EMDR for Survivors of Life-Threatening Cardiac Events: Results of a Pilot Study

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This pilot study evaluated the effectiveness of eye movement desensitization and reprocessing (EMDR) in treating posttraumatic stress disorder (PTSD) symptoms and concomitant depressive and anxiety symptoms in survivors of life-threatening cardiac events. Forty-two patients undergoing cardiac rehabilitation who (a) qualified for the PTSD criterion "A" in relation to a cardiac event and (b) presented clinically significant PTSD symptoms were randomized to a 4-week treatment of EMDR or imaginal exposure (IE). Data were gathered on PTSD, anxiety, and depressive symptoms at pretreatment, posttreatment, and 6-month follow-up. EMDR was effective in reducing PTSD, depressive, and anxiety symptoms and performed significantly better than IE for all variables. These findings provide preliminary support for EMDR as an effective treatment for the symptoms of PTSD, depression, and anxiety that can follow a life-threatening cardiac event.

Keywords: PTSD; depression; anxiety; EMDR; cardiovascular disease; rehabilitation

In the United States, the estimated annual incidence of myocardial infarction is 610,000 new attacks and 325,000 recurrent attacks, leading to 150,000 deaths per year. Also, every year, approximately 295,000 out-of-hospital cardiac arrests are treated by emergency medical services, with median reported survival at hospital discharge of 8% (American Heart Association Statistics Committee and Stroke Statistics Subcommittee, 2009). Furthermore, 7,200,000 vascular and cardiac surgical procedures were carried out in the United States in 2007, including more than 2,200 heart transplants (American Heart Association Statistics Committee and Stroke Statistics Subcommittee, 2009). Although these events are highly deadly, a considerable number of individuals survive these events.

A large body of evidence has documented that survivors of life-threatening cardiac events (e.g., myocardial infarctions, cardiac arrests, heart surgeries, and transplantations) are at risk for experiencing posttraumatic stress disorder (PTSD; Spindler & Pedersen, 2005). According to the *Diagnostic Manual of Mental Disorders* (*DSM-IV-TR*; American Psychiatric Association [APA], 2000), the diagnostic criteria for PTSD require that the individual has experienced a life-threatening event accompanied by fear or helplessness and has symptoms of intrusive recollections of the traumatic event, avoidance of stimuli associated with the event, emotional numbing, and hyperarousal. In survivors of a cardiac arrest, prevalence rates of PTSD may range between 19% and 38% (Gamper et al., 2004; Ladwig et al., 1999; O'Reilly, Grubb, & O'Carroll, 2004). In addition, several studies have found prevalence of PTSD following a myocardial infarction ranging from 16% to 22% (Ginzburg, Solomon, Dekel, & Bleich, 2006; Pedersen, Middel, & Larsen, 2003; Shemesh et al., 2006). Also, after cardiac surgeries rates of PTSD range from 8% to 18% (Connolly, McClowry, Hayman, Mahony, & Artman, 2004; Doerfler, Pbert, & DeCosimo, 1994; Schelling et al., 2003) and following heart transplants, PTSD prevalence has ranged from 11% to 16% (Dew et al., 1996, 1999, 2000, 2001).

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In addition to the psychological distress and functional impairment associated with a diagnosis of PTSD, PTSD symptoms were shown to have negative effects on long-term mortality risk, both in patients with implantable cardioverter-defibrillators (Dew et al., 2000) and in patients who had undergone heart transplant (Ladwig et al., 2008). Although PTSD symptoms have been found to predict greater likelihood of cardiovascular-related readmission in patients who experienced postmyocardial infarction (Shemesh et al., 2004), research to date has focused on depression as the main psychological factor contributing to recurrence of cardiac events and mortality in these populations. Research focusing on the treatment of depression—both psychological and pharmacological—in these patients has found modest improvements in symptoms of depression but no improvements in cardiac outcomes (Berkman et al., 2003; Thombs et al., 2008). These findings suggest that a refocusing on a broader range of psychological factors, such as PTSD and other anxiety disorders, could prove critical in reducing recurrence and mortality in these populations along with symptom reduction.

To date, only one study has investigated the efficacy of psychological treatments in reducing PTSD symptoms subsequent to a life-threatening cardiac event (Shemesh et al., 2010). In particular, this study examined the effectiveness of three to five sessions of imaginal exposure (IE) in patients who suffered from PTSD following a life-threatening cardiovascular event. Results of this study showed (a) nonsignificant improvement in the overall sample but (b) reduced PTSD symptoms in the subgroups of patients who experienced an unscheduled cardiovascular event and presented high baseline PTSD levels. However, in this study, the number of sessions (3–5) were less than what is commonly used (8–10), perhaps reducing the positive effects of the treatment.

In the current pilot study, we evaluate the effectiveness of eye movement desensitization and reprocessing (EMDR) in decreasing PTSD symptoms and concomitant depressive and anxiety symptoms in a sample of patients undergoing cardiac rehabilitation who experienced a life-threatening cardiac event. We compare EMDR (Shapiro, 2001), which recent practice guidelines and meta-analyses have designated as a first-line treatment for trauma (APA, 2004; Bisson & Andrew, 2007; U.S. Department of Veterans Affairs & U.S. Department of Defense, 2004; Foa, Keane, Friedman, & Cohen, 2009; Seidler & Wagner, 2006), with a control group treated with IE, a treatment that has also been found effective in reducing symptoms of PTSD both in patients with cardiovascular disease (Shemesh et al., 2010) and in patients with noncardiovascular disease (Bryant, Moulds, Guthrie, Dang, & Nixon, 2003). IE was used because, like EMDR, it does not use homework, which was avoided because of safety concerns and because it was thought to be too taxing for this particular population. It was also considered to be an appropriate comparison for EMDR, because some researchers have hypothesized that EMDR's effects may be caused by a component of IE (e.g., Sanderson & Carpenter, 1992; cf., Lee, 2008).

We hypothesized that (a) EMDR and IE would be effective in decreasing PTSD and concomitant anxiety and depressive symptoms in a population of survivors of life-threatening cardiac events and that (b) EMDR would be more effective than IE in reducing these symptoms. The reason for this hypothesis is that EMDR may be less taxing than IE, given the level of debilitation of this population of patients undergoing cardiac rehabilitation. EMDR has been found to have a "distancing" effect (Lee & Drummond, 2008), which may be more gentle than having subjects "relive" the trauma. Furthermore, studies have indicated that the eye movements used in EMDR may activate the parasympathetic system, resulting in a de-arousal effect (Elofsson, Von Schèele, Theorell, & Söndergaard, 2008; Sack, Lempa, & Lemprecht, 2007).

Method

Participants

Participants were patients involved in a postsurgery cardiac rehabilitation program at an Italian hospital who were selected for treatment of severe PTSD symptoms based on their scoring 22 or higher on the Impact of Event Scale—Revised (IES-R; Weiss & Marmar, 1997). Each participant ($n = 141$) had undergone a surgical heart operation within 45 days preceding the beginning of the cardiac rehabilitation program, with many of these individuals undergoing this surgery because of a previous major cardiac event (e.g., myocardial infarction, cardiac arrest, unstable angina).

For this study, participation was limited to those patients undergoing cardiac rehabilitation whose PTSD symptoms were related to a life-threatening cardiac event (e.g., cardiac surgery, myocardial infarction, cardiac arrest) that the participants reported as within the classification of PTSD criterion "A." According to the *DSM-IV-TR* (APA, 2000), the PTSD criterion "A" is met if (a) the stressor or event the person experienced, witnessed, or was confronted with involved actual or threatened death or serious injury, or a threat to the physical integrity of self or others; and if (b) the person's response to the stressor involved fear,

helplessness, or horror. The clinician who delivered the treatment assessed the endorsement of the PTSD criterion "A" in the first session of the treatment.

As with many self-report measures, different cutoff scores for clinical significance have been recommended for the IES-R, varying across populations exposed to different traumatic stressors (e.g., IES-R ≥22 [Rash, Coffey, Baschnagel, Drobes, & Saladin, 2008]; IES-R ≥24 [Asukai et al., 2002]; IES-R ≥33 [Creamer, Bell, & Failla, 2003]). In determining which patients should be eligible for trauma treatment for this study, it was decided to favor sensitivity over specificity for two reasons. First, empirical evidence has found significant impairment caused by subclinical PTSD (Marshall et al., 2001), with this impairment potentially as debilitating as that experienced by patients meeting criteria for full PTSD (Zlotnick et al., 2004). Second, to date, no recommended cutoff score has been established for patients with cardiac abnormalities. Hence, an inclusion criterion of 22 (Rash et al., 2008) on the IES-R was chosen, but additional analyses were performed for those with scoring 33 or greater (Creamer et al., 2003), a more conservative cutoff found to highly correlate with the PTSD Checklist (0.84; Creamer et al., 2003). We therefore present two sets of results: one for the overall sample and one for those scoring 33 and greater.

After these screenings (i.e., endorsement criterion A, and IES-R score of 22 or greater), participants were randomly assigned to either EMDR or IE. Written consent was obtained from all participants in the study after the nature of the procedure was explained. Because the information used in the current study was not collected specifically for this study and the information did not include any identifiable private information, the UCLA Institutional Review Board (IRB) provided an exemption for this study. The study was performed in compliance with the Code of Ethics of the World Medical Association.

Measures

The IES-R (Weiss & Marmar, 1997) is a 22-item questionnaire designed to measure core phenomena of traumatic stress reactions: intrusion (8 items), avoidance (8 items), and hyperarousal (6 items). The scale asks respondents about the frequency with which each symptom has occurred over the past week, ranging from 0 (not at all) to 4 (extremely). The total score ranges from 0 to 88, with higher scores corresponding to higher levels. The scale has shown high-internal consistency ($\alpha = 0.96$).

The State-Trait Anxiety Inventory (STAI; Spielberger, 1983) is a self-report 20-item questionnaire designed to evaluate current feelings and persistent symptoms of anxiety. The first part of the questionnaire (STAI-1) assesses state anxiety, whereas the second part (STAI-2) assesses trait anxiety, using a 4-point response scale, ranging from 1 (not at all) to 4 (very much). Scores range from 20 to 80, with higher scores corresponding to higher levels of anxiety. A cutoff of 40 is normally used for clinically significant symptoms of a state of anxiety. The State-Trait questionnaire has shown good internal consistency (alpha coefficients ranging from 0.83 to 0.92).

The Beck Depression Inventory (BDI-II; Beck, Steer, & Brown, 1996) is a self-report 21-item questionnaire measuring cognitive, affective, and somatic symptoms of depression in the previous 2 weeks. Each of the 21 items on the BDI consists of four statements representing increasing degrees of severity, with scores ranging from 0 to 3. Total scores on the BDI can range from 0 (no depression) to a maximum score of 63 (severe state of depression). A BDI score of 10 or greater is considered to indicate the possibility of at least mild depression. The BDI-II has shown good internal consistency ($\alpha = 0.86$).

Treatments

Treatments were carried out by a doctoral level therapist with extensive training and experience in both forms of treatment. With regard to EMDR treatment fidelity, the therapist was an EMDR supervisor certified by the recognized accrediting association in Italy (Association of EMDR–Italia). A fidelity check evaluating the therapist's IE delivery—conducted by a CBT supervisor with expertise in this type of treatment—found it was satisfactory. Independent professionals conducted the data collection, whereas the statistical analysis was conducted by another independent professional.

The delivery of the psychological treatment started at least 45 days after the life-threatening cardiac event. Both treatments began with two preparatory sessions, consisting of information gathering and providing the treatment's rationale and preparation. Following these preparatory sessions, two weekly therapy sessions of 45 minutes each were delivered for 4 weeks (i.e., two preparatory sessions plus eight therapy sessions). In both treatments, the target was the life-threatening cardiac event that lead to the development of the measured PTSD symptoms. Data were gathered on symptoms of PTSD, anxiety, and depression at three times: pretreatment, posttreatment, and 6-month follow-up.

Eye Movement Desensitization and Reprocessing Treatment. The EMDR treatment included all eight phases composing the EMDR therapy (Shapiro, 2001), provided in a shorter session time (45 minutes).

During the reprocessing phases, the patient was instructed to identify an image that represents the worst part of the cardiac event, a negative irrational self-belief associated with the image, a positive adaptive cognition, emotions, and attendant body sensations. Then, initially focusing on the image, negative belief, and sensation, the client was guided according to standardized procedures to simultaneously move his or her eyes back and forth following the therapist's fingers as they moved across his or her field of vision for a "set" of approximately 24–36 seconds. After the set, the client reported any new associations that may have emerged. Such associations generally became the focus of the next set of dual attention or were guided by the clinician. This process continued until the target memory was desensitized (as measured from 0 to 10 on the Subjective Units of Disturbance [SUD] scale: Shapiro, 2001; Wolpe, 1990). Then, further eye movement sets were used while the patient was thinking of an identified adaptive belief. This was repeated until the new statement felt true to the patient, and until all physical disturbances were dissipated. Over the sessions, this treatment process was used to address memories of the cardiac event and associated present triggers, as well as anticipatory anxiety related to potential future incidents. The patient was asked to document briefly any disturbance between sessions. No treatment techniques were prescribed as homework.

Imaginal Exposure Treatment. IE was used in session as it is described and recommended for the administration of prolonged exposure (PE) therapy (Foa & Rothbaum, 1998). Namely, the first session began with a presentation of the rationale for confronting the trauma memory in imagination and initiation of IE. These procedures consisted of the participants visualizing the traumatic event and recounting it aloud in the present tense for 45–60 minutes without allowing their mind to move into any other memories or associations. If the patients reported problems during the visualization, they were allowed to write a narrative of the event, and then read or tell the story of the traumatic experience to the therapist in the first person and in present tense. In this case, the patients were also explicitly instructed to focus on the entire range of sensory and affective reactions to the event. The target trauma memory recounting was repeated if necessary to allow total reliving of 45–60 minutes. The subsequent session continued the IE procedures. It should be noted that although PE is an empirically supported treatment for PTSD, it includes an additional 1–3 hours of daily imaginal and in vivo exposure homework to achieve its effects (Foa & Jaycox, 1999).These elements were not added to the patients' regime because of concerns regarding patients' safety and physical debilitation. Therefore, treatment sessions and IE occurred on the premises of the rehabilitation clinic, where any potential safety concern could have been addressed by experienced and equipped staff. Despite the lack of homework, the standardized and widely used procedures offered an excellent controlled condition to examine the comparative efficacy of in-session IE and EMDR.

Data Analysis

Comparisons between groups and over time were conducted using a repeated measures linear mixed model analysis using the "intent-to-treat paradigm." Consistent with intent to treat analysis, all available data were included once a participant was randomized into a group. No data imputation strategies were used. Unlike univariate analysis of variance (ANOVA) or multivariate ANOVA (MANOVA) approach, mixed effects models allow incorporating missing observations under the assumption of missing at random, that is, unrelated to the treatments. Descriptive and inferential statistical analyses were conducted using SPSS 15.0 statistical software (SPSS, Chicago, IL) and STATA 11.0 (StataCorp, College Station, TX). Baseline measures were compared using *t* tests and chi-square tests to ensure comparability between the groups. An interval of 5% ($p < .05$) was used to detect significance (refer to Tables 1 and 2 for means and standard deviations). Sidak multiple tests adjustment was used when calculating *p* values for multiple comparisons. Data collection and analysis were conducted independently.

Results

Descriptive and Completion Statistics

The sample was composed of 42 individuals, 28 males (66.7%) and 14 females (33.3%), with a mean age of 63.48 ($SD = 10.32$; range = 34–79). All the participants completed the pretreatment and the posttreatment tests. Some attrition was present at follow-up. Nineteen percent of the sample (8 subjects on the initial 42 [5 EMDR group, 3 IE group]; difference not statistically significant) could not complete the follow-up tests because of death or exacerbation of physical health issues.

Baseline Measures

Overall Sample. Means and 95% confidence intervals for the overall sample are shown in Table 1. There was no statistically significant difference between the two groups at the beginning of the treatment for any of the variables (IES-R, $F[1, 40] = .26$, $p = .613$; BDI,

TABLE 1. Means for the Overall Sample With 95% Confidence Intervals ($n = 42$)

	EMDR		IE	
Outcome	Means	95% CIs	Means	95% CIs
IES-R				
Pretreatment	33.62	(30.34–36.90)	32.29	(29.01–35.57)
Posttreatment	12.10	(8.82–15.37)	19.67	(16.39–22.95)
Follow-up	7.95	(4.37–11.53)	13.64	(10.20–17.09)
BDI				
Pretreatment	17.14	(13.85–20.44)	15.57	(12.28–18.87)
Posttreatment	6.38	(3.09–9.68)	11.48	(8.18–14.77)
Follow-up	5.34	(1.73–8.95)	9.50	(6.03–12.97)
STAI-1				
Pretreatment	48.67	(45.13–52.20)	44.90	(41.37–48.44)
Posttreatment	33.10	(29.56–36.63)	40.19	(36.65–43.73)
Follow-up	32.45	(28.59–36.30)	37.95	(34.24–41.66)
STAI-2				
Pretreatment	41.00	(36.93–45.08)	40.43	(36.35–44.50)
Posttreatment	32.90	(28.83–36.98)	39.62	(35.54–43.69)
Follow-up	32.86	(28.64–37.09)	39.07	(34.91–43.22)

Note. CI = confidence interval; EMDR = eye movement desensitization and reprocessing; IE = imaginal exposure; IES-R = Impact of Event Scale—Revised; BDI = Beck Depression Inventory; STAI-1 = State-Trait Anxiety Inventory–1; STAI-2 = State-Trait Anxiety Inventory–2.

$F[1, 40] = .27, p = .603$; STAI-1, $F[1, 40] = 1.51, p = .226$; STAI-2, $F[1, 40] = .03, p = .855$). Participants presented high average levels of PTSD symptoms ($M = 32.95$), depressive symptoms ($M = 16.36$), state anxiety ($M = 46.79$), and trait anxiety ($M = 40.71$). At this time, 45% of the participants (19 out of 42) scored 33 or greater on the IES-R, whereas the rest of the sample (55%) scored 22 or greater. Of those scoring 33 or greater, 38% (8) were in the IE group and 52% (11) were in the EMDR group (8 vs. 11). A Fisher's exact text showed that this difference was not significant ($p = .268$).

Subsample of Participants With IES ≥33. Means and 95% confidence intervals for the 19 participants scoring 33 or greater on the IES-R are shown in Table 2. Scores for this subsample at pretreatment, posttreatment, and 6-month follow-up for each measure are shown in Figure 1. No statistically significant differences were shown between the two groups at the beginning of the treatment on any of the variables (IES-R, $F[1, 17] = .71, p = .794$; BDI, $F[1, 17] = .119, p = .74$; STAI-1, $F[1, 17] = .46, p = .508$; STAI-2, $F[1, 17] = .87, p = .365$). In this subsample, average scores were high: 40.37 on the IES-R, 16.95 on the BDI, 51.68 on the STAI-1, and 42.68 on the STAI-2.

Change From Pretreatment to Posttreatment

Overall Sample. In the overall sample of 42 participants, the IE group showed a significant pretreatment and posttreatment decrease for all measures except the STAI-2 (IES-R, $z = 7.89, P > |z| = .000$; BDI, $z = 2.47, P > |z| = .046$; STAI-1, $z = 2.76, P > |z| = .021$; STAI-2, $z = 0.67, P > |z| = .879$). On the other hand, the EMDR group showed significant pre/post improvements for all variables (IES-R, $z = 13.5, P > |z| = .000$; BDI, $z = 6.5, P > |z| = .000$; STAI-1, $z = 9.13, P > |z| = .000$; STAI-2, $z = 6.69, P > |z| = .000$). Comparing IE and EMDR posttreatment scores, the EMDR group scores were significantly lower than the IE group for all measures (IES-R, $z = -3.25, P > |z| = .002$; BDI, $z = -2.18, P > |z| = .033$; STAI-1, $z = -2.82, P > |z| = .006$; STAI-2, $z = -2.34, P > |z| = .023$). At posttreatment, 21% (9) of the 42 participants still reported scores 22 or greater; these included 33% (7) of the IE group and 10% (2) of the EMDR group (Fisher's exact text, $p = .065$).

Subsample of Participants With IES ≥33. In the subsample of 19 participants who began the study with

TABLE 2. Means With 95% Confidence Intervals for Participants Scoring 33 or Greater on the IES-R ($n = 19$)

	EMDR		IE	
Outcome	Means	95% CIs	Means	95% CIs
IES-R				
Pretreatment	40.00	(35.53–44.47)	40.88	(35.63–46.12)
Posttreatment	13.73	(9.25–18.20)	25.13	(19.88–30.37)
Follow-up	8.03	(2.97–13.08)	17.67	(12.16–23.19)
BDI				
Pretreatment	17.64	(12.98–22.23)	16.00	(10.54–21.46)
Posttreatment	6.09	(1.43–10.75)	14.75	(9.29–20.21)
Follow-up	4.71	(−.65–10.06)	12.36	(6.58–18.15)
STAI-1				
Pretreatment	53.09	(48.29–57.89)	49.75	(44.12–55.39)
Posttreatment	32.55	(27.74–37.35)	45.25	(39.62–50.89)
Follow-up	30.00	(24.67–35.34)	43.86	(37.98–49.74)
STAI-2				
Pretreatment	40.73	(35.05–46.41)	45.38	(38.71–52.04)
Posttreatment	32.64	(26.96–38.32)	46.25	(39.59–52.91)
Follow-up	30.73	(24.79–36.67)	46.63	(38.85–52.40)

Note. CI = confidence interval; EMDR = eye movement desensitization and reprocessing; IE = imaginal exposure; IES-R = Impact of Event Scale—Revised; BDI = Beck Depression Inventory; STAI-1 = State-Trait Anxiety Inventory–1; STAI-2 = State-Trait Anxiety Inventory–2.

scores of 33 or greater on the IES-R, the EMDR group showed significant pretreatment and posttreatment reduction for all variables scores (IES-R, $z = 10.9$, $P > |z| = .000$; BDI, $z = 4.17$, $P > |z| = .001$; STAI-1, $z = 8.7$, $P > |z| = .000$; STAI-2, $z = 4.64$, $P > |z| = .000$). In the same subsample, the IE group showed significant pretreatment and posttreatment improvement on IES-R and BDI scores only, with no improvement in STAI-1 and STAI-2 scores (IES-R, $z = 5.57$, $P > |z| = .000$; BDI, $z = 0.39$, $P > |z| = .974$; STAI-1, $z = 1.63$, $P > |z| = .303$; STAI-2, $z = 2.43$, $P > |z| = .964$). Comparing IE and EMDR posttreatment scores for this subgroup of participants, the EMDR group scores were significantly lower than the IE group for all variables (IES-R, $z = 23.34$, $P > |z| = .002$; BDI, $z = 22.43$ $P > |z| = .019$; STAI-1, $z = 23.48$, $P > |z| = .001$; STAI-2, $z = 23.21$, $P > |z| = .004$). In addition, only 1 (2%) of the 19 subjects scoring 33 or greater on the IES-R at pretreatment still scored 33 or greater (the subject was in the IE group) at posttreatment.

Six-Month Follow-Up

Attrition at follow-up was caused by death or exacerbation of physical health issues. Eight of the initial 42 participants (5 EMDR, 3 IE; difference was not statistically significant) could not complete the follow-up tests.

Overall Sample. For the IE group, the positive results persisted at follow-up, with IES-R outcomes showing further improvement since posttreatment (IES-R, $z = 3.57$, $P > |z| = .002$; BDI, $z = 1.13$, $P > |z| = .595$; STAI-1, $z = 1.25$, $P > |z| = .518$; STAI-2, $z = 0.43$, $P > |z| = .963$). In addition, the EMDR group treatment effects all maintained at the same level (IES-R, $z = 2.36$, $P > |z| = .061$; BDI, $z = .571$, $P > |z| = .920$; STAI-1, $z = 0.345$, $P > |z| = .981$; STAI-2, $z = 0.32$, $P > |z| = 1.00$). At this point, the EMDR group scores remained significantly lower than the IE group for all variables except the BDI (IES-R, $z = 22.28$, $P > |z| = .025$; BDI, $z = 21.65$, $P > |z| = .103$; STAI-1, $z = 22.04$, $P > |z| = .044$; STAI-2, $z = 22.10$, $P > |z| = .040$). Only 4 subjects (12%) still presented IES-R scores of 22 or greater (all in the IE group, composing 22% of this group; Fisher's exact text, $p = .066$).

Subsample of Participants With IES ≥33. Regarding the participants scoring 33 or greater on the IES-R, from posttreatment to follow-up, the EMDR group showed stable scores for all the measures (IES-R, $z = 2.12$, $P > |z| = .117$; BDI, $z = 0.45$, $P > |z| = .959$;

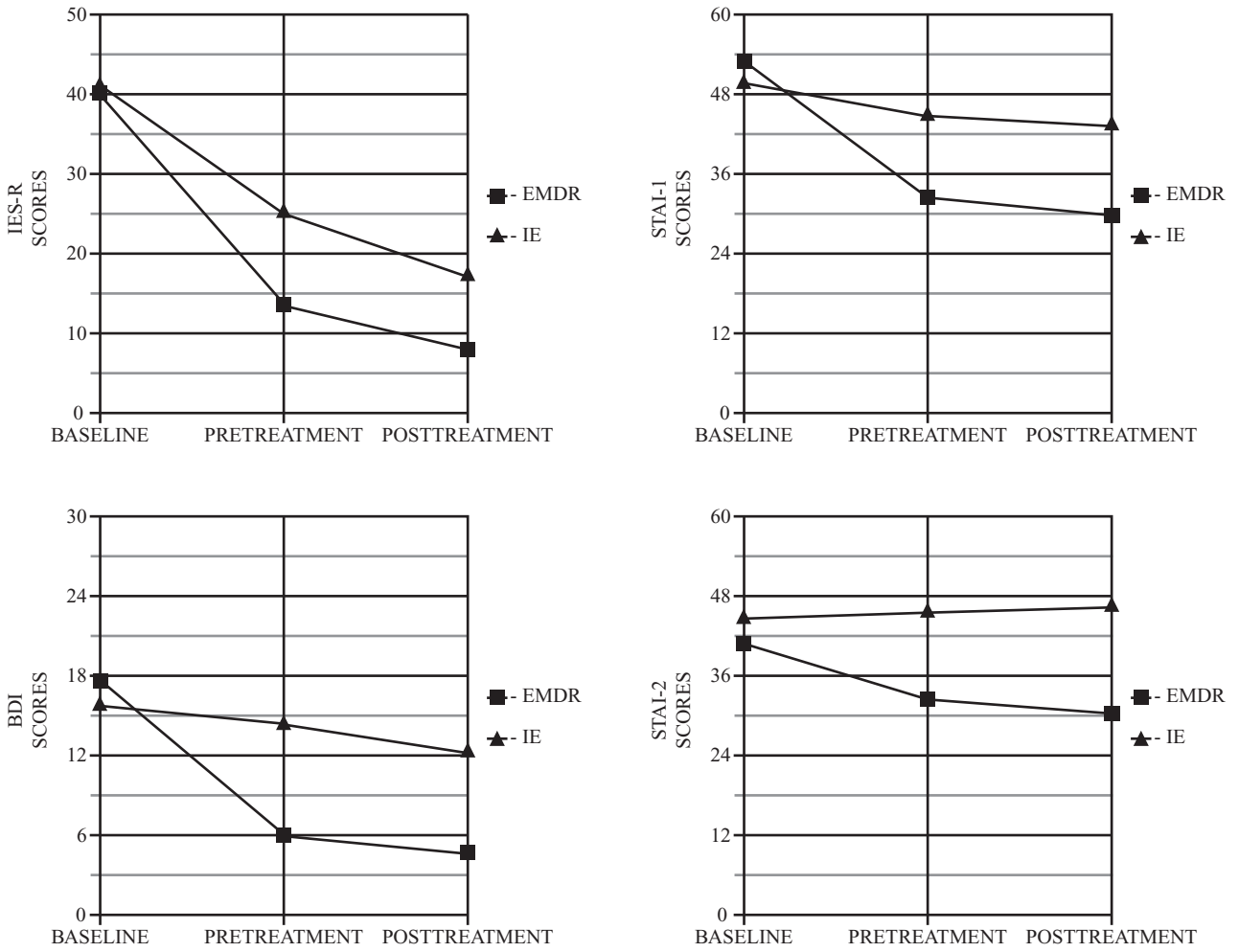

FIGURE 1. Scores for participants scoring 33 or greater on the IES-R ($n = 19$).

STAI-1, $z = 0.96$, $P > |z| = .715$; STAI-2, $z = 0.97$, $P > |z| = .711$). The IE group showed a further improvement in IES-R scores, and stable levels on the other scores (IES-R, $z = 2.52$, $P > |z| = .048$; BDI, $z = 0.71$, $P > |z| = .864$; STAI-1, $z = 0.48$, $P > |z| = .951$; STAI-2, $z = 0.29$, $P > |z| = .988$). At this point in this subsample, the EMDR group scores were significantly lower than the IE group for all variables except the BDI, with the difference in scores approaching significance (IES-R, $z = 22.60$, $P > |z| = .013$; BDI, $z = 21.95$ $P > |z| = .057$; STAI-1, $z = 23.52$, $P > |z| = .001$; STAI-2, $z = 23.39$, $P > |z| = .002$). The single subject (in the IE group) scoring 33 or greater at posttreatment showed no improvement at follow-up.

Discussion

To our knowledge, the present research is only the second study investigating the effects of psychotherapy for PTSD symptoms in survivors of life-threatening cardiac events and the first applying EMDR to this population. In this study, EMDR was effective in reducing PTSD and concomitant depressive and anxiety symptoms, both in the overall sample and in the subsample with more severe PTSD symptoms. In addition, IE was found, in part, to be effective in reducing psychological symptoms in this population, which is consistent with a previous study (Shemesh et al., 2010). However, EMDR performed significantly better than IE for all variables at posttreatment and for all variables except for the BDI at follow-up, both in the overall sample and in those with more severe PTSD symptoms (see Figure 1, Table 1, and Table 2). These results support EMDR and, in part, IE as effective treatments of PTSD symptoms in survivors of life-threatening cardiac events.

Comparison of Imaginal Exposure and Eye Movement Desensitization and Reprocessing

IE was chosen as a control condition for EMDR in this study because it has a greater established efficacy than present-centered therapy or placebo conditions.

Although IE has some empirical evidence in the treatment of PTSD, it was also expected to create less between-session emotional and physiological distress than those treatments requiring daily homework that focuses on the traumatic incident (e.g., PE [Foa & Rothbaum, 1998]; cognitive processing therapy [Resick & Schnicke, 1996]). IE was a good control for EMDR because neither treatment requires homework, which is avoided in this setting because of concerns regarding patients' safety and physical debilitation. It also controlled for the exposure to the traumatic memory, and consequently allowed for the investigation of whether EMDR's effects in this study could be attributed to therapist attention, therapy time, or to exposure to the event. The difference in the results indicates that EMDR's effects extend beyond exposure and the therapeutic relationship. Because the standardized IE procedures used were those employed in-session during PE (Foa & Rothbaum, 1998), the results are also instructive regarding the relative efficacy of both treatments without the addition of homework.

Furthermore, the fact that significant therapeutic results could be obtained through EMDR without the homework typical of exposure therapy (e.g., involving further exposure by listening to tapes of the therapy session and in vivo assignments) suggests that EMDR may be better tolerated by this type of patients, and also that all sessions and exposure may occur in safe premises. In addition, because homework is unnecessary to achieve clinical effects with EMDR, there exists the possibility of providing treatment over consecutive days to treat mental health concomitants of medical patients. For example, EMDR therapy could perhaps be implemented through multiple sessions so that treatment could be completed during short rehabilitation stays of a week or two. Future research should investigate this possibility.

The different results between EMDR and IE may indicate different underlying mechanisms of change. In IE, as in PE, the client is asked to focus on the traumatic event, and not allow his or her mind to move into other memories or associations. In EMDR, the instructions are to "let whatever happens happen" and to "just notice" what is happening. This nondirective approach of EMDR, as opposed to continually keeping the client focused on the target memory, are factors that theoretically should detract from therapeutic efficacy in exposure models (Foa & Jaycox, 1999; Marks, Lovell, Noshirvani, Livanou, & Thrasher, 1998). The fact that EMDR has differential efficacy than IE alone suggests that EMDR is a distinct therapy with different mechanisms of change, as posited by the adaptive information processing model (Shapiro, 1995, 2001; Solomon & Shapiro, 2008). Other research (e.g., Lee & Drummond, 2008; Lee, Taylor, & Drummond, 2006) has also concluded that EMDR may involve different mechanisms than traditional exposure.

Reduction in Posttraumatic Stress Disorder Symptoms

Both IE and EMDR were effective in treating PTSD symptoms, with EMDR achieving significantly greater reductions in IES-R scores at posttest and follow-up. EMDR resulted in significant reductions at posttreatment, which remained stable at follow-up. The IE group showed continual improvement over time, although IE did not achieve the same level of results as EMDR. This suggests that EMDR may be not only more effective in treating trauma symptoms than IE, but also more efficient, taking less time to achieve significant improvement. Clearly, cardiac events and other medical issues as well (e.g., strokes, onset of cancer, or other major illnesses/diseases) can have a traumatic impact and can be treated. However, future research needs to determine the specific and additive effects of the different interventions provided to subjects in this study.

Reduction in Depressive Symptoms

EMDR resulted in significantly greater reductions in depressive symptoms than IE at posttreatment. At follow-up, IE scores continued to improve, whereas EMDR results remained stable. EMDR showed greater reduction than IE, although the difference in symptom reduction only approached significance. This suggests that EMDR may be more efficient than IE in treating depression symptoms, with greater reduction in symptoms taking place earlier and maintaining over time.

Our findings show that EMDR can be effective in treating depressive symptoms following life-threatening cardiac events, suggesting that in posttraumatic settings, the use of EMDR may be potentially extended beyond the sole treatment of PTSD. These results correspond with other randomized controlled studies (Ironson, Freund, Strauss, & Williams, 2002; Marcus, Marquis, & Sakai, 1997; van der Kolk et al., 2007), which found that EMDR treatment had a simultaneous effect in reducing depressive symptoms in survivors of traumatic events who developed PTSD symptoms. Although the effectiveness of EMDR in treating posttraumatic major depressive disorder (MDD) has yet to be investigated, the modest improvement so far achieved with antidepressant and cognitive behavioral therapy in survivors

of life-threatening cardiac events (Thombs et al., 2008) calls for the investigation of other effective treatments. Further research should investigate if EMDR treatment can have a beneficial effect on depression following distressing events as well as other medical problems.

Reduction in Anxiety Symptoms

Anxiety can be "state" or short term; or "trait" or long term, reflecting a tendency to respond with state anxiety to threatening situations. This study showed EMDR to be effective in reducing both state and trait anxiety, and significantly more so than IE. Other studies have also shown EMDR to result in reductions in state and trait anxiety as well (Raboni, Tufik, & Suchecki, 2006; Scheck, Schaeffer, & Gillette, 1998). In addition, case series have indicated that EMDR treatment focusing on past traumas was effective in treating generalized anxiety disorder (GAD; Fernandez & Faretta, 2007; Gauvreau & Bouchard, 2008). Further research should investigate the use of EMDR in the treatment of anxiety disorders.

Strengths and Limitations of This Study

The current pilot study presents various strengths. Many of the methodological gold standards (Max field & Hyer, 2002) were met: Symptoms were clearly defined; measures were reliable and valid; patients were randomly assigned to conditions; data collection, data analysis, and treatments were all conducted independently.

Nonetheless, some limitations warrant caution in interpreting these results. For example, no diagnostic assessment was completed and it is not known how many participants would have received a diagnosis of PTSD, MDD, or GAD. This limits the findings because it is not possible to conclude that EMDR is effective for postcardiac psychiatric disorders. However, empirical evidence has shown the significant impairment caused by subclinical PTSD (Marshall et al., 2001), with this impairment potentially as debilitating as that experienced by patients meeting criteria for full PTSD (Zlotnick et al., 2004). Furthermore, studies evaluating PTSD symptoms (rather than a PTSD diagnosis) have shown that these symptoms may have adverse effects on mortality risk in patients who had undergone heart transplant (Ladwig et al., 2008) and also that these symptoms predict greater likelihood of cardiovascular-related readmission in patients who experienced postmyocardial infarction (Shemesh et al., 2004). Findings of these studies indicate that PTSD symptoms, beyond a diagnosis of PTSD, may both cause functional impairment and affect prognostic outcomes in those who survived a life-threatening cardiac event. Therefore, results of the current study have important implications for programs treating survivors of life-threatening cardiac events and other life-threatening conditions, who developed posttraumatic reactions, even if these reactions do not meet the criteria for full-blown PTSD.

The control condition IE has only some empirical evidence for the treatment of PTSD (Bryant et al., 2003; Tarrier et al., 1999), and a more empirically based PTSD therapy may have produced results comparable to those of EMDR. For example, PE (Foa & Rothbaum, 1998; Foa, Rothbaum, Riggs, Murdock, & Walsh, 1991), which entails homework assignments, has been found to be as effective as EMDR in treating PTSD and correlated symptoms (Ironson et al., 2002; Rothbaum, Astin, & Marsteller, 2005). However, as previously stated, daily homework, including in vivo exposure, is deemed necessary to achieve clinical effects in PE (see Foa & Jaycox, 1999), and this was considered to be too debilitating for the current patients with cardiac abnormalities. Therefore, IE was chosen as a control for exposure to the traumatic event because neither treatment involves homework.

Finally, although acceptable fidelity in both treatments was independently assessed, there was no taping of sessions during the study to assess potential drift. Future research should include ongoing fidelity assessments by expert evaluators.

Recommendations for Future Research

Future research in patients with cardiac abnormalities needs to replicate these results in larger samples. Such research on the treatment of psychiatric symptoms following life-threatening cardiac event should compare EMDR to other empirically based treatments for PTSD and depression using full diagnostic assessments. In addition, given that MDD and GAD are common following traumatic events (e.g., Grant, Beck, Marques, Palyo, & Clapp, 2008), future research should also investigate whether trauma-focused treatments may be helpful in treating non-PTSD disorders triggered by life-threatening cardiac events.

Finally, it is important to investigate the long-term effects of trauma-focused treatments on physical health variables and quality of life in survivors of life-threatening cardiac events. Perhaps, along with symptom reduction, trauma-focused treatments may reduce mortality risk and the recurrence of new cardiac events in this population. Such research would be of great benefit because it may potentially improve the prognosis of those who survived life-threatening cardiac events.

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