BIOFEEDBACK AND THE ROLE OF PARADOXICAL INSTRUCTION

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ABSTRACT

BIOFEEDBACK AND THE ROLE OF PARADOXICAL
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Biofeedback assisted relaxation has become widely used in the treatment of stress-related disorders in the past decade. Research has generally indicated that it is more effective to provide the electromyographic signal to the client than to use a no-feedback control. Paradoxical instruction has similarly become very popular with clinicians as a method to create change in their clients. Heretofore, the use of paradoxical instruction in conjunction with biofeedback training has not been examined. It appears that paradoxical techniques may be incorporated in conjunction with particular relaxation strategies to create positive change with clients.

This study investigated the use of standard or paradoxical instruction in conjunction with biofeedback training in the achievement of relaxation. The sex of the subject and the type of treatment received were also explored. Each subject received either electromyographic biofeedback (EMGBF), progressive muscle relaxation (PMR), or a self-relaxation (SR) control as the treatment variable. The physiological measures of muscle activity and digital skin temperature served as the dependent variables.

A main effect of treatment was observed with EMG data. SR and EMGBF were found to produce more relaxation over the course of the session than PMR. EMGBF produced the greatest decrease in muscle activity for all subjects, but did not differ significantly when compared with SR. There were no significant main effects of instruction or sex. While there was no significant main effect of treatment or instruction for skin temperature, there was a main effect of sex of the subject. Males were able to significantly elevate their skin temperature higher than females during the treatment phase of the experiment. A significant interaction of instruction and sex indicated, that for males, the greatest gains in skin temperature were achieved in the paradoxical condition. This result was further clarified in the significant interaction of Treatment x Sex x Instruction. This interaction showed that males attained the greatest gain in temperature with the SR-paradoxical treatment, while females achieved the

greatest gain with the SR-standard treatment. It is believed that the SR Treatment allows subjects to concentrate more on elevating skin temperature. Pardoxical instruction may be more appropriate with males than females.

Each treatment, even self-relaxation, resulted in some degree of relaxation. It is believed that no one treatment proved superior for generalized relaxation with EMG due to the posttreatment session (particularly with PMR) and the expectancies for the session to end. SR may be more effective solely in raising skin temperature. Paradox may be more readily employed with males than females, but future research should address this issue more carefully. In addition, future research would need to establish more refined uses of paradoxical instruction with biofeedback clients.

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INTRODUCTION

With the proliferation of stress-related symptomatology in today's society, an increasing emphasis has been placed upon methods which can be employed to treat these stress-related disorders. One of the more popular methods in use today is biofeedback training (Basmajian, 1979). To many individuals, biofeedback appears to be the method of choice due to the ideological belief that individuals can learn to relax and return their bodies to a state of homeostasis without the use of drugs or other intrusive methods. The growing number of reports dealing with biofeedback training attest to its growing significance (Qualls & Sheehan, 1981). In fact, the proliferation of biofeedback studies and an ever increasing interest has resulted in the publication of several new journals, books, annuals, and convention proceedings, many of which were not in existence several years ago. In addition to these publications, numerous biofeedback workshops, training programs, conventions, associations, and treatment clinics provide evidence of the growing acceptance and use of biofeedback techniques.

History

Some of the earliest biofeedback work was performed by Jacobson (1933), long before the term "biofeedback" was coined. In the late 1920's and early 1930's, he developed a relaxation therapy which employed primitive electromyographic equipment to monitor the level of tension in the muscles of his patients. He was limited in his research by the development of the apparatus at the time, but nonetheless, he developed methods of electrical measurement of the muscular status of tension and with these measurements he was able to employ progressive muscular relaxation for a number of psychosomatic symptoms. In Germany, Schultz (1959) developed a related technique, autogenic training, which was popularized in America by his colleague, Luthe (1969). Although autogenic training did not require specific biofeedback equipment, it was one of the early sources of much of today's biofeedback application in the treatment of psychosomatic symptoms (Basmajian, 1979).

Early work in biofeedback consisted of research with laboratory animals and experimental subjects and is found under such titles as visceral learning, augmented sensory feedback or instrumental conditioning of autonomically medicated behavior (Fuller, 1979). The field of diagnostic electromyography grew out of studies of neuromuscular and spinal cord functions. It began with the work of Adrian and Bronk (1929) which demonstrated that the electrical activity in single muscles could provide an accurate reflection of the actual functional activity of the muscles. Smith (1934) and Lindsley (1935) found that humans were able to monitor and maintain conscious control of individual motor unit potentials. Lindsley even stated that at rest "subjects can relax a muscle so completely that...no active units are found." Lindsley found that deep relaxation was not difficult to obtain in any of his subjects.

Research with laboratory animals by Neal Miller and others (Dicara & Miller, 1968; Miller, 1969; Miller & Banuazizi, 1968; Miller & Carmana, 1967; Miller & Dicara, 1968) produced convincing evidence that the autonomic nervous system, previously considered automatic and unavailable to voluntary control, responds to instrumental conditioning and can therefore be brought under voluntary control. Other researchers were reporting their attempts to train subjects to control peripheral vascular responses (Snyder & Noble, 1968), heart rate (Brener & Hathersall, 1967), alpha brain waves (Kamiya, 1968), and other such "involuntary" physiological activities. The basic principle underlying these human studies was that the subjects were given information about their own physiological activities which are usually not within the realm of awareness. The subjects did learn to modify or control these activities.

As early as 1960, Morinacci and Horande (1960) discussed the effectiveness of the display of the electromyograph signal to patients in an effort to alleviate symptomatology in various neurological conditions. By the mid-1960s, the idea gained from the investigations interested in muscle relaxation and those interested in myoelectric control were incorporated and spawned further research uniting both areas. Budzynski, Stoyva, Adler, and Mullaney (1973) developed a technique for inducing generalized body relaxation for the relief of tension headaches. According to Basmajian (1979), the most successful applications of biofeedback to large numbers of patients have been in the area of myoelectric biofeedback. Both for generalized relaxation, which alleviates many symptoms due to anxiety or tension, and for muscular reeducation, myoelectric feedback has become very popular and more widely accepted than ever before.

Biofeedback, as we know it today, involves a learning process. Stoyva (1976) defined it as follows:

> Biofeedback training consists of detecting an electrical signal generated by some bodily tissue. This signal is amplified and then used to trigger a visual or auditory display, thus providing the subject with continuous information as to his progress in controlling the signal. In other words, the subject is connected in a feedback loop

> with some physiological responses he himself is generating. (p. 379)

It is believed by many researchers and clinicians that individuals can master this learning process to help overcome psychophysiological disorders. These problems arise when an individual perceives danger (either physical or in the form of social stressors) and an alert reaction is stimulated. Normally, when this danger is gone, the body returns to a state of physiological equilibrium. However, when an individual continues to perceive danger and has no appropriate method to escape from or deal with this danger, the body does not recover complete equilibrium. Increasing levels of arousal in the body can result in the loss of homeostasis and eventual destruction of vital tissues (Fuller, 1980; Stoyva, 1976). Gastrointestinal disorders, low back pain, stroke, diabetes, muscle tension, migraine headaches, asthma, and susceptibility to other conditions are some common stress-related disorders (Brown, 1977).

As a consequence of the increased perception that biofeedback training is successful in combating psychosomatic illness, many studies have been undertaken to assess the abilities and limitations of the equipment. Many clinicians believed biofeedback could be applied to any number of psychophysiological problems

(Brown, 1977), while others believed biofeedback was a hoax and had no efficacy (Davis, 1980). Therefore, as biofeedback was being used clinically, biofeedback research yielded mixed results.

<u>The Importance of Feedback</u>

As previously stated, some of the early research with biofeedback involved the use of a tone or lights which enabled the subject to attempt to gain control over physiological process (Morinacci & Horande, 1960). Budzynski and Stoyva (1969) concluded the EMG feedback should be particularly useful as a "method of reliably accelerating and perhaps deepening the process of muscle relaxation." The Budzynski and Stoyva article stimulated much research, and significant decreases in EMG frontalis activity have been reported on numerous occasions. A survey of the published literature (Qualls & Sheehan, 1981) indicates that most studies reported reductions in levels of fronalis muscle tension following the EMG biofeedback training.

Experimental effects should be evaluated against control conditions in order to determine the importance of the experimental effects. The most frequent control method employed is the no-feedback conditions in which the subject is simply instructed to relax as fully as possible, and no feedback is provided (Reinking & Kohl, 1975). The no-feedback control is considered by

Blanchard and Young (1974) to be the most appropriate control condition for biofeedback research, and most biofeedback research employing this method reported significantly lower levels of frontalis EMG activity for the biofeedback conditions compared to the no-feedback conditions (Qualls & Sheehan, 1981). Goudette, Prins, and Kahane (1983) compared three groups in regard to EMG frontalis reduction. Each group received either auditory feedback, visual feedback, or no feedback (control). The two biofeedback groups produced a more pronounced relaxation in the frontalis muscle than did the control group. They also observed that no significant differences were found between visual and auditory conditions.

Some researchers, however, have contended that feedback may be no more beneficial than a self-relaxation control. Most notable among these researchers are Alexander, White, and Wallace (1977); Davis (1980); Cott, Goldman, Pavlovski, Kirschberg, and Tolich (1981); and Guglielini, Roberts, and Patterson (1982). In these studies, similar reduction in frontalis EMG levels were evident in both biofeedback and no-feedback conditions. These authors, therefore, have argued that since EMG is not superior to self-relaxation, alternative relaxation treatments are preferable on a cost-benefit basis. Reinking and Kohl

(1975) performed research in which they compared four relaxation conditions and a no-feedback condition over 12 training sessions. During the final 6 sessions, the subjects in the three EMG biofeedback groups showed deeper levels of relaxation than the subjects in the other groups. Reinkling and Kohn stated, "A number of procedures can teach this control (deep muscle relaxation), but some are more effective than others. In particular, some form of EMG feedback seems to be needed to produce maximum results" (p. 598). A similar finding is observed by Rawson (1983). Qualls and Sheehan (1981) state that perhaps EMG biofeedback is more effective when used with long-term treatment, since Reinking and Kohl did not obtain superior results for EMG biofeedback until the sixth session. Qualls and Sheehan conclude that EMG biofeedback is a beneficial form of treatment and should not be discarded on a "cost-benefit" basis as others have suggested. The majority of the research on the matter also suggests their position.

Electromyographic Biofeedback and Progressive Muscle Relaxation

The majority of the research demonstrates that EMG biofeedback is more beneficial than a self-relaxation control (Qualls & Sheehan, 1981). In addition to EMG biofeedback, another active technique which is very popular in Progressive Muscle Relaxation (PMR) (Jacobson, 1933). PMR involves systematically tensing and relaxing various muscle groups while the client is in a relaxed environment. The theory of this method is that it allows the client to more easily differentiate between tension and relaxation. By tensing specific muscles and then releasing that tension, the client can note how much more pleasing relaxation is than tension. The tensing activity also allows the muscles to become more elongated and relaxed.

Generally, the available research indicates that PMR is more beneficial than self-relaxation for inducing relaxation. Freedman and Papsdorf (1976) treated insomniac patients with EMG biofeedback, PMR, and a self-relaxation control. Their results indicated that EMG biofeedback and PMR were much more successful with this clinical population in reducing EMG levels than self-relaxation. Sime and DeGood (1977), when working with anxious and tense subjects, found similar results in which PMR and EMG biofeedback were more beneficial than self-relaxation for clinical clients.

It has been demonstrated that PMR excels when compared with self-relaxation. What does the research indicate when comparing PMR and EMG biofeedback in terms of generalized relaxation? Overall, research with normal and clinical populations demonstrates that EMG biofeedback is superior. Fee and Girdano (1978) compared the results obtained with a nonclinical population and found that EMG biofeedback was more beneficial than PMR autogenic training, self-relaxation, or meditation. Similarly, Delman and Johnson (1976) observed that EMG biofeedback was superior to PMR when used with a normal population. Canter, Kondo, and Knott (1975) employed EMG biofeedback and PMR with anxious subjects and found that EMG biofeedback was clearly superior in EMG reduction and in the reduction of clinical anxiety. It appears, therefore, that PMR will prove superior to self-relaxation and that EMG biofeedback will be superior to both PMR and self-relaxation.

The Paradoxical Effect

In recent years the use of paradoxical interventions has become more widespread, as evidenced by an increasing number of papers (Weeks & L'Abate, 1978). To date, it appears there is no published literature concerning the effect of paradoxical techniques upon EMG biofeedback performance. Paradoxical techniques were first used by Adler (Mozdiertz, Moccitelli, & Lisiecki, 1976). Adler saw the paradox in that the patient simultaneously wanted and did not want to give up the symptom. The patient improved by an increase in self-esteem following a successful power move against the therapist who suggested that the symptom be kept.

Selvini-Palazzali, Cecchin, Prata, and Boscolo (1978) suggest that the mechanism of change resides with the therapist's positive connotation of all behavior. In this way, the family or person is thrown into a bind by being asked to accept the positive qualities of the symptom they ambivalently ask to be rid of. Similarly, Watzlawich, Beavin, and Tochson (1967) state that symptoms prescription is very powerful. The patient, who describes his/her symptom as involuntary, is asked to perform his/her symptom on purpose. In the course of voluntarily performing his/her symptom, the patient becomes no longer able to behave in the same involuntary fashion. Thus, he/she must surrender the symptom. Watzlawich et al. state that this symptom prescription creates a "therapeutic double bind." The patient is presented with a symptom prescription that: (a) reinforces the behavior the patient expects to be changed, (b) implies that the reinforcement is a vehicle of change, and (c) thereby creates a paradox because the patient is told to change by remaining unchanged.

According to Fisher, Anderson, and Jones (1981), the past literature on paradoxical intervention and their own clinical experiences indicates that the best procedure for therapeutic intervention is a three step procedure. The therapist must: (a) redefine the behavior by giving it another meaning, (b) escalate the behavior by increasing the frequency of its expression or by provoking a crisis, and (c) redirect the behavior by changing an aspect of the symptom. Redefinition is an attempt to alter the apparent meaning put on a particular behavior. For example, the behavior of a child throwing a temper tantrum is quite obnoxious and should be extinguished. In some families, however, these tantrums may serve the purpose of uniting drifting parents. When this knowledge is recognized by the child, the particular symptom (tantrum) is usually dropped by the "helpful" child. Escalation is similar to the learning theory of massed practice. The symptom is prescribed often, thus taking the response out of the realm of conscious control. Redirection involves prescribing the circumstances under which the symptoms will occur. For example, a hypochondriac could be told that only at certain times could he/she talk about his/her physical problems, thus making him/her not want to talk about somatic complaints at that time. As can be seen from Appendix D, the subjects who receive paradoxical instructions are exposed to the above components in their instructions. For example, they are told that the tension they may feel is positive and that they may learn something beneficial from it. The tension is redefined as something that is positive. In addition, the symptom (tension) is prescribed often by repeated phrases such as "do not learn relaxation very quickly" and "you may be one of those individuals who takes a long time to relax."

The Placebo Effect and Expectancies

The placebo effect is recognized as a very powerful aspect of science and medicine (Shapiro, 1959). Actually, until this century the physician's reputation rested largely on the placebo effect, since most medical remedies were either innocuous or actually harmful. In the placebo effect, the physician or clinician seeks to produce in the patient an attitude of expectant faith. A series of studies have found that on the average the placebo effect accounts for about 60% of the effectiveness of all pain relievers (Evans, 1974).

Biofeedback is heavily loaded with placebo components. The two particularly powerful healing aspects of biofeedback techniques are their ability to inspire the patient's hope and to enhance the sense of mastery or self-efficacy. Biederman (1983) observed that patients with chronic back pain who were given biofeedback training established expectancies of personal mastery which affected their coping behavior. Thus, the enhanced perception of self-efficacy improves the therapeutic value of biofeedback. Hope is a healing element and it motivates the patients to stay in treatment, while a sense of mastery over the equipment (making the tone decrease, raising peripheral skin temperature) combats demoralization by increasing the patient's self-esteem. Biofeedback techniques are inspiring for Americans because we like gadgetry and often expect science and technology to solve all problems (Frank, 1982).

In terms of the present research, how does the placebo effect determine how the subjects will perform? It is expected that EMG biofeedback performance will be superior to self-relaxation and progressive muscle relaxation performance because the subjects have the opportunity to control the volume and pitch of the feedback tone and because the subjects will have expectations that the equipment and its feedback is very technological and should be able to help them relax. In addition, college students in modern society are well acquainted with technical machinery and have observed many benefits from the "information and technical age" (Frank, 1982).

Michenbaum (1976), in his cognitive theory of self-control, analyzed the role of clients' self-statements and imagery in each phase of his biofeedback training. He found that often a patient's internal dialogue concerning physiological responses included a sense of helplessness and absence of control. Goldberg, Weller, and Blittner (1982) took Michenbaum's study one step further and attempted to experimentally influence subjects' beliefs. In this study, the researchers examined a training approach which included a positive-cognitive stage that establishes and reinforces a self-control belief system and found it to be more successful in reduction of EMG activity than a treatment procedure solely concerned with training or a treatment procedure which included a negative-cognitive stage. Katses and Segreto-Bures (1983) found that when subjects are exposed to excessively positive expectancies concerning reduction of EMG levels (this will be very easy) or excessively negative expectancies (this will be most difficult), these subjects did not perform as well as those subjects who had more realistic expectations about the process.

The present researcher theorizes that if the subject is given paradoxical instructions such as "do not expect to learn relaxation very quickly," some subjects will not feel under distinct pressure to relax to abolish the feedback tone. The sense of helplessness and absence of control which Michenbaum (1976) mentions will not be present and, subsequently, the subject will be able to relax more thoroughly by "letting go" to a greater extent. With other subjects who are not prone to feel as helpless and who do not fear a loss of control, the paradoxical intervention will have the classic affects of giving the subject "power" over the experimenter by doing the opposite of what the experimenter asks.

Statement of the Problem

Findings in the biofeedback research indicate that, generally, electromyographic feedback is superior to a no-feedback condition (Qualls & Sheehan, 1981). The vast majority of research supports this, although a few findings indicate no difference in the relaxation achieved with versus without feedback (Alexander, White, & Wallace, 1977; Davis, 1980; Cott et al., 1981; Guglielini et al., 1982). It is therefore hypothesized that EMG feedback will prove superior to self-relaxation in which no feedback tone will be present.

To this researcher's knowledge, no literature is available which examines the use of paradoxical instruction with biofeedback training. There is no doubt, however, that paradoxical techniques are powerful, but until this study can be completed, it is difficult to determine if these techniques possess efficacy with the biofeedback technique. In many respects, therefore, this study is designed to be a pilot study or survey to determine which groups of subjects perform well when given paradoxical instruction. It is hypothesized that paradoxical instruction will prove superior to the standard script because:

1. It does not create unrealistic expectancies in subjects, paradoxical instruction does not lead to a sense of helplessness and loss of control in those subjects who cannot initially create a decrease in the feedback tone.

2. It will achieve the results in other individuals of allowing them to "gain power" over the experimenter. Those individuals who receive EMG biofeedback, paradoxical treatment should reduce their electrical activity to a greater degree than those individuals who receive self-relaxation, paradoxical instruction or progressive muscle relaxation, paradoxical instruction because of the positive expectancies gained from the equipment. Those individuals who receive progressive muscle relaxation should perform better than those receiving self-relaxation because of the fact that activity is involved. The subjects who receive progressive muscle relaxation should not, however, reduce their electromyographic readings as fully as those subjects receiving EMG biofeedback because of the lack of the tone in the PMR condition.

METHOD

Design

A 3 x 2 x 2 between subjects factorial design is employed in this study. The independent variables are composed of three treatment conditions, two instruction conditions, and sex of the subject. The three treatments compared were electromyographic biofeedback (EMGBF), progressive muscle relaxation (PMR) (Goldfried & Davidson, 1976), and a self-relaxation control (SR). The instruction variable determined whether a subject received standard instruction or paradoxical instruction (Appendix D). Paradoxical instruction differs from standard instruction in that it incorporates the components of redefinition, escalation, and redirection which were discussed in the introduction. For example, a statement used with paradoxical instruction such as, "You may be one of those individuals who takes a long time to relax" differs markedly from a statement such as, "Continue to relax and let the tone become lower and softer. As you can see, it's not very difficult." The latter statement is used with standard instruction. The sex variable compared male and female subjects with the above procedures. The dependent measures were EMG (frontalis) muscle activity and digital skin temperature.

Subjects

Seventy-two males and females enrolled at Appalachian State University in introductory psychology classes participated in this study. This subject pool was composed of an equal number of females (36) and males (36) and was selected from a larger subject pool of over 170 volunteers in several classes by being told that they were to receive extra credit for taking a test that would be beneficial in the author's research project. After completing the pretest, the subjects were all told that they may or may not be later contacted, depending upon scores on the pretest. Subjects' selection for the remainder of the experiment was dependent upon each subjects' total score on the Hopkins Symptom Checklist (HSC)(Deragatis, Lipman, Rickels, Uhlenhuth, & Covi, 1974). If they were dropped from the experiment (due to a low score on the HSC, see below), they were given credit by their instructor. Those subjects continuing in the experiment received additional credit.

Each subject was randomly assigned to one of six treatment conditions: (a) self-relaxation paradoxical instruction, (b) self-relaxation standard instruction,

(c) electromyograph biofeedback paradoxical instruction, (d) electromyograph biofeedback standard instruction, (e) progressive muscle relaxation paradoxical instruction, and (f) progressive muscle relaxation standard instruction. Twelve subjects were employed in each group, divided equally among males and females. If subjects were contacted to participate in the treatment phase of the experiment, they were asked to abstain for the two hours just prior to their appointment from alcohol, caffeine, nicotine, and drugs other than those prescribed by a physician.

Subjects were asked to sign a consent form and were informed of their rights, including the right to terminate participation in the experiment at any time. The ethical standards of the American Psychological Association were maintained in the treatment of all subjects.

Test

The pretest employed (Appendix A) was the Hopkins Symptom Checklist (Deragatis et al., 1974), a 58-item checklist of psychological feelings and symptoms. The test provides a 4-point scale which subjects use to note varying degrees of distress. The higher the score, the more distress the individual is experiencing. Only those subjects who scored above 100 total points were contacted; this being an effort to approximate the characteristics of a clinical population. Approximately 41% of the total population tested fit the criteria for continuing the experiment and were later contacted.

Apparatus

Autogenic Systems biofeedback equipment was used to measure and monitor physiological response. Frontalis muscle activity was measured by an Autogen 1700 feedback myograph. Two silver chloride sensors were attached with electrode collars to the forehead approximately one inch to either side of the central inactive sensor. Settings for the 1700 were as follows: scale = XI, feedback = AN3, volume = 5, bandpass = 100-200 Hz., response = 2.5 seconds, average time = 20. An autogen series 5100 pulse wave analyzer/digital integrator connected to the 1700 unit analyzed the signal and provided digital readings. The time intervals were set for one minute compute and five seconds rest periods. Peripheral skin temperature was monitored by an Autogen 2000b unit. The thermistors were attached to the first, third, and fifth fingers of the dominant hand. Current to each of the biofeedback units was provided by an Autogen P-50 isolated power supply. An interface was devised which allows the data from the biofeedback equipment to be fed into an Apple II-Plus computer. A graph showing EMG and skin temperature readings over time was provided, with each new reading taken at one minute intervals. Subjects were shown this graph at the end of the session.

Experimental Setting

Subjects were tested in the Biofeedback Lab of the Counseling and Psychological Services Center at Appalachian State University. The carpeted 12 x 12.5 room was dimly lit by one lamp to the right of the subject. A speaker for the feedback tone was placed behind the subject and roughly three feet away, and another speaker for the tape recorded instructions was place approximately five feet from the subject. An audio cassette recording provided all instructions for the six treatment conditions.

Procedure

The experiment was conducted during October and November, 1983. The author visited introductory psychology classes (with permission of the instructor) and recruited subjects by telling them that they could volunteer to participate in an experiment dealing with relaxation techniques and could receive extra credit for their participation. Subjects were informed that they were under no obligation to participate. Those who did elect to participate completed the Hopkins Sympton Checklist and relevant demographic data. Upon completion of this task, the subjects were informed that some of them may be later contacted and that they would receive extra credit if they were contacted.

Each subject was called several days before the appointment to be scheduled and was asked to refrain for the two hours prior to the appointment from alcohol, nicotine, caffeine, or any other drugs other than those prescribed by a physician. Upon arrival, the subjects were again informed that they were participating in an experiment that dealt with various relaxation procedures and that they would receive one of these relaxation procedures. The same experimenter was used for all conditions and subjects. The subjects were informed that the instructions would be heard on tape and to follow these instructions carefully. All subjects were asked to sign an informed consent/contract and were reminded that they could terminate participation in the experiment at any time.

The subject was seated in a reclining chair and the experimenter cleansed the EMG sensor site (frontalis muscle) with alcohol and a soft abrasive pad. The sensors were attached and the thermistors were connected to the fingers of the dominant hand. A standard script was used to deliver the appropriate pre-session information (Appendix C). The subjects were told to close their eyes (subjects were previously warned not to wear contact lenses) and the tape-recorded instructions were begun (Appendix D). Sessions consisted of a 10 minute adaptation phase and a 30 minute training period.

Readings for EMG activity were taken every 10 seconds and averaged by the Apple II-Plus computer. One minute averages were presented on a screen which the subject was unable to view in a reclining position. Skin temperature was recorded concomitant with the EMG readings. All physiological data were later presented on computer paper with the aid of a printer connected to the Apple II-Plus computer.

Following the session, the subject was shown the graph of individual progress throughout the session and the experiment was explained in detail. Each subject was asked to refrain from sharing information about the session with his/her classmates, assured of extra credit and thanked.

RESULTS

Physiological Variables

A 3 x 2 x 2 analysis of variance is used to analyze the results. Three independent variables are employed in this study: treatment, instruction, and sex. The treatment variable consisted of electromyographic biofeedback, progressive muscle relaxation, or self-relaxation. The instruction variable involves the use of either standard or paradoxical instruction for each subject and the sex variable involves comparing male and female subjects. For each of the groups tested the effects of the independent variables are observed through changes in the dependent variables of frontalis electromyographic activity and digital skin temperature.

EMG

Frontalis EMG was given in 10 second instantaneous readings and for each 60 seconds of data, six readings were combined to achieve a one minute average. This process continued throughout the 10 minute adaptation, 25 minute treatment, and 5 minute posttreatment periods. This process produced 40 EMG readings. Each series of five consecutive one minute averages were averaged to yield eight data points which were indicative of EMG activity at successive intervals throughout the adaptation, treatment, and posttreatment process. These data points are referred to as time blocks one through eight.

In order to assess the subjects' initial levels of EMG activity, the readings which represent the adaptation phase (time blocks one and two) are compared in a 3 (treatment) x 2 (instruction) x 2 (sex) analysis of variance (Appendix E, Table 1). A significant difference is observed when comparing starting EMG readings as a function of treatments ($F(2, 60) = 3.05$, $p < .0549$). Subjects who were in the self-relaxation (SR) and progressive muscle relaxation (PMR) treatment conditions began the sessions with relatively equal mean readings (SR = 2.06μv, PMR = 2.04μv). Those subjects receiving electromyographic biofeedback (EMGBF) began the sessions with a mean reading (2.67 μv); this differs significantly from the PMR and SR conditions (Figure 1). The overall starting mean for all treatments is 2.25 microvolts, which does not differ markedly from the overall starting mean (2.30) recorded by a similar study using identical equipment (Rawson, 1983). Figure 2 indicates that all subjects average 2.25 microvolts as a starting mean and gradually decrease their EMG readings to a low of approximately 1.50 microvolts at

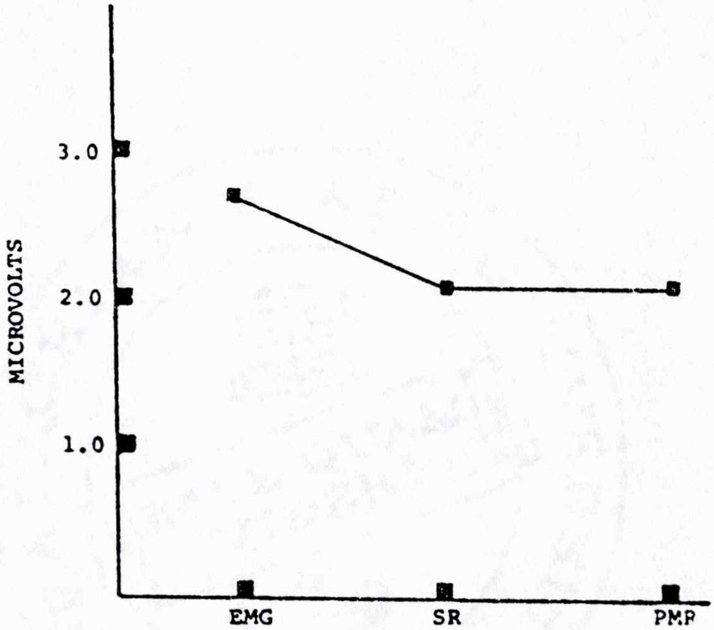

Figure 1. Average EMG starting levels as a function of treatment.

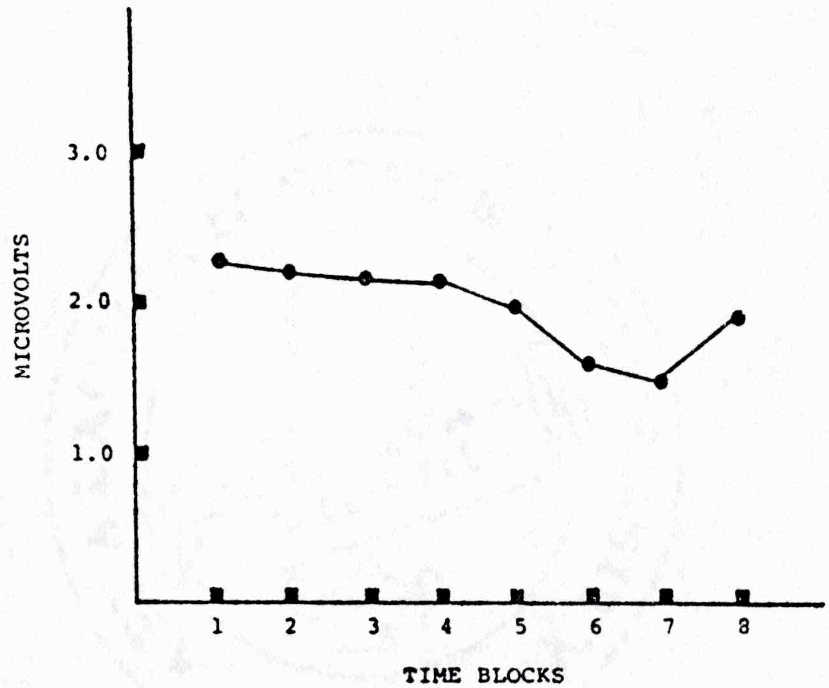

Figure 2. Average EMG readings for all subjects across eight time blocks.

time block seven. EMG readings increase to an average of 1.80 microvolts at time block eight (posttreatment phase).

The 3 x 2 x 2 analysis of variance summarized in Table 2 (Appendix E) provides an indication of the change that occurs in EMG activity from the adaptation phase to the last two time blocks in the experiment. By averaging time blocks one and two and subtracting the average of time blocks seven and eight, we arrive at a measure of the amount of change that occurs during the course of the treatment period. The main effect of Treatment is significant ($\underline{F}(2, 60) = 8.36$, $\underline{p} < .0006$). A posthoc Newman-Keuls F test for simple effects (Bruning & Kintz, 1977) applied to the group means (Appendix E, Table 3) indicates that both SR and EMGBF produce greater muscular relaxation than PMR, at the .05 significance level. Self-relaxation and EMGBF do not differ significantly in the amount of relaxation recorded ($\underline{F} = .13$, $p > .05$). The means of SR and EMGBF in the final two time blocks are relatively equal, with SR having a mean EMG reading of 1.65μv and EMGBF with a slightly better mean reading of 1.55μv. In Figure 3, it may be noted that PMR readings are elevated in time block eight ($\overline{x} = 2.45$). Undoubtedly, this explains the significant results achieved in the Newman-Keuls comparison, since average PMR readings in time block seven

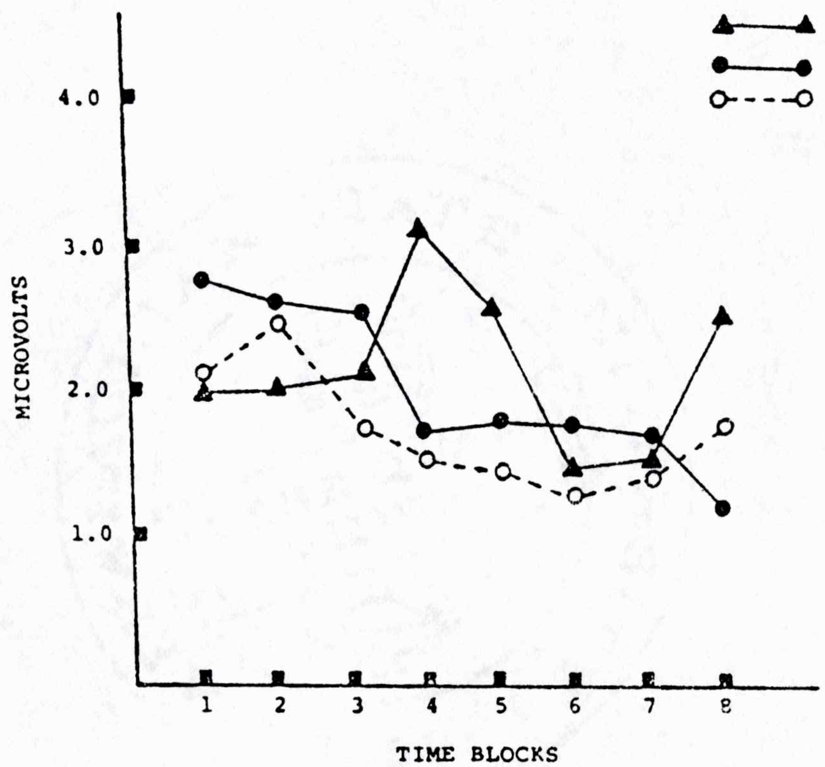

Figure 3. Average EMG readings for all subjects across eight time blocks as a function of treatment.

are essentially equal to SR and EMGBF readings. Again referring to Appendix E, Table 2, the main effect of Instruction (standard or paradox) is not significant ($F(1, 60) = 2.10$, $p < .1525$). The effect of sex of the subject (male or female) approaches significance ($F(1, 60) = 3.13$, $p < .0820$). Males are able to achieve a mean reduction in EMG levels of .78μν, while females are able to achieve a mean reduction of .28μν. The interaction of Instruction and Sex ($F(1, 60) - 3.40$, $p < .0701$) approached but did not achieve significance. Figure 4 indicates that for standard instruction with males and females there is no difference in EMG reduction (male $\bar{x}$ = .32μν; female $\bar{x}$ = .34μν). However, when comparing the use of paradoxical instruction with males and females, males responded better to paradoxical instruction (mean reduction = 1.24μν) than females (mean reduction = .23μν). In addition, paradoxical-instruction males achieve more EMG reduction than standard-instruction males and females. Other comparisons which are nonsignificant when interpreting the analysis in Table 2 are the interaction of Treatment and Instruction (T x I), Treatment and Sex (T x S) and Treatment, Instruction, and Sex (T x I x S).

Digital Skin Temperature

Skin temperature readings were recorded simultaneously with the EMG data. Readings were taken every 10

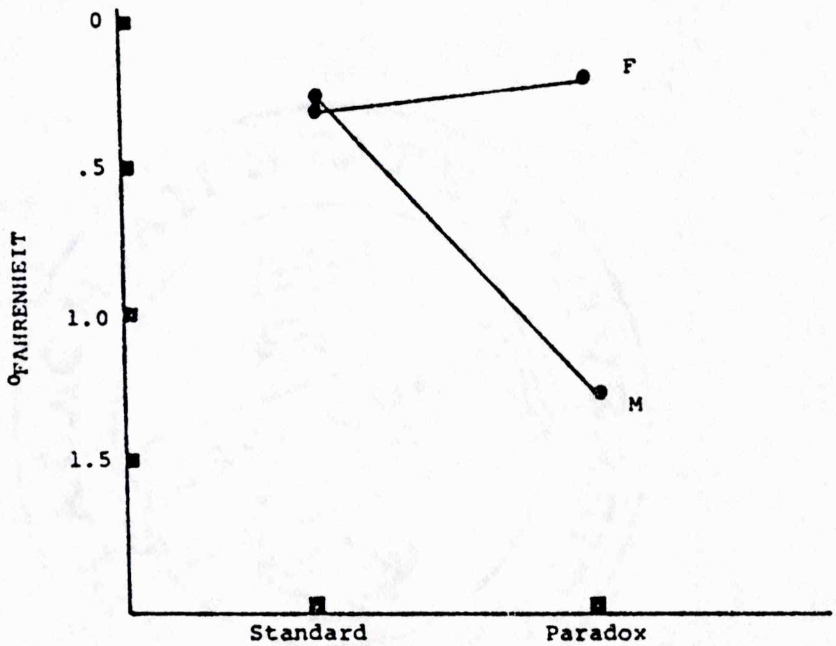

Figure 4. Average EMG reduction for all subjects as a function of sex and type of instruction (Time Blocks 1 + 2 - Time Blocks 7 + 8)/2.

seconds and averaged for one minute intervals. Each of the 40 data points were averaged across five minute intervals (time blocks one through eight) which correspond to the averaged EMG readings. In order to compare the subjects' initial temperature levels, the readings which represent the adaptation phase (time blocks one and two) are averaged and compared in a 2 (instruction) x 2 (sex) x 3 (treatment) analysis of variance (Appendix E, Table 4). None of the main effects are significant; subjects do not differ widely in starting temperature. The mean temperature of all subjects during the adaptation phase was 85.74°F. Subjects continue to increase their digital skin temperature following the adaptation phase. As Figure 5 indicates, temperature steadily increases to a peak mean of 88.43°F at time block five and decreases slightly to a mean of 87.73°F at time block eight.

As with EMG data, a 3 x 2 x 2 analysis of variance was employed to analyze skin temperature changes (Appendix E, Table 5). In this design, the adaptation phase (time blocks one and two) was averaged and the last treatment period and posttreatment period were averaged together (time blocks seven and eight). Ending temperature was subtracted from starting temperature, giving a change score. The main effect of treatment ($\underline{F}(2, 60) = .54$, $\underline{p} < .5844$). The average

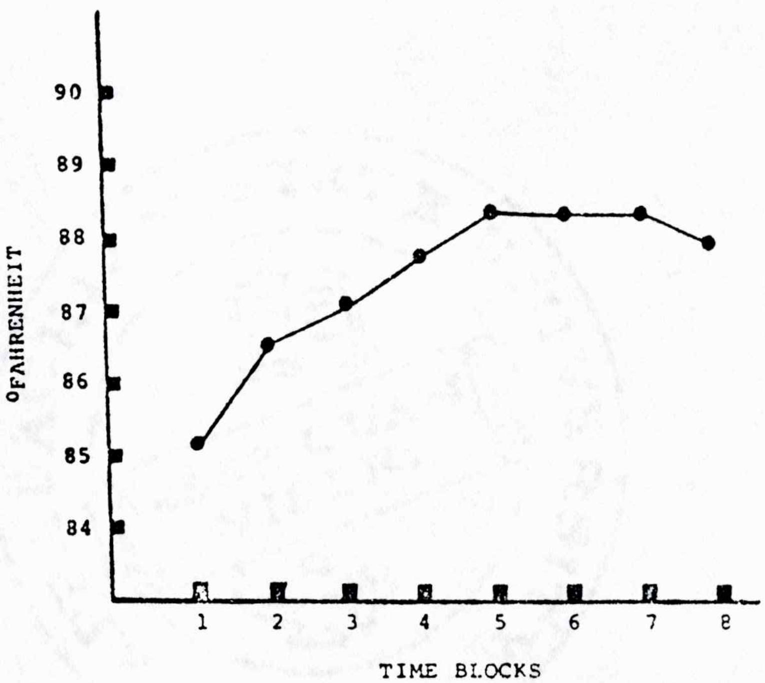

Figure 5. Average skin temperature readings for all subjects across eight time blocks.

temperature readings for all subjects across the eight time blocks as a function of Treatment (Figure 6) indicates that it does not matter whether subjects receive PMR, EMGBF, or SR; the pattern of gradual increase, leveling off, and slight decrease is nearly identical. In all treatments, the greatest temperature increase occurs in the first 10 minutes of the experiment.

There was a significant effect of sex in this analysis ($\underline{F}(1, 60) = 9.90$, $\underline{p} < .0026$). Males were able to increase their digital skin temperatures an average of 4.57°F from the starting phase (time blocks one and two) to the ending phase (time blocks seven and eight) while females actually decreased their skin temperature an average of 1.11°F during the same period. The main effect of instruction upon digital skin temperature was not significant ($\underline{F}(1, 60) = 1.10$, $\underline{p} < .2976$).

The interaction of Instruction and Sex ($\underline{F}(1, 60) = 4.71$, $\underline{p} < .0340$) does produce a significant difference which may be clearly observed in Figure 7. As is indicated by Figure 7, males in both modes of instruction (standard and paradox) exhibited higher temperature increases than females with either standard or paradoxical instruction. Females performed essentially the same with standard and paradoxical instruction, changing their temperature levels very little (less than 1.50°F) from the adaptation phase to the end of

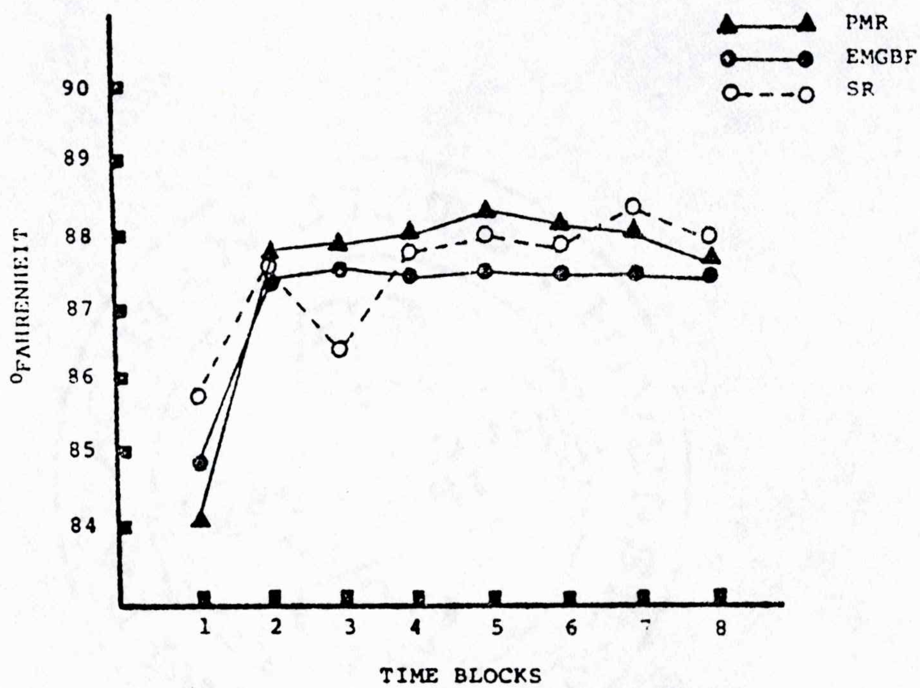

Figure 6. Average skin temperature readings for all subjects across eight time blocks as a function of treatment.

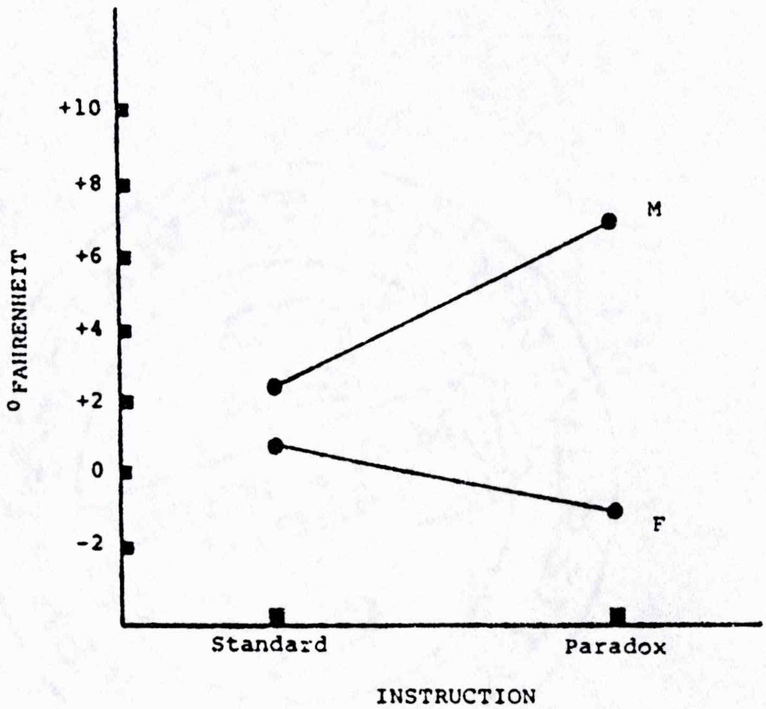

Figure 7. Average skin temperature increase as a function of sex and instruction (Time Blocks 1 + 2 - Time Blocks 7 + 8)/2.

treatment and posttreatment phases. Males who received paradoxical instruction were able to increase their digital skin temperature an average of 7.14°F, while those males receiving standard instruction increased their skin temperature only 2.18°F. Females who received paradoxical instruction actually decreased their skin temperature 1.04°F during the experiment.

In the same analysis there is a significant interaction of Treatment, Instruction, and Sex (T x I x S) ($\underline{F}(2, 60) = 4.28$, $\underline{p} < .0184$). Observing Figure 8, a more detailed explanation of the fact that males who receive paradoxical instruction are able to show more relaxation (increasing digital skin temperature) is evident. In this interaction, it is apparent that the SR treatment is primarily responsible for the large discrepancy between males and females with regard to the type of instruction they receive. Males who received paradoxical instruction in the SR treatment condition were able to significantly elevate their skin temperature an average of 13.45°F, but females in the SR-paradoxical treatment condition performed poorly; decreasing their overall skin temperature 2.66°F. Females in the SR-standard instruction condition performed better than all the other female groups, increasing their digital skin temperature 2.79°F while males in the SR-standard instruction group performed

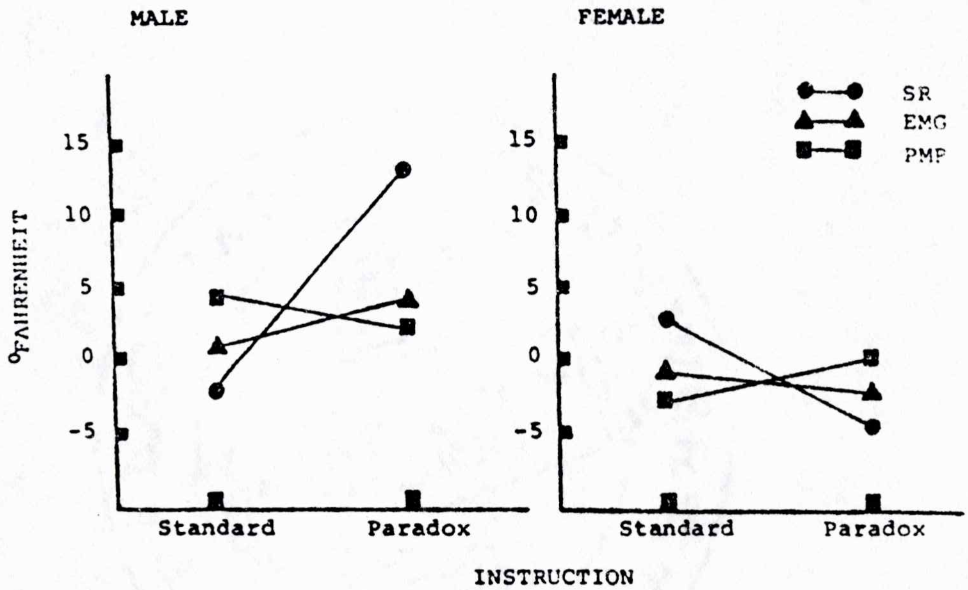

Figure 8. Average skin temperature increase as a function of treatment, sex, and instruction (Time Blocks 1 + 2 - Time Blocks 7 + 8)/2.

the poorest of all the male groups, decreasing their overall skin temperature .13°F. The remaining interactions were not significant.

DISCUSSION

Biofeedback is a very popular treatment used for stress-related disorders (Basmajian, 1979). Much research supports the contention that biofeedback training is a viable and positive tool for the clinicians' use in an effort to contend with stress-related symptomatology. In an effort to determine if a particular technique is initially more effective than others, this study observed the differences achieved with electromyographic biofeedback, progressive muscle relaxation, and a self-relaxation control. Another component of this study addressed the issue of whether paradoxical instruction may be successfully implemented in conjunction with biofeedback training. Heretofore, no similar research has been conducted. Male and female subjects were compared to determine which method could be employed more readily with each gender.

Physiological Measures

All subjects were able to achieve relaxation of some degree during the treatment process. Relaxation was observed through a reduction of EMG frontalis activity and visceral relaxation, demonstrated as an increase in digital skin temperature. Generally, as EMG activity decreased, digital skin temperature increased, as would be suspected. The majority of temperature increase occurred during the adaptation phase, with marginal increase during the treatment phase. This appeared to be more of a gradual process during the treatment session, rather than a correlation of the dependent measures which would be demonstrated by a reduction in EMG activity producing an immediate and concomitant elevation in skin temperature.

EMG

As expected, all subjects decreased EMG activity. Although all treatments produced muscular relaxation, EMGBF proved most effective in reducing EMG activity. This treatment differed significantly from PMR, as was noted in the Newman-Keuls comparions (Appendix E, Table 3) and in Figure 3. This finding paralleled the earlier research of Canter, Kondo, and Knott (1975) and Reinking and Kohl (1975) in which it was discovered that EMGBF was a more effective treatment than PMR for reducing muscular tension. This also supports the author's hypothesis and may be explained through the placebo effect and the positive expectancies gained from the use of the sophisticated equipment. The subjects were able to make immediate responses because they were receiving direct feedback. The above hypothesis was not supported, however, with regard to self-relaxation. It was believed that EMGBF would provide a significantly greater amount of relaxation than the self-relaxation control. The effectiveness of SR noted in the current study contradicted the results achieved by Reinking and Kohl (1975) and Haynes, Mosley, and McGowan (1975) in which EMGBF was superior to SR. In the present study, EMGBF did produce greater EMG reduction, but not at a significant level. This finding is nearly identical to a similar study (Rawson, 1983).

The above results may be affected by the significant difference observed between the treatments in the adaptation phase (Appendix E, Table 1). As was noted, subjects who were assigned to the EMGBF condition began their session with a mean EMG reading of 2.67 μv. This is a significant difference when compared with the starting mean for SR (2.06 μv) and PMR (2.04 μv). The amount of EMG reduction achieved with EMGBF may be significantly greater than that achieved with PMR because of the large amount of change that is necessary during the EMGBF treatment to achieve a regression to the mean (Campbell & Stanley, 1963). Since EMGBF subjects began their sessions with a more elevated mean reading, they had to experience more change in order to arrive at final readings that were relatively equal to the SR and PMR treatments (note time block seven, Figure 3).

A more viable explanation for the above differences may have to do with the posttreatment session involved in this study. As Figure 3 indicates, PMR subjects' mean readings in the posttreatment sessions increase markedly. While PMR readings are increasing over 1.00 microvolt, EMGBF readings continue to decrease approximately .40 microvolts. Although subjects are told to "continue to relax quietly for another five minutes" by the taped instructions, PMR subjects began to become tenser and actually were more tense at the end of posttreatment than was indicated in the adaptation phase. Perhaps they were rehearsing the instructions previously heard such as "wrinkle your forehead" or "squint your eyes." In addition, this time period marked the interval in which the subjects were without instructions for the first time. To these subjects, this could be interpreted as the end of the session and a return to normal physiological arousal. It is believed that EMG readings continued to decrease due to the presence of the auditory tone during the posttreatment session. Future research should control for this. Subjects receiving the SR control treatment increased their EMG readings an average of .25 μv from the last treatment time block to the posttreatment time block. It is believed they were experiencing expectancies concerning the end of the session and the return of the experimenter to the room. A similar study by Rawson (1983) reports a similar phenomenon. SR subjects did not receive the continued stimulus of the auditory tone and were probably able to concentrate more on the impending arrival of the experimenter and the end of the session.

The predicted effect of the type of Instruction (standard or paradox) was not demonstrated at a significant level. Instead, an interaction of Instruction and Sex approached significance. Here, when comparing standard or paradoxical instruction for males and females with EMG, results show there is no change among males and females if they receive standard instruction. However, when comparing the use of paradoxical instruction with males or females, males are able to employ paradoxical instruction more effectively than are males receiving standard instruction and females receiving standard or paradoxical instruction. It is possible that paradoxical interaction may be more successful with males because of the predicted outcome of the subject "gaining power over the experimenter" by not complying with the instructions (Mozdiertz et al., 1976). Males may be more prone to attempt a power move against the therapist because of the social beliefs that males are to be more assertive and to question authority more readily (Bem, 1974). Since the experimenter was male, male subjects may have chosen to respond in a more masculine manner. Further research should be conducted in the area of the use of paradoxical instruction and its effect upon gender.

Another issue in biofeedback research arises when comparing data achieved with different types of equipment. The adaptation mean of 2.25μv found in this study was much less than the 8.32μv found by Sime and DeGood (1977) and 9.08μv reported by Qualles and Sheehan (1979). Such differences are probably due to the failure of EMG units to share universal calibration, or to the possibility that their subjects were selected with higher mean readings. A similar study conducted with the same equipment (Rawson, 1983) yielded an adaptation mean of 2.30μv, which is very similar to the adaptation mean achieved in the present study. It is essential that manufacturers begin to produce equipment that is calibrated with other manufacturers' equipment in order for the reporting of absolute values to have meaning.

Digital Skin Temperature

A significant increase in digital skin temperature occurred during the adaptation phase, but only slight gains were made during training. It is obvious, therefore, that the majority of visceral relaxation, as observed by digital temperature increase, occurs during the first 10 minutes of relaxation and that it can be achieved with self-relaxation (since no treatment occurred during the adaptation phase). During the treatment phase, it did not matter which treatment subjects received; there was no significant effect of treatment upon subjects (Figure 6). The lack of treatment effect contradicted the findings of Bass, Mittenberg, and Peterson (1981). An explanation may be that subjects in that study received feedback training which was specific to digital skin temperature rather than feedback which was specific to the EMG feedback employed here. In addition, their subjects who were high in trait anxiety were better able than less anxious subjects to increase skin temperature. In the present study, all subjects were high in trait anxiety (as determined by high scores on the HSC) and all may have been equally proficient at increasing skin temperature.

The results have indicated that males are able to significantly elevate their skin temperature readings to a higher degree than females. It is possible that male subjects are not experiencing as much anxiety as the female subjects during the course of the treatment and less anxiety allows elevated skin temperature. This may be explained by the fact that the experimenter was a male and the females may have been more self-conscious of performing well, thus inhibiting their overall performance due to anxiety. The results achieved with regard to sex may be more clearly explained in the significant interaction of Sex and Instruction. As is indicated by Figure 7, males in both modes of instruction exhibited higher temperature increase than females with either standard or paradoxical instruction. Females performed essentially the same with standard and paradoxical instructions, changing their skin temperature levels very little from the end of the adaptation phase to the posttreatment phase. Males who received paradoxical instruction showed substantial increases in their skin temperature (7.14^{o}F) while males receiving standard instruction increased their skin temperature only slightly (2.18^{o}F) during the same period. This data helps to substantiate the findings observed with EMG readings in which males who receive paradoxical instruction were able to achieve a higher level of relaxation (reduced EMG reading) than males who received standard instruction and females with standard and paradoxical instruction. It appears that paradoxical instruction benefits males and has little effect upon females. The original hypothesis may be fulfilled in that: (a) this type of instruction allows the subject to make a "power move" against the therapist (which males are more prone to do), and (b) perhaps by not creating unrealistic expectancies in subjects, paradoxical instruction does not lead to a sense of helplessness and loss of control in those subjects who cannot initially create a decrease in the feedback tone.

The significant interaction of Treatment x Sex x Instruction allows us to become more specific with suggestions regarding the appropriate intervention for a particular client. This interaction indicates that the SR treatment is primarily responsible for the large discrepancy between males and females with regard to variety of instruction. Observing Figure 8, it is apparent that with males, SR with paradoxical instruction is the preferred method to increase digital skin temperature. With females, SR-standard instruction is the preferred temperature elevator. These findings differ from the hypothesis earlier stated. It was believed that EMGBF would produce greater relaxation with digital skin temperature as well as with EMG readings because as EMG readings decrease and the subject receives positive feedback, skin temperature should increase because greater relaxation is occurring. Some results of this study with regard to digital skin temperature parallel those results achieved by Rawson (1983). She observed that females receiving SR showed greater skin temperature increase than PMR, AT, or EMGBF. It is possible that the SR treatment allows subjects to concentrate more on warming their hands (since sensors are attached there) rather than following directions (PMR) or making a tone decrease in pitch (EMGBF). These subjects have more of an opportunity to think about the equipment and its function and allow the placebo effect to occur. Females who receive SR combined with paradox do poorly; perhaps females do not like this type of instruction when they can concentrate only on that and become tenser. Males, on the other hand, perform well with the SR paradox treatment. It appears that they can concentrate on the paradoxical instruction without other interventions and use it to make the appropriate "power move."

Future Considerations

An attempt was made to approach a representative sample of the clinical population by requiring a high score on the Hopkins Symptom Checklist (HSC) for participation in the treatment phase of this experiment. Perhaps one or more additional personality measures could be employed in conjunction with the HSC to achieve an ever more representative sample. Other individual characteristics such as intelligence, methods of approaching tasks, learning history, and degree of state anxiety may be helpful when conducting similar research on relaxation training. In addition, a true clinical population could be studied rather than a population composed exclusively of college students.

Treatment outcome is affected by many variables in biofeedback research. Such variables as the physical qualities of the biofeedback laboratory, sex of the experimenter, presence or absence of the experimenter in the room, the presession interaction, and the wording of the relaxation instructions could all be explored and reported. In particular, the paradoxical aspect of this study could be further explored. Some interesting results were achieved with this study, and it is believed that paradoxical instruction may some day occupy an appropriate place in a biofeedback clinician's repertoire. Further research concerning gender and the use of paradoxical intervention should be employed. There is no doubt that future experimenters would be able to incorporate more powerful paradoxical instructions in their research and expand upon some of the pilot-study components of this study. Other research could involve a longer treatment session in order to determine how subjects deal with frustration and how paradoxical intervention would relate to this. More specific instructions telling subjects to continue deep relaxation at the end of the session may prevent the subject from anticipating the end of the session, which generally caused reduced relaxation. The standardized experimental setting employed here may detract from more powerful results that could be achieved with paradoxical instruction in a clinical setting. In a clinical setting, intervention may be tailored to a particular client without concern for the experimental controls which may interfere with generalization of treatment effect.

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APPENDIX A

Hopkins Symptom Checklist

HOPKINS SYMPTOM CHECKLIST

Below is a list of 58 symptoms most commonly experienced. Across from each symptom is a 4-point scale representing various degrees of distress:

1 Not at all
2 A little bit
3 Quite a bit
4 Severe

In each of the following examples, circle the number that best approximates your level of distress.

1.	Headaches	1 2 3 4
2.	Nervousness or shakiness inside	1 2 3 4
3.	Being unable to get rid of bad thoughts or ideas	1 2 3 4
4.	Faintness or dizziness	1 2 3 4
5.	Loss of sexual interest or pleasure	1 2 3 4
6.	Feeling critical of others	1 2 3 4
7.	Bad dreams	1 2 3 4
8.	Difficulty in speaking when you are excited	1 2 3 4
9.	Trouble remembering things	1 2 3 4
10.	Worried about sloppiness or carelessness	1 2 3 4
11.	Feeling easily annoyed or irritated	1 2 3 4
12.	Pains in the heart or chest	1 2 3 4
13.	Itching	1 2 3 4
14.	Feeling low in energy or slowed down	1 2 3 4
15.	Thoughts of ending your life	1 2 3 4
16.	Sweating	1 2 3 4
17.	Trembling	1 2 3 4

18.	Feeling confused	1	2	3	4
19.	Poor appetite	1	2	3	4
20.	Crying easily	1	2	3	4
21.	Feeling shy or uneasy with the opposite sex	1	2	3	4
22.	A feeling of being trapped or caught	1	2	3	4
23.	Suddenly scared for no reason	1	2	3	4
24.	Temper outbursts you could not control	1	2	3	4
25.	Constipation	1	2	3	4
26.	Blaming yourself for things	1	2	3	4
27.	Pains in the lower part of your back	1	2	3	4
28.	Feeling blocked or stymied in getting things done	1	2	3	4
29.	Feeling lonely	1	2	3	4
30.	Feeling blue	1	2	3	4
31.	Worried or stewing about things	1	2	3	4
32.	Feeling no interest in things	1	2	3	4
33.	Feeling fearful	1	2	3	4
34.	Your feelings easily hurt	1	2	3	4
35.	Having to ask others what you should do	1	2	3	4
36.	Feeling others do not understand you or are unsympathetic	1	2	3	4
37.	Feeling that people are unfriendly or dislike you	1	2	3	4
38.	Having to do things very slowly in order to be sure you are doing them right	1	2	3	4

39.	Heart pounding or racing	1	2	3	4
40.	Nausea or upset stomach	1	2	3	4
41.	Soreness of your muscles	1	2	3	4
42.	Feeling inferior to others	1	2	3	4
43.	Difficulty in falling asleep or staying asleep	1	2	3	4
44.	Having to check and double check what you do	1	2	3	4
45.	Difficulty making decisions	1	2	3	4
46.	Wanting to be alone	1	2	3	4
47.	Trouble getting your breath	1	2	3	4
48.	Hot or cold spells	1	2	3	4
49.	Having to avoid certain places or activities because they frighten you	1	2	3	4
50.	Your mind going blank	1	2	3	4
51.	Numbness or tingling in parts of your body	1	2	3	4
52.	A lump in your throat	1	2	3	4
53.	Feeling hopeless about the future	1	2	3	4
54.	Trouble concentrating	1	2	3	4
55.	Weakness in parts of your body	1	2	3	4
56.	Feeling tense or keyed up	1	2	3	4
57.	Heavy feelings in your arms or legs	1	2	3	4

58. Please comment on any special concern:

APPENDIX B

Contract to Participate

CONTRACT TO PARTICIPATE

I understand that I will be participating in a biofeedback research experiment. I will receive one hour's extra credit for my participation and I understand that I may elect to terminate my participation in this study at any time.

Subject

Experimenter

APPENDIX C

Script for Pretreatment Interaction With Subjects

Presession Interaction

First I will wipe your forehead with alcohol, and then attach three sensors to your forehead. The sensors are connected to monitors that record your muscle activity. No current passes through the sensors so you can't receive a shock (attach the sensors). The sensors attached to your fingers will monitor your skin temperature (attach the sensors). In a moment, I will play an audio tape that will have your instructions for the rest of the session. I will stay in the room for approximately 10 minutes, making any necessary adjustments to the equipment, and then I will leave the room until the session is completed. Do you have any questions? Recline in the chair and sit quietly while I start the tape.

APPENDIX D

Transcripts of Taped Relaxation Instructions:
EMGBF-standard, EMGBF-paradox,
PMR-standard, PMR-paradox,
SR-standard, SR-paradox

EMGBF STANDARD INSTRUCTION

Please sit quietly for the next 10 minutes and wait for further instructions from the tape (10 minutes)...For the next 25 minutes, I would like you to practice relaxation. Close your eyes (slight pause). Find a comfortable position in the chair (slight pause), and listen carefully to the following instructions. For the next few minutes, I want you to practice relaxation by listening to the tone (tone begins)...As you become relaxed, the tone will become softer in volume and will decrease in pitch. For example, wrinkle your forehead...Notice how the tone increases in pitch and gets louder...Now smooth your forehead and relax... Notice the difference in tone...As you can see, it is easy to make the tone become louder and softer...Begin your relaxation now...(5 minutes). Keep listening to the tone and just let your body relax. Notice how the tone changes when you relax even more...(5 minutes). Continue to relax and let the tone go lower and lower. As you can see, it's not very difficult...(5 minutes) As you are relaxing, let your muscles become smoother and more at ease...(5 minutes). Continue to sit quietly with the tone and relax even more...(5 minutes). Continue to attempt relaxation for the next 5 minutes... (5 minutes). In a moment, I will return to the room and disconnect the sensors. Now I will count from one to four. One...move your hands and feet, two...stretch your hands and feet, three...move your head around, and four...open your eyes. Please remain seated until I return to the room. Thank you for your cooperation.

EMGBF PARADOXICAL INSTRUCTION

Please sit quietly for the next 10 minutes and wait for further instructions from the tape (10 minutes)...For the next 25 minutes, I would like you to practice relaxation. Close your eyes (slight pause), find a comfortable position in the chair (slight pause), and listen carefully to the following instructions. For the next few minutes I want you to practice relaxation by listening to the tone...(tone begins). As you become relaxed, the tone will become softer in volume and decrease in pitch. For example, wrinkle your forehead...Notice how the tone increases in pitch and gets louder...Now smooth your forehead and relax...Notice the difference in the tone...As you practice this skill, don't expect to learn the technique very fast. You may be one of those individuals who takes a long time to master the technique. Now, continue to relax and make the tone decrease in volume. Begin relaxation now... (5 minutes). Keep listening to the tone and let your body relax. Be careful not to learn the skill too fast, don't expect too much from yourself too soon... (5 minutes). Continue to relax. Keep in mind that the tension you feel is a good thing and shows that you are in touch with your feelings and emotions...(5 minutes). As you are relaxing, let your muscles become quiet and let the tone go lower. Remember, the stress you may experience is part of your life, something important, and may be a source of energy...(5 minutes). Remember, it is okay not to relax fully at first...(5 minutes). Continue to attempt relaxation for the next 5 minutes ...(5 minutes). In a moment, I will return to the room and disconnect the sensors. Now, I will count from one to four. One...move your hands and feet, two...stretch your hands and feet, three...move your head around, and four...open your eyes. Please remain seated until I return to the room. Thank you for your cooperation.

PROGRESSIVE MUSCLE RELAXATION

STANDARD INSTRUCTION

Please sit quietly for the next 10 minutes and wait for further instructions...(10 minutes). For the next 25 minutes, I would like for you to practice relaxation. Close your eyes, find a comfortable position in the chair, and listen carefully to the following instructions. Now settle back as comfortably as you can, close your eyes, and listen to what I'm going to tell you. I'm going to make you aware of certain sensations in your body and then show you how you can reduce these sensations. First, direct your attention to your left arm, your left hand in particular. Clench your left fist. Clench it tightly and study the tension in the hand and in the forearm. Study those sensations of tension...now let go. Relax the left hand and let it rest on the arm of the chair. Note the difference between the tension and the relaxation...Once again now, clench your left hand into a fist tightly, noticing the tensions in the hand and in the forearm. Study those tensions, and now, let go. Let your fingers spread out relaxed and note the difference, once again, between muscular tension and muscular relaxation...Now let's do the same with the right hand. Clench the right fist. Study those tensions...and now relax. Relax the right fist. Note the difference once again between the tension and the relaxation, and enjoy the contrast... Once again now, clench the right fist. Clench it tight. Study the tensions. Study them. And now, relax the right fist. Let the fingers spread out comfortably. See if you can keep letting go a little bit more. Even though it seems as if you have let go as much as you possibly can, there always seems to be that extra bit of relaxation. Note the difference once again between the tension and the relaxation. Note the looseness beginning to develop in the left and right hands. Both your left and right arms and hands are a little bit more relaxed...Now bend both hands back at the wrist so that you tense the muscles in the back of the hand and in the forearm, fingers pointing towards the ceiling. And now relax. Let your hands return to their resting positions, and note the difference between tension and relaxation...Do that once again, fingers pointing to the ceiling, feeling that tension in the back of the hands and in the forearms. And now relax...Let go further...Now clench both your hands into fists and bring them towards your shoulders so as to tighten your biceps muscles, the large muscles in the upper part of the arm. Feel the tension in the biceps muscles. And now relax. Let your arms drop down again to your sides, and note the difference between the tension that was in your biceps and the relative relaxation you feel now...Let's do that once again now. Clench both biceps muscles, bringing both arms up, trying to touch with your fists the respective shoulders. Study the tension. Hold it. Study it. And now relax. Once again, let the arms drop, and study the feelings of relaxation, the contrast between tension and relaxation. Just keep letting go of those muscles further and further...Now we can direct our attention to the shoulder area. Shrug your shoulders, bringing both shoulders up towards your ears as if you wanted to touch your ears with your shoulders, and note the tension in your shoulders and up in your neck. Study that tension. Hold it. And now relax. Let both shoulders return to a resting position. Just keep letting go further and further. Once again, note the contrast between the tension and the relaxation that is now spreading into your shoulder area...Do that once again. Bring both shoulders up as if to touch the ears. Feel the tension in the shoulders, in the upper back, and the neck. Study the tension in these muscles. And now relax. Loosen those muscles. Let your shoulders come down to a resting position, and study the contrast once again between the tension and the relaxation... You can also learn to relax more completely the various muscles of the face. So, what I want you to do now is to wrinkle up your forehead and brow. Wrinkle it until you feel all your forehead very much wrinkled, the muscles tense and the skin furrowed. And now relax. Smooth out the forehead. Let those muscles become loose...Do that once again. Wrinkle up the forehead. Study those tensions in the muscles above the eyes in the forehead region. And now smooth out your forehead. Relax those muscles. And once again, note the contrast between the tension and the relaxation...Now close your eyes very tightly. Close them tightly so that you can feel tension all around your eyes and the many muscles that control the movement of the eyes... And now, relax those muscles. Let them relax, noting the difference between the tension and the relaxation... Do that once again now, eyes tightly closed, and study the tension. Hold it. And relax. Let go, and let your eyes remain comfortably closed...Now purse your lips. Press your lips together. That's right, press them together very tightly and feel the tension all around the mouth. Now relax. Relax those muscles around the mouth and just let your chin rest comfortably...Once again now, press your lips together, and study the tension around the mouth. Hold it. And now relax. Let go of those muscles more and more, further and further. Note how much more loose the various muscles perhaps have become in those parts of the body that we have successfully tensed and relaxed your hands, forearms, upper arms, your shoulders, the various facial muscles. And now, we'll turn our attention to the neck. Press your head back against the surface on which it's resting. Press it back so that you can feel the tension primarily in the back of the neck and in the upper back. Hold it. Study it. Now let go. Let your head rest comfortably now. Enjoy the contrast between the tension you created before and the greater relaxation you feel now. Just keep letting go, further and further, more and more, to the best of your ability. Do that once again, head pressed back. Study the tension. Hold it. And now, let go. Just relax. Let go further and further...Now, I'd like you to bring your head foward and try to bury your chin into your chest. Feel the tension especially in the front of your neck. And now relax. Let go further and further. Do that once again now, chin buried in the chest. Hold it. And now relax. Just relax further and further...Now we can direct our attention to the muscles of the upper back. Arch your back, arch it, sticking out your chest and stomach so that you can feel tension in your back primarily in your upper back. Study that tension. And now relax...Let the body once again rest against the back of the chair or the bed, and note the difference between the tension and the relaxation, letting those muscles get more and more loose...Once again, arch the back way up. Study the tensions. Hold it. Now relax. Relax the back once again, letting go of all the tensions in these muscles...And now, take a deep breath, filling your lungs, and hold it. Hold it and study the tension all through your chest and down into your stomach area. Study that tension, and now relax. Let go. Exhale and continue breathing as you were. Note once again the difference between the tension and the relaxation...Let's do that once again. Take a deep breath and hold it. Hold it. Study those tensions. Study them. Note the muscles tensing. Note the sensations. And now exhale and continue breathing as you were, very comfortably breathing, letting those muscles of the chest and some of the stomach muscles relax, getting more and more relaxed each time you exhale...And now, tighten up the muscles in your stomach. Tense those stomach muscles. Hold it. Make the stomach very hard. And now relax. Let those muscles become loose. Just let go and relax...Do that once again. Tighten those stomach muscles. Study the tension. And now relax. Let go further and further, more and more. Loosen the tensions. Get rid of the tensions, and note the contrast between tension and relaxation...I'd like you now to stretch both legs. Stretch them so that you feel tension in the thighs. Stretch them way out. And now relax. Let them relax and note the differences once again between tension in the thigh muscles and the relative relaxation you can feel now...Do that once again, locking your knees, stretch out both legs so that you can feel the muscles. Let them get loose. Get rid of all tensions in the muscles of your thighs... Now tense both calf muscles by pointing your toes towards your head. If you point your toes upwards towards your head, you can feel the pulling, the tension, the contraction in your calf muscles and in your shins as well. Study that tension. And now relax. Let the legs relax and note once again the difference between tension and relaxation...Once again now, bend the feet back at the ankles, toes pointing towards your head, and study the tension. Hold it. Study it. And now let go. Relax those muscles further and further, more and more deeply relaxed...Just as you have been directing your muscles to tense you have also been directing them to relax or to loosen. You've noted the difference between tension and muscular relaxation. You can notice whether there is any tension in your muscles, and if there is, you can try to concentrate on that part, send messages to that muscle to loosen, to relax. If you think of loosening that muscle, you will, in fact, be able to do so, even if only a little. Now as you sit there in the chair, I'm going to review the various muscle groups that we've covered. As I name each group, try to notice if there is any tension in those muscles. If there is any, try to concentrate on those muscles and send messages to them to relax, to loosen. Relax the muscles in your feet, ankles, and calves... shins, knees, and thighs...buttocks and hips...loosen the muscles of your lower body...Relax your stomach, waist, lower back...upper back, chest, and shoulders... Relax your upper arms, forearms, and hands right to the tips of your fingers...Let the muscles of your throat and neck loosen...Relax your jaw and facial muscles... Let all the muscles of your body become loose...Now sit quietly with your eyes closed...Do nothing more than that. Just sit quietly with your eyes closed for a few minutes...(1 minute). Now continue to sit quietly for the next 10 minutes...(10 minutes). Now I will count from one to four. On the count of one, move your hands and feet; two, stretch your hands and feet; three, move your head around; and four, open your eyes. One. Move your hands and feet. Two. Stretch your hands and feet. Three. Move your head around. Four. Open your eyes. Please remain seated until someone comes in and unhooks the sensors. Thank you for your participation.

PROGRESSIVE MUSCLE RELAXATION

PARADOXICAL INSTRUCTION

Please sit quietly for the next 10 minutes and wait for further instructions...(10 minutes). For the next 25 minutes I would like for you to practice relaxation. Close your eyes, find a comfortable position in the chair, and listen carefully to the following instructions. Now settle back as comfortably as you can, close your eyes, and listen to what I'm going to tell you. I'm going to make you aware of certain sensations in your body and then show you how you can reduce these sensations. However, don't expect to become very relaxed at first. You may be one of those individuals who takes a long time to relax. This is okay. Keep in mind that if you feel any tension, it is a good thing and shows that you are in touch with your feelings and emotions. First, direct your attention to your left arm, your left hand in particular. Clench your left fist. Clench it tightly and study the tension in the hand and in the forearm. Study those sensations of tension...Now let go. Relax the left hand and let it rest on the arm of the chair. Note the difference between the tension and the relaxation...Once again now, clench your left hand into a fist tightly, noticing the tensions in the hand in in the forearm. Study those tensions, and now, let go. Let your fingers spread out relaxed and note the difference, once again, between muscular tension and muscular relaxation...Now let's do the same with the right hand. Clench the right fist. Study those tensions...And now relax. Relax the right fist. Note the difference once again between the tension and the relaxation, and enjoy the contrast...Once again, now clench the right fist. Clench it tight. Study the tensions...Study them...And now, relax the right fist. Let the fingers spread out comfortably. See if you can keep letting go a little bit more. Even though it seems as if you have let go as much as you possibly can, there always seems to be that extra bit of relaxation. Note the difference once again between the tension and the relaxation. Note the looseness beginning to develop in the left and right hands. Both your left and right arms and hands are a little bit more relaxed...Now bend both hands back at the wrist so that you tense the muscles in the back of the hand and in the forearm, fingers pointing towards the ceiling. And now relax. Let your hands return to their resting positions, and note the difference between tension and relaxation...Do that once again, fingers pointing to the ceiling, feeling that tension in the backs of the hands and in the forearms. And now relax...Let go further...Now clench both your hands into fists and bring them towards your shoulders so as to tighten your biceps muscles, the large muscles in the upper part of the arm. Feel the tension in the biceps muscles. And now relax. Let your arms drop down again to your sides, and note the difference between the tension that was in your biceps and the relative relaxation you feel now... Let's do that once again now. Clench both biceps muscles, bringing both arms up, trying to touch with your fists the respective shoulders. Study the tension. Hold it. Study it. And now relax. Once again, let the arms drop, and study the feelings of relaxation, the contrast between tension and relaxation. Just keep letting go of those muscles further and further...Now we can direct our attention to the shoulder area. Shrug your shoulders, bringing both shoulders up towards your ears as if you wanted to touch your ears with your shoulders, and note the tension in your shoulders and up in your neck. Study that tension. Hold it. And now relax. Let both shoulders return to a resting position. Just keep letting go further and further. Once again, note the contrast between the tension and the relaxation that is now spreading into your shoulder area...Do that once again. Bring both shoulders up as if to touch the ears. Feel the tension in the shoulders, in the upper back, and the neck. Study the tension in these muscles. And now relax. Loosen those muscles.

Let your shoulders come down to a resting position, and study the contrast once again between the tension and the relaxation...You can also learn to relax more completely the various muscles of the face. So, what I want you to do now is to wrinkle up your forehead and brow. Wrinkle it until you feel all your forehead very much wrinkled, the muscles tense and the skin furrowed. And now relax. Smooth out the forehead. Let those muscles become loose...Do that once again. Wrinkle up the forehead. Study those tensions in the muscles above the eyes in the forehead region. And now smooth out your forehead. Relax those muscles. And once again, note the contrast between the tension and the relaxation...Now close your eyes very tightly. Close them tightly so that you can feel tension all around your eyes and the many muscles that control the movement of the eyes...And now, relax those muscles. Let them relax, noting the difference between the tension and the relaxation...Do that once again now, eyes tightly closed, and study the tension. Hold it. And relax. Let go, and let your eyes remain comfortably closed...Now purse your lips. Press your lips together. That's right, press them together very tightly and feel the tension all around the mouth. Now relax. Relax those muscles around the mouth and just let your chin rest comfortably...Once again now, press your lips together, and study the tension around the mouth. Hold it. And now relax. Let go of those muscles more and more, further and further. Note how much more loose the various muscles perhaps have become in those parts of the body that we have successfully tensed and relaxed--your hands, forearms, upper arms, your shoulders, the various facial muscles. And now, we'll turn our attention to the neck. Press your head back against the surface on which it's resting. Press it back so that you can feel the tension primarily in the back of the neck and in the upper back. Hold it. Study it. Now let go. Let your head rest comfortably now. Enjoy the contrast between the tension you created before and the greater relaxation you feel now. Just keep letting go, further and further, more and more, to the best of your ability. Do that once again, head pressed back. Study the tension. Hold it. And now, let go. Just relax. Let go further and further...Now, I'd like you to bring your head forward and try to bury your chin into your chest. Feel the tension especially in the front of your neck. And now relax. Let go further and further. Do that once again now, chin buried in the chest. Hold it. And now relax. Just relax further...Now we can direct our attention to the muscles of the upper back. Arch your back, arch it, sticking out your chest and stomach so that you can feel tension in your back primarily in your upper back. Study that tension. And now relax...Let the body once again rest against the back of the chair or the bed, and note the difference between the tension and the relaxation, letting those muscles get more and more loose...Once again, arch the back way up. Study the tensions. Hold it. Now relax. Relax the back once again, letting go of all the tensions in these muscles...And now, take a deep breath, filling your lungs, and hold it. Hold it and study the tension all through your chest and down into your stomach area. Study that tension, and now relax. Let go. Exhale and continue breathing as you were. Note once again the difference between the tension and the relaxation...Let's do that once again. Take a deep breath and hold it. Hold it. Study those tensions. Study them. Note the muscles tensing. Note the sensations. And now exhale and continue breathing as you were, very comfortably breathing, letting those muscles of the chest and some of the stomach muscles relax, getting more and more relaxed each time you exhale...And now, tighten up the muscles in your stomach. Tense those stomach muscles. Hold it. Make the stomach very hard. And now relax. Let those muscles become loose. Just let go and relax...Do that once again. Tighten those stomach muscles. Study the tension. And now relax. Let go further and further, more and more.

Loosen the tensions. Get rid of the tensions, and note the contrast between tension and relaxation...I'd like you now to stretch both legs. Stretch them so that you can feel tension in the thighs. Stretch them way out. And now relax. Let them relax and note the differences once again between tension in the thigh muscles and the relative relaxation you can feel now...Do that once again, locking your knees, stretch out both legs so that you can feel the muscles. Let them get loose. Get rid of all tensions in the muscles of your thighs. Now tense both calf muscles by pointing your toes towards your head. If you point your toes upwards towards your head, you can feel the pulling, the tension, the contraction in your calf muscles and in your shins as well. Study that tension. And now relax. Let the legs relax and note once again the difference between tension and relaxation...Once again now, bend the feet back at the ankles, toes pointing towards your head, and study the tension. Hold it. Study it. And now let go. Relax those muscles further and further, more and more deeply relaxed...Just as you have been directing your muscles to tense you have also been directing them to relax or to loosen. You've noted the difference between tension and muscular relaxation. You can notice whether there is any tension in your muscles, and if there is, you can try to concentrate on that part, send messages to that muscle to loosen, to relax. If you think of loosening that muscle, you will, in fact, be able to do so, even if only a little. Now as you sit there in the chair, I'm going to review the various muscle groups that we've covered. As I name each group, try to notice if there is any tension in those muscles. If there is any, try to concentrate on those muscles and send messages to them to relax, to loosen...Relax the muscles in your feet, ankles, and calves...shins, knees, and thighs...buttocks and hips... loosen the muscles of your lower body...Relax your stomach, waist, lower back...upper back, chest, and shoulders...Relax your upper arms, forearms, and hands right to the tips of your fingers...Let the muscles of your throat and neck loosen...Relax your jaw and facial muscles...Let all the muscles of your body become loose...Now sit quietly with your eyes closed... Do nothing more than that. Just sit quietly with your eyes closed for a few minutes...(1 minute). Now continue to sit quietly for the next 10 minutes...(10 minutes). Now I will count from one to four. On the count of one, move your hands and feet; two, stretch your hands and feet; three, move your head around; and four, open your eyes. One. Move your hands and feet. Two. Stretch your hands and feet. Three. Move your head around. Four. Open your eyes. Please remain seated until someone comes in and unhooks the sensors. Thank you for your participation.

SELF-RELAXATION

PARADOXICAL INSTRUCTION

Please sit quietly for the next 10 minutes and wait for further instructions from the tape...(10 minutes). For the next 25 minutes, I would like you to practice relaxation. Close your eyes (slight pause), find a comfortable position in the chair (slight pause), and listen carefully to the following instructions. For the next few minutes I want you to practice relaxation using any means you wish. Use any method of relaxation that works for you, or any combination of methods that have been successful in the past. However, don't expect to become very relaxed at first. You may be one of those individuals who takes a long time to relax. This is okay. Begin your relaxation now... (5 minutes). Continue your relaxation using your favorite method. Remember, don't expect too much from yourself initially...(5 minutes). Continue to relax. Keep in mind that if you feel any tension, it is a good thing and shows that you are in touch with your feelings and emotions...(5 minutes). As you are relaxing, let your muscles become quiet. Remember, the stress you may be experiencing is part of your life, something important, and may be a source of energy...(5 minutes). Remember, it is okay not to relax fully at first...(5 minutes). Continue to attempt relaxation for the next 5 minutes...(5 minutes). In a moment, I will return to the room and disconnect the sensors. Now I will count from one to four. One...move your hands and feet, two...stretch your hands and feet, three...move your head around, and four...open your eyes. Please remain seated until I return to the room. Thank you for your cooperation.

APPENDIX E

Tables

Table 1

ANOVA Summary and Descriptive Statistics for EMG Adaptation Phase

A. ANOVA Summary

Source	Df	Mean Square	F	Significance
Treatment (T)	2	3.07	3.05	.0549
Instruction (I)	1	0.24	0.24	.6271
Sex (S)	1	0.05	0.06	.8122
T x I	2	0.01	0.01	.9862
T x S	2	1.48	1.47	.2372
I x S	1	2.69	2.67	.1078
T x I x S	2	1.78	1.77	.1799
Error	60	1.01		

B. Means (and Standard Deviations) for All Groups

Males

	EMGBF	PMR	SR
Standard Deviation	2.45 (.87)	1.89 (.71)	1.78 (.47)
Pardoxical Instruction	3.45 (1.57)	1.76 (.79)	2.41 (1.76)

Table 1 continued

	Females		
	EMGBF	PMR	SR
Standard Instruction	2.78 (1.18)	2.14 (.64)	2.19 (.34)
Paradoxical Instruction	2.02 (.67)	2.40 (1.25)	1.88 (.65)

Table 2

ANOVA Summary and Descriptive Statistics for Average EMG Change (Time Blocks 1 + 2 - Time Blocks 7 + 8)/2

A. ANOVA Summary

Source	Df	Mean Square	F	Significance
Treatment (T)	2	11.92	8.36	.0006
Instruction (I)	1	2.94	2.10	.1525
Sex (S)	1	4.46	3.13	.0820
T x I	2	.49	.35	.7081
T x S	2	.87	.62	.5433
I x S	1	4.85	3.40	.0701
T x I x S	2	.28	.20	.8182
Error	60	1.42		

B. Means (and Standard Deviations) For All Groups

Males

	EMGBF	PMR	SR
Standard Instruction	2.45 (.87)	1.89 (.71)	1.78 (.47)
Paradoxical Instruction	3.45 (1.57)	1.76 (.79)	2.41 (1.76)

Table 2 continued

	Females		
	EMGBF	PMR	SR
Standard Instruction	2.78 (1.18	2.14 (.64)	2.19 (.34)
Paradoxical Instruction	2.02 (.67)	2.40 (1.25)	1.88 (.65)

Table 3

Newman-Keuls Multiple F-Test for EMG Change Score

	EMGBF	PMR	SR
1 - EMGBF	-----	* .48	.13
2 - PMR		----	*.61
3 - SR			---

*Significant at p < .05

Table 4

ANOVA Summary and Descriptive Statistics for Temperature Adaptation Phase

A. ANOVA Summary

Source	Df	Mean Square	F	Significance
Treatment (T)	2	9.08	.16	.8561
Instruction (I)	1	42.43	.74	.3944
Sex (S)	1	3.33	.06	.8118
T x I	2	98.60	1.69	.1933
T x S	2	4.44	.08	.9267
I x S	1	197.67	3.39	.0706
T x I x S	2	27.92	.48	.6220
Error	60	58.35		

B. Means (and Standard Deviations) for All Groups

Males

	EMGBF	PMR	SR
Standard Instruction	86.82 (8.36)	86.27 (6.88)	90.91 (.96)
Pardoxical Instruction	84.04 (7.15)	86.31 (4.12)	79.07 (13.68)

Table 4 continued

	Females		
	EMGBF	PMR	SR
Standard Instruction	85.54 (8.34)	84.44 (6.14)	85.36 (8.83)
Paradoxical Instruction	88.10 (5.22)	87.59 (5.78)	84.96 (8.92)

Table 5

ANOVA Summary and Descriptive Statistics for Average Temperature Change (Time Blocks 1 + 2 - Time Blocks 7 + 8)/2

A. ANOVA Summary

Source	Df	Mean Square	F	Significance
Treatment (T)	2	23.16	.54	.5844
Instruction (I)	1	47.20	1.10	.2976
Sex (S)	1	423.40	9.90	.0026
T x I	2	31.37	.73	.4843
T x S	2	14.56	.34	.7126
I x S	1	201.33	4.71	.0340
T x I x S	2	182.83	4.28	.0184
Error	60	42.75		

B. Means (and Standard Deviations) for All Groups

Males

	EMGBF	PMR	SR
Standard Instruction	1.92 (3.91)	4.75 (6.35)	-.13 (1.97)
Paradoxical Instruction	4.78 (6.06)	3.19 (5.49)	13.45 (15.58)

Table 5 Continued

	Females		
	EMGBF	PMR	SR
Standard Instruction	-.08 (2.28)	-.68 (5.09)	2.79 (7.70)
Paradoxical Instruction	-.43 (4.17)	-.05 (5.55)	-2.66 (2.13)

VITA

Lofton Verner Anderson was born March 13, 1985 in Fayetteville, North Carolina. He attended public schools in Dunn, North Carolina, and in 1977 he graduated on the Dean's list from The Asheville School in Asheville, North Carolina. Four years later, Lofton received his Bachelor of Arts, Cum Laude, from The University of Richmond. His major was in psychology.

Lofton has been employed at two psychiatric hospitals. In the summer of 1979, he worked at Highland Hospital in Asheville, North Carolina on the acute and adolescent wards. In 1980, he was employed at Westbrook Hospital in Richmond, Virginia and worked on the adolescent ward.

Since August, 1981, Lofton has been living in Boone, North Carolina where he has been involved in the Appalachian State University Master of Arts program in clinical psychology. His major is in clinical psychology and his minor is in experimental psychology. He worked as a part-time student employee at the Counseling and Psychological Services Center where he later worked on his thesis. Lofton completed his internship at the

Blue Ridge Center in Asheville, North Carolina. While there, he worked on the adult crisis and short-term therapy service. Lofton is a member of the Psi Chi Psychology Honor Society and the Southeastern Psychological Association.

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