SEQUENCE EFFECTS OF RELAXATION TRAINING, EMG, AND TEMPERATURE BIOFEEDBACK ON ANXIETY, SYMPTOM REPORT, AND SELF-CONCEPT[1]

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Assessed the effects of particular treatment combinations of relaxation training, temperature, and EMG biofeedback on state-trait anxiety, symptom report, and self-concept. The four groups received one of the following sequences: (a) relaxation training, temperature, and EMG biofeedback; (b) temperature, EMG biofeedback, and relaxation; (c) temperature followed by EMG biofeedback; (d) EMG biofeedback followed by temperature. A sample of 37 volunteers participated in 16 20-minute training sessions over an 11-week period, which totaled 800 appointments. Training was found equally effective for decreasing frontalis EMG and increasing finger skin temperature, regardless of sequence. Most substantial improvement occurred after 8 sessions, whereas little improvement was found after 16 sessions. Each group became increasingly homogeneous over time on all measures.

Clinical treatment programs often introduce patients to a combination of biofeedback modalities and relaxation training as a comprehensive program in stress management. Several studies have examined the relative effectiveness of these techniques by comparing various strategies in the treatment of specific psychophysiological disorders (Beiman, Israel, & Johnson, 1978; Blanchard, Theobald, Williamson, Silver, & Brown, 1978; Canter, Kondo, & Knott, 1975; Miller, 1978; Reinking & Kohl, 1975). Frequently, results have supported the superiority of one treatment or a combination of treatments as the choice application for various clinical objectives. Most of the controversy and debate have been particularly difficult in light of inadequacies in research design, treatment method, and length of treatment (Blanchard, Miller, Abel, Haynes, & Wicker, 1979; Seer, 1979; Silver & Blanchard, 1978).

Another important consideration concerns the issue of sequence. Specifically, are there particular applications of biofeedback modalities and relaxation techniques that optimize therapeutic benefits? The present study was designed to test both the order and type of treatment method with temperature, EMG biofeedback, and relaxation training on state-trait anxiety, symptom report, and self-concept.

METHOD

Subjects

A sample of 37 volunteers from the local community (8 males and 29 females) employed with the university and various social service agencies, i.e., Rape Crisis Center (STAR), Battered Women's Shelter (AWAIC), Court Service, and Continuing Education for Adults (CETA), participated in this study. The mean age was 32 years with a range of 18 to 66. *S*s received 11 weeks of biofeedback or relaxation training, which included 16 20-minute training sessions and 3 baseline assessment sessions per *S*. Eight hundred individual appointments were necessary to complete this study.

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Procedure

The research program provided biofeedback and/or relaxation training to all participants with a particular focus on the order or sequence of treatments. There were three baseline assessment periods over 11 weeks (weeks 1, 6, and 11). Each baseline session involved 20 minutes of individual testing while the *S* was seated in a padded reclining chair with no feedback. Room temperature was recorded prior to each base measurement session to ensure that it remained fairly constant at 74° ± 1°. *S*s were requested to sit quietly while frontalis EMG and finger skin temperature were recorded every minute. *S*s then were asked to fill out three counterbalanced inventories. Training was split into two blocks of 4-week periods. This allowed 8 sessions per block because *S*s trained twice a week. Each training session involved 5 minutes of hook-up and discussion followed by 20 minutes of individual training. *S*s were left alone in a counseling room with the door slightly ajar during training. Two rooms were available, and, consequently, two *S*s could train simultaneously. The same *E* met with all *S*s in all groups to control possible *E* effects. An independent *E* who had no contact with *S*s during training collected all three baseline assessments.

*S*s were assigned randomly to one of four treatment sequences as shown in Table 1. The groups experienced one of the following sequences: Group 1 received relaxation training, temperature, and EMG biofeedback (RTE); Group 2 received temperature, EMG biofeedback, and relaxation (TER); Group 3 received temperature training followed by EMG (TE); Group 4 received EMG biofeedback followed by temperature (ET).

Instruments

The instruments used in this research were: 2 Cyborg P642 Feedback Thermometers, 2 Cyborg P303 Clinical EMGs, 1 Cyborg Q700 Data Accumulator, 2 cassette tape recorders, and 2 sets of relaxation tapes. The progressive and autogenic relaxation exercises were based on Jacobson's (1938) and Shultz' and Luthe's techniques (1969).

Anxiety was measured by the State-Trait Anxiety Inventory developed by Spielberger, Gorsuch, and Lushene (1970). The inventory provides two scores; it assesses general attitudes as Trait Anxiety and situational circumstances as State Anxiety.

Symptom self-report was assessed via a Symptom Check List developed by Spinelli (1973). Each *S* recorded the present frequency of specific anxiety symptoms, i.e., nausea, perspiration, etc.

Self-concept was assessed with the Personal Attribute Inventory (Parish & Eads, 1977) as a checklist with the target stimulus labeled "yourself." Scoring was the number of negative adjectives selected. Maximum possible score was 30.

TABLE 1

Summary of Treatment Sequences

Training periods		Treatment sequence			
Week	No. of sessions	Group 1 (N = 8)	Group 2 (N = 10)	Group 3 (N = 10)	Group 4 (N = 9)
1	1	Base 1	Base 1	Base 1	Base 1
2-3	4	Progressive	Temp	Temp	EMG
4-5	4	Autogenic	EMG	Temp	EMG
6	1	Base 2	Base 2	Base 2	Base 2
7-8	4	Temp	Progressive	EMG	Temp
9-10	4	EMG	Autogenic	EMG	Temp
11	1	Base 3	Base 3	Base 3	Base 3

Note.—Group 1 & 2 Reverse Treatments. Group 3 & 4 Reverse Treatments.

Previous research with other personality scales (Kappes & Parish, 1979) had indicated that personality characteristics such as apprehension, undisciplined self-conflict, and tension were particularly associated with a low self-concept. For a further discussion see Kappes, 1980. The order of administration was counterbalanced and required 30 minutes to complete.

Each *S* provided six dependent measures: Two physiological measures (frontalis EMG and finger skin temperature) and four self-report measures (a State and Trait Anxiety Inventory, a Symptom Check List, and the Personal Attribute Inventory as a measure of self-concept).

Results

An analysis of variance with the three baselines as a repeated measure examined the effects of sequence on the six dependent variables. The results demonstrate a time main effect on all six measures: (EMG $F(2,66) = 16.06, p < .001$, Temperature $F(2,66) = 6.97$, $p < .01$; State Anxiety $F(2,66) = 6.21, p < .001$; Trait Anxiety $F(2,66) = 20.58, p < .001$; Symptom Checklist $F(2,66) = 25.01, p < .001$; and Self-concept $F(2,66) = 5.01, p < .01$). All groups, regardless of sequence, produced significant improvement over time. The most significant improvements on physiological measures occurred during the first 8 sessions with little or no substantial change after 16 sessions. There were no significant group (treatment sequence) differences on both physiological measures, EMG $F(3,33) = .25$, $p > .05$, and skin temperature with effect of room temperature removed, $F(3,30) = 2.15$, $p > .05$. Results revealed a lack of relationship between frontalis EMG and hand temperatures.

All subjective reports except for symptoms revealed significant overall group main effects: State Anxiety $F(3,33) = 3.22, p < .05$; Trait Anxiety $F(3,33) = 3.24, p < .05$; Self-concept $F(3,33) = 3.60, p < .05$. In each case the RTE and ET groups were significantly lower than the TER or TE groups. However, this was only true on overall means. There was no significant group-by-time interaction. Thus, both physiological and subjective results showed significant improvement over time, yet neither was particularly influenced by sequence. A final analysis on perceived value of training indicated that all *S*s who received relaxation training found their training to be of significantly greater value than those who received biofeedback only, regardless of order.

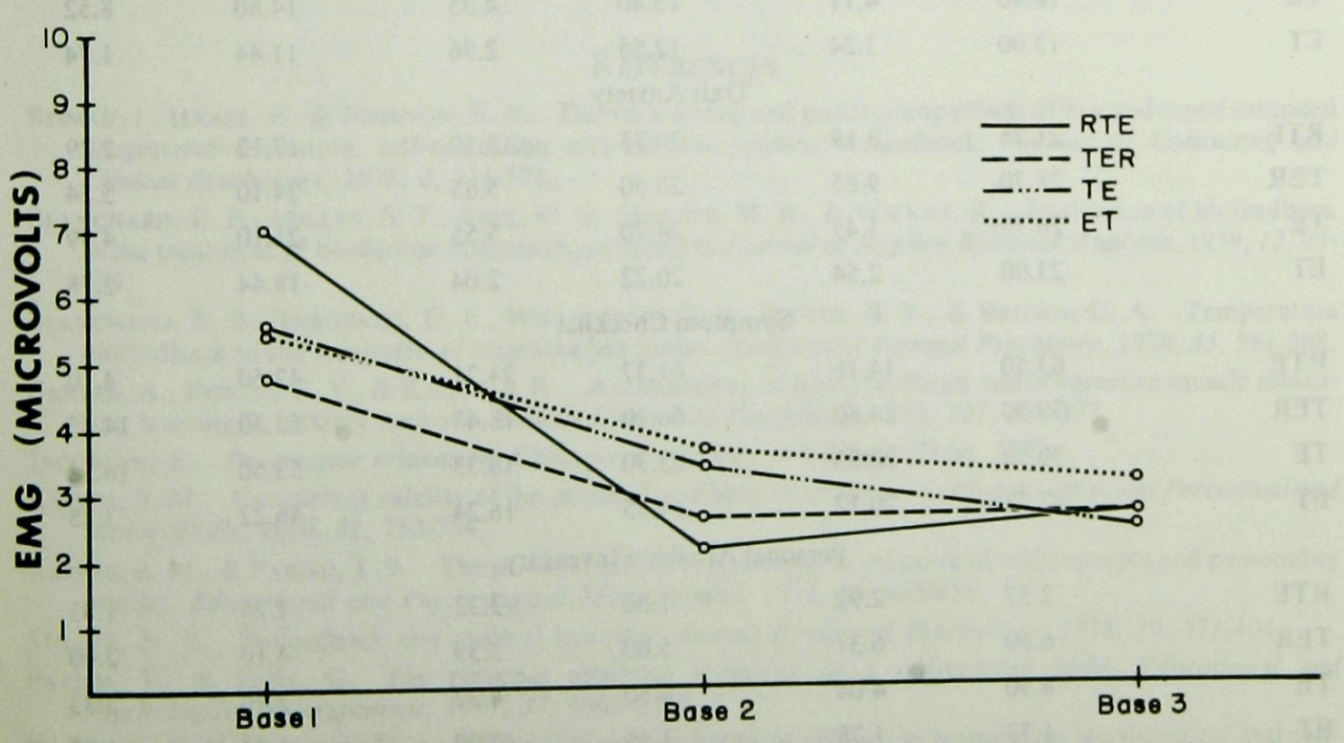

FIG. 1. Mean group EMG over base measurements.

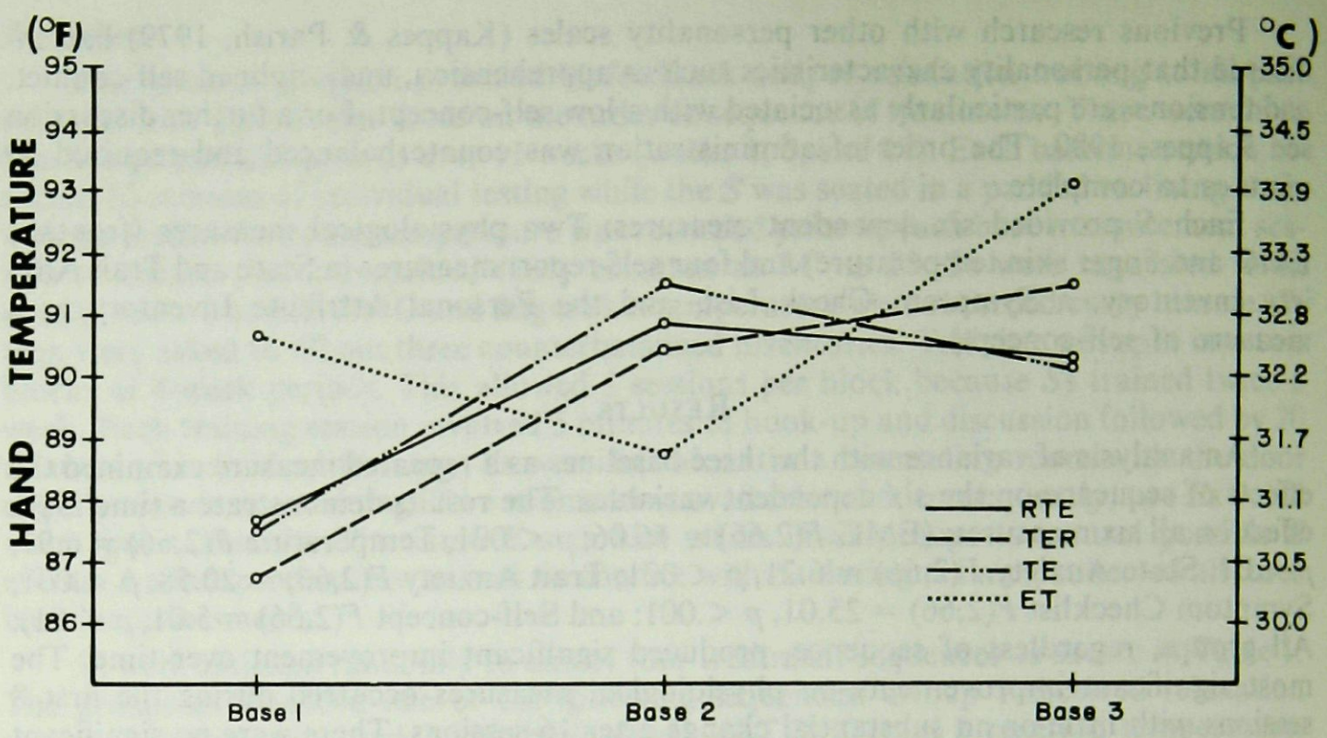

FIG. 2. Mean group hand temperatures over base measurements.

TABLE 2

Summary of Self-report Measures

	Time of testing					
	Base 1		Base 2		Base 3	
Group	$\bar{X}$	*SD*	$\bar{X}$	*SD*	$\bar{X}$	*SD*
			State Anxiety			
RTE	14.12	2.58	12.25	2.65	11.25	1.66
TER	19.30	4.54	16.20	7.37	13.30	3.26
TE	16.40	4.11	15.40	4.35	14.80	8.52
ET	13.00	3.24	12.55	2.96	11.44	1.74
			Trait Anxiety			
RTE	21.75	3.19	20.75	3.10	17.12	2.29
TER	28.70	9.85	23.50	5.85	24.10	5.54
TE	26.70	5.45	24.70	5.55	21.10	4.99
ET	23.00	2.54	20.22	2.04	19.44	2.78
			Symptom Checklist			
RTE	63.50	14.16	61.37	24.21	42.50	4.10
TER	79.50	24.80	66.10	18.48	53.30	14.45
TE	70.50	22.26	63.30	18.33	53.50	16.52
ET	57.77	20.12	54.55	16.24	46.22	7.25
			Personal Attribute Inventory			
RTE	2.37	2.92	1.50	2.32	1.25	1.83
TER	6.80	6.37	5.00	3.39	4.10	2.60
TE	4.90	4.04	4.50	4.22	2.70	3.33
ET	1.77	1.78	1.55	2.00	1.44	1.87

Discussion

The various treatment groups displayed a consistent reduction on experimental measures and clinical measures over time. Relaxation and biofeedback training were found equally effective for decreasing frontalis EMG and increasing finger skin temperature. *S*s also reported reductions in both State and Trait Anxiety, a decrease in somatic complaints, and a decrease in the number of negative self-attributes, all over time. Moreover, the results showed that the most substantial improvements occurred after 8 sessions, whereas little further improvement could be found after 16 sessions. Training methods were found to be basically equivalent on physiological as well as subjective measures, regardless of sequence, and positive results seem to be readily attainable in very few sessions.

An interesting result showed that temperature and EMG biofeedback were not related significantly to one another. This seems to support the independence of physiological systems. Specifically, temperature biofeedback often is indicated for training autonomic responses, while EMG biofeedback is associated with neuromuscular or somatic responses. Both modalities seemed to contribute equally to an increased overall relaxation response.

While overall scores on subjective reports for RTE and ET were lower than TER or TE, the training sequence was not effective over time. RTE and ET groups may have had lower overall subjective scores for different reasons. The RTE group received cognitive instruction via relaxation prior to biofeedback. The ET group appeared less frustrated with early phases of training. The TER and TE groups reported dissatisfaction at the onset because early success with temperature regulation was difficult. Despite these speculations, it was evident that there were no significant differences on objective measures, and each group became increasingly homogeneous over time on all measures.

What is clear from this research is that different methods can produce similar therapeutic results. Some would argue that biofeedback instruments are unnecessary, particularly because one could reasonably obtain the same results with relaxation tapes at less expense. An alternative point, however, is that biofeedback training was equally effective, and, therefore, for some individuals this training may prove important in teaching a relaxation response.

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THE EFFECTS OF RATIONAL AND IRRATIONAL SELF-VERBALIZATIONS ON PERFORMANCE EFFICIENCY AND LEVELS OF ANXIETY

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Investigated the effects of rational vs. irrational belief systems (as measured by the Ellis Irrational Values Scale) and rational vs. irrational self-verbalizations on levels of anxiety and persistence on a performance task. *S*s (N = 40) were instructed to assemble a virtually insolvable task call Soma. The variables of interest were how long each *S* would persist on this task and how much anxiety (as measured by the A-State portion of the State-Trait Anxiety Inventory) was aroused in working on this task. Following a baseline trial trying to solve Soma, *S*s were assigned to either a rational or irrational self-talk condition and were led to believe that such self-talk would help in a second attempt to solve Soma. In line with cognitive models of psychology, it was found that rational self-talk *S*s showed a significant decrease in levels of state anxiety compared to irrational self-talk *S*s in attempting to solve Soma in the second trial. Contrary to cognitive models of psychology, scores obtained from the EIVS and the A-Trait portion of the STAI were not found to be related to persistence.

According to Ellis (1962), our cognitions and self-verbalizations determine our emotional responses, which, in turn, directly influence our behavior in any given situation. There seems to be a growing body of research that has provided support for the notion that thinking influences emotion (e.g., Coleman, 1975; Goldfried & Sabocinski, 1975; Hale & Strickland, 1976; Rimm & Litvak, 1969; Velton, 1968). Fewer studies, however, have examined the relationship between cognitive self-statements and

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