BIOFEEDBACK AND PROGRESSIVE RELAXATION IN THE TREATMENT OF MUSCLE TENSION HEADACHES: A COMPARISON

DISSERTATION

Presented to the Graduate Council of the North Texas State University in Partial Fulfillment of the Requirements

For the Degree of

DOCTOR OF PHILOSOPHY

By

Donald Everett Trahan, M. S.
Denton, Texas
December, 1979
Trahan, Donald Everett, Biofeedback and Progressive Relaxation in the Treatment of Muscle Tension Headaches: A Comparison. Doctor of Philosophy (Clinical Psychology), December, 1979, 52 pp., 4 tables, references, 46 titles.

This study was designed to compare the clinical effectiveness of EMG biofeedback and progressive relaxation training in the treatment of muscle tension headache. These procedures also were compared with a treatment-element control group. The subjects were 15 adults who responded to advertisements in local newspapers. Each respondent was screened initially, and only those considered to have tension headaches were chosen to participate in the study. Subjects were required to refrain from other forms of treatment while participating in this study.

For each subject, data on headache frequency, intensity, and duration were collected during a 2-week baseline period. During this time, subjects also received two 30-minute monitoring sessions during which EMG potentials were measured. After the baseline period, five subjects were assigned randomly to each of the three groups.

Subjects in the biofeedback group then received 12 30-minute sessions of auditory EMG feedback. During the first 20 minutes of each session, subjects received veridical EMG feedback. During the final 10 minutes of each session,
subjects no longer received biofeedback, but they continued to relax while frontalis tension was monitored for 10 1-minute trials. The mean of these trials served as the measure of muscular tension during a given session.

Subjects in the progressive relaxation training group received 12 30-minute training sessions. During the first 20 minutes of each session, subjects listened to taped recordings of relaxation instructions. During the final 10 minutes of each session, they no longer listened to tapes but continued relaxing while focusing on feelings of warmth and heaviness. During this time period, 10 1-minute recordings of EMG tension were obtained.

Subjects in the control group also received 12 "treatment" sessions. However, the feedback presented to these subjects was actually bogus feedback which had been recorded from a previous patient over 12 consecutive sessions. These feedback tapes were designed to create the impression that relaxation was occurring both within and across sessions. During each session, subjects listened to these tapes for 20 minutes and then continued relaxing as 10 1-minute recordings of EMG tension were obtained.

Results from this study indicated that EMG biofeedback, progressive relaxation, and the control procedures all led to significant improvements across sessions on EMG and most self-report measures. There was little evidence that either treatment technique was superior to the other or to the control procedures. Although in most cases there were rather large
numerical differences between groups, these differences generally were not statistically significant. This may have been due in part to the limited number of subjects in each group or to the lack of generalization from EMG frontalis feedback and monitoring to other muscle groups involved in headache pain. The significant improvements obtained for all three groups were impressive in view of the fact that all subjects in this study had reported a long history of tension headache problems, and most had been refractory to other forms of treatment. Results obtained from the control group are of particular interest and strongly suggest that future studies investigate the role of nonspecific effects more closely.

Analysis of correlations between EMG and self-report data revealed a pattern of variable but generally nonsignificant relationships. However, for the biofeedback and progressive relaxation groups, there were a number of highly significant correlations. The pattern of correlations suggested that the relationship between EMG tension and subjective headache pain may be better predicted by something other than a strict linear model.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>LIST OF TABLES</th>
<th>iv</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIST OF ILLUSTRATIONS</td>
<td>v</td>
</tr>
<tr>
<td><strong>Dissertation</strong></td>
<td></td>
</tr>
<tr>
<td>Introduction</td>
<td>1</td>
</tr>
<tr>
<td>Method</td>
<td>17</td>
</tr>
<tr>
<td>Subjects</td>
<td></td>
</tr>
<tr>
<td>Procedure</td>
<td></td>
</tr>
<tr>
<td>Results</td>
<td>24</td>
</tr>
<tr>
<td>Discussion</td>
<td>35</td>
</tr>
<tr>
<td>Appendix</td>
<td>43</td>
</tr>
<tr>
<td>References</td>
<td>43</td>
</tr>
</tbody>
</table>
# LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Correlations Between EMG and Headache Frequency</td>
<td>32</td>
</tr>
<tr>
<td>2. Correlations Between EMG and Headache Intensity</td>
<td>33</td>
</tr>
<tr>
<td>3. Correlations Between EMG and Average Headache Duration</td>
<td>34</td>
</tr>
<tr>
<td>4. Correlations Between EMG and Total Headache Duration</td>
<td>35</td>
</tr>
</tbody>
</table>
**LIST OF ILLUSTRATIONS**

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Electromyographic Data for the Biofeedback, Progressive Relaxation, and Control Groups</td>
<td>25</td>
</tr>
<tr>
<td>2.</td>
<td>Headache Frequency Data for the Biofeedback, Progressive Relaxation, and Control Groups</td>
<td>27</td>
</tr>
<tr>
<td>3.</td>
<td>Headache Intensity Data for the Biofeedback, Progressive Relaxation, and Control Groups</td>
<td>28</td>
</tr>
<tr>
<td>4.</td>
<td>Average Headache Duration for the Biofeedback, Progressive Relaxation, and Control Groups</td>
<td>30</td>
</tr>
<tr>
<td>5.</td>
<td>Total Headache Duration for the Biofeedback, Progressive Relaxation, and Control Groups</td>
<td>31</td>
</tr>
</tbody>
</table>
BIOFEEDBACK AND PROGRESSIVE RELAXATION IN THE TREATMENT OF MUSCLE TENSION HEADACHES: A COMPARISON

In our modern stress-filled society, one may well expect that tension headaches will remain a common problem. Ostfeld (1962) reported that this form of headache usually results from sustained contractions of muscles in the scalp, neck, or face. Numerous strategies have been developed to deal with this growing problem. Among the more popular treatments currently in use are medication, hypnosis, transcendental meditation, progressive relaxation training, and biofeedback. Because of the variety of techniques being used, individuals seeking help in alleviating muscle tension headaches are faced with the dilemma of having to choose from numerous available treatments. To make a difficult problem worse, usually neither the individual nor his doctor has knowledge of the relative effectiveness of various treatments. In view of this, the present study was designed to compare the effectiveness of two procedures, progressive relaxation training and EMG biofeedback, in reducing headache symptoms.

In both progressive relaxation training and biofeedback, the objective is to assist the patient in learning to reduce the abnormally high levels of muscular tension which are assumed to be the primary causative factors in this type of headache pain (Dalessio, 1972). However, the two procedures
differ in other respects. Traditional relaxation training normally utilizes verbal cognitive instruction (Jacobson, 1938; Mitchell, 1969; Schultz & Luthe, 1959) and often focuses on reducing tension throughout the body. Biofeedback training, on the other hand focuses more upon physiological factors (DiCara, 1969; Miller, 1969). This procedure typically utilizes electromyographic (EMG) feedback of the frontalis (forehead) muscle to reduce tension in that area alone (Epstein & Abel, 1977). Although there has been speculation that EMG frontalis training might be effective in producing a generalized relaxation response, one investigation (Alexander, 1975) has indicated that the effects may be quite specific and localized.

The effectiveness of biofeedback in helping patients to achieve deep muscle relaxation has been well established. The earliest attempts to demonstrate the usefulness of this technique were conducted by Budzynski and Stoyva (1969) and Green, Walters, Green, and Murphy (1969). These preliminary reports were followed by numerous clinical studies. Jacobs and Felton (1969) utilized EMG feedback to help 14 patients who had sustained injuries to the trapezius muscle and were unable to relax their neck. They found that brief EMG training was sufficient to allow these patients to reduce their muscle tension significantly to a level equal to that of normal control subjects. This study was followed by several attempts to apply biofeedback procedures to patients
experiencing high levels of anxiety (Garrett & Silver, 1972; Raskin, Johnson, & Rondestvedt, 1973; Townsend, House, & Addario, 1975). Although investigators in each study reported that EMG training produced significant reductions in muscle tension, only Townsend et al. (1975) found these reductions to be correlated highly with subjective changes in anxiety and performance. Recent investigations with nonclinical subjects also have supported the effectiveness of EMG biofeedback in assisting muscle relaxation. Coursey (1975) compared auditory biofeedback with two control procedures. In one control group, subjects were told simply to relax and were presented with a constant tone. In the other control group, individuals were given brief verbal instructions concerning how to relax and also were presented with a constant tone. Results showed the biofeedback procedure to be significantly more effective than the control procedures in reducing EMG levels. Similar results indicating the effectiveness of EMG biofeedback in reducing muscle tension were found by other investigators (Canter, Kondo, & Knott, 1975; Davis, 1975; Duane, 1974; Haynes, Mosely, & McGowan, 1975b; Kinsman, O'Banion, Robinson, & Staudenmayer, 1975; Reinking & Kohl, 1975).

In reviewing the literature on progressive relaxation procedures, it is evident that several distinct techniques have been used. Perhaps the most frequently used procedure is that advocated by Jacobson (1938, 1970) which consists
of having the patient alternate tensing and relaxing various muscle groups. Attention initially is focused on specific muscles and ends with a period of total body relaxation. A second method (Wolpe, 1969) does not rely on alternate periods of tensing and relaxing. Individuals are instructed to attend to various muscle groups and to allow them to become relaxed passively. Finally, there is the autogenic training procedure described by Luthe (1963). In addition to emphasizing relaxation, this method also has the patient focus on feelings of warmth and heaviness as he becomes more and more relaxed. Although these procedures may appear to be distinctively different, they often are modified or used in combination.

As with biofeedback, research supporting the apparent effectiveness of progressive relaxation procedures in reducing muscle tension is abundant (Jacobson, 1938; Mitchell, 1969; Schultz & Luthe, 1959). More recently, Haynes et al. (1975b) compared five procedures in effectiveness of reducing muscle tension. The methods used were (1) biofeedback, (2) passive relaxation, (3) active relaxation, (4) false feedback, and (5) no treatment. Results indicated that biofeedback and passive relaxation were significantly more effective than the last three procedures in reducing EMG levels. Similarly promising results were found by others comparing relaxation with no-treatment procedures (Reinking et al., 1975). Several other investigators also have found relaxation methods to be effective in reducing EMG levels while using within-subject
designs (Canter et al., 1975; Davis, 1975; Hutchings & Reinking, 1976).

Although the previous studies have established both progressive relaxation and biofeedback as effective clinical techniques, little has been mentioned regarding the comparative efficacy of these two procedures. Reinking and Kohl (1975) compared five different procedures. In their study, 50 subjects were randomly assigned to one of five conditions: (1) classic Jacobson-Wolpe instructions, (2) EMG biofeedback, (3) EMG feedback plus Jacobson-Wolpe instructions, (4) EMG feedback plus a monetary reward, or (5) no-treatment control. Results indicated that all four treatment groups showed significant reductions in tension on both EMG and self-report measures. However, biofeedback groups were superior to the Jacobson-Wolpe group in both speed of learning and depth of relaxation as measured by EMG changes. Also, it appeared that procedures accompanying EMG feedback had little additive effect.

Duane (1974) compared four procedures on ability to reduce muscle tension and self-reported anxiety. Subjects were assigned to four conditions: (1) verbal feedback of EMG, (2) brief relaxation training (Jacobsonian), (3) verbal feedback plus brief relaxation training, and (4) a control condition. Results indicated that feedback of EMG with and without relaxation training led to significant reductions in EMG levels. However, relaxation training alone failed to produce significant results. Interestingly, all four groups
showed significant improvements on self-report measures of anxiety, but only for the first of the three sessions. This effect was attributed largely to novelty and expectation.

Haynes et al. (1975a), as cited earlier, compared biofeedback, passive relaxation, active relaxation, false feedback, and no treatment in reducing EMG levels. Biofeedback and passive relaxation were found equally effective in reducing muscle tension. Active relaxation procedures (alternating tensing and relaxing various muscle groups) were not significantly more effective than control procedures. However, each subject in this study was administered only a single 20-minute treatment session. There is some doubt whether this is sufficient to measure the true effectiveness of the procedures.

Canter, Kondo, and Knott (1975) studied biofeedback and Jacobson progressive relaxation with a group of psychiatric patients having the diagnosis of anxiety neurosis. Patients were assigned to one of the two treatment groups. There was no control condition. Dependent variables measures were EMG readings, patients' self-reports of anxiety, and therapists' ratings of anxiety. Results indicated that both EMG feedback and progressive relaxation training produced significant reductions in frontalis tension levels. However, EMG feedback was found generally to be superior in producing larger reductions in muscle activity. EMG training also appeared superior to progressive relaxation on measures of anxiety,
with 85% of the feedback patients reporting improvements, compared to 50% in the relaxation group.

As a group, these studies indicate that both EMG biofeedback and progressive relaxation training, when given in sufficient amounts, are effective in producing reductions in muscle tension. However, EMG training appears to work more quickly and in brief treatment programs usually achieves a greater depth of relaxation. There is little evidence that a combination of the two techniques produces a significant additive effect.

Although the previous studies have demonstrated the effectiveness of both procedures as relaxation techniques with psychiatric and normal populations, the present review is concerned more with the application of these treatments to a particular clinical syndrome, the muscle tension headache. Budzynski, Stoyva, and Adler (1970) were among the first to apply EMG biofeedback to the treatment of tension headaches. The subjects were five patients with a history of muscle tension headaches. After collecting baseline data on both EMG and headache activity, patients were given two to three 30-minute sessions of biofeedback training weekly for a period of 4 to 13 weeks. During this time, they also were encouraged to practice relaxation at home. Posttreatment results indicated that all patients showed steady decreases in EMG frontalis activity. Three of the five patients reported that
headaches were either eliminated or markedly reduced. Continued home relaxation and feedback for the other two patients produced elimination of their headaches as well.

Wickramasekera (1972) used the Budzynski procedure with five patients experiencing tension headaches. After an initial baseline period and 3 weeks of pseudofeedback, patients were given two 30-minute sessions of EMG feedback per week for 12 weeks. It was reported that there were reductions in both intensity and duration of headaches during the final phase of treatment; however, it was not reported whether or not the reductions were statistically significant.

Budzynski, Stoyva, Adler, and Mullaney (1973) expanded their own work by selecting 18 tension headache patients and placing them into one of three groups: (1) an EMG feedback group, (2) an attention-placebo group receiving pseudofeedback, or (3) a no-treatment control group. After a baseline period, patients in the first two groups were seen twice per week for 8 weeks. The no-treatment group simply recorded headache activity. The first two groups also were encouraged to practice relaxation at home. Results indicated that patients in the veridical EMG feedback group experienced significantly fewer headaches after treatment than either the attention-placebo group or the no-treatment control group. An 18-month follow-up indicated that four of six of the experimental group had maintained their low level of headache activity. However, only one of six of the attention-placebo group and
none in the no-treatment group reported such reductions. One very important consideration in this study is that the success of treatment appeared to be influenced largely by the degree to which patients maintained their home relaxation practice.

Data obtained from subsequent investigations continue to support the contention that muscle relaxation achieved through EMG biofeedback training is an effective treatment for tension headaches. Raskin et al. (1973), in a study designed to utilize EMG frontalis feedback to reduce anxiety symptoms, found that four patients who had been experiencing tension headaches reported abatement of these symptoms. Epstein, Hersen, and Hemphill (1974) used music feedback contingent upon reductions in frontalis muscle tension. They found that reductions in both EMG and headache activity could be achieved using this procedure. Although the low rate of headache activity continued during a 2-month follow-up, the patient also had used additional relaxation techniques during this time period. Epstein and Abel (1977) attempted to design a treatment program for patients with tension headaches in order to determine whether or not tension control learned with the help of biofeedback would generalize to other conditions. Although it was found that patients could lower tension levels while utilizing EMG feedback, they were not able to maintain these reductions in self-management sessions without such feedback. It was reported that three of six patients experienced fewer headaches, but there was no clear
relationship between physiological changes and reduction of pain. Finally, Francisco (1975) demonstrated the efficacy of a program combining biofeedback and transactional analysis. He found this combination to be significantly more effective in reducing intensity and frequency of headaches than either procedure alone.

Investigations similar to those mentioned previously also have been conducted to determine the efficacy of progressive relaxation exercises in alleviating muscle tension headaches (Jacobson, 1938; Mitchell, 1969; Schultz et al., 1959). Tasto and Hinkle (1973) used progressive relaxation to treat six patients with frequent tension headaches. Each patient received four training sessions plus specific instructions to practice relaxation on a daily basis. All patients reported reduction in both frequency and duration of headaches. A follow-up 2½ months later indicated that all six had maintained their low level of headache activity. Fichtler and Zimmerman (1973) conducted a similar study using four taped recordings of relaxation instructions. After completion of the four sessions, patients were given a 15-minute tape to take home and were instructed to practice twice per day. Data indicated that there were significant reductions in intensity, duration, and interference of headaches. In a single case study, Mitchell and White (1976) described a self-management program designed to reduce tension headaches. Progressive relaxation was a major element in this program, but the patient also was
taught self-management skills and self-desensitization. They reported that by the end of treatment, there had been a 100% reduction in headache activity and that after 6 months the headaches had not returned.

With the efficacy of both EMG and progressive relaxation fairly well established, several studies were undertaken to compare the effectiveness of the two procedures. Cox, Freundlich, and Meyer (1975) compared (1) auditory EMG feedback, (2) progressive relaxation, and (3) a medication placebo in alleviating chronic tension headaches in 27 patients. Results indicated that both the feedback and relaxation procedures were superior to the medication placebo in achieving reductions in frequency, intensity, and duration of headaches. The two treatment groups did not differ significantly from one another. However, the authors reported that the correlation between reduction of EMG frontalis activity and headache measures ($r = .42$) accounted for only 18% of the variance in treatment effect. Furthermore, steps were not taken to control adequately for nonspecific effects of treatment (e.g., expectancy, credibility of treatment). In addition, subjects continued taking regular headache medication, making it difficult to attribute therapeutic gains solely to the new procedures.

Haynes, Griffin, Mooney, and Parise (1975a) compared the relative efficacy of (1) biofeedback, (2) relaxation training, and (3) no-treatment control. Baseline data were collected,
and patients were seen for two 30-minute sessions per week for 3 weeks. The dependent measures in this study were frequency, intensity, and duration of headaches. Results indicated that both the feedback and relaxation groups were superior to the no-treatment control in reducing headache frequency and overall activity (i.e., frequency, duration, and intensity combined). The two treatment groups did not differ significantly from one another. Again, however, no attempt was made to establish the credibility of control procedures or to insure that people in the no-treatment group had expectancies equivalent to those in other groups. The length of treatment also was somewhat brief. The authors also did not report correlations between self-report and physiological measures.

Hutchings and Reinking (1976) compared the effectiveness of (1) Jacobson-Wolpe autogenic-relaxation training, (2) EMG relaxation training, and (3) EMG relaxation training combined with Jacobson-Wolpe instructions. They found all three treatment procedures significantly effective in reducing average EMG readings and headache activity in medically documented tension headache sufferers. Both the biofeedback and combined biofeedback and relaxation groups were equally superior to relaxation alone. There was no evidence that the combined procedures resulted in an additive treatment effect. The weakness of this study is that no procedure was used to control for placebo effects.
Chesney and Shelton (1976) assigned patients with muscle contraction headaches to one of four conditions: (1) biofeedback, (2) progressive relaxation, (3) combined biofeedback and progressive relaxation, or (4) no-treatment control. Results indicated that a muscle relaxation treatment and a combined muscle relaxation and biofeedback treatment were equally more effective than either a biofeedback treatment alone or a no-treatment control in reducing headache frequency and duration. However, only the combined treatment procedure proved to be more effective than the no-treatment control in reducing headache severity. The lack of significant treatment effects for the biofeedback group was assumed to result from the atypical results obtained by two patients. Also, in this study no attempt was made to equate conditions in the no-treatment group with those in the treatment groups with regard to nonspecific effects. Correlations between self-report and physiological measures were not reported.

In its totality, current research appears to support the contention that both EMG feedback of frontalis (forehead) activity and progressive relaxation techniques are effective in reducing muscular tension and alleviating the symptoms of muscle contraction headaches. However, close scrutiny of the research reveals several important inadequacies in most of the available information: (1) too often there has been a lack either of control procedures or other methods which adequately account for the nonspecific effects of treatment, (2) despite
the assumption that it is physiological changes which are responsible for modifications of headache pain, the correlation between these variables often is not reported or is observed to be remarkably low, (3) several different procedures often are combined, making it difficult to attribute therapeutic gains to any particular technique, and (4) the length of time in treatment is often too brief to assess the effectiveness of a given procedure adequately.

Lack of adequate control procedures constitutes perhaps the most serious methodological flaw in current research. Although many investigators have attempted to institute control procedures by utilizing no-treatment groups (Budzynski et al., 1973; Chesney et al., 1976; Haynes et al., 1975b; Schmidt, 1975), placebo control groups (Budzynski et al., 1973; Cox et al., 1975), or within-subject designs (Epstein et al., 1977; Epstein et al., 1974; Fichtler et al., 1973; Hutchings et al., 1976; Mitchell et al., 1976; Raskin et al., 1973; Tasto et al., 1973; Wickramasekera, 1972), few have made a serious effort to control for the nonspecific effects of treatment. Recent publications have seriously questioned the adequacy of control procedures which do not account for variations in patient expectancy and credibility of treatment (Kazdin & Wilcoxon, 1976; Meichenbaum, 1976). Andrews (1975) employed differential instructions in a negative-placebo model to alter expectancies of success in achieving criterion frontalis EMG levels. Significant differences were found
between high- and low-frequency trials in time from onset of feedback to 70% reduction of EMG activity. Duane (1974) reported that in no-treatment control subjects, novelty factors and expectancy produced changes in dependent measures during early trials of relaxation training. These studies indicate the necessity of controlling not only patient expectancies, but also credibility of procedures, since there is an integral relationship between the two (Kazdin et al., 1976). Yet, to this author's knowledge, no published study has reported the use of a treatment-element control group or even an attempt to assess the effects of varying cognitions among subjects in different treatment conditions.

A second inadequacy in much of the current research is the failure to report the relationship between measures of physiological change and subjective reports of reduction in pain. Since the assumption underlying the use of both biofeedback and progressive relaxation as treatments for tension headache is that they effectively reduce the contractions responsible for pain, it is theoretically and practically important to establish correlations between the two measures. Although Budzynski et al. (1973) reported a high correlation ($r = .90$) between reduction in EMG and headache activity, the figure reported is usually much lower. Cox et al. (1975) reported a correlation of only .42. Another revealing observation was made by Reinking et al. (1975). They found that during the first 3 of 12 training sessions there was a
rather low correlation \((r = .38)\) between subjects' self-reports of relaxation and actual EMG levels. However, during the final three sessions, this correlation was much higher \((r = .57)\). From these reports there appears to be a relationship between the number of training sessions and correlations of dependent variables. As the number of sessions increases and patients become more adept in their ability to relax, correlations tend to be higher.

A third criticism of current research is that patients often are being treated simultaneously with several different procedures so that even if significant results are obtained, it is very difficult to isolate the effects of any particular technique. Patients in "biofeedback" groups often receive other relaxation training which they are to practice at home; and in addition, they may be taking one or several medications. From a practical standpoint, these investigations may be extremely useful in demonstrating the effectiveness of a given treatment "package;" however, they tell us little about which elements of treatment are responsible for therapeutic change. There is a definite need for research in which the procedures used with a given group are relatively "pure."

Another inadequacy in much of the current research is that some individuals have utilized very brief treatment procedures in attempting to establish the efficacy of a given technique. In some studies (Jacobs et al., 1969) only one brief session reportedly was used. This raises two important
questions. First, if correlations between physiological changes and self-report are not high until late in treatment, then lack of reported improvement in brief procedures may mean not that the technique is ineffective, but may reflect the difficulty reporting tension changes accurately. Second, if biofeedback works more quickly than progressive relaxation, then results from brief treatment programs will show one method to be superior when they are perhaps equally effective. This issue is particularly relevant in view of recent evidence that effects of biofeedback may be seen earlier in treatment (Haynes et al., 1975b; Kinsman et al., 1975; Reinking et al., 1975). Comparative research thus requires that sufficient sessions be used to allow all treatments to take effect.

The present study was designed to investigate the relative efficacy of frontalis biofeedback and progressive relaxation training in alleviating the symptoms associated with muscle tension headaches. Specific measures were designed to minimize the methodological inadequacies inherent in other studies.

Method

Subjects

The subjects were 15 adults who responded to advertisements in a local newspaper. Each respondent was interviewed in order to determine the type and frequency of headache which was experienced. Only those individuals exhibiting symptoms predominantly of muscle tension headache were accepted for treatment (Blumenthal, 1975; Dalessio, 1975; Graham, 1975).
Subjects were screened according to the Headache Symptom Checklist developed specifically for this study (see Appendix A). During the initial interview, each subject was asked in simple terms about the presence or absence of each symptom during headache attacks. In order to be accepted, a subject must have exhibited more of the symptoms indicative of tension headache than of migraine headache and must have shown no more than three symptoms from the migraine list. There were five subjects who were screened out because their headaches appeared to be migraine. Two others were not accepted because their headaches appeared to be related to allergy or sinus conditions. Subjects also must have averaged at least two headaches per week or one headache per week lasting 24 hours or more.

Procedure

Subjects accepted for treatment during the interview were given forms on which to record daily headache activity (see Appendix B). Each day for 2 weeks they recorded frequency, intensity, and duration of headache pain. During this baseline period, the experimenter called each subject to answer questions and encourage subjects to daily record headache activity.

After the baseline period, subjects were assigned randomly to one of three conditions: (1) biofeedback, (2) progressive relaxation training, or (3) treatment-element control. Each group was assigned a total of five subjects. They then were given a rationale for treatment (see Appendix C).
In this study it was necessary to select 3 of the 15 subjects from a different setting. Whereas 12 of the subjects were selected in the previously described manner from an urban community in Texas, three subjects were selected from an urban community in Ohio. The 12 original subjects were monitored with a BFT 401 feedback myograph. EMG signals were integrated using a BFT 215 Time Period Integrator which provided integral averaged EMG potentials per 60-second period over a bandpass of 95-1000 Hz. The three subjects from the Ohio sample were monitored on an Autogen 1700 feedback myograph with a bandpass of 100-1000 Hz. EMG signals for these subjects were monitored on an Autogen 5100 digital time period integrator which provided integral averaged EMG potentials per 60-second period. In terms of critical functions, the machines were essentially identical. One subject from the Ohio sample was assigned to each of the three treatment conditions. There were not significant differences between readings obtained from subjects in the two settings.

Subjects assigned to the biofeedback training group received two 30-minute baseline sessions during which EMG potentials were measured. During these initial sessions, subjects became acquainted with the biofeedback equipment. They had their foreheads rubbed with Brasivol skin cleaner and then alcohol. Electrode cream was placed on leads of the feedback myograph. The electrodes then were placed on the frontalis muscle, one directly above each eye, and
secured with a rubber headband. Subjects then were monitored for a 30-minute period. During this time, they were seated in a comfortable recliner chair; and lights in the room were turned off. For the first 20 minutes, they were asked simply to close their eyes and relax as they became accustomed to the equipment. Then the EMG readings for 10 1-minute trials were recorded. The mean for these trials served as the measure of pretreatment muscle tension levels.

Subjects in the EMG biofeedback group then received 12 1-minute training sessions during a 4-week period (Kondo, Canter, & Bean, 1977). During the first 20 minutes of each session, they received continuous auditory feedback of existing muscle tension. They were informed that the tone of the auditory signal was directly proportional to the amount of tension and instructed to keep the tone as low as possible. During the final 10 minutes of each training session, subjects received no further biofeedback. At this time, however, average EMG readings from 10 1-minute trials were recorded. Mean EMG levels from these trials served as the measure of muscular tension during that session.

Individuals in the progressive relaxation training group initially were observed for two 30-minute baseline sessions in the same manner as biofeedback subjects. After baseline data had been recorded, these subjects received 12 30-minute treatment sessions during a 4-week period. Throughout each session, EMG frontalis tension was monitored. During
the first 20 minutes of each session, subjects sat with closed eyes in a comfortable recliner chair. They then listened to taped instructions of traditional Jacobson-Wolpe relaxation techniques. These tapes were made using the experimenter's voice on Scotch C-60 Highlander/Low Noise tape and a General Electric Model M8455A cassette recorder. The instructions utilized in the study were taken from Goldfried and Davison (1976, p. 88-93). For the final 10 minutes of each session, subjects were instructed to continue relaxing and to focus on feelings of warmth and heaviness as all tension left the body. During this time, average EMG readings from 10 1-minute trials were recorded; and the mean served as the measure of muscular tension during that session.

Subjects in the treatment-element control group were observed for two baseline sessions in exactly the same manner as for the other two groups, each being monitored for two 30-minute sessions and asked to complete the Record of Daily Headache Activity. These subjects then received 12 30-minute treatment sessions over a 4-week period. During the initial 20 minutes of each session, they were given continuous auditory bogus feedback.

The feedback utilized with this control group was obtained by recording auditory feedback from a bogus client using the same equipment mentioned previously. Recordings were obtained for 12 sessions. The 12 recordings were presented consecutively to each subject during each of the treatment sessions 1 through
12. By utilizing this design, the feedback which subjects received indicated an apparent reduction in their level of muscular tension during the 20-minute period. The purpose of this manipulation was to create the belief that relaxation had taken place. It was hoped that the procedure would be believable enough to enable one to determine the degree to which the two types of treatment produced therapeutic gains above and beyond the effects of certain nonspecific elements. It is realized that the procedures instituted here actually controlled only for nonspecific elements in the biofeedback group. However, this author is not aware of a workable procedure, published or otherwise, which might establish this type of control for the progressive relaxation group. Nevertheless, the novelty factors and expectancies associated with biofeedback approach produced a control condition superior to the typical no-treatment and attention-placebo procedures.

During the final 10 minutes of the control sessions, subjects no longer received bogus feedback; but average EMG readings per 1-minute trial were recorded. Mean ratings for these trials served as the level of muscle tension during that session. After completion of the 12 "treatment" sessions, all subjects in the control group received an additional six sessions of veridical biofeedback.

During the treatment phase, all groups continued to monitor daily headache activity. Measures of intensity,
frequency, and duration of symptoms were recorded. Subjects were encouraged to utilize what they had learned in treatment whenever they believed a headache to be imminent. In order to continue participating in the study, it also was required that they discontinue medication typically taken only for tension headaches.

Results

Analysis of Data

EMG data were analyzed using a 3 X 5 ANOVA (Winer, 1971). The biofeedback, progressive relaxation, and control groups constituted the three levels of treatment. Data from these groups were examined at five different phases of treatment: (1) baseline, (2) sessions 1-3, (3) sessions 4-6, (4) sessions 7-9, and (5) sessions 10-12. In those cases where significant differences were found, Newman-Keuls procedure (Winer, 1971) was used to determine the source of those differences.

Self-report measures of headache activity were examined using a 3 X 3 ANOVA in a treatment X sessions design. This procedure was followed in examining data on headache frequency, intensity, and average duration per headache. In each case the treatment and control groups constituted three levels of treatment. Self-report data collected during baseline represented phase 1 of sessions, data collected during treatment sessions 1-6 represented phase 2, and data collected during sessions 7-12 represented phase 3. In those cases where
significant differences were found, Newman-Keuls procedure was used to determine the source of those differences.

Although random assignment of subjects produced group means at baseline which were not significantly different from one another for each of the above variables, there were significant differences among groups for the variable of total headache duration (i.e., total time the subject experienced headache during a 2-week baseline), \( .05 > p > .01 \). In view of this, 1 X 3 ANOVA's were computed separately for the biofeedback, progressive relaxation, and control groups. In those cases where significant differences were found, Newman-Keuls procedure was used to determine where the differences were.

The correlations between recorded EMG levels and self-reports of headache pain were examined. Pearson product-moment correlations between EMG and all self-report variables were computed individually for the treatment and control groups. Correlations also were computed separately for three phases: (1) baseline period, (2) the first 2 weeks of treatment (sessions 1-6), and (3) the final 2 weeks of treatment (sessions 7-12). All correlations then were tested for significance.

**Electromyographic Data**

Results from the EMG data indicate that subjects in both treatment and control groups were able to reduce their levels of muscle tension significantly, \( F (4, 48) = 9.88, p < .01 \). Overall, there were no statistically significant differences among the three groups in terms of reducing muscular tension,
$F(2,12) = 1.19, p > .25$. Further analysis of data indicates that significant reductions across trials were obtained only within the first three sessions. The further improvements which were obtained for the two treatment groups were not statistically significant (see Figure 1).

Subjects in the treatment-element control group made significant gains during the first three sessions, reducing their tension levels from an average of 7.4 microvolts during
baseline to 4.24 microvolts in sessions 1-3. However, from that point on in therapy, no further improvement was made; and these subjects exhibited average tension levels of 4.46 at the end of 12 sessions.

Subjects in the progressive relaxation training group likewise were able to lower tension levels significantly during the first three sessions. Although they continued to make lesser improvements in subsequent sessions and after 12 sessions had reduced average tension levels to 4.28 microvolts, these further reductions were not statistically significant. It is believed that the results would have been more dramatic were it not for the results obtained from one subject in the group who remained essentially unchanged throughout therapy.

Subjects in the biofeedback group lowered their tension levels from 7.95 microvolts during baseline to 3.12 microvolts during sessions 1-3. They continued to improve in subsequent sessions and after 12 sessions had reached a low level of 2.36 microvolts; however, these further reductions were not statistically significant. Although these subjects were not different from those in the progressive relaxation group, they had achieved significantly lower tension levels at the end of treatment than control subjects, t(2-tail) = 3.315, p < .02.

**Headache Frequency**

Results obtained from self-reports of headache frequency indicated that significant reductions were reported throughout
Figure 2. Headache frequency data for the biofeedback, progressive relaxation, and control groups.

treatment, $F(2, 24) = 34.26$, $p < .01$. No statistically significant differences were found among the three groups, $F(2, 12) = 1.87$, $p > .10$. Further analysis revealed that significant progress was reported not only from baseline to sessions 1-6, but also from sessions 1-6 to 7-12. Results obtained from this data were similar to those obtained from EMG data. Significant improvements across sessions were found for the treatment groups. However, improvements which did not differ significantly from those in treatment groups also were obtained from control subjects (see Figure 2).
Figure 3. Headache intensity data for the biofeedback, progressive relaxation, and control groups.

**Headache Intensity**

Data from reports of headache intensity revealed that significant reductions were obtained across the 12 treatment sessions, $F(2, 24) = 12.29, p < .01$. There were no significant differences between the treatment and control groups, $F(2, 12) = 3.82, p = .053$. However, results obtained were near the arbitrary cut-off level of .05. Further analysis revealed a significant groups X sessions interaction, $F(4, 24) = 4.13, p < .05$, indicating that the effectiveness of the procedures may vary across time. To determine the
nature of these differences, simple effects were analyzed by computing 1 X 3 ANOVA's separately for each group. Results of this analysis indicated that subjects in the progressive relaxation training group reported marked improvements which are statistically significant, $F(2, 8) = 17.73, p < .01$. The largest improvements were obtained during the first six sessions; however, further improvements also were recorded during the final six treatment sessions. Subjects in the biofeedback and control groups did not report statistically significant improvements over the 12 treatment sessions.

**Average Headache Duration**

Average headache duration was computed by obtaining the numerical average for each subject of the length of time for each headache reported. Reference to Figure 4 indicates that significant improvements were reported across sessions for the three groups combined, $F(2, 24) = 4.65, p < .05$. Like other variables, there were no statistically significant differences between the treatment and control groups, $F(2, 12) = 1.85, p > .10$. Subjects in the progressive relaxation group appeared to show the most dramatic clinical improvements, but these changes did not differ significantly from other groups. These subjects initially reported headaches averaging 4.2 hours. The average duration of their headaches improved to 1.2 hours during the final six treatment sessions.

Subjects in the biofeedback group initially reported headaches averaging 4.27 hours. Average duration of headaches
reported by these individuals improved to 3.00 hours during the final six sessions. These results certainly are less dramatic than those for the progressive relaxation group; but the effectiveness of biofeedback in reducing average headache duration is masked somewhat by the results obtained from one subject who showed essentially no progress on this variable. Four of five subjects in the group showed marked reductions (averaging 49%) during the 12 treatment sessions.

Subjects in the control group reported headaches averaging 5.37 hours during the baseline period. These subjects reported
small improvements during treatment and at the termination of the final bogus feedback session still were reporting headaches averaging 4.1 hours.

![Total Headache Duration](image)

**Figure 5.** Total headache duration for the biofeedback, progressive relaxation, and control groups.

**Total Headache Duration**

Total headache duration was computed by determining the numerical total for length of time each subject experienced headache pain. This was computed separately for each phase of treatment. Since random assignment of subjects to the conditions did not result in groups which were matched on
this variable, simple effects were analyzed by computing 1 X 3 ANOVA's for each group individually. Analysis of the data for the progressive relaxation group revealed that significant improvements were obtained across sessions, $F(2, 8) = 11.25$, $p < .01$. The most dramatic improvements were recorded during the first six treatment sessions. Further improvements were not statistically significant (see Figure 5).

Subjects in the biofeedback and control groups reported improvements across sessions of 77% and 66%, respectively. However, neither figure was statistically different at the .05 level from baseline levels.

**Correlational Data**

Results obtained from computing Pearson product-moment correlations between EMG and headache frequency data are presented in Table 1. Reference to this table reveals that

<table>
<thead>
<tr>
<th>Treatment Phase</th>
<th>Biofeedback</th>
<th>Progressive Relaxation</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>.073</td>
<td>-.526</td>
<td>.492</td>
</tr>
<tr>
<td>Sessions 1-6</td>
<td>-.503</td>
<td>.990*</td>
<td>.608</td>
</tr>
<tr>
<td>Sessions 7-12</td>
<td>.668</td>
<td>.687</td>
<td>-.019</td>
</tr>
</tbody>
</table>

*$p_{(1-tail)} < .01$
correlations obtained during baseline and treatment generally were variable and nonsignificant for all groups. However, subjects in the progressive relaxation group obtained highly significant correlation during sessions 1-6. This correlation dissipated somewhat in later stages of treatment. Although other computed correlations often were high numerically, the small sample size prevented rejection of the null hypothesis at the .05 level.

Table 2
Correlations Between EMG and Headache Intensity

<table>
<thead>
<tr>
<th>Treatment Phase</th>
<th>Biofeedback</th>
<th>Progressive Relaxation</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>.529</td>
<td>.208</td>
<td>-.440</td>
</tr>
<tr>
<td>Sessions 1-6</td>
<td>.898**</td>
<td>.825*</td>
<td>-.498</td>
</tr>
<tr>
<td>Sessions 7-12</td>
<td>.785</td>
<td>.300</td>
<td>.299</td>
</tr>
</tbody>
</table>

*p(1-tail) < .05  **p(1-tail) < .025

Computation of correlations between EMG and headache intensity data are presented in Table 2. Reference to this table indicates that correlations between these variables also were generally inconsistent and nonsignificant; but subjects in both the progressive relaxation and biofeedback groups obtained highly significant correlations in sessions 1-6.
Results from computation of correlations between EMG and average headache duration are presented in Table 3. This table indicates a variable pattern of nonsignificant correlations for both treatment and control groups. As with the previous data, there were significant correlations in several cases. However, these high correlations disappeared in later stages of treatment.

Table 3

Correlations Between EMG and Average Headache Duration

<table>
<thead>
<tr>
<th>Treatment Phase</th>
<th>Biofeedback</th>
<th>Group</th>
<th>Progressive Relaxation</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>.867*</td>
<td>- .914**</td>
<td>.170</td>
<td></td>
</tr>
<tr>
<td>Sessions 1-6</td>
<td>.224</td>
<td>.661</td>
<td>-.202</td>
<td></td>
</tr>
<tr>
<td>Sessions 7-12</td>
<td>.797</td>
<td>.272</td>
<td>-.213</td>
<td></td>
</tr>
</tbody>
</table>

*p(1-tail) < .05  
**p(1-tail) < .025 

Results obtained from computing correlations between EMG and total headache duration are presented in Table 4. Reference to this table reveals correlations which generally are nonsignificant. However, as on two other variables, subjects in the progressive relaxation group obtained highly significant correlations during sessions 1-6. Subjects in the biofeedback group obtained significant correlations for sessions 7-12.
Table 4

Correlations Between EMG and Total Headache Duration

<table>
<thead>
<tr>
<th>Treatment Phase</th>
<th>Biofeedback</th>
<th>Group</th>
<th>Progressive Relaxation</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>.951***</td>
<td>- .564</td>
<td>.470</td>
<td></td>
</tr>
<tr>
<td>Sessions 1-6</td>
<td>-.168</td>
<td>.998***</td>
<td>.310</td>
<td></td>
</tr>
<tr>
<td>Sessions 7-12</td>
<td>.919**</td>
<td>.103</td>
<td>-.277</td>
<td></td>
</tr>
</tbody>
</table>

**$p(1\text{-tail}) < .025$  
***$p(1\text{-tail}) < .01$  

Discussion

Results obtained from this study indicate that EMG biofeedback, progressive relaxation training, and the control procedures led to significant reductions in symptoms of muscle tension headache. Overall, there was little evidence to show that either treatment was superior to the other or to the control on most measures. Biofeedback led to significant reductions across trials in muscle tension, self-reported headache frequency, and average duration. Similar results were obtained by the control group. Progressive relaxation training led to significant improvements across trials on these as well as headache intensity and total duration. These results are impressive in that subjects accepted for this study had reported a long history of chronic headache problems. Most had obtained little relief from numerous medications. All
initially were observed to have tension levels well above the 10 microvolt criterion often used for tension headache patients (Epstein & Abel, 1977) and also well above the 3 microvolt level often reported for normal individuals not suffering from tension headaches. Even after 20 minutes of relaxation during baseline sessions, EMG levels typically exceeded 8 microvolts.

Data obtained from the treatment-element control group are interesting. The purpose for including this group was to determine the extent to which biofeedback and progressive relaxation could produce improvements in headache symptoms above and beyond the placebo effects of a highly credible no-treatment condition. Analysis of the data for the control group revealed that large improvements were obtained on both physiological and self-report measures. The two-way ANOVA's computed for EMG, headache frequency, and average headache duration indicated that the control subjects were not significantly different from those in either treatment group in terms of improvements on these measures. However, in one case during the final three sessions, subjects in the biofeedback group had obtained significantly lower EMG levels than control subjects, \( t_{(2\text{-tail})} = 3.315, p < .02 \). With this degree of significance, it seems likely that the differences are real even though several analyses were computed.

Individual analysis of data on headache intensity and total duration revealed no significant improvements across
trials for subjects in the control group. However, subjects in the biofeedback group likewise did not exhibit significant improvements on these variables. Only subjects in the progressive relaxation group showed significant improvements across sessions on these variables.

Overall, these results present us with some very important issues. Although both EMG feedback and progressive relaxation training led to significant improvements across sessions on EMG and most self-report measures, there was little evidence that these procedures were superior to a rather elaborate control procedure which produced essentially the same improvements. However, there are several crucial points which must be considered when viewing these results. First, in most cases there were numerically large differences between the treatment and control groups even though these differences were not statistically significant. However, considering the limited number of subjects in each group, exceedingly large differences would have been required in order to attain an acceptable degree of statistical significance. Considering the nature of the numerical differences obtained in this study, it would seem incumbent upon future researchers to attempt to replicate these differences with larger samples while continuing to use a highly credible control condition. If the magnitude of these differences can be replicated in larger samples, then potentially important clinical results may also attain statistical significance.
A second important issue involves the type of feedback given to subjects in the control group. While the feedback was actually bogus feedback recorded from another individual prior to the study, the extent to which it actually was nonveridical for the control subjects could not be determined. The bogus feedback tapes were recorded in such a way as to indicate a gradual reduction in muscular tension both within and across sessions. To the extent that subjects were able to relax simply by sitting still and remaining calm, it is quite possible that some degree of correlation may have existed between the taped feedback presented to subjects and actual tension levels simply as a matter of coincidence. If these assumed correlations were high enough, control subjects may actually have received substantial amounts of true feedback, even though it was entirely unplanned. This certainly is an issue which should be addressed in future research. If we are to establish with confidence that elaborate and expensive techniques such as biofeedback and progressive relaxation are in fact superior to highly credible placebo procedures, then it is imperative that no-treatment procedures used in such comparative studies do not offer substantial amounts of actual treatment. Otherwise, we may simply be comparing various forms of actual treatment.

A third issue which must be considered is that tension headache suffers may differ somewhat in their patterns of headache pain. Although many tension headache patients may
experience pain which is primarily frontal in nature, others may have headaches associated primarily with tension in the back of the neck and head. In fact, subjects in this study differed in terms of this important variable. Since the biofeedback being offered was frontalis feedback and since EMG monitoring was performed exclusively from the frontalis region for subjects in all groups, it is possible that the lack of significant differences may have been due to the rather specific nature of the techniques used. Although some degree of generalization may have been expected, it is possible that patients whose headaches are not primarily frontal may respond better to feedback and monitoring of the neck or other facial regions. This issue of generalization has been addressed to some degree by Alexander (1975) who found that the effects of biofeedback in particular may be rather specific and localized.

Investigation of the relationship between measures of physiological change and subjective reports of headache pain also is quite interesting. Since the assumption underlying both treatment procedures is that they reduce the muscle contractions responsible for headache pain, it is important to establish the correlation between the two measures. Results from this study indicated no significant correlations for the control subjects. Results for the two treatment groups are mixed. The pattern of correlations obtained from these groups revealed variable but generally nonsignificant relationships. However, for the progressive relaxation group, significant
correlations were obtained during the middle sessions (1-6) for three of four variables measured. Correlations for these subjects were lowered during latter stages of treatment. For the biofeedback group, correlations tended to be higher during baseline and again during latter stages of treatment (sessions 7-12). The data suggests several possible interpretations. First, it is possible that the variable pattern results from physiological states not being related to subjective pain. However, this reasoning is theoretically unsound and seems unlikely. A second possibility is that physiological factors, in addition to direct muscle tension, contribute to this type of headache pain. If this is the case and the other factors are not modified along with tension levels, then headache pain may dissipate only to a limited degree. A third possibility is that EMG data obtained during the two baseline sessions were not representative samples of the subjects' average tension level during headaches and typical daily functioning. In fact, it was rare for a subject to be monitored while having a headache. The same was true, but to a lesser extent, during treatment sessions. In order to establish the correlation between these measures, perhaps it would be more efficacious to improve the sampling by recording multiple samples of EMG activity during baseline and treatment and to compare these with data from subjective reports. This could be performed without having to provide additional treatment sessions.
Finally, it appears that the relationship over time between physiological states and subjective reports may be predicted more effectively by something other than a linear model. Data from this study suggest that this relationship may in fact conform more closely to a curvilinear model, particularly for the progressive relaxation group. With improved methodology and larger samples, it may be possible to assess these relationships more accurately.

Overall, this study presents several distinct improvements over previous research. One particular advantage was that treatment procedures used here were relatively pure. Subjects not willing to discontinue headache medications were screened out prior to the study. Furthermore, no other treatment procedures were allowed during the course of the study. In view of this, it is fairly certain that results obtained were due primarily to the procedures being used and not to other sources.

Furthermore, it appears that the number of sessions utilized in this study was sufficient to assess the efficacy of each treatment adequately. This corrects an important methodological flaw inherent in much previous research which utilized only a few treatment sessions. From this study it appears that a significant portion of the treatment effect is obtained by the sixth session. However, in some cases statistically significant improvements continued throughout sessions 7-12.
Although this study does not answer completely all the questions which had been posed by previous research, it does alleviate many of the methodological inadequacies inherent in earlier studies. It is hoped that this particular investigation will serve as a stimulus for further improvements and refinements in this currently popular field of study.
### Tension Headaches

- Dull pain
- Persistent pain
- Tender areas in neck or forehead
- Bandlike constrictions in parietal area
- Bandlike constrictions in occipital areas
- Gradual onset
- Steady pressure or ache
- Headache starts with feeling of heaviness of fullness
- Bilateral pain in neck muscles
- Bilateral pain in frontal region
- Feelings of dizziness
- Accompanying feelings of anxiety

### Migraine Headaches

- Preceded by visual aura
- Preceded by scotoma
- Preceded by paresthesia
- Preceded by loss of motility or aphasia
- Aching, throbbing pain
- Pain usually unilateral
- Pain accompanied by nausea and vomiting
- Photophobia present
- Extreme sensitivity to sound
- Movement of head intensifies pain
- Loss of appetite
- Body chills and cold feet
- Onset often while sleeping or after waking
- Pain accompanied by constipation or diarrhea
- Pain accompanied by inability to concentrate
- Pain accompanied by disruption of memory
- Pain accompanied by unusual visual distortions
- On previous day felt depressed and physically fatigued
Appendix B

Record of Daily Headache Activity

Name: __________________________ Date: ____________

Headache Intensity:

1  No headache.
2  Low level headache which is noticeable only when you think about it.
3  Low level headache which can be ignored at times.
4  Painful headache which makes concentration difficult, but you could perform tasks of an undemanding nature.
5  Severe headache which makes concentration difficult, but you could perform tasks of an undemanding nature.
6  Very severe headache which makes it almost impossible to do anything until it is over.

Headache Duration:

How long did the headache last (to the nearest quarter hour?)

________________________
Appendix C

Instructions to Biofeedback and Control Subjects

The purpose of this procedure is to make you aware of bodily cues which indicate that you are tense and to enable you to achieve a greater degree of relaxation. During these exercises, I want you to sit comfortably in the recliner, close your eyes, and relax. Each session will last 30 minutes. During the first 20 minutes, you will hear a tone which I want you to listen to carefully. The frequency or pitch of the tone will be proportional to the amount of muscle tension in your body. A tone with a high pitch indicates a great deal of tension; a low-pitched tone indicates relative relaxation. During each session I want you to be aware of the bodily cues which indicate that you are relaxed when the pitch of the tone is lowest. Your task will be to use this information to remain as relaxed as possible, to keep the tone as low as possible. Again, you will receive 20 minutes of this type of feedback. At the end of that time, I want you to continue relaxing as deeply as you can. You will hear no tone, but I will continue to record your level of tension.

Instructions to Progressive Relaxation Training Subjects

The purpose of this procedure is to make you aware of bodily cues which indicate that you are tense and to enable you to achieve a greater degree of relaxation. During these
exercises I want you to sit comfortably in the recliner, close your eyes, and relax. Each session will last 30 minutes. During the first 20 minutes, you will hear a tape which I want you to listen to carefully. The tape will give you instructions on how to systematically relax various muscle groups throughout your body. As you learn to alternately tense and relax your muscles, you will be able to achieve a much greater degree of relaxation than you now can. Each tape will last 20 minutes. At the end of 20 minutes, you will receive no further instructions; but I will continue to record your level of tension. During this time, I want you to continue relaxing as deeply as you possibly can.
References


Duane, W. The comparative effect of brief relaxation procedures and a verbal operant-feedback technique in


Haynes, S., Mosely, D., & McGowan, W. Relaxation training and biofeedback in the reduction of frontalis muscle tension. Psychophysiology, 1975b, 12, 547-552.


