Comparison of Eye Movement Desensitization and Reprocessing and Biofeedback/Stress Inoculation Training in Treating Test Anxiety

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Eye movement desensitization and reprocessing (EMDR) and Biofeedback/Stress Inoculation Training (B/SIT) treatment and no treatment (NT) were compared in reducing test anxiety. Thirty college students with high test anxiety were randomly assigned to each condition. Pre-post assessments were conducted using the Test Anxiety Inventory (TAI), State-Trait Anxiety Inventory (STAI), Rational Behavior Inventory (RBI), and Autonomic Perception Questionnaire (APQ). Treatment therapists were licensed professionals with at least 2 years experience in their respective modality. Statistical analysis using a two-way analysis of variance with repeated measures found significant interactions between time (pre-post) and treatment conditions for all measures except the RBI. Post hoc Newman–Keuls analyses were conducted on the change scores, indicating that both EMDR and B/SIT significantly reduced test anxiety. EMDR generally outperformed B/SIT.

Keywords: test anxiety; EMDR; biofeedback; stress inoculation

Test anxiety is a problem commonly experienced by individuals through their life span. There are many instances when an individual is faced with participating in some form of measurement of knowledge. Individuals who suffer from test anxiety tend to perceive evaluative situations as personally threatening, and in a test situation, they are often excessively nervous, tense, apprehensive, and emotionally aroused. They also tend to have negative self-centered cognitions that distract their attention and interfere with their concentration during examinations (Beidel, Turner, & Dancu, 1985; Schulz, Alpers, & Hoffman, 2008). This can result in overwhelming anxiety.

Test anxiety can be experienced in many different settings. Examples include not getting into graduate schools because of poor Graduate Record Exam scores, not passing the Certified Public Accountant exam, doing poorly on medical school exams, failing the state bar exam, or not being able to pass a specific course that is required for college graduation. Tests are also given to get a driver's license, to receive an assignment in the armed forces, or whenever there is a need to prove proficiency. Most clients report that they have studied and have been confident in their grasp of the material, but in the actual testing situation, their minds "go blank" or they experience an "anxiety attack" that leaves them unable to perform. Typically, test anxiety has been dismissed as not important, and clients report that they have been told to just go on to something else, to forget their aspirations, and to accept that they are just not good test takers.

Test anxiety also crosses cultural boundaries. Studies have been published from Israel, Japan, China, the Netherlands, Germany, Belgium, Turkey, England, and the United States. Test anxiety also occurs in both sexes, all ages, and in all socioeconomic conditions.

Research in the field of test anxiety demonstrates that test anxiety is composed of both physiological and cognitive components (Cassady & Johnson, 2002; Eckman & Shean, 1997). The need for treatment of test anxiety is apparent. Research by Naveh-Benjamin, Lavi McKeachie, and Lin (1997) found a negative correlation in the reduction of test anxiety and the retention of study material. Pluess, Conrad, and Wilhelm (2009) cited that the typical recovery rate of anxiety is only about 40% with current psychological therapy; therefore, treatments with a better understanding of potential

psychophysiological mechanisms are vital. Falsetti (2003) cited that treatment of trauma and anxiety issues was enhanced by the augmentation of cognitive behavioral therapy such as stress inoculation therapy.

Eye Movement Desensitization and Reprocessing

Originally introduced by Shapiro (2001), eye movement desensitization and reprocessing (EMDR) has been internationally recognized as an efficacious treatment for posttraumatic stress disorder (e.g., American Psychiatric Association, 2004; Bisson & Andrew, 2007/2009; Bradley, Greene, Russ, Dutra, & Westen, 2005; U.S. Department of Veterans Affairs & U.S. Department of Defense, 2004/2010). There have been about 20 randomized, controlled studies investigating EMDR treatment of posttraumatic stress disorder. Rothbaum et al. (2005) and van der Kolk et al. (2007) compared EMDR and cognitive behavioral therapy, and Carlson, Chemtob, Rusnak, Hedlund, and Muraoka (1998) compared EMDR to biofeedback, which demonstrated that EMDR was more effective. Lee, Gavriel, Drummond, Richards, and Greenwald (2002) compared EMDR to stress inoculation treatment with prolonged exposure, which showed no significant differences at posttreatment but an advantage for EMDR at follow-up.

Much less research has been done of EMDR treatment of various anxiety disorders, and findings have showed mixed results. De Jongh and ten Broeke (2009) suggested that EMDR may be most effective for anxiety disorders, which have their origin in a traumatic event.

EMDR (Shapiro, 2001) focuses on the desensitization and reprocessing of distressing memories and addresses past incidents, current triggers, and future potential challenges. Shapiro has posited that the decrease or elimination of distress from the disturbing memory will result in the alleviation of presenting symptoms, an improved view of the self, relief from bodily disturbance, and resolution of present and future anticipated triggers. During EMDR, the client focuses on the memory and related affective, cognitive, and somatic material, which engages in short sets (about 24 seconds) of rapid, rhythmic horizontal eye movements under the therapist's direction. After each set, the client tells the therapist what material was elicited, and that material generally becomes the focus of the next set of dual attention. The client rates the level of anxiety using a 10-point Subjective Unit of Disturbance (SUD) scale, where 0 represents *neutral intensity* and 10 equals the *highest possible disturbance or anxiety* (Shapiro, 2001; Wolpe, 1991). Upon desensitization of the targeted memory, an installation of the identified (desired) positive cognition is performed using the same eye movements.

The client then rates the results of this process through a 7-point semantic differential scale—designated the Validity of Cognition (VOC) scale where 1 represents *completely false* and 7 means *completely true*—to test for the success of the process (Shapiro, 2001). Treatment of the memory is considered complete when the client reports no disturbance on the SUD scale, the positive cognition is rated as valid, no somatic distress is reported, and all current and future triggers are addressed.

EMDR Treatment of Test Anxiety

EMDR has been shown to be effective in treating test anxiety in both one- and two-session treatment regimens. Maxfield and Melnyk (2000) compared EMDR and waitlist/delayed treatment and demonstrated that a single session of EMDR significantly reduced the emotional and physiological components of test anxiety using assessment tools, including the Test Anxiety Inventory (TAI) and State-Trait Anxiety Inventory (STAI), with participants moving from the 90th percentile on the TAI at pretreatment to the 50th percentile at follow-up. In a controlled study with 62 undergraduate students, Stevens and Florell (1999) showed that EMDR was most effective in reducing distress, whereas rational emotive therapy (RET) reduced global test anxiety more than an information-only condition.

Other studies have yielded inconclusive results. Bauman and Melnyk (1994) compared an EMDR variant to metronome-timed finger taps and found that both therapies produced a decrease on the emotionality subscale of the TAI, but not on the worry or total TAI scales. Gosselin and Matthews (1995) compared EMDR with eye movements to EMDR with fixed gaze, in conditions of high and low expectancy. They found that all participants showed significant improvement on the TAI and that there was no effect for either eye movements or expectancy. Enright, Baldo, and Wykes (2000) called for the need for further comparative research between EMDR and other established modalities for the treatment of test anxiety.

Biofeedback

Biofeedback is a well-established treatment for the physiological symptoms of stress and anxiety. The origins of biofeedback are found in the principles of operant conditioning that lie at the core of learning theory. Research has supported the effectiveness of biofeedback in reducing the emotionality or physiological components of test anxiety (Hurwitz, Kahane, & Mathieson, 1986; Ratanasiripong, Sverduk, Hayashino, & Prince, 2010). Schwartz and Andrasik (2003) indicated that biofeedback is most effective when combined with cognitive behavioral therapy.

In treating stress or anxiety, biofeedback training teaches the client how to control the physiological responses that occur when he or she begins to think distressing thoughts. It includes many techniques such as muscle relaxation, hand warming, and diaphragmatic breathing. In biofeedback, the client is first taught to control stress or anxiety while hooked up to a monitor that displays any or all of the following measures: body temperature; galvanic skin response (GSR), which measures autonomic nervous system activity; or electromyography (EMG), which measures muscle tension (Schwartz & Andrasik, 2003). The ultimate goal is to learn to replicate the same results without the machine in everyday life situations. In learning to master the control of these responses, a client is able to reduce their anxiety and better performance is anticipated.

Biofeedback Treatment of Test Anxiety

There are several studies that have explored the use of biofeedback in the reduction of test anxiety and its various components. Biofeedback has successfully treated the emotional or physiological arousal component and the cognitive or worry component of test anxiety (Kiselica, Baker, Thomas, & Reedy, 1994). Ratanasiripong et al. (2010) demonstrated the effective use of a portable biofeedback mechanism for treatment of test anxiety in college students.

Research supports the efficacy of biofeedback in reducing the physiological symptoms of test anxiety. However, the use of a cognitive modification treatment as an adjunct is advised to address the worry or cognitive aspect (Kiselica et al., 1994). Various studies have compared biofeedback with another modality in treating test anxiety. Although all these studies indicated positive impact of biofeedback on test anxiety, none found biofeedback to be significantly more effective than the modality to which it was being compared for efficacy. Studies have compared biofeedback to hypnosis (Spies, 1979), to systematic desensitization (Romano & Cabianca, 1978), and to cue-controlled relaxation (Counts, Hollandsworth, & Alcorn, 1978).

Stress Inoculation Training

Stress inoculation is a type of self-instructional training that consists of many different coping skills that are applicable in treatment of anxiety. Meichenbaum (1996) has compared this approach to the immunization approach in medicine. When a person is inoculated, he or she is given the opportunity to deal with a small dose of the stress-related stimulus in a controlled environment. The experience in learning to cope with small units of the stimuli helps develop coping skills for more threatening situations (Rehm & Rokke, 1988). Designed to help people with stressful situations by increasing their coping skills, stress inoculation has three phases (Meichenbaum, 1996; Sheehy & Horan, 2004). The first phase is educational in nature. The client is introduced to one or two theoretical approaches to stress reactions in order to provide a framework for understanding his or her own responses. For the highest therapeutic yield in implementing coping strategies, it is important that the information be readily applicable to the client's own experiences. For example, the client could be instructed on how fear responses have two major components—physiological arousal and cognitive (images and self-statements)—and that these components contribute to the increase in anxiety.

The second phase involves the rehearsal of many different coping techniques that are developed for each client, such as creation of positive self-statements, imagining a pleasant scene, or other relaxation techniques. Finally, the third phase consists of the client using coping strategies in a series of graduated stressful situations. This application can begin in the therapy session and then the client practices the coping skills in real-life settings and in other mildly stressful situations.

Stress Inoculation Training Treatment of Test Anxiety

Saunders, Driskell, Johnston, and Salas (1996) performed a literature review of stress inoculation treatment of test anxiety and other performance issues, reporting that this approach was found to be effective in nine studies with moderate to strong results. Sheehy and Horan (2004) found that stress inoculation training, using Meichenbaum's (1996) three-stage approach, was effective in the treatment of test and academic anxiety for first-year law students.

Method

Purpose

The purpose of this study was to compare EMDR to biofeedback/stress inoculation training (B/SIT). All three treatments have research support for their effectiveness in the treatment of test anxiety. In addition, biofeedback provides an objective measure of physiological arousal. Stress inoculation training includes a cognitive restructuring component, which made it appropriate for combining with biofeedback for the purposes of this study. The null hypothesis was that there would be no difference in treatment outcome between EMDR and B/SIT.

Participants

Thirty adult participants (college students recruited from local junior and 4-year undergraduate colleges

and graduate schools) ranging in age from 19 to 53 years ($M = 36.9$) participated in the study. Eight subjects were males and 22 were females. Their education ranged from 8 to 18 years ($M = 14.4$). Psychological exclusion criteria included active substance abuse, dissociative disorders, psychosis, and psychological problems other than test anxiety as reflected in high scores on the Symptom Checklist-90-R. Medical exclusion criteria included visual problems, epilepsy, neurological impairment, and pregnancy. Other screening criteria included self-reported level of subjective disturbance rated on the SUD scale regarding test anxiety. Subjects that rated an SUD scale score of 6 or higher were referred for selection in the study.

Assessment

Prescreening Tools

Potential participants were given the Symptom Checklist-90-R and the Dissociative Events Scale to screen for psychological problems in addition to test anxiety.

Pre, Post, and Follow-Up Measures

Testing was done at pretreatment and at 30–45 days following the pretest and/or completion of treatment. For pretreatment and posttreatment assessment, the following scales were used: TAI, STAI, Rational Behavior Inventory (RBI), and Autonomic Perception Questionnaire (APQ). The principal investigator remained blind to the results of the psychological testing until completion of the research.

Test Anxiety Inventory. The TAI was developed by Spielberger (1980) and consists of a 20-item, self-report questionnaire, with responses recorded on 4-point Likert scale. Testing demonstrates a range of scores from 20 to 80. Higher scores indicate higher anxiety. Three scores are obtained from the following assessment: a total score, the worry component, and an emotional component.

State-Trait Anxiety Inventory. The STAI (Spielberger, 1983) has been used frequently as a measure of trait and state anxiety in research on test anxiety (Reed et al., 1980; Thyer et al., 1981). It consists of a 20-item questionnaire, with responses recorded on 4-point Likert scale. Testing demonstrates a range of scores from 20 to 80. The higher the score, the higher the anxiety. Results of the STAI can be used in the formulation of a clinical diagnosis, to help differentiate anxiety from depression, for psychological and health research, and for the assessment of clinical anxiety in clients in medical, surgical, and psychiatric settings (Spielberger, 2008).

Rational Behavioral Inventory. The RBI (Shorkey & Whiteman, 1977) was developed for use in RET as a measure of irrational beliefs. It has also been used as a measure of change in internal self-statements (Thyer et al., 1981). It consists of a 37-item questionnaire, with higher scores indicating higher rationality.

Autonomic Perception Questionnaire. The APQ (Borkovec, 1978) was designed to measure physiological arousal. The anxiety-related version of the APQ is a self-report inventory and measures attentiveness to bodily responses in anxiety-provoking situations (e.g., "When I feel anxious, I can feel my heart beating faster"). The APQ asks for a brief description of a situation in which the respondent felt anxious using a 21-item, 9-point Likert scale, with the initial description serving as reference for rating the responses. These are finally summarized into a total score, with a range from 21 to 180 with higher scores indicating greater perceived autonomic activity (e.g., hyperventilation, sweaty palms).

Treatment

Participants were randomly assigned to EMDR, B/SIT, or a no treatment (NT) condition. Treatment was standardized for both EMDR and B/SIT conditions in a manner that was consistent with each model.

Each treatment condition consisted of the same number of therapeutic minutes but divided differently between sessions. The B/SIT participants received three 90-minute sessions, which were used primarily for treatment. The EMDR participants' sessions were divided between one 45-minute session for introductory and therapeutic information issues and then three 75-minute therapeutic sessions. The NT control group received no therapy.

Therapists providing treatment to subjects were either master's or doctoral level and licensed in their field. The four EMDR clinicians had been trained and certified by the EMDR Institute. Two had obtained facilitator status with the EMDR Institute. The four biofeedback clinicians had been trained and certified by the Biofeedback Certification Institute of America. The biofeedback clinicians used existing equipment already present in their practices. In order to prevent researcher bias, the principal investigator did not participate as a therapist but had extensive experience in both EMDR and biofeedback.

Results

A two-way analysis of variance (ANOVA) with repeated measures was performed on the data to determine if there was a significant interaction between the groups and the pre-post tests. When there was a significant interaction, pairwise comparisons using the Newman–Keuls test were conducted to determine if there was a statistical difference between the means. Comparisons were conducted for the pretreatment means and for

the means of the change scores (pretreatment minus posttreatment scores). The clinical significance of treatment was determined by calculating the percentage of pre-post change for each measure, and by noting the percentile ranks of the mean pre-post scores for the TAI and STAI measure, using the normative tables in each treatment manual for female college students.

STAI-Trait

The results of the ANOVA demonstrated a significant interaction between the type of group and the pre-post scores, $F(2,27) = 12.97$, $p < .001$. Newman–Keuls tests showed no significant difference between the STAI-T means at pretreatment. Subsequent Newman–Keuls analysis for the STAI-T revealed that both EMDR and B/SIT produced larger changes than NT ($p < .05$). Although there was not a significant difference between the two treatment groups, EMDR participants moved from the 93rd percentile to the 52nd percentile on the normative scale, with a 25.7% change, and B/SIT participants moved from the 76th percentile to the 65th percentile, with a 6.7% change (see Tables 1 and 2 and Figure 1).

TABLE 1. Means and Standard Deviations (_SD_s) for Pretreatment, Posttreatment, and Change Scores

	Pretreatment			Posttreatment			Change Scores		
	_M_	_SD_	Percentile	_M_	_SD_	Percentile	_M_	_SD_	% Change
TAI-Total									
EMDR	64.3	10.88	96th	33.9	9.7	30th	30.40	7.40	47.3
B/SIT	64.2	10.00	96th	53.7	13.1	84th	10.50	11.81	16.4
NT	66.8	10.70	98th	64.9	12.6	97th	1.90	6.93	2.8
TAI-Worry									
EMDR	24.7	5.10	98th	12.0	3.9	33rd	12.70	3.92	51.4
B/SIT	24.5	5.10	97th	19.4	6.6	83rd	5.10	5.68	20.8
NT	27.1	4.80	99th	25.1	5.5	98th	2.00	2.40	7.4
TAI-Emotionality									
EMDR	27.1	4.50	94th	14.1	3.9	26th	13.00	3.265	48.0
B/SIT	26.7	4.10	93rd	22.6	5.4	78th	4.10	5.04	15.4
NT	27.4	5.00	94th	26.6	6.0	92nd	0.80	3.55	2.9
STAI-Trait									
EMDR	54.1	11.50	93rd	40.2	10.1	52nd	13.90	7.06	25.7
B/SIT	46.4	8.80	76th	43.3	8.5	65th	3.10	6.045	6.7
NT	55.2	10.90	95th	55.0	11.8	94th	0.20	5.84	0.36
STAI-State									
EMDR	57.1	30.60	96th	31.2	11.5	27th	25.90	7.96	45.4
B/SIT	42.6	11.90	66th	38.4	11.6	52nd	4.20	10.22	9.9
NT	52.3	14.40	90th	49.5	15.9	85th	2.80	5.84	5.4
APQ									
EMDR	106.0	30.70		44.0	31.0		62.00	24.77	58.5
B/SIT	95.6	25.90		66.2	33.0		29.40	32.49	30.8
NT	106.4	40.20		98.9	43.9		7.54	21.19	7.1
RBI									
EMDR	21.7	4.60		23.8	2.7		−2.10	2.77	−9.7
B/SIT	24.2	3.90		24.6	4.0		−0.40	3.39	−1.7
NT	19.4	4.70		19.7	4.6		−0.30	3.46	−1.5

Note. Percentile rankings were derived from treatment manual norms for female college students. TAI = Test Anxiety Inventory; EMDR = eye movement desensitization and reprocessing; B/SIT = Biofeedback/Stress Inoculation Training; NT = no treatment; STAI = State-Trait Anxiety Inventory; RBI = Rational Behavior Inventory; APQ = Autonomic Perception Questionnaire.

TABLE 2. Newman–Keuls Analysis of the Comparisons of the Change Score Means

	EMDR > B/SIT	EMDR/B/SIT > NT	EMDR > NT	B/SIT > NT
TAI	Y	Y	Y	Y
TAI-W	Y	Y	Y	Y
TAI-E	Y	Y	Y	Y
STAI-T	N	Y	Y	Y
STAI-S	N	Y	Y	Y
RBI	N	N	N	N
APQ	N	Y	Y	Y

Note. N = no significant difference between means; Y = significant difference between means at $p \leq .05$. EMDR = eye movement desensitization and reprocessing; B/SIT = Biofeedback/Stress Inoculation Training; NT = no treatment; TAI = Test Anxiety Inventory; STAI = State-Trait Anxiety Inventory; RBI = Rational Behavior Inventory; APQ = Autonomic Perception Questionnaire.

STAI-State

The results of the ANOVA demonstrated a significant interaction between the type of group and the pre-post tests, $F(2,27) = 3.94$, $p = .004$. Newman–Keuls tests showed no significant difference between the STAI-S means at pretreatment. Subsequent Newman–Keuls analysis for the STAI-S revealed that both EMDR and B/SIT produced larger changes than NT ($p < .05$). Although there was not a significant difference between the two treatment groups, EMDR participants moved from the 96th percentile to the 27th percentile on the normative scale, with a 45.4% change, and
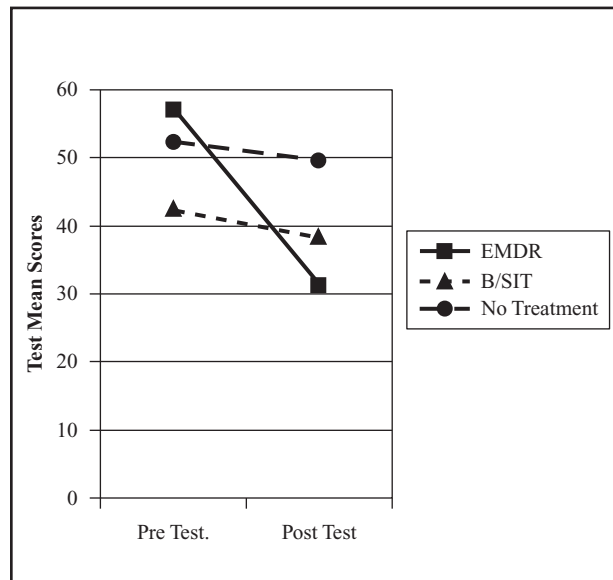
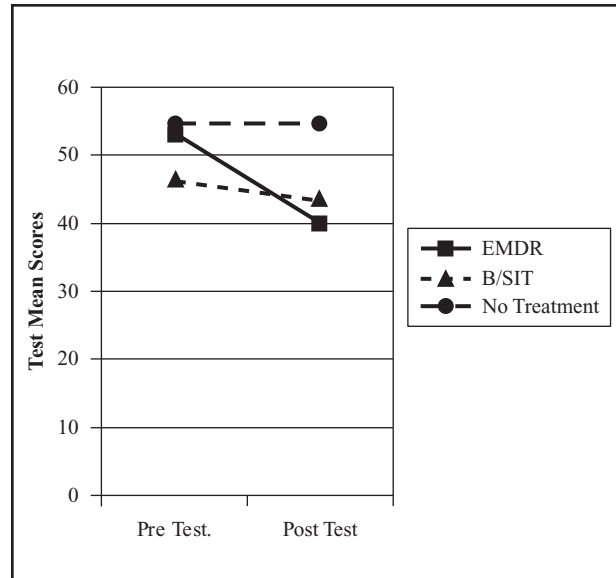**FIGURE 1.** Pre-post scores on the State-Trait Anxiety Inventory (state).

FIGURE 2. Pre-post scores on the State-Trait Anxiety Inventory (trait).

B/SIT participants moved from the 66th percentile to the 52nd percentile, with a 9.9% change (see Tables 1 and 2 and Figure 2).

TAI-Total

The results of the ANOVA demonstrated a significant interaction between the type of group and the pre-post tests, $F(2,27) = 26.30$, $p \leq .001$. Newman–Keuls post hoc tests showed no significant difference between the TAI-Total means at pretreatment, but demonstrated that both EMDR and B/SIT produced significantly larger change than NT ($p < .05$) and that the EMDR mean score was significantly larger than B/SIT ($p < .05$). The EMDR participants moved from the 96th percentile to the 30th percentile on the normative scale, with a 47.3% change, and B/SIT participants moved from the 96th percentile to the 84th percentile, with a 16.4% change (see Tables 1 and 2 and Figure 3).

TAI-Worry

The results of the ANOVA demonstrated a significant interaction between the type of group and the pre-post scores, $F(2,27) = 17.01$, $p < .001$. Newman–Keuls post hoc tests showed no significant difference between the TAI-W means at pretreatment, but demonstrated that both EMDR and B/SIT produced significantly larger change than NT ($p < .05$) and that the EMDR mean score was significantly larger than B/SIT ($p < .05$). The EMDR participants moved from the 98th percentile to the 33rd percentile on the normative scale,
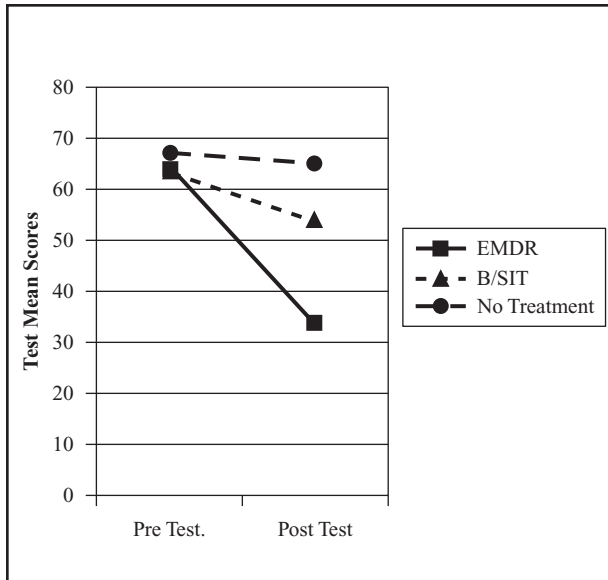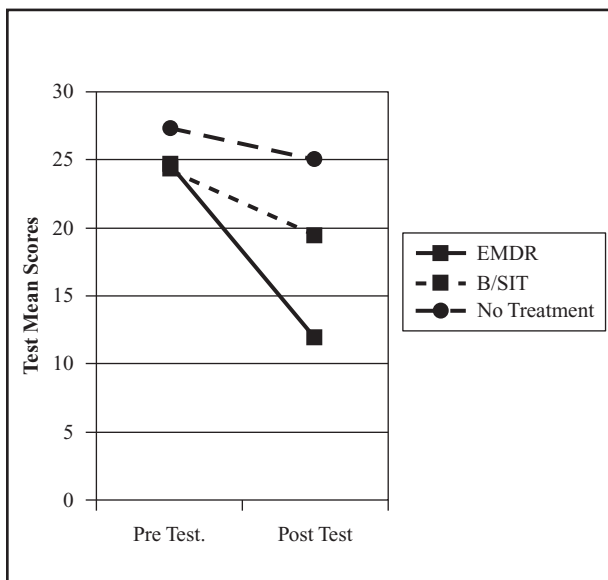
FIGURE 3. Pre-post scores on the Test Anxiety Inventory.

with a 51.4% change, and B/SIT participants moved from the 97th percentile to the 83rd percentile, with a 20.8% change (see Tables 1 and 2 and Figure 4).

TAI-Emotionality

The results of the ANOVA demonstrated a significant interaction between the type of group and the pre-post scores, $F(2,27) = 24.52$, $p < .001$. Newman–Keuls post hoc tests showed no significant difference between the TAI-E means at pretreatment, but demonstrated that both EMDR and B/SIT produced significantly larger change than NT ($p < .05$) and that the EMDR mean score was significantly larger than B/SIT ($p < .05$). The

FIGURE 4. Pre-post scores on the Test Anxiety Inventory (worry).
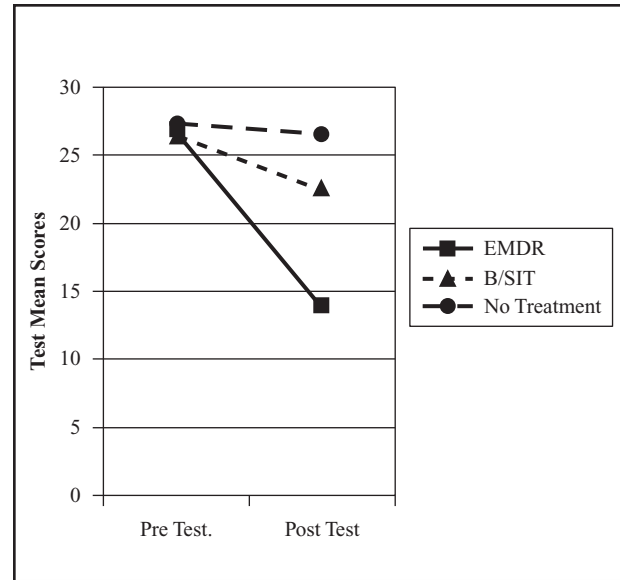
FIGURE 5. Pre-post scores on the Test Anxiety Inventory (emotionality).

EMDR participants moved from the 94th percentile to the 26th percentile on the normative scale, with a 48.0% change, and B/SIT participants moved from the 93rd percentile to the 78th percentile, with a 15.4% change (see Tables 1 and 2 and Figure 5).

Rational Behavioral Inventory

The results of the ANOVA demonstrated no significant effect for the condition and no interaction between the type of group and the pre-post scores, $F(2,27) = 0.89$, $p = 0.423$. Because of this, a Newman–Keuls was not performed (see Tables 1 and 2 and Figure 6).
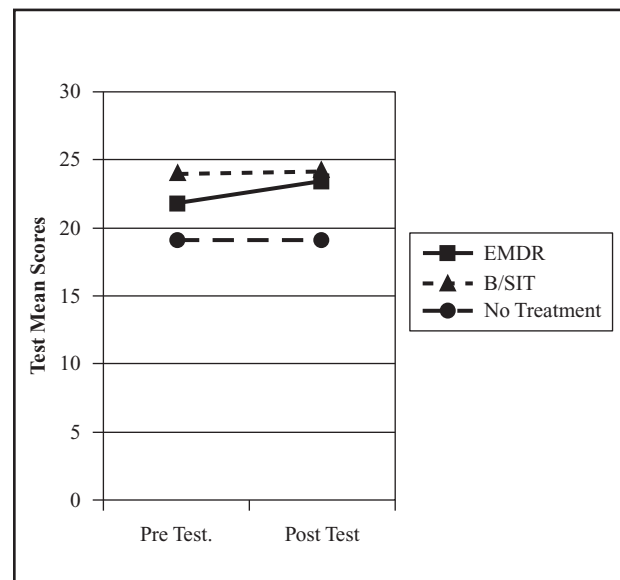

FIGURE 6. Pre-post scores on the Rational Behavioral Inventory.

Autonomic Perception Questionnaire

The results of the ANOVA demonstrated a significant interaction between the type of group and the pre-post scores, $F(2,27) = 10.62$, $p < .001$. Newman–Keuls post hoc tests showed no significant difference between the APQ means at pretreatment. Subsequent Newman–Keuls analysis for the APQ revealed that both EMDR and B/SIT produced larger changes than NT ($p < .05$). Although there was not a significant difference between the two treatment groups, there was a 58.5% change for EMDR and a 30.8% change for B/SIT (see Tables 1 and 2 and Figure 7).

Discussion

Results showed that both EMDR and B/SIT were effective in reducing test anxiety, with both conditions producing significantly smaller symptoms on all tests (except the RBI) than the NT control. The null hypothesis that there would be no difference between EMDR and B/SIT was rejected at < .05 levels for the TAI, TAI-E, and TAI-W, with EMDR resulting in significantly lower symptoms on these two measures. There were no significant differences between EMDR and B/SIT on the APQ, STAI-S, or STAI-T, although EMDR consistently showed lower symptoms on these measures than B/SIT (see Figures 1, 2, and 7). There appear to have been no treatment effects for either condition on the RBI. These results provide preliminary evidence that EMDR may be a more effective treatment for test anxiety than B/SIT treatment.
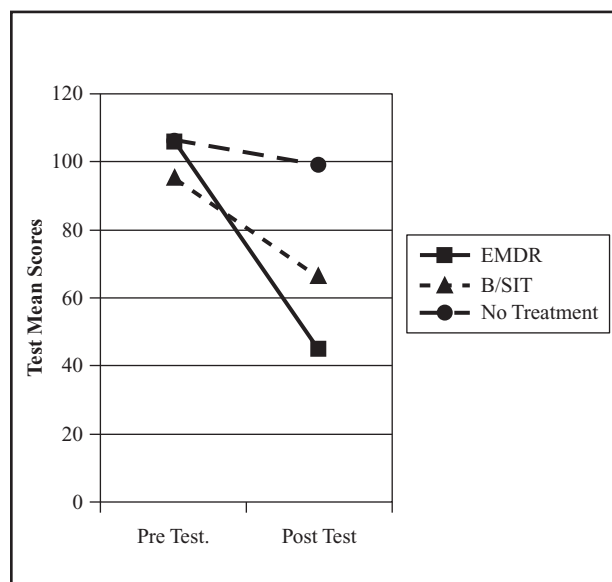

FIGURE 7. Pre-post scores on the Autonomic Perception Questionnaire.

Test Anxiety

The TAI assesses levels of test anxiety. Its worry subscale, the TAI-W, measures anxious thoughts, worries, and the negative self-statement aspects surrounding test anxiety. Its emotionality subscale, the TAI-E, measures the emotionality in test anxiety with some of the questions related specifically to physiological arousal, such as rapid heartbeat, feeling jittery, or tense.

Although both EMDR and B/SIT effectively reduced these symptoms, EMDR produced a significantly greater reduction of test anxiety than B/SIT as shown in the Newman–Keuls post hoc analyses for all three TAI scales (see Figures 3, 4, and 5). There were large differences in the amount of symptom reduction between B/SIT and EMDR. For example, the pre-post reduction on the TAI-W scores was 51.4% for EMDR versus 20.8% for B/SIT (see Table 1). The EMDR treatment group indicated a reduction of all three measures that was more than twice that of the reduction shown by the B/SIT treatment group. These differences are also apparent on the percentile rankings. The clinical effects analysis demonstrated that EMDR dropped from the 98th to the 33rd percentile in the worry scale as compared to B/SIT, which dropped from 97th to 83rd percentile, and NT, which dropped from 99th to 98th percentile. Based on the results of the TAI, EMDR appears to be more effective than B/SIT in treating test anxiety.

State and Trait Anxiety

The STAI measures the amounts of state (temporary conditions of anxiety that arises from a specific situation) and trait (enduring personality characteristic that is viewed as a relatively stable condition of anxiety proneness) anxiety. Because test anxiety is a state anxiety condition, subjects were asked to consider how they felt during the time when they were taking a battery of tests for the study. Both EMDR and B/SIT showed significant reduction in state and trait anxiety as compared to the NT condition. Although there was not a significant difference between the two treatment conditions on either of these scales, there was an apparent advantage for EMDR. For example, the reduction from pre to post STAI-S means was 45.4% for EMDR versus 9.9% for the B/SIT group, and the change in percentile rankings for EMDR was from the 96th to the 27th percentile, compared to a change from the 66th to the 52nd percentile for B/SIT. The lack of statistical significance may be a function of low power, with only 10 participants per group, or a function of the large variability in treatment scores. Further research is needed to explore this aspect.

Rationality of Self-Beliefs

The RBI measures the rationality of self-beliefs. Analysis demonstrated that there was no interaction between pretests and posttests and the kind of treatment group. It appeared that neither treatment impacted the types of symptoms measured on the RBI. This finding may reflect that a decrease of irrational beliefs related to test anxiety was not significantly possible due to the shortness of treatment in both treatment groups. Future research is needed, exploring whether longer treatment with either EMDR or B/SIT would produce more change in the rationality of personal beliefs for patients with test anxiety.

Perceived Physiological Arousal

The APQ measures the amount of perceived physiological arousal. Compared to the NT condition, both EMDR and B/SIT showed a significant reduction in scores measure perceived physiological arousal, as measured on the APQ. There was no significant difference between treatment groups; however, EMDR treatment group demonstrated a greater reduction, with a reduction in mean score of 58.5% for the EMDR group compared to 30.8% for B/SIT and 7.1% for NT.

One of the questions asked in the study was whether EMDR was comparable to an established treatment for test anxiety. Test anxiety has an emotional or physiological arousal component that has been treated successfully with biofeedback (Romano & Cabianca, 1978). A consideration in comparing EMDR treatment with biofeedback was whether it would be as effective in reducing physiological arousal symptoms. The results of the APQ indicate that EMDR is as effective or more so in treating physiological arousal symptoms as biofeedback. The results on both the TAI-E and the APQ appear to support the efficacy of EMDR in treating physiological arousal.

Summary

This study compared EMDR and B/SIT to an NT condition and found that both appeared to be effective treatments for test anxiety. In particular, there appeared to be strong advantage for EMDR because it resulted in significantly lower scores on the TAI scales than B/SIT. There were no differences in scores on the STAI or APQ, although the percentage of change produced by EMDR was consistently larger. Neither treatment had any effect on irrational self-beliefs as measured on the RBI. These findings support the use of EMDR in college counseling centers for the treatment of test anxiety with the expectation that the application of EMDR may assist students in overcoming the debilitating effects of test anxiety.

Recommendations for Future Research

Continued emphasis should be placed on comparative research in the effectiveness between the modalities. Should this study be replicated, changes in the research design should include a larger sample and a pretest, treatment of 1 month prior to final exams, posttest immediately prior to exams, and then followed by another posttest a month following examinations. Research could also be done on a single session of EMDR for treatment of test anxiety compared to biofeedback in evaluating potential cost/time effectiveness of the treatments. Evaluation of the therapeutic effectiveness/cost benefits of longer versus shorter treatment could be researched. Consideration should also be given to longitudinal studies for long-term effectiveness of EMDR versus B/SIT.

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