The Effect of Emotional Freedom Techniques on Stress Biochemistry

A Randomized Controlled Trial

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Abstract: This study examined the changes in cortisol levels and psychological distress symptoms of 83 nonclinical subjects receiving a single hourlong intervention. Subjects were randomly assigned to either an emotional freedom technique (EFT) group, a psychotherapy group receiving a supportive interview (SI), or a no treatment (NT) group. Salivary cortisol assays were performed immediately before and 30 minutes after the intervention. Psychological distress symptoms were assessed using the SA-45. The EFT group showed statistically significant improvements in anxiety (−58.34%, $p < 0.05$), depression (−49.33%, $p < 0.002$), the overall severity of symptoms (−50.5%, $p < 0.001$), and symptom breadth (−41.93%, $p < 0.001$). The EFT group experienced a significant decrease in cortisol level (−24.39%; SE, 2.62) compared with the decrease observed in the SI (−14.25%; SE, 2.61) and NT (−14.44%; SE, 2.67) groups ($p < 0.03$). The decrease in cortisol levels in the EFT group mirrored the observed improvement in psychological distress.

Key Words: Cortisol, stress, depression, anxiety, physiology, EFT (emotional freedom techniques).

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Cortisol is a physiological biomarker for stress. Stress produces elevated cortisol levels for as long as the body can supply the precursors, pregnenolone and progesterone. Elevated cortisol levels are associated with physical conditions such as impaired immune system function, cardiovascular disease, stroke, and accelerated aging, as well as psychological distress (Gold, 2005). If the adrenal cortex, which produces cortisol, is stimulated by the physical or psychological environment to produce stress hormones, these tissues inhibit the synthesis of the body's primary cell regeneration hormone dehydroepiandrosterone, which may lead to disability and premature aging (Haren et al., 2007; Wolkowitz et al., 2010).

Cortisol is a "master hormone" regulating the levels of certain inflammation and immune markers and neurotransmitters. High levels of cortisol correlate with other measures of stress, such as depressed immune system function, inflammation, and increased heart rate variability (HRV; Lester et al., 2010; Lutgendorf et al., 2000; Stalder et al., 2010). HRV is a measure of the arousal of the sympathetic branch of the autonomic nervous system, which is active in the fight-or-flight response. Efferent neural bundles originating in the sympathetic nervous system communicate with the digestive, circulatory, reproductive, respiratory, and musculoskeletal systems; stress thus implicates many of the body's organs. The patterns of HRV dysregulation noted in stressed patients are associated with reports of impaired digestion, sexual function, sleep, and overall health (Dardik, 1996).

Not only is increased stress associated with increased cortisol; the reverse effect has also been noted. As subjects learn to relax, their upregulation of cortisol in response to stress is moderated (Lutgendorf et al., 2000; Newberg, 2008). Married couples modeling positive behaviors showed increased cortisol regulation (Robles et al., 2006).

Emotional freedom techniques (EFTs) have been studied as an intervention for a variety of psychological conditions, including phobias, depression, anxiety, and posttraumatic stress disorder (PTSD). This therapy is based on an earlier method called Thought Field Therapy, or TFT (Callahan, 2002). Whereas TFT uses elaborate diagnostic protocols to determine which acupressure points to stimulate, and in which order, EFT simply uses a defined set of 12, in any order. It is typically found to reduce symptoms significantly in highly compressed time frames. These range from one session for phobias (Baker and Siegel, 2010; Salas et al., 2011; Wells et al., 2003) to four sessions for clinical PTSD (Karatzias et al., 2011). The study by Karatzias et al. (2011) was performed in Britain's National Health Service to compare EFT, a novel therapy, with eye movement desensitization and reprocessing (EMDR), an established therapy. Both were found to be efficacious for clinical PTSD in four sessions. Several other published and unpublished studies of EFT for PTSD have found similar effects in treatment time frames of between 6 and 10 sessions (Church, 2010).

EFT has been compared with various control conditions in other studies. Wells et al. (2003) found that a single session of EFT significantly reduced fear in subjects. The Wells et al. study was replicated by Salas et al. (2011), who used a crossover design from the active control to the experimental (EFT) arm of the study, and vice versa, to demonstrate that the fear-reduction effects were observed in the EFT but not the diaphragmatic breathing arm. The Wells et al. study was extended by Baker and Siegel (2010). Baker and Siegel carefully designed their study to control for nonspecific effects, such as therapist attention, empathetic listening, and client expectancy. They also used supportive interview (SI) as an active comparator and further controlled for experimental artifacts such as regression to the mean, practice effects, and the passage of time. They found that, after controlling for these nonspecific treatment effect variables, the positive effects of EFT remained. The current study builds on these findings by examining the endocrine changes that might accompany the reduction of psychological stress.

As outcome studies of EFT have proliferated, a theoretical framework for its physiological mechanisms of action has emerged. A series of review papers has elucidated the neuronal, genetic, neurotransmitter, and hormonal pathways that may be engaged when EFT alleviates psychological stress (Feinstein, 2010; Feinstein and Church, 2010; Gallo, 2009; Lane, 2009). Studies from the fields of neuroplasticity, epigenetics, and psychoneuroimmunology suggest that, just as emotional trauma may be encoded physiologically by brief traumatic experiences, interventions that reduce stress can rapidly and permanently reverse the process (Oschman, 2006).

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EFT borrows elements from established therapies such as exposure therapy and cognitive therapy but supplements these with the novel addition of somatic stimulation. EFT directs clients to vividly recall a traumatic memory and combines this with a cognitive reframe of self-acceptance. While maintaining exposure to the memory, EFT clients tap with their fingertips on a series of 12 acupressure points associated with stress reduction. EFT has clients assess the intensity of their traumatic experiences on an 11-point Likert-type scale before treatment and again afterward. Progress is client-assessed for each memory, until the emotional intensity is reduced to a comfortable level.

EFT's use of acupressure points to reinforce its cognitive and exposure components is supported by trials showing reductions in fear after acupoint stimulation. In studies of acupuncture that use functional magnetic resonance imaging to measure its effects on the brain, acupuncture is found to directly modulate the stress response, by down-regulating hyperarousal of the amygdala and other structures of the limbic system (Fang et al., 2009; Hui et al., 2000; Napadow et al., 2007). Pressure on acupoints has been found to be as efficacious as acupuncture needling (Cherkin et al., 2009). A study of EFT that used electroencephalography (EEG) demonstrates a down-regulation of those brain frequencies associated with anxiety (Lambrou et al., 2003). Feinstein (2010) summarized the evidence for EFT, hypothesizing "that (a) tapping on selected acupoints (b) during imaginal exposure (c) quickly and permanently reduces maladaptive fear responses to traumatic memories and related cues."

Efficacy studies of psychological interventions typically use questionnaires to assess outcomes. More recently, with advances in the understanding of stress biochemistry and its relationship to psychological change, biochemical markers have been examined as well (Kendall-Tackett, 2009). Salivary cortisol assays are conventionally used in series, 4 hours apart, to determine a subject's diurnal cortisol rhythm. This rhythm provides a spectrum of information about a subject's general level of function, including sleep quality, mood, typical daily energy levels, and the balance of neurotransmitters and hormones.

In contrast, a spot cortisol assay taken before and after intervention provides a snapshot of the immediate stress-reduction effects of therapy. For this reason, salivary cortisol has been advocated as an objective biomarker of the efficacy of psychotherapy (Hellhammer et al., 2008; Kirschbaum and Hellhammer, 1989). One study stated that "These findings suggest that salivary cortisol represents an objective neuroendocrine marker for changes in anxiety and distress observed during relaxation training" (Cruess et al., 2000). The reliability of the relationship between cortisol levels and mental health treatment has led to a number of studies using cortisol biomarkers (Belanoff et al., 2001; Gaab et al., 2003; Kellner et al., 2002; McKinney et al., 1997; Olff et al., 2007; Thase et al., 1996).

Because EFT has previously been shown to produce substantial improvements in psychological symptoms, as well as the regulation of EEG stress markers, the current study tested the hypothesis that it produces similar effects on the endocrine system and that a pre-post salivary cortisol assay could be examined as well as psychological symptom change.

METHODS

Participants

Participants were 83 nonclinical subjects recruited, via online bulletin boards, ostensibly for a free cortisol test at an integrative medical clinic. To maximize the generalizability of the study, inclusion criteria were defined as an age range between 18 and 80 years and as the ability to understand instructions and complete written forms. The demographic characteristics of participants are recorded in Table 1. The T1 study was reviewed for human subject protections by the research committee of the Association for Comprehensive Energy Psychology and was registered at ClinicalTrials.gov (NCT00641394). Participants were randomly assigned to a no treatment (NT) group, an EFT group, or an SI group by generating random number lists (one for each location, based on number of available appointment slots) from the Web site randomizer.org. To control for the effect of circadian rhythms on cortisol levels, three subjects were randomized, one to each treatment group during every 1-hour appointment slot throughout the day. The coordinator was given the lists and assigned subjects to a group when they made their appointment. A review by Behar and Borkovec (2003) concluded that to control for nonspecific effects such as sympathetic attention and expectancy, supportive listening was the best choice for an active control.

TABLE 1. Participant Characteristics, SA-45 and Cortisol Baseline Means and Standard Deviations

	NT (n = 27)		EFT (n = 28)		SI (n = 28)		Total Sample			
Measure	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	$F_{2,80}$	p
Age	51.3	13.07	48.82	12.37	53.79	10.43	51.30	12.02	1.99	0.307
Female, n (%)	22 (81.5%)		23 (82.1%)		21 (75.0%)		66 (79.5%)		0.53[a]	0.766
SA-45 scale										
Anxiety	55.07	7.68	60.00	7.57	60.54	6.52	58.58	7.59	4.69	0.012
Depression	53.52	5.96	57.32	7.87	58.82	8.17	56.59	7.66	3.72	0.028
Hostility	55.78	4.22	57.25	5.97	60.14	6.74	57.75	5.97	4.11	0.020
Interpersonal sensitivity	53.44	5.10	55.82	6.90	58.79	6.87	56.05	6.65	4.88	0.010
Obsessive-compulsive	55.26	7.39	57.64	9.09	60.36	9.41	57.78	8.83	2.37	0.100
Paranoid ideation	53.30	6.64	53.82	7.45	57.46	7.92	54.88	7.51	2.64	0.078
Phobic anxiety	59.89	3.26	60.75	5.37	61.96	5.04	60.88	4.69	1.38	0.259
Psychoticism	60.48	3.68	60.54	4.70	61.32	4.12	60.78	4.16	0.35	0.706
Somatization	56.41	8.44	60.21	8.16	61.11	8.19	59.28	8.41	2.50	0.089
PST	52.81	9.31	56.75	9.10	59.43	7.51	56.37	8.98	4.04	0.021
GSI	52.33	8.14	56.89	8.53	59.79	7.72	56.39	8.60	5.85	0.004
Cortisol	2.78	0.54	2.59	1.14	2.51	0.97	2.63	0.91	0.62	0.541

Post hoc Tukey tests: Anxiety: NT < EFT (p = 0.037) and SI (p = 0.018). Depression: NT < SI (p = 0.026). Hostility: NT < SI (p = 0.017). Interpersonal sensitivity: NT < SI (p = 0.007). PST: NT < SI (p = 0.016). GSI: NT < SI (p = 0.003).

[a] χ^2_2.

xNT indicates no treatment; EFT, Emotional Freedom Techniques; SI, supportive interview; PST, Positive Symptom Total; GSI, General Symptom Index.

A total of 103 subjects applied for the study. Subjects were excluded if they described a history of major depressive disorder, PTSD, or chronic diseases characterized by abnormal cortisol levels, such as Addison's disease or Cushing's syndrome. Subjects were also excluded from analysis if the therapist reported the recall of an emotionally significant trauma during the last 20 minutes of the session. The theoretical basis for this criterion is the likelihood that cortisol will rise during and immediately after such recall. Subjects were also excluded from analysis if their baseline cortisol readings were above 6 ng/ml, or below 0.5 ng/ml, indicating a possibility of abnormal hypothalamic-pituitary-adrenal axis or adrenal function. Fifteen of the 103 applicants were no-shows on the day of assessment. Four subjects were excluded based on recall of a new trauma in the last 20 minutes, and one, based on abnormal cortisol levels. Data analysis was performed on the remaining group ($n = 83$). After laboratory results were obtained, copies were mailed to subjects, and in the case of the subject with abnormal cortisol levels, a recommendation was made for a full assessment from a physician.

Measures

Pre-post outcome measures were psychological distress symptoms and cortisol levels. Psychological distress symptoms were assessed using the SA-45, a validated instrument with 45 items scored on a scale from 1 to 5 (Davison et al., 1997; Maruish, 1999). It contains nine subscales for mental health conditions such as anxiety and depression and two general scales that measure the breadth, Positive Symptom Total (PST), and depth, General Symptom Index (GSI), of psychological symptoms. T-scores based on sex-normed data for nonclinical populations are calculated. Scores greater than 60 are considered in the clinical range. Cortisol levels were assessed with commercially available salivary assays according to the manufacturer's instructions (Sabre Sciences, Carlsbad, CA). Saliva rather than serum cortisol was selected because of its ease of administration and its identification of bioavailable as opposed to total cortisol. Demographic information was gathered using a health survey form.

Treatments

When subjects made appointments, they were randomly assigned to one of the three groups. The SI group received a 50-minute session from either a licensed clinical psychologist or a marriage and family therapist. The SI procedure was based on the principles of cognitive behavior therapy and focused on providing sympathetic attention and challenging negative client cognitions. It focused on establishing rapport, listening to the client's presenting issues, expressing empathy, and challenging negative cognitions. The EFT group received a 50-minute session from a nonlicensed life coach certified in EFT, identifying traumatic memories and performing the EFT tapping routine on the participants. The NT group sat in the waiting room of the clinic and read magazines or chatted with each other until their second test.

Procedures

The settings were five integrative therapy centers in California. Upon arrival at the clinic, subjects signed an informed consent form, completed an initial SA-45, filled out the health questionnaire, and provided a saliva sample. Thirty minutes after therapy concluded, or 90 minutes later in the case of the NT group, a second SA-45 was completed and a second saliva sample was provided. In a series of tests conducted before the commencement of this study, to determine a reliable hormone collection protocol, the 30-minute interval between the end of the therapy session and cortisol collection was found to be sufficient to allow reuptake of the hormone.

Health questionnaires and preintervention and postintervention saliva samples were placed in sealed containers by clinic personnel and shipped to the laboratory for analysis. Vials were coded by number to ensure blind analysis. SA-45 results were sent to a biostatistician who remained blind to group assignment. Therapists were blinded to the experimental hypotheses by recruiting them to assist in a study of the effects of therapy on cortisol levels. AQ2

The EFT Manual was available as a free online download starting at the inception of the method in the mid-1990s and subsequently in print, which led to uniform application of the protocol (Craig, 2008/2011). Fidelity was monitored by reviewing the session notes made by the life coach subsequent to each session.

RESULTS

Baseline Group Characteristics

One-way analyses of variance were conducted on age, the SA-45 scales, and cortisol level at baseline to determine if any baseline group differences were present. Post hoc Tukey's tests were conducted on significant models. Chi-square analyses were conducted on sex.

Age, sex, baseline SA-45, and cortisol levels are presented in Table 1. There were no statistically significant differences in age or sex between the treatment groups. Statistically significant differences between the three treatment groups at baseline were found for several of the SA-45 scales. Both global scales were significant, as were the anxiety, depression, hostility, and interpersonal sensitivity scales. Trends were also observed for the obsessive-compulsive, paranoid ideation, and somatization scales. Post hoc Tukey's tests were conducted for the significant models. There was no significant baseline difference in cortisol between the groups. The NT group had significantly lower scores, indicating less distress at baseline, than did the SI group for all of the statistically significant models. The NT group also had significantly lower anxiety at baseline than the EFT group did.

Change Over Time

Analytic Approach

To control for baseline difference between the three treatment groups, analyses of covariance (ANCOVAs) were conducted. Separate models predicting the posttest score were conducted for the SA-45 global indices (GSI and PST) and individual symptom scales, controlling for baseline scores with treatment group as the independent variable. An ANCOVA controlling for baseline score was also performed on the cortisol percentage change score (created by subtracting the baseline from the 90-minute reading multiplying by 100 to obtain the percentage change). Bonferroni corrected post hoc pairwise comparisons were conducted on all significant models.

TABLE 2. ANCOVA[a] Results for Percentage Change in Cortisol (Controlling for Baseline Cortisol Level) AQ3

	NT ($n = 27$)		EFT ($n = 28$)		SI ($n = 28$)			
	Mean	SE	Mean	SE	Mean	SE	$F_{2,79}$	p
Percentage change in cortisol	−14.44	2.67	−24.39	2.61	−14.25	2.61	4.92	0.01

Pairwise comparison: EFT > NT ($p = 0.028$) and SI ($p = 0.022$).
[a]Controlling for baseline score.
ANCOVA indicates analysis of covariance; NT, no treatment; EFT, Emotional Freedom Techniques; SI, supportive interview.

TABLE 3. ANCOVA[a] Results for SA-45 Global and Individual Symptom Scales Posttest Scores

	NT (n = 27)		EFT (n = 28)		SI (n = 28)			
SA-45 scale	**Mean**	**SE**	**Mean**	**SE**	**Mean**	**SE**	$F_{2,79}$	p
Anxiety	54.44	0.94	49.25	0.90	55.94	0.90	15.39	<0.001
Depression	54.67	0.75	51.05	0.72	54.59	0.73	8.17	0.001
Hostility	55.97	0.55	54.26	0.53	56.20	0.54	4.01	0.022
Interpersonal sensitivity	54.17	0.62	50.93	0.59	53.88	0.61	9.01	<0.001
Obsessive-compulsive	55.58	0.99	51.32	0.96	55.77	0.98	6.81	0.002
Paranoid ideation	52.76	0.77	48.51	0.76	53.01	0.77	11.10	<0.001
Phobic anxiety	60.45	0.49	59.84	0.48	60.58	0.48	0.68	0.511
Psychoticism	60.51	0.36	58.97	0.35	59.78	0.35	4.79	0.011
Somatization	57.36	0.93	53.22	0.90	54.26	0.90	5.37	0.006
PST	53.71	0.89	47.19	0.85	53.21	0.87	18.02	<0.001
GSI	53.48	0.93	46.62	0.88	52.56	0.90	17.84	<0.001

Pairwise comparisons: Anxiety: EFT < NT (p = 0.001) and SI (p < 0.001). Depression: EFT < NT and SI (p = 0.003). Hostility: EFT < SI (p = 0.038). Interpersonal sensitivity: EFT < NT (p = 0.001) and SI (p = 0.003). Obsessive-compulsive: EFT < NT (p = 0.008) and SI (p = 0.005). Paranoid ideation: EFT < NT (p = 0.001) and SI (p < 0.001). Psychoticism: EFT < NT (p = 0.008). Somatization: EFT < NT (p = 0.006). PST: EFT < NT and SI (p < 0.001). GSI: EFT < NT and SI (p < 0.001).

[a]Controlling for baseline score.

ANCOVA indicates analysis of covariance; NT, no treatment; EFT, Emotional Freedom Techniques; SI, supportive interview; PST, Positive Symptom Total; GSI, General Symptom Index.

Cortisol Level Results

There was a statistically significant difference between treatment groups on change in cortisol level. In the post hoc comparisons, the EFT group showed a greater percentage decrease in cortisol level (24%) than the other two groups did (14% in both). There was no difference between the SI and NT groups (Table 2).

SA-45 Results

Results for psychological distress symptoms are presented in Table 3. Statistically significant models were found for the SA-45 global scales and all but one of the individual symptom scales (phobic anxiety scale). In the pairwise comparisons for the significant models, the EFT group had significantly lower scores at posttest than did either of the other groups for all of the scales, with the exception of hostility, psychoticism, and somatization. In the comparisons for psychoticism and somatization, EFT had significantly lower scores than NT only. For hostility, EFT had significantly lower scores than SI only. None of the comparisons between the SI and NT groups were significant.

Percentage Change in SA-45 Scores

Analytic Approach

An ANCOVA controlling for baseline score was also performed on the SA-45 percentage change score. The SA-45 percentage change score was created by first calculating a difference score by subtracting the optimal (lowest possible) T-score based on sex-based norms for normal adults from the observed T-score from at baseline and posttest. The percentage change score was calculated by then subtracting the baseline difference score from the posttest difference score and dividing by the baseline difference score. The change score was multiplied by 100 to

TABLE 4. ANCOVA[a] Results for SA-45 Global and Individual Symptom Scales Percentage Change Scores

	NT (n = 27)		EFT (n = 28)		SI (n = 28)			
SA-45 scale	**Mean**	**SE**	**Mean**	**SE**	**Mean**	**SE**	$F_{2,79}$	p
Anxiety	−28.86	8.32	−58.34	7.92	−19.89	7.96	6.50	0.002
Depression	−11.88	6.60	−49.33	6.31	−17.02	6.40	10.18	<0.001
Hostility	−14.64	6.49	−37.76	6.26	−21.71	6.44	3.54	0.034
Interpersonal sensitivity	−15.13	8.22	−53.26	7.86	−27.77	8.11	5.99	0.004
Obsessive-compulsive	−18.69	7.54	−40.31	7.30	−14.45	7.41	3.59	0.032
Paranoid ideation	−16.90	7.95	−55.76	7.77	−17.89	7.91	8.06	0.001
Phobic anxiety	−13.52	6.47	−15.47	6.31	−8.65	6.37	0.30	0.739
Psychoticism	−3.64	5.22	−18.26	5.12	−20.49	5.13	3.11	0.050
Somatization	−11.32	6.12	−33.73	5.90	−34.02	5.94	4.50	0.014
PST	−12.51	4.30	−41.93	4.11	−16.88	4.20	14.70	<0.001
GSI	−14.46	5.12	−50.50	4.83	−23.23	4.98	14.74	<0.001

Pairwise comparisons: Anxiety: EFT > NT (p = 0.04) and SI (p = 0.003). Depression: EFT > NT (p < 0.001) and SI (p = 0.002). Hostility: EFT > NT (p = 0.036). Interpersonal sensitivity: EFT > NT (p = 0.004). Obsessive-compulsive: EFT > NT and SI (p = 0.045). Paranoid ideation: EFT > NT (p = 0.002) and SI (p = 0.003). Somatization: EFT > NT (p = 0.032). PST: EFT > NT and SI (p < 0.001). GSI: EFT > NT (p < 0.001) and SI (p = 0.001).

[a]Controlling for baseline score.

ANCOVA indicates analysis of covariance; NT, no treatment; EFT, Emotional Freedom Techniques; SI, supportive interview; PST, Positive Symptom Total; GSI, General Symptom Index.

obtain a percentage change score. Bonferroni corrected post hoc pairwise comparisons were conducted on all significant models. The correlation between change in SA-45 global scales and change in cortisol was also examined for the sample as a whole to identify a possible relationship between this biomarker and psychological distress.

Results

The overall models for the SA-45 global scales and all but one of the individual symptom scales (phobic anxiety scale) were statistically significant. In the pairwise comparisons for the significant models, the EFT group showed greater percentage improvement (decrease in distress from baseline) than the NT and SI groups did for both global scales. For the PST scale, a 42% average decrease in distress was observed for EFT, *vs.* 13% for NT and 17% for SI. Similarly, EFT showed an average of 51% decrease in symptoms on the GSI, whereas NT had an average decrease of 14% and SI had a 17% decrease. A similar pattern of results was observed for anxiety, depression, and paranoid ideation. The EFT group showed a greater percentage improvement than the NT group did on the hostility, interpersonal sensitivity, and somatization scales. In the obsessive-compulsive model, the EFT group showed a greater improvement than the SI group only. The post hoc test results for psychoticism were nonsignificant. These results are presented in Table 4. Changes in the SA-45 global scales were significantly correlated with change in cortisol level (PST: $r = 0.274$; $p = 0.012$; GSI : $r = 0.304$; $p = 0.005$), indicating that greater decreases in cortisol level were associated with greater improvement in psychological distress.

DISCUSSION

Biological assessments are rarely used in psychotherapy. However, the experiences that drive clients to seek psychotherapeutic treatment may produce corresponding dysregulation of the autonomic nervous system. A shift from parasympathetic to sympathetic dominance is associated with sleep problems, decreased sexual function, digestive difficulties, and other issues for which patients may seek counseling. Psychotherapists are often unaware of the physiological sequelae of successful mental health treatment; only recently has a detailed understanding of the link been articulated (van der Kolk, 2006).

Feinstein and Church (2010) reviewed the literature demonstrating gene expression changes in response to reductions in stress. They summarized the evidence showing that successful psychotherapy can function as an epigenetic signal, down-regulating stress-related gene expression. They further noted that treatments that include a somatic component such as the acupressure stimulation used in EFT may be more effective at shifting gene expression than those that rely on cognitive processes alone. When hormone levels change, such as a reduction in cortisol, the underlying levels of molecular biology are, of necessity, changing also. Such an effect was demonstrated by Nater et al. (2009), for example, who reported on cortisol effects evident on peripheral blood gene expression patterns of healthy men, including regulation of genes with glucocorticoid receptor promoter sequences.

Cortisol may therefore be a link in a chain of events that begins with an emotionally triggering memory and, through cellular signal transduction pathways, lead to long-term physiological effects. A veteran experiencing a flashback of a combat experience, for instance, stimulates the fight-or-flight response. The traumatic memory signals the body's threat-response mechanism to engage and that nonessential systems such as reproduction, digestion, cell regeneration, and the immune system are down-regulated, as the body shifts its biological resources to meet the imagined threat.

Although such responses were adaptive in an archaic environment in which real and objective predators abounded, they are maladaptive in an environment in which the main source of stress is a worried mind preoccupied with emotionally triggering memories. The body's conditioned fight-flight response, vital to the survival of our distant ancestors who might have shared an ecosystem with lions and tigers, is dysfunctional in an environment in which threats to our health can arise from the paper tigers in our minds. Although entirely subjective, traumatic memories and intrusive thoughts can in fact be perceived by the body as epigenetic signals, up-regulating stress-related genes as though they were an objective threat.

Successful psychotherapy can affect this trajectory. EFT draws on the work of pioneers such as Joseph Wolpe (1973), who developed the self-report scale now used in the EFT protocol as he sought reliable interventions to countercondition the stress response in the 1950s. Several new psychotherapy methods are demonstrating promise, spurred especially by the needs of veterans returning from the wars in Iraq and Afghanistan. Research on the reconsolidation of memories suggests that traumatic experiences may be counterconditioned when they are remembered while paired with concurrent nonstressful cues (LeDoux and Gorman, 2001). Whereas EFT uses acupoint tapping as the self-soothing cue, others use diaphragmatic breathing, eye movements, bilateral stimulation and other somatic elements as confounding inputs to assure the body that the paper tigers in our minds are not real tigers requiring activation of the physiological machinery of stress.

Salivary cortisol assays are a quick and inexpensive method of determining the effectiveness of such treatments on the biological level. They can be used to customize treatment regimens. For instance, salivary cortisol testing might show that one client has a better hormonal reaction to a combination of prolonged exposure therapy and EFT. Another might respond better to EMDR, cognitive therapy, and mindfulness. Salivary assays can be used to quickly determine the body's response to a multimodal intervention and build an individualized treatment plan. They have an objective quality lacking in self-reports and clinician assessments. Given their low cost (about $100) and ease of administration, they can be a valuable addition to a clinician's toolkit.

The limitations of this study include the small sample size, single-session design, and nonclinical sample. Future research should focus on replicating the findings from the current study in clinical samples and throughout the course of short- or long-term therapy. Although the systematic bias that may occur due to variation cortisol levels throughout the day was controlled for by the randomization procedures used in this study, the preintervention and postintervention spot cortisol assay approach needs to be further validated to develop a testing protocol that can be easily applied in a therapeutic setting outside the clinic.

CONCLUSIONS

Significant improvements were observed in subjects who received EFT counseling compared with those who received NT or an SI. Their psychological distress symptoms decreased, as did their cortisol levels. These results are consistent with the published literature on EFT's efficacy and underscore its impact on both psychological and physiological stress. Cortisol testing is an inexpensive method of validating different methods of psychotherapy and can play a part in customizing a treatment plan for a particular client. Further research is required to determine whether EFT affects other physiological systems such as HRV and the expression of the genes involved in the stress response.

DISCLOSURES

The authors declare no conflict of interest.

REFERENCES

Baker AH, Siegel L (2010) Emotional freedom techniques (EFT) reduces intense fears: A partial replication and extension of Wells, Polglase, Andrews, Carrington, & Baker (2003). *Energy Psychol Theory Res Treat*. 2:13–29.

Behar ES, Borkovec TD (2003) Psychotherapy outcome research. InSchinka JA, Velicer WF, Weiner IB (Eds), *Handbook of psychology* (Vol. 2, pp 213–240). Hoboken, NJ: John Wiley & Sons Inc.

Belanoff JK, Kalehzan M, Sund B, Ficek SK, Schatzberg AF (2001) Cortisol activity and cognitive changes in psychotic major depression. *Am J Psychiatry.* 158:1612–1616.

Callahan R, Trubo R (2002) *Tapping the healer within: Using Thought Field Therapy to instantly conquer your fears, anxieties, and emotional distress*. New York: McGraw Hill.

Cherkin DC, Sherman KJ, Avins AL, Erro JH, Ichikawa L, Barlow WE, Delaney K, Hawkes R, Hamilton L, Pressman A, Khalsa PS, Deyo RA (2009) A randomized trial comparing acupuncture, simulated acupuncture, and usual care for chronic low back pain. *Arch Intern Med*. 169:858–866.

Church D (2010) The treatment of combat trauma in veterans using EFT (emotional freedom techniques): A pilot protocol. *Traumatology.* 16:55–65.

Craig G (2008/2011). *The EFT manual*. Santa Rosa, CA: Energy Psychology Press.

Cruess DG, Antoni MH, Kumar M, Schneiderman N (2000) Reductions in salivary cortisol are associated with mood improvement during relaxation training among HIV-seropositive men. *J Behav Med*. 23:107–122.

Dardik I (1996) The origin of disease and health, heart waves: The single solution to heart rate variability and ischemic preconditioning. *Cycles*. 46:67–77.

Davison ML, Bershadsky B, Bieber B, Silversmith D, Maruish ME, Kane RL (1997) Development of a brief, multidimensional, self-report instrument for treatment outcomes assessment in psychiatric settings: Preliminary findings. *Assessment* 4:259–275.

Fang J, Jin Z, Wang Y, Li K, Kong J, Nixon EE, Zeng Y, Ren Y, Tong H, Wang Y, Wang P, Hui KK (2009) The salient characteristics of the central effects of acupuncture needling: Limbic-paralimbic-neocortical network modulation. *Hum Brain Mapp*. 30:1196–1206.

AQ4 Feinstein D (2008) Energy psychology in disaster relief. *Traumatology.* 14:124–137.

Feinstein D (2010) Rapid treatment of PTSD: Why psychological exposure with acupoint tapping may be effective. *Psychother Theory Res Pract Train*. 47: 385–402.

Feinstein D, Church D (2010) Modulating gene expression through psychotherapy: The contribution of non-invasive somatic interventions. *Rev Gen Psychol*. 14:283–295.

Gaab J, Blättler N, Menzi T, Pabst B, Stoyer S, Ehlert U (2003) Randomized controlled evaluation of the effects of cognitive-behavioral stress management on cortisol responses to acute stress in healthy subjects. *Psychoneuroendocrinology.* 28:767–779.

Gallo F (2009) Energy psychology in rehabilitation: Origins, applications, and theory. *Energy Psychol Theory Res Treat*. 1:57–72.

Gold PW (2005) The neurobiology of stress and its relevance to psychotherapy. *Clin Neurosci Res*. 4:315–324.

Haren MT, Malmstrom TK, Banks WA, Patrick P, Miller DK, Morley JE (2007) Lower serum DHEAS levels are associated with a higher degree of physical disability and depressive symptoms in middle-aged to older African American women. *Maturitas*. 57:347–360.

Hellhammer DH, Wüsta S, Kudielka BM (2008) Salivary cortisol as a biomarker in stress research. *Psychoneuroimmunology.* 34:163–171.

Hui KKS, Liu J, Makris N, Gollub RW, Chen AJW, Moore CI, Kennedy DN, Rosen BR, Kwong KK (2000) Acupuncture modulates the limbic system and subcortical gray structures of the human brain: Evidence from fMRI studies in normal subjects. *Hum Brain Mapp*. 9:13–25.

Karatzias T, Power K, Brown K, McGoldrick T, Begum M, Young J, Loughran P, Chouliara Z, Adams S (2011) A controlled comparison of the effectiveness and efficiency of two psychological therapies for post-traumatic stress disorder: EMDR vs. EFT. *J Nerv Ment Dis*. 199:372–378.

Kellner M, Yehuda R, Arlt J, Wiedemann K (2002) Longitudinal course of salivary cortisol in post-traumatic stress disorder. *Acta Psychiatr Scand*. 105:153–156.

Kendall-Tackett K (2009) Psychological trauma and physical health: A psychoneuroimmunology approach to etiology of negative health effects and possible interventions. *Psychol Trauma Theory Res Pract Policy.* 1:35–48.

Kirschbaum C, Hellhammer DH (1989) Salivary cortisol in psychobiological research: An overview. *Neuropsychobiology.* 22:150–169.

Lane J (2009) Using acupressure as a method of desensitization during psychotherapy: The biochemistry of counterconditioning. *Energy Psychol Theory Res Treat*. 1:31–44.

Lambrou PT, Pratt GJ, Chevalier G (2003) Physiological and psychological effects of a mind/body therapy on claustrophobia. *Subtle Energies Energy Med*. 14:239–251.

LeDoux JE, Gorman JM (2001) A call to action: Overcoming anxiety through active coping. *Am J Psychiatry.* 158:1953–1955.

Lester SR, Brown JR, Aycock JE, Grubbs SL, Johnson RB (2010) Use of saliva for assessment of stress and its effect on the immune system prior to gross anatomy practical examinations. *Anat Sci Educ*. 3:160–167.

Lutgendorf S, Logan H, Kirchner HL, Rothrock N, Svengalis S, Iverson K, Lubaroff D (2000) Effects of relaxation and stress on the capsaicin-induced local inflammatory response. *Psychosom Med*. 62:524–534.

Maruish ME (1999) Symptom Assessment-45 Questionnaire (SA–45). In Maruish ME (Ed), *The use of psychological testing, treatment planning and outcomes assessment* (2nd ed.). Mahwah, NJ: Erlbaum. **AQ5**

McKinney CH, Antoni MH, Kumar M, Tims FC, McCabe PM (1997) Effects of guided imagery and music (GIM) therapy on mood and cortisol in healthy adults. *Health Psychol*. 16:390–400.

Napadow V, Kettner N, Liu J, Li M, Kwong KK, Vangel M, Makris N, Audette J, Hui KK (2007) Hypothalamus and amygdala response to acupuncture stimuli in carpal tunnel syndrome. *Pain*. 130:254–266.

Nater UM, Whistler T, Lonergan W, Mletzko T, Vernon SD, Heim C (2009) Impact of acute psychosocial stress on peripheral blood gene expression pathways in healthy men. *Biol Psychol*. 82:1250–132.

Newberg A (2008) *Spirituality, the brain, and health*. In *Compilation* (p 356). Boulder, CO: Sounds True Inc. **AQ6**

Olff M, de Vries GJ, Güzelcan Y, Assies J, Gersons BP (2007) Changes in cortisol and DHEA plasma levels after psychotherapy for PTSD. *Psychoneuroendocrinology.* 32:619–626.

Oschman J (2006) Trauma energetics. *J Bodyw Mov Ther.* 10:21.

Robles TF, Shaffer VA, Malarkey WB, Kiecolt-Glaser JK (2006) Positive behaviors during marital conflict: Influences on stress hormones. *J Soc Pers Relat*. 23:305–325.

Salas MM, Brooks AJ, Rowe JE (2011) The immediate effect of a brief energy psychology intervention (emotional freedom techniques) on specific phobias: A pilot study. *Explore*. 7:155–161.

Stalder T, Evans P, Hucklebridge F, Clow A (2010) Associations between the cortisol awakening response and heart rate variability. *Psychoneuroendocrinology.* 36:454–462.

Thase ME, Dube S, Bowler K, Howland RH, Myers JE, Friedman E, Jarrett DB (1996) Hypothalamic-pituitary-adrenocortical activity and response to cognitive behavior therapy in unmedicated, hospitalized depressed patients. *Am J Psychiatry.* 153:886–891.

van der Kolk B (2006) The trauma spectrum: The interaction of biological and social events in the genesis of the trauma response. *J Trauma Stress*. 1:273–290.

Wells S, Polglase K, Andrews HB, Carrington P, Baker AH (2003) Evaluation of a meridian-based intervention, emotional freedom techniques (EFT), for reducing specific phobias of small animals. *J Clin Psychol*. 59:943–966.

Wolkowitz OM, Epel ES, Reus VI, Mellon SH (2010) Depression gets old fast: Do stress and depression accelerate cell aging? *Depress Anxiety.* 27:327–338.

Wolpe J (1973) *The Practice of Therapy* (2nd ed.) New York: Pergamon Press.