuals, including a conservatively estimated 1,500 people suffering from PTSD symptoms. In addition, informational booklets describing the psychological effects of trauma were prepared; 200,000 copies of these booklets were printed and delivered to people in the earthquake areas by TPA, Ankara Chapter.

The tent city clinics were operational within days following the earthquake, but it was quickly apparent that the volunteer therapists needed additional trauma therapy training. Many of the initial efforts of therapists were directed at assisting survivors in reconnecting with loved ones, teaching essential survival skills (such as water sterilization), and in directing survivors to available services. However, for those clients with posttraumatic nightmares, visual flashbacks, hyperarousal, and avoidance symptoms, therapists reported that their general counseling skills were of very limited use. Consequently, a decision was made to initiate a training program in treatment methods appropriate to the situation.

Unfortunately, there is little scientific evidence of the effectiveness of postdisaster mental health interventions available to guide the practicing clinician (e.g., Litz, Gray, Bryant, & Adler, 2002). There has been support for psychological debriefing as an effective intervention following a traumatic

event (Chemtob, Tomas, Law, & Cremniter, 1997), but these research results have been inconsistent, and some reviewers have concluded that group debriefing may have no effect, or even contribute to the development of PTSD symptoms (Bisson, McFarlane, & Rose, 2000; van Emmerik, Kamphuis, Hulsbosch, & Emmelkamp, 2002). Only EMDR therapy (Shapiro, 1995, 2001), and cognitive behavior therapy (CBT; Foa & Meadows, 1998; Walser et al., 2004) treatments have been listed as efficacious for PTSD by the International Society for Traumatic Stress Studies (Foa, Keane, & Friedman, 2000) and by a taskforce of the Clinical Division of the American Psychological Association (Chambless, Baker, Baucom, Beutler, Calhoun, Crits-Christoph, et al., 1998).

Many of the Turkish therapists in our study previously had formal training in the CBT methods of exposure, belief-restructuring, and stress inoculation. However, these specific methods were judged to be inappropriate in the ongoing chaotic conditions of the tent cities, where clients' irrational self-defeating negative cognitions often had a high level of subjective validity, and therapy sessions often took place within the sight or hearing distance of others, thereby inhibiting clients' willingness to acknowledge anxiety and weakness. In addition, Turkish earthquake survivors, as a group, were generally not accustomed to using psychotherapy and tended to utilize affect suppression as the preferred means of responding to posttraumatic disturbance. Moreover, exposure methods, with their focus on the stress-inducing details of the traumatic incident, were thought to be generally unsuitable for a population suffering from high levels of bereavement, anxiety, and continuing threat of the repetition of the disaster (Bryant & Harvey, 2000). Also, the use of assigned homework between sessions, as prescribed by CBT, was clearly impractical under these circumstances.

Based on these considerations, a committee of the TPA determined that EMDR might be a more appropriate response to these disaster conditions and proposed that a training program in this method be initiated for Turkish therapists working in the earthquake zone. EMDR, which currently has empirical support in 16 randomized clinical trials, and has also been given the highest level of recommendation (American Psychiatric Association, 2004; DoD/DVA, 2004), and tends to require fewer sessions (3–5) of therapy for single-incident trauma, compared with other commonly used treatments (DVA/DoD, 2004; Maxfield & Hyer, 2002; Van Etten & Taylor, 1998). Also, since it does not require the client to verbally disclose details of the traumatic experience, or complete homework between sessions, it appeared better suited for the specific needs of the Turkish earthquake survivors. Four studies have examined the effectiveness of EMDR following disaster events (Fernandez et al., 2004; Grainger, Levin, Allen-Byrd, Doctor, & Lee, 1997; Chemtob et al., 2002; and Silver, Rogers, Knipe, & Colleli, 2005) and found significant reductions in posttraumatic symptoms.

Based on demonstrated effectiveness of EMDR in treating PTSD within a brief number of sessions, the senior author, who at the time was President of the TPA-IB, contacted EMDR training organizations to request volunteer assistance in training Turkish therapists. Through a series of training programs, 309 Turkish therapists received EMDR training, in preparation for providing therapy in the earthquake zone. This report describes an evaluation of treatment outcomes for a representative subset of the more than 1,500 individuals diagnosed with PTSD and receiving pro bono EMDR treatment through the tent city clinics.

METHOD

Participants

In January 2001 (17 months following the Marmara, Turkey, earthquake and the establishment of the tent city clinics), 167,000 persons were still residing in temporary housing in the earthquake area. Beginning January 12, 2001, until June 30, 2002, all individuals seeking therapy in the clinics in the Izmit, Derince, and Yalova tent cities were given the PTSD Symptom Scale Self-Report (PSS-SR) (Foa, Riggs, Dancu, & Rothbaum, 1993) along with an intake interview. Following this initial evaluation, all individuals exhibiting PTSD in both the clinical interview and on the PSS-SR were assigned to one of the five therapists. Prior to the study, it was decided to exclude all participants who, in the initial interview, exhibited psychosis, dissociative disorder, or the potential of danger to self or others, but no participants with these conditions were detected in the subject pool. All 58 participants meeting selection criteria agreed to participate in the study. The three tent cities were selected solely upon the basis of proximity to the investigators, and differed in no other respect from the other treatment locations. That is, these three sites appeared to be representative of the entire earthquake zone in terms of the extent of earthquake-related death and injury, structural damage, socioeconomic disruption, population density, and other variables that might influence traumatization. Moreover, the group of individuals participating in this study did not appear to be systematically different from the much larger population of individuals receiving PTSD treatment at the seven tent city clinics established by the TPA.

The generally unstable living conditions within the tent cities, as well as the fact that many residents relocated during this time to their distant home villages, resulted in both attrition in the pool of those participating in therapy and frequent inconsistency in appointment scheduling. Ten participants dropped out of the project prior to the completion of therapy (after an average

of 3.0 sessions), and seven participants did not take the posttreatment PSS-SR even though they continued and completed the therapy. There were no significant differences on any pretreatment measure or on any outcome measure, between completers and dropouts (t test values ranged from -0.64 to 0.65, $p > .05$). Therapists attempted to follow up with those participants who dropped out of the study, and it appeared that in nearly every case, the individual was no longer available because of relocating out of the tent city. Of the remaining 41 participants who completed the posttreatment PSS-SR, 31 were female (ages 20–69, $M = 43.32$) and 10 were male (ages 19–74, $M = 41.20$). Five of the participants had completed one or more years of university education, sixteen completed grades 9–12 only, eight completed grades 5–8 only, and twelve participants had less than five years of education. Of the 41 participants completing the posttreatment testing, 21 were available at follow-up.

Design

Because of the mode of operation of the clinics, and the conditions in the tent cities, it was not possible to implement a randomized, delayed treatment condition. In order to partially correct for this problem, several analyses were carried out. Participants were divided into the early-treated (first 50% of participants entering treatment, between January and July, 2001) and the late-treated (last 50%, between August 2001 and June 2002), and these groups were compared with regard to pretreatment PSS-SR scores. In addition, in order to provide a comparison similar to a wait-list control group, a method of cohort analysis developed by Silver et al. (2005) was used, comparing the posttreatment PSS-SR scores of the early-treated group with the pretreatment scores of the late-treated group. In addition, for each participant who completed the posttreatment PSS-SR, number of days between the earthquake and the PSS-SR pretest was determined and correlation coefficients calculated between this variable and PSS-SR score at pretreatment and posttreatment measurement periods. Intuitively, it would seem that less educated individuals would be more likely to experience traumatization, since, as a group, these people have fewer vocational opportunities and resources than more educated people. Thus, participants were categorized into one of four educational levels (5 years of education or less, 6–8 years, 9–12 years, and more than 12 years) in order to address the possibility of an interaction between education and treatment. At the time of intake, 11 participants showing PTSD symptoms were concurrently taking prescribed psychotropic medication. Ten were taking sertraline, one was taking alpra-

zolam, and three were taking the antihistamine medication hydroxyzine to reduce anxiety. Because of the perceived needs and expectations of these individuals, and the mission of the clinics in the tent cities, it was considered impractical to exclude these people from the study. Therefore, these participants were included in the sample, with the decision to track their data separately, while pooling their results with those participants not taking psychotropic medicine.

Assessment Instruments

The PSS-SR (Foa et al., 1993) is a self-report version of the PSS structured interview for PTSD. The 17 items on this scale directly correspond to *Diagnostic and Statistical Manual of Mental Disorders–Fourth Edition* (*DSM-IV*) symptoms, and thus a diagnosis of the disorder is possible from the obtained scores. For each participant, this diagnosis from scores was corroborated by observations during the intake interview. A PSS-SR total score is obtained by summing subscale scores, which in turn are calculated by summing symptoms in the Re-experiencing (5 items), Avoidance (7 items), and Arousal (5 items) clusters. The Turkish version of the PSS-SR (Yurtsever, 2002) has very acceptable psychometric properties. The Cronbach alpha coefficients are: total score, .89; Re-experiencing subscale, .67; Avoidance subscale, .76; and Arousal subscale: .82.

The PSS-SR was given to participants during the initial intake interview (pretreatment measure), immediately following the final therapy session (posttreatment measure), and at a follow-up, which was planned at six months (average: 5.9 months) following the final therapy session. At each measurement point, the coded PSS-SR blank form was filled out in an area separate from the treating therapist and then given to an assistant.

The Subjective Units of Disturbance scale (SUD; Wolpe, 1990) was used to track changes in emotional disturbance on a 0 (*no disturbance*) to 10 (*highest disturbance imaginable*) scale. The Validity of Cognition scale (VOC; Shapiro, 1989, 2001) measures positive changes in self-concept on a 1 (*a positive self-referencing cognition feels completely false*) to 7 (*feels completely true*) scale. For instance, on this latter scale, the earthquake survivor before treatment might have a self-attribution of "I'm helpless" and the desired positive belief "I'm in control" might show a low subjective validity (e.g., VOC = 3). Both SUD and VOC scores were assessed by the treating therapist and were used both as research measures and as process measures during the course of treatment.

Therapists and Treatment Fidelity

Five Masters level Turkish therapists participated in this study. All had actively used EMDR for 15 months prior to the research. They had received the EMDR standard Part I and Part II training, and in addition had received a minimum of 20 hours of advanced EMDR training and case consultation. When this evaluation study began, two of these therapists had less than one year of postdegree clinical experience, having taken the EMDR training course while still in graduate school, two had three years of clinical experience, and one had 20 years of experience. Therapists met weekly during the time of the study to discuss their cases in order to monitor fidelity to the EMDR method.

Procedure

Following intake and assessment procedures, 90-minute EMDR sessions were initiated. Effort was made to schedule sessions weekly, although, because of situational constraints, this was not always possible. The average interval between EMDR sessions was 11.1 days. During a participant's pretreatment assessment, rapport was established (including education regarding psychotherapy), demographic information and relevant personal history obtained, the procedures of the EMDR treatment described, and informed consent for participation in the study obtained. In addition to the usual EMDR preparation phase (Shapiro, 2001), each participant was asked to identify the most disturbing visual images associated with the event of the earthquake. Specifically, participants were asked, "Do you have visual memory images of the earthquake that are very disturbing to you?" This preidentification of intrusive images was intended to assist participants' understanding of the planned course of treatment, as well as to provide criteria for assessing the completion of therapy. It was hypothesized that, for a traumatic event of this magnitude, it would be necessary for many participants to work on more than one disturbing visual image in order to fully resolve PTSD symptoms. It was also anticipated that there would be generalization effects from image to image; i.e., as effective treatment occurred with the most disturbing images, there would be a reduction in disturbance in other images, so that not all initially disturbing images would need to be addressed during the course of treatment.

The EMDR treatment proceeded through the standard eight phases and protocol for trauma treatment described by Shapiro (1995, 2001). During the first EMDR session, following practice in using a "safe place" guided imagery procedure, each participant was asked to access the visual memory

image representing "the worst part" of the earthquake (designated "Picture 1"), and then, over the course of one or more sessions, this image was the focus of Phases 3–8 of the EMDR treatment model. For nearly all clients, bilateral stimulation occurred through eye movements, guided by the therapist's moving fingers. For a small number of clients (less than 10%) who had difficulty tracking the therapist's moving fingers, stimulation was provided with alternating taps on clients' hands. Following completion of treatment for Picture 1, the next most disturbing images (designated "Picture 2," "Picture 3," etc., respectively) were also targeted in sequence. Pre and posttreatment SUD and VOC scores were obtained by the therapists for each of these separate pictures. Sessions continued until the individual participant reached criterion for completion of therapy for the earthquake trauma. Therapy was considered complete when the participant reported a SUD score of 0 or 1 on all preidentified pictures, a lack of emotional disturbance while thinking of the event of the earthquake, and a report of a subjective sense that therapy for this disturbing memory had been completed.

RESULTS

Therapist Experience

The combined mean scores of the two least experienced therapists did not differ from the combined mean scores of the three more experienced therapists on any outcome variable: PSS-SR total, Re-experiencing, Avoidance, Arousal scores, respectively: $F(1, 19) = 0.24$, $p > .05$; $F(1, 19) = 0.31$, $p > .05$; $F(1, 19) = 0.25$, $p > .05$; $F(1, 19) = 0.03$, $p > .05$. The participants of both less and more experienced therapists showed significant differences between pre, post, and follow-up PSS-SR total, Re-experiencing, Avoidance, Arousal scores, respectively: $F(2, 38) = 104.25$, $p < .01$, partial $\eta^2 = 0.85$; $F(2, 38) = 72.20$, $p < .01$, partial $\eta^2 = 0.79$; $F(2, 38) = 74.36$, $p < .01$, partial $\eta^2 = 0.80$; $F(2, 38) = 71.83$, $p < .01$, partial $\eta^2 = 0.79$.

Control Group Analogue Procedures

Figure 1 presents the pre and posttreatment PSS-SR scores for the early-treated and the late-treated groups on the PSS-SR total score, as well as the Re-experiencing, Avoidance, and Arousal subscales. A series of t tests found no differences between early- and late-treated groups in their pretreatment results (t values ranged from 1.00–1.51, $p > .05$).

To control for the effects of the mere passage of time, an analogue delayed-

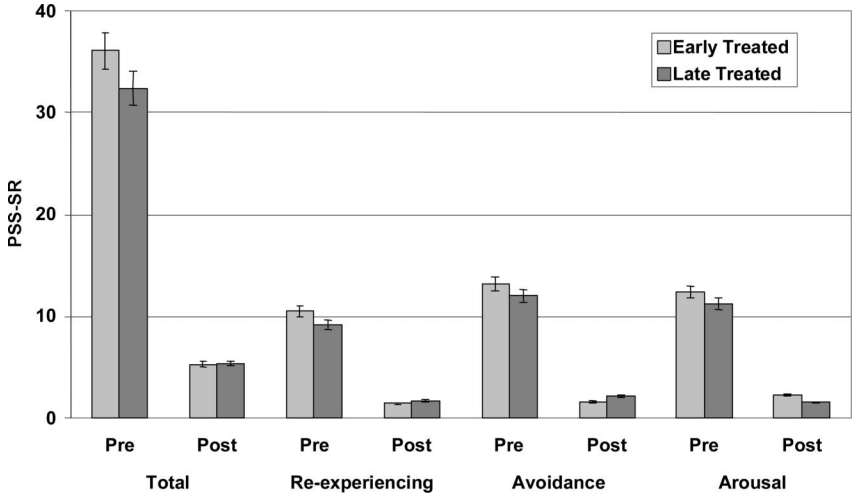

Figure 1. Comparison of early and late treatment pre and posttest Posttraumatic Stress Disorder Symptom Scale Self-Report (PSS-SR) scores ($N = 41$).

treatment condition was used. Posttreatment scores on PSS-SR Re-experiencing, Avoidance, Arousal, and total score for the early-treated group were compared by t test with the pretreatment scores on each of these variables for the late-treated group. All of these comparisons showed a significant difference in the direction of lower scores for the early-treated group (t score values ranged from 7.54–8.73, $p < .01$). Finally, for each participant, the days between the earthquake and the date of the PSS-SR pretreatment test were determined and correlation coefficients between this variable and pretreatment, posttreatment and follow-up PSS-SR scores for Re-experiencing, Avoidance, Arousal, and total score were calculated. Correlation coefficients were also determined between the number of days and all pretreatment and posttreatment SUD and VOC scores for each participant. None of these correlation coefficients proved statistically significant ($p > .05$).

Treatment Effects

For the 41 participants with pre and posttreatment scores, the mean number of EMDR sessions needed to reach criterion for completion of therapy was 5.02 ($SD = 2.52$; range = 2–12 sessions). The mean number of total sessions (including intake and assessment procedures) was 8.22 ($SD = 3.97$; range = 3–24). Mean time from pre to posttreatment assessment was 3.05 months ($SD = 1.28$; range = 1–5.37 months).

The PSS-SR scores for all participants at pretreatment, posttreatment,

Table 1. Pretreatment, Posttreatment, and Follow-up Scores for PSS-SR Total Score and Re-experiencing, Avoidance, and Arousal Subscale Scores

PSS-SR	Total *M* (*SD*)	Re-experiencing *M* (*SD*)	Avoidance *M* (*SD*)	Arousal *M* (*SD*)
Pretreatment ($N = 41$)	34.29 (7.96)	9.88 (3.20)	12.61 (3.80)	11.80 (2.96)
Posttreatment ($N = 41$)	5.37 (4.76)**	1.56 (1.84)**	1.88 (2.18)**	1.93 (1.72)**
Follow-up ($N = 21$)	7.76 (7.99)***	2.14 (2.50)***	2.48 (2.60)***	3.14 (3.86)***

Note. PSS-SR = Posttraumatic Stress Disorder Symptom Scale Self-Report.
* $p > .05$, not significantly different from posttreatment score. ** $p < .01$, significantly different from pretreatment score.

and follow-up measurement periods are presented in Table 1 and Figure 2. Of the 41 participants who completed therapy and took the posttreatment PSS-SR, 21 were available for testing at follow-up. Analysis of mean PSS-SR total scores and subscale scores indicated that there were no pre or posttreatment differences between those who were available for follow-up testing and those who were not (*t* test values ranged from –1.12 to .65, $p < .05$).

For the follow-up group, a one-way analysis of variance (ANOVA) with repeated measures was carried out to determine the significance and direction of PSS-SR score differences among pretreatment, posttreatment, and follow-up measurement periods. There were significant differences for Re-experiencing: $F(2, 40) = 75.69$, $p < .01$ [partial $\eta^2 = 0.791$; Observed Power ($\alpha = 0.05$) = 1.000]; Avoidance: $F(2, 40) = 72.47$, $p < .01$ [partial $\eta^2 = 0.784$; Observed Power ($\alpha = 0.05$) = 1.000]; Arousal: $F(2, 40) =$

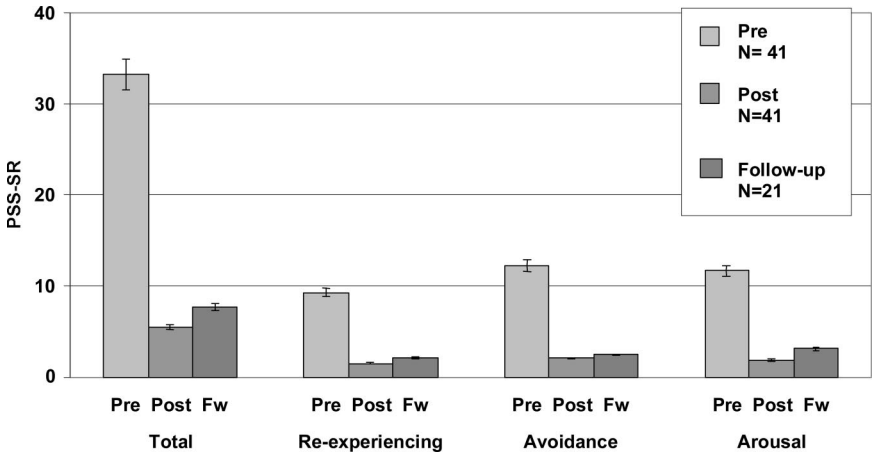

Figure 2. Comparison of pre and post follow-up Posttraumatic Stress Disorder Symptom Scale (PSS-SR) scores ($N = 21$) for early- and late-treated groups combined.

72.78, $p < .01$ [partial $\eta^2 = 0.784$; Observed Power ($\alpha = 0.05$) = 1.000]; and PSS-SR total score: $F(2, 40) = 105.33$, $p < .01$ [partial $\eta^2 = 0.840$; Observed Power ($\alpha = 0.05$) = 1.000]. The differences were in the direction of a positive treatment effect between pretreatment and posttreatment ($p < .01$) and between pretreatment and follow-up ($p < .01$), but there were no significant differences between posttreatment and follow-up. For the larger group of 41 participants available at posttreatment, paired samples t tests revealed pre-post changes in all PSS-SR variables (Total score: $t(40) = 19.72$, $p < .01$; Re-experiencing: $t(40) = 16.42$, $p < .01$; Avoidance: $t(40) = 15.85$, $p < .01$; and Arousal: $t(40) = 18.56$, $p < .01$), in the direction of positive treatment effects. The paired samples t tests for these 21 participants in pretreatment, posttreatment, and follow-up measurement periods revealed that the differences were in the direction of a positive treatment effect between pretreatment and posttreatment (Total score: $t(20) = 12.17$, $p < .01$ [Cohen's $d = 2.67$]; Re-experiencing: $t(20) = 10.10$, $p < .01$ [Cohen's $d = 2.20$]; Avoidance: $t(20) = 9.18$, $p < .01$ [Cohen's $d = 2.00$]; and Arousal: $t(20) = 13.11$, $p < .01$ [Cohen's $d = 2.86$]) and between pretreatment and follow-up (Total score: $t(20) = 11.22$, $p < .01$ [Cohen's $d = 2.45$]; Re-experiencing: $t(20) = 10.24$, $p < .01$ [Cohen's $d = 2.23$]; Avoidance: $t(20) = 9.00$, $p < .01$ [Cohen's $d = 1.96$]; and Arousal: $t(20) = 8.93$, $p < .01$ [Cohen's $d = 1.95$]), but there were no significant differences between posttreatment and follow-up. For the larger group of 41 participants available at posttreatment, paired samples t tests revealed prepost changes in all PSS-SR variables (Total score: $t(40) = 19.72$, $p < .01$ [Cohen's $d = 3.08$]; Re-experiencing: $t(40) = 16.42$, $p < .01$ [Cohen's $d = 2.57$]; Avoidance: $t(40) = 15.85$, $p < .01$ [Cohen's $d = 2.48$]; and Arousal: $t(40) = 18.56$, $p < .01$ [Cohen's $d = 2.90$]), in the direction of positive treatment effects (see Figure 2).

Using the PSS-SR criteria, 38 (92.7%) of the 41 participants who were tested at pretreatment no longer exhibited PTSD at posttreatment. The three participants who continued to meet criteria for PTSD at posttreatment were each showing large reductions in all PSS-SR scores at posttreatment (pretreatment total scores of 38, 38 and 37, and posttreatment total scores of 17, 16, and 17, respectively). At follow-up, 18 (85.7%) of the 21 participants no longer met criteria for PTSD.

Number of Pictures Needed to Complete Therapy, and Changes in SUD and VOC Scores

For the 41 participants for whom preposttreatment PSS-SR scores were available, the mean number of pictures initially identified during intake was

3.22 (SD = 2.06; range = 1–10 pictures). The mean number of pictures actually targeted in order to reach criterion for completion of therapy was 2.20 (SD = 1.27; range = 1–6 pictures). Thus, generalization of positive treatment effects occurred from pictures targeted to pictures not targeted. Thirteen of these participants needed to target only one disturbing visual image, sixteen targeted two images, and twelve targeted three or more disturbing pictures. For Pictures 1, 2, and 3, t tests revealed highly statistically significant prepost changes in the positive direction for both SUD and VOC scores as seen in Table 2. Resolving the first disturbing picture required the highest number of sessions (Range = 1–6; M = 2.78; SD = 1.17); resolving the second picture (if targeted) required lower number of sessions (Range = 1– 4; M = 2.21; SD = 1.20), and resolving the third picture (if targeted) required even lower number of sessions (Range: 1–3; M = 1.50; SD = 0.67).

Subject Variables

No significant differences in posttreatment or follow-up treatment effects were observed on any outcome variable between the 11 participants who were taking psychotropic medication at the time of intake and the 30 participants who were not: PSS-SR total, Re-experiencing, Avoidance, Arousal scores, respectively: $F(1, 19) = 1.43$, $p > .05$; $F(1, 19) = 0.93$, $p > .05$; $F(1, 19) = 0.70$, $p > .05$; $F(1, 19) = 1.35$, $p > .05$. Subjects using medication and not using medication both showed significant differences between prepost and follow-up PSS-SR total, Re-experiencing, Avoidance, Arousal scores, respectively: $F(2, 38) = 78.75$, $p < .01$, partial $\eta^2 = 0.81$;

Table 2. Preposttreatment t test Comparisons for SUD and VOC Scores, Picture 1, Picture 2, and Picture 3

Variable	N	M (SD)	t	df
Picture 1 (N = 41)	Pre	8.15 (2.21)	15.24	40
SUD score**	Post	1.05 (1.60)		
Picture 1 (N = 41)	Pre	2.34 (1.44)	−13.40	40
VOC score**	Post	6.49 (1.12)		
Picture 2 (N = 28)	Pre	6.43 (2.13)	12.48	27
SUD score**	Post	1.14 (1.51)		
Picture 2 (N = 28)	Pre	3.29 (1.56)	−8.09	27
VOC score**	Post	6.18 (1.36)		
Picture 3 (N = 12)	Pre	7.25 (2.05)	11.88	11
SUD score**	Post	0.42 (0.79)		
Picture 3 (N = 12)	Pre	2.58 (1.24)	−8.09	11
VOC score**	Post	6.42 (1.08)		

Note. SUD = Subjective Units of Disturbance scale; VOC = Validity of Cognition scale.
** $p < .01$, two-tailed.

$F(2, 38) = 56.31$, $p < .01$, partial $\eta^2 = 0.75$; $F(2, 38) = 53.34$, $p < .01$, partial $\eta^2 = 0.74$; $F(2, 38) = 55.17$, $p < .01$, partial $\eta^2 = 0.74$. There was no apparent interaction between medicine use and treatment effect for PSS-SR total, Re-experiencing, Avoidance, Arousal scores, respectively: $F(2, 38) = 0.32$, $p > .05$; $F(2, 38) = 0.23$, $p > .05$; $F(2, 38) = 0.41$, $p > .05$; $F(2, 38) = 0.20$, $p > .05$. At the time of the posttreatment assessment, 10 of the 11 initially medicated participants were still using prescribed medication (one participant had spontaneously discontinued the use of sertraline and hydroxyzine). By the time of the follow-up, six initially medicated participants could be located, and five of these six participants had spontaneously discontinued use of medication between the time of completion of treatment and the follow-up assessment. Of these five participants, three had begun the study using sertraline alone, one participant using sertraline and hydroxyzine, and one participant using hydroxyzine alone. The one participant still using medication at follow-up had started the study using both sertraline and alprazolam. Table 3 shows mean PSS-SR total scores for participants initially taking prescribed medication and those not taking medication, across pretreatment, posttreatment, and follow-up measurement periods, for the 21 participants available at follow-up.

Mean pretreatment and posttreatment PSS-SR total scores varied inversely with educational level, as indicated in Table 4. These differences were significant at pretreatment, $F(3, 40) = 6.267$, $p < .01$, but not at posttreatment, $F(3, 40) = .92$, $p > .05$.

Subjects at all educational levels showed significant differences between pre and post PSS-SR total, Re-experiencing, Avoidance, Arousal scores, respectively: $F(1, 37) = 299.79$, $p < .01$, partial $\eta^2 = 0.89$; $F(1, 37) = 225.16$, $p < .01$, partial $\eta^2 = 0.86$; $F(1, 37) = 192.18$, $p < .01$, partial $\eta^2 = 0.84$; $F(1, 37) = 277.87$, $p < .01$, partial $\eta^2 = 0.88$.

There was no interaction between educational level and treatment effect for PSS-SR total, Re-experiencing, Avoidance, Arousal scores, respectively:

Table 3. Comparison of PSS-SR Total Scores for Participants Taking Medication and Those Without Medication

Variable	EMDR with and without medication	*M* (*SD*)
Pretreatment total*	Only EMDR ($N = 30$)	33.13 (9.64)
	Medication + EMDR ($N = 11$)	33.67 (7.34)
Posttreatment total*	Only EMDR ($N = 30$)	4.33 (3.60)
	Medication + EMDR ($N = 11$)	8.50 (5.01)
Follow-up total*	Only EMDR ($N = 15$)	6.80 (7.20)
	Medication + EMDR ($N = 6$)	10.17 (10.03)

Note. PSS-SR = Posttraumatic Stress Disorder Symptom Scale Self-Report; EMDR = eye movement desensitization and reprocessing.
* $p > .05$.

Table 4. Pretreatment and Posttreatment PSS-SR Total Scores Across Educational Levels

PSS-SR scores	Groups	*N*	*M*	*SD*
Pretreatment PSS-SR total score**	Grade 5 or less	12	38.33	6.91
	Grades 6–8	8	34.88	6.60
	Grades 9–12	16	33.69	7.43
	More than 12	5	25.60	8.62
	Total	41	34.29	7.96
Posttreatment PSS-SR total score*	Grade 5 or less	12	7.58	6.08
	Grades 6–8	8	5.63	4.75
	Grades 9–12	16	4.31	3.24
	More than 12	5	3.00	4.47
	Total	41	5.37	4.76

Note. PSS-SR = Posttraumatic Stress Disorder Symptom Scale Self-Report.
** $p < .01$. * $p > .05$.

$F(3, 37) = 0.92$, $p > .05$; $F(3, 37) = 2.28$, $p > .05$; $F(3, 37) = 0.02$, $p > .05$; $F(3, 37) = 2.29$, $p > .05$.

SUMMARY AND CONCLUSIONS

This study obtained strong evidence that EMDR can be effective in the treatment of PTSD (as measured by the PSS-SR) in a group of natural disaster survivors receiving treatment in tent-city clinics and that these effects are maintained over time. Although only 41 clients participated in this experiment, we have no reason to assume that they were not representative of the approximately 1,500 people being treated for PTSD with EMDR throughout the area affected by the Marmara, Turkey, earthquake. Furthermore, an analogue delayed treatment analysis indicated that the EMDR effects were not simply because of the passage of time. Participants' SUD and VOC scores, which served as therapy process measures, showed significant changes during treatment, reflecting a decrease in emotional disturbance and an increase in positive self-attributions. The number of sessions ($M = 5.02$) and the magnitude of the treatment effects are consistent with results reported in the most rigorous randomized controlled EMDR studies (Maxfield & Hyer, 2002) of single-event trauma.

Although the present field conditions necessitated the inclusion of participants on medication, the study was not designed to investigate the influence of psychotropic medication. However, it is noteworthy that, as indicated in Table 3, medication was neither additive, nor detrimental to EMDR treatment effects with PTSD. It is not known whether patients who discontinued medication after completing treatment did so following the advice of a physician, or simply decided to do so independently. However, the maintenance of the positive outcomes at the same level as those who were not

medicated in this study of EMDR treatment effects has important implications that should be explored more rigorously in future research. Questions regarding both comparisons and interactions are particularly important given the high incidence of relapse reported in other studies subsequent to termination of medication in the treatment of PTSD (Sherman, 1998). One controlled study directly comparing EMDR with antidepressants (van der Kolk, 2003) reported that after the termination of treatment the medication participants again became symptomatic, while the EMDR group continued to improve. Such studies are important to determine the first line treatment for postdisaster response.

As predicted, before treatment there was a significant difference in symptomatology that was inversely correlated with education level. Interestingly, these initial differences did not occur with regard to Avoidance symptoms. However, within the group of participants in this study, the pretreatment level of mean PSS-SR total scores, and Re-experiencing and Arousal subscales did follow this pattern. That is, the less education, the more initially reported intrusive visual imagery, nightmares, hypervigilance, and anxiety. We can speculate that those people with less education are more vulnerable to the effects of a life-disrupting traumatic event because of fewer vocational and economic resources. In addition, the general breadth of knowledge acquired through education may protect an individual, to some extent, against posttraumatic fears, feelings of lack of control, and intrusive symptoms. The treatment appeared to be a leveler of these initial educational differences in PTSD disturbance, with all groups benefiting from EMDR, and no significant differences between educational groups in any PSS-SR scores at posttreatment assessment or at follow-up. Since this study was not designed to answer questions of prevalence of PTSD symptoms across educational groups, nor questions of how EMDR procedures may interact with specific education variables, conclusions from these results must be limited.

The development and use in this study of a control group analogue suggests that positive changes in PTSD symptoms were probably due to the treatment provided, not simply to the passage of time. Conditions in the tent cities were too chaotic to permit a randomized design. However, the finding in this study of no differences in pretreatment PTSD symptoms between the early- and late-treated groups is consistent with previous research (summarized by McFarlane & Yehuda, 1996), which indicates that individuals who exhibit PTSD a year or more following a traumatic event tend either to remain traumatized as time continues or show a very gradual decline in symptoms over the course of several years. In a study of people traumatized in New York by the September 11, 2001, terrorist attacks, PTSD symptoms were actually observed to worsen with the passage of time (Silver et. al., 2005). Nevertheless, we cannot completely rule out the possibility that the changes observed in the present study occurred independently of treatment,

since there was no randomized control condition. Given the ethical and logistical restraints in evaluating disaster response, the use of an analogue control and time-outcome correlation coefficients may be valuable procedures for partially controlling for passage-of-time variables in future research evaluations of psychotherapeutic interventions following traumatic events.

It may also be possible for future research to incorporate a randomized treatment and delayed treatment group within a seven to ten day period. EMDR sessions may be given on successive days, since the treatment does not require an intervening week to complete the homework assignments that are included in the empirically supported CBT exposure therapy protocols (Foa et al., 1999; Foa & Rothbaum, 1998; Marks, Lovell, Noshirvani, Livanou, & Thrasher, 1998; Taylor et al., 2003), Consequently, a complete course of EMDR treatment may be completed within less than 10 days. This particular design was not considered before the inauguration of the present study, but might be an option for outcome research in future postdisaster situations.

The TPA Program, created following the 1999 earthquake, provides an example of how a project of intervention following widespread trauma can be carried out in a developing country. A mental health response to a disaster situation was planned and implemented through successive stages of the establishment of emergency clinics, therapist training in the EMDR method of trauma therapy, active outreach and therapy services to those people who were suffering following the disaster, and the evaluation of the therapy model focusing on a representative subset of the population served. In addition, with this program of therapist training now implemented, the northeast area of Turkey is more prepared for future potentially traumatic events, such as the additional major earthquake that seismologists predict could strike in this region during the next 30 years. Indeed, following several more recent earthquakes in eastern Turkey, additional programs of response by volunteer therapists were organized and in place within days to assist the survivors of these incidents. It is hoped that this report may provide a model to assist other countries to plan and implement needed services in the case of other natural or human-caused disasters.

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