THE REDUCTION OF TENSION HEADACHE USING EMG BIOFEEDBACK AND LOCUS OF CONTROL AS PREDICTORS

DISSERTATION

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By

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This study investigates the status of biofeedback treatment and locus of control (LOC) affiliation on the reduction of tension headache. Three LOC groups designated as internals, powerful-other externals and chance externals (using Wallston and Wallston's, 1978, Multidimensional Health Locus of Control Scale) were administered an eight week electromyogram (EMG) frontalis muscle biofeedback training program using an Autogen 1700 biofeedback unit. Subjects were 12 female and four male undergraduate students who had a history of tension headache. Results indicated no significant difference in frontalis muscle tension between the beginning and end of sessions in either a biofeedback or self-control condition for any of the LOC groups. Further, there was no significant difference among LOC groups in ability to reduce muscle tension in either the training or self-control condition. Finally, neither biofeedback training nor LOC groups were significant predictors of headache reduction. Extreme within-group variability and small sample size affected study findings and these and other implications for future research are discussed.
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THE REDUCTION OF TENSION HEADACHE USING
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When considered from an epidemiologic point of view, headache is a major health problem. In one large survey it was found to be one of the 14 most frequent problems for which individuals seek outpatient medical care (DeLozier & Gagon, 1975); and in a survey of complaints drawn from people using a prepaid medical plan, it was the third most frequent complaint (Leviton, 1978). Biofeedback, which refers to any technique, usually involving instrumentation, that provides an individual with instantaneous information on one of his or her physiological functions, has been empirically established as an effective treatment for muscle contraction, or tension headache (Silver & Blanchard, 1978). Electromyogram (EMG) biofeedback has been documented as the most successful biofeedback treatment for tension headache (Hutchings & Reinking, 1976; Kondo & Cantor, 1977; Phillips, 1977). Traditional explanations for the effectiveness of EMG biofeedback in the treatment of tension headache center on a “physiological model,” that is, the efficacy of biofeedback is assumed to result from reduced muscle tension, usually targeting the frontalis muscle. Recently
researchers investigating the mechanisms underlying the effectiveness of biofeedback have speculated that cognitive variables may be more important in headache reduction than physiological variables (Andrasik & Holroyd, 1980; Blanchard, Andrasik, Evans, Neff, Applebaum & Rodichok, 1985; Holroyd, Penzien, Hursey, Tobin, Rogers, Holm & Mariclle, 1984). Of the cognitive variables that have been investigated, locus of control has received the most attention. Several studies indicate that individual differences in locus of control influence the degree of physiological control attained through biofeedback training (Abramowitz, Bell, Folkins, Wolfe and DuRand, 1984; Carlson, Bridges & Williams, 1982).

Overviews of research in the areas of locus of control, and the treatment of headache using biofeedback will be presented in two separate sections. The literature review provided only two studies which combined all three variables: locus of control, headache and biofeedback. A critical review of these two studies will be detailed in a third and final section of the literature review.

The Treatment of Headache Using Biofeedback

Headache is a common bodily complaint and the type called "tension headache" comprises the largest headache group in today's clinical population (Adams, 1977; Phillips, 1977). The Ad Hoc Committee on Classification of Headache
(1962) describes tension headache as:

Ache or sensation of tightness, pressure or constriction widely varied in intensity, frequency and duration, sometimes long-lasting, and commonly suboccipital. It is associated with sustained contraction of skeletal muscles in the absence of permanent structural change, usually as part of the individual's reaction during life stress (p. 718).

Tension headaches involve not only occipitofrontal muscles but also the mass of the suboccipital muscles whose function is to hold the head in its upright position (Adams, 1977). Pain may extend further down the back of the neck to the trapezius muscle. From this continuous base, the pain may spread to involve the frontal areas and the vertex of the cranium during intensified periods of exacerbation (White & Tursky, 1982).

The early research examining the effectiveness of biofeedback as a treatment for tension headache was based on the theory that teaching the subject to decrease frontalis muscle tension would result in decreased headache pain. In a 1975 study by Haynes, Griffin, Mooney and Parise, a group receiving biofeedback was compared to a group receiving autogenic training for reduction of tension headache. These authors were careful to use a "pure" form of EMG biofeedback, that is, the biofeedback group received no other form of relaxation therapy such as progressive muscle relaxation.
(PMR), imagery, or hypnosis. Additionally, the biofeedback group received no psychotherapy. Use of "pure" biofeedback was intended to reduce the potential confound associated with combining therapeutic procedures, and make any observed treatment effects more likely to be attributable to biofeedback. The results of this study indicated that both the EMG biofeedback group and the autogenic training group experienced a significant reduction in tension headache activity as compared to a control group which received only initial instructions to become as relaxed as possible. However, there was no significant difference in the degree of headache reduction observed between the two treatment groups. This was one of the earliest studies demonstrating the effectiveness of biofeedback without the additional use of autogenic training, PMR, imagery or any other relaxation therapy. Also, this was one of the first studies documenting the equivalent effectiveness of biofeedback and autogenic relaxation in the treatment of tension headache.

In a study by Kondo and Canter (1977) accurate or contingent biofeedback was compared with non-contingent or false feedback in the reduction of tension headache. Non-contingent feedback was accomplished by the use of a tape-recorded tone made during the training of a subject who was not a participant in the 1977 study. The feedback tone decreased in pitch throughout the training session giving a false impression that frontalis muscle tension was being
reduced. The group receiving the contingent form of biofeedback, which was an accurate reflection of their frontalis muscle tension, presented significantly fewer headaches after EMG training than did the group receiving the false feedback. The authors interpreted the findings of this study as evidence that the effectiveness of biofeedback results not from placebo effects, but from the subject's biofeedback assisted learning of frontalis tension reduction.

Other researchers during the mid-1970's succeeded in demonstrating the effectiveness of EMG biofeedback training as a treatment for tension headache. During this time it was generally accepted that the effectiveness of biofeedback stemmed from training the subject to relax the frontalis muscle (Budzynski, Stoyva, Adler & Mullaney, 1973; Chesney & Shelton, 1976; Cox, Freudlich & Meyer, 1975; Hutchings & Reinking, 1976). This assumption was challenged by Andrasik and Holroyd (1980) who questioned whether the reduction of tension headache through the use of biofeedback results from reduced muscle tension or perhaps from some non-specific variable(s) associated with the biofeedback treatment. In an attempt to answer this question, these researchers designed a study comparing three different biofeedback procedures and a no-treatment procedure. One group was trained to decrease frontalis muscle tension in the tradition of past biofeedback research. The second group was trained to maintain their frontalis muscle at a
constant level of tension. The third group was trained to increase frontalis muscle tension. The no-treatment control group subjects were attached to the EMG machine and no instructions were given. The study included an element of deception as the biofeedback machines were rigged so that when the subjects were performing the desired response, consisting of either reducing, maintaining or increasing frontalis tension as determined by group membership, they received feedback indicating they were reducing frontalis tension. All of the three treatment groups demonstrated reduction in tension headache that significantly departed from the no-treatment control group. In an explanation of these results the authors concluded that as the subjects were being deceived regarding their actual biofeedback performance, the reduction in headache activity probably resulted from the spontaneous, untutored development of cognitive strategies such as imagery, focused attention, or controlled breathing which was used by the subjects to succeed in the biofeedback training. The authors validated this conclusion through questioning their subjects and finding that many of the subjects did spontaneously generate cognitive strategies as an adjunct to their biofeedback training. It is important to note that only frontalis muscle tension and headache activity were actually measured in the study. Consequently all that was really established was that subjects who succeeded in learning
to manipulate their frontalis muscle, despite being deceived regarding direction of changes in tension, also experienced headache reduction. Nevertheless, results of this study succeeded in questioning the traditional notion that the efficacy of biofeedback in the treatment of tension headache results simply from the reduction of frontalis muscle tension.

The physiological model of biofeedback treatment became increasingly suspect as other researchers failed to find a direct relationship between levels of muscle tension and headache activity. For example, Phillips (1977) found a lack of concordance between the ability to reduce muscle tension, as learned through the use of contingent biofeedback, and headache reduction. Despite the fact that subjects were successful in learning to reduce muscle tension, they did not experience a concomitant reduction in headache. Using a psychiatric sample, Phillips and Hunter (1981) attempted to clarify results of the 1977 study by following each of six biofeedback training sessions with a brief period during which the subject was instructed to continue trying to reduce muscle tension but without the aid of biofeedback delivered by the machine. The authors found that although subjects were able to reduce muscle tension with the aid of feedback, there was little evidence of subjects achieving self-controlled (no feedback) muscle relaxation. Moreover, it appeared that the biofeedback
training was ineffectual in reducing headache. The authors concluded that there is not a one-to-one relationship between levels of muscle tension and headache activity, and that factors other than muscle tension are crucial to symptom reduction and maintenance. Despite the use of a psychiatric patient sample, the authors made very general statements about the role of biofeedback in headache reduction. It may be that in examining their data, these authors inadvertently passed over the presence of systematic subject variables characterizing mentally disturbed patients which influenced their ability to utilize biofeedback training. Without comparing the ability to execute self-controlled muscle relaxation and post-treatment headache activity with the same data derived from a group of non-psychiatric subjects, final conclusions regarding the role of biofeedback in headache reduction cannot be made.

Resulting from the findings of researchers such as Andrasik and Holroyd (1980), Phillips (1977) and Phillips and Hunter (1981), there was a move to try to identify the active components of biofeedback in the treatment of tension headache. Led principally by the conclusions of Andrasik and Holroyd (1980) researchers began to search for cognitive variables responsible for the effectiveness of biofeedback.

Locus of Control

The search to identify cognitive variables
underlying the effectiveness of biofeedback has become centered on locus of control. The roles of other cognitive variables were also investigated. These have included MMPI scores, State and Trait anxiety measures, Beck depression scores, scores on the Rathus Assertiveness Survey (Blanchard, Andrasik, Neff, Arena, Ahles, Jurish, Pallmeyer, Saunders, Teders, Barron & Rodichok, 1982), but none of these have been as thoroughly researched as locus of control (Carlson, Bridges & Williams, 1982). To facilitate a clear description of the role locus of control plays in biofeedback and headache, a brief review of the development of locus of control measurement is warranted.

Julian Rotter pioneered research investigating locus of control as a cognitive style (1966). The concept of locus of control is derived from social learning theory where control of reinforcement, referred to as "locus of control", involves an interaction of person and context or situation. Rotter's use of the term reinforcement refers to the onset of any desired event in a person's life. What locus of control measures then is the degree to which a person believes, or expects, that he or she is able to bring about these desired events. Rotter hypothesized that people fall into one of two unidimensional categories of locus of control: internal or external. People characterized by an internal locus of control believe that reinforcement is contingent upon their own actions and is therefore under
their control. People characterized by an external locus of control believe reinforcement is not contingent upon their actions and therefore is not under their control (Rotter, 1966). Subsequent factor analytic studies of Rotter's scale found internals to be a fairly homogeneous population but considerable heterogeneity in people labeled external was identified (Collins, 1974; Gurin, Gurin, Lao & Beattie, 1969; Mirels, 1970). This led to refinement of Rotter's scale: the most widely accepted version is Hanna Levenson's scale (1972). Levenson hypothesized that the heterogeneity found among externals could result from the existence of two types of externals. One type, labeled "powerful others", view reinforcement as contingent upon the powerful others in their lives. The other type, labeled "chance", view the world as a place where there is no connection between reinforcement and action: essentially, events in their lives are construed as random happenings with no connection to their behavior. The external type, "powerful others", includes some potential for control. Conceivably, belief in control by powerful others provides for the perception of enough regularity in the behavior of these others for an individual to believe that he or she can obtain specific desired outcomes (Lefcourt, 1981). "Chance" externality, on the other hand, contains no component for control.

Researchers claim to have increased the reliability and validity of locus of control measures through use of
instruments designed to reveal subjects' expectancies in very circumscribed behavioral domains (Lefcourt, VonBaeyer, Ware & Cox, 1979; Wallston & Wallston, 1976). For example, recent research of the relationship between locus of control and health-related behaviors has revealed that increased question specificity serves to enhance the predictive efficiency of the locus of control measure. That is, when researchers have designed locus of control questionnaires so they tap attitudes toward health issues specifically, the predictive validity of the locus of control measure is enhanced (Carlson, Bridges & Williams, 1982; Lefcourt et al., 1979; Wallston & Wallston, 1978). In the current literature, the most frequently used health-related measure of locus of control is Wallston and Wallston's (1978) Multidimensional Health Locus of Control Scale (MHLC). Modeled on Levenson's (1972) scale, the MHLC measures three distinct dimensions: Internality (IHLC), Chance Externality (CHLC) and Powerful Others Externality (PHLC). The MHLC queries an individual regarding his or her role in health maintenance using items such as "regarding my health, I can only do what my doctor tells me to do" (indicating PHLC). In this way a direct light is cast revealing the person's characteristic expectancy of their ability to control the events (reinforcements) that ensure their health.

Locus of Control, EMG Biofeedback and Tension Headache
In a 1982 study Carlson, Bridges and Williams examined the relationship between scores on Wallston and Wallston's Health Locus of Control Scale (1976), and the ability to reduce frontalis muscle tension using EMG biofeedback. These authors did not find a significant relationship between biofeedback performance and health locus of control. There are many instances where previous researchers have found internals superior to externals in the ability to gain biofeedback assisted control over some aspect of their physiology, including the frontalis muscle (Fotopoulus, 1970; Fotopoulous & Binger, 1976; Gatchel, 1974; Goesling, May, Lavond, Barnes & Carrevia, 1974; Johnson & Meyer, 1974; Jordan & Schallow, 1975; Ray, 1974; Ray & Lamb, 1974; Reinking, Morgret & Tamayo, 1975; Wagner, Bourgeois, Levenson & Denton, 1974). The reasons for the discrepant findings of Carlson et al. (1982) can be explained through a close examination of their design and methodology. First, these authors used only two sessions of biofeedback training which is probably not an adequate number to expose differences in learning biofeedback as a function of locus of control. Second, a tape with instructions for autogenic relaxation was used as an adjunct to the biofeedback training. Due to the contamination of the biofeedback treatment with elements of autogenic relaxation, any conclusions made by these authors regarding the ability of their subjects to learn biofeedback must be viewed with
caution. Third, even though the use of Wallston and Wallston's Health Locus of Control Scale (1976) made it possible to examine the sub-categories of externality (powerful-others and chance) these authors collapsed the data into one broad category of externality for statistical analysis. As a consequence, the observation of any systematic difference between powerful-others and chance externals in the use of biofeedback to reduce muscle tension was prevented. This is especially noteworthy because if one considers the difference between powerful-others and chance locus of control there is reason to predict that they would differ in their ability to utilize biofeedback. Powerful-other externals would be expected to respond to the machine as if it were a "powerful other", and as a consequence, succeed in reducing frontalis muscle tension with the aid of the "powerful other" (machine). Chance externals, on the other hand, would be expected to exhibit random fluctuations in levels of frontalis tension, unable to gain control over their frontalis muscle in response to biofeedback. (Recall that chance externals operate as if there is no connection between reinforcement -- reducing frontalis muscle tension -- and their behavior.) Each of these three methodological weaknesses contributes significant confounds and renders the findings of Carlson et al. (1982) questionable. Methods for controlling the secondary variables resulting in these confounds were included in the design of the present study.
First, eight sessions of biofeedback training were included in an effort to maximize differences in biofeedback performance as a function of locus of control. Second, only contingent biofeedback was used, eliminating the contaminating effects associated with combining different forms of relaxation training. Third, all three types of locus of control, internal, powerful-other external and chance external, were included in the sample in order to add clarity to conclusions made regarding the interaction between locus of control and biofeedback training.

The review of the literature revealed two studies that examined the relationship between locus of control and biofeedback in headache reduction. Abramowitz, Bell, Folkins, Wolfe and DuRand (1984) exposed seven subjects identified as having an external locus of control (measured by Wallston and Wallston's, 1976, Health Locus of Control Scale) to a combination of biofeedback and psychotherapy while measuring their daily headache activity. All subjects underwent a two week post-assessment period during which daily headache activity was recorded. An analysis of post-treatment headache scores revealed that the external subjects demonstrated a relative greater improvement in headache activity compared to the internals. The authors concluded that externals responded more favorably to biofeedback relative to internals because the "directive" nature of biofeedback was more suitable to the externals.
Several methodological weaknesses are evident. First, the number of externals (five) was small. Of these five, it is not known how many were powerful-others and how many were chance externals. Second, since the biofeedback treatment was combined with psychotherapy, it cannot be concluded that reduction in headache resulted from biofeedback. Finally, these authors kept no record of initial frontalis muscle tension levels or any changes in frontalis muscle tension levels that might have resulted from the biofeedback training. They treated headache reduction as a measure of success at biofeedback training. The possibility exists, in the absence of precise measures of biofeedback performance, that levels of these two variables were actually independent of each other and this went undiscovered. In the present study, exact measures of frontalis muscle tension were collected during a training period and a posttraining period (self-control condition), where subjects' ability to decrease frontalis tension without the aid of biofeedback was tested. Additionally, each subject recorded daily headache activity throughout training and posttraining. This permitted two related analyses, looking first at the relationship between locus of control and biofeedback performance and second, at the relationship between biofeedback and headache activity. The strength of the relationship between biofeedback and headache reduction as a function of locus of control was then possible to determine.
These analyses included equal numbers of powerful-other and chance external subjects in an effort to elucidate any differences between these two types.

By far, the most complex examination of the relationship between biofeedback, locus of control and tension headache reduction was conducted by Holroyd, Penzien, Hursey, Tobin, Rogers, Holm, Marcille, Hall and Chila (1984). In this study, the authors found that locus of control was more predictive of headache reduction than success at biofeedback. The authors concluded that cognitive variables, specifically locus of control and self-efficacy, were responsible for the reduction in headache activity. While the study provided the most sophisticated analysis to date, the authors nevertheless used some methodological approaches that could have inadvertently biased the results. For example, these authors found that biofeedback performance was not correlated with headache reduction. It is important to note that their use of biofeedback included deception. The subjects were divided into two groups: one group received false feedback (feedback that was fabricated and then played back to the subject during the session) which led them to believe that they were being highly successful in their efforts to reduce muscle tension. The other group received false feedback which led them to believe that they were being moderately successful in their efforts to reduce
muscle tension. Regardless of actual muscle tension levels, the subjects receiving the high-success false feedback showed greater reduction in headache activity than subjects receiving moderate-success false feedback. Technically, since the subjects were getting false information regarding their physiological performance, this cannot be considered biofeedback. When examining Holroyd et al.'s use of biofeedback from this perspective, it is not surprising that biofeedback training failed to lead to headache reduction. The authors also found that subjects receiving high-success feedback showed increases in a measure of self-efficacy from the beginning to the end of the study. The measures of self-efficacy consisted of a 5 point Likert-type scale that required the subjects to rate the degree to which they felt confident of their ability to prevent headaches. The apparent increase in "self-efficacy" could have been a result of the demand characteristics associated with being in a 12 week training program explicitly designed to help them reduce headache activity. The authors also found that in the high-success condition, subjects tended to become more internal in locus of control as measured by a modified version of the MHLC Scale (Wallston & Wallston, 1978). All scale items were modified to refer specifically to headache. The authors' reason for making this modification was to increase specificity. While an increase in specificity was certainly accomplished, it also increased
the risk of demand characteristics associated with use of
the modified scale. The conclusion of Holroyd et al. that
headache reduction arises from cognitive variables
accompanying biofeedback (specifically, changes in locus of
control and increases in self-efficacy) rather than from the
physiological learning that accompanies biofeedback is
weakened by the deceptive nature of the biofeedback and the
demand characteristics associated with their measures of
locus of control and self-efficacy. The present study used
Wallston and Wallston's MHLC Scale (1978) in its standard
form. This should have supplied adequate specificity
without being too obvious and creating demand
characteristics. Also, all subjects received information,
in the form of biofeedback, regarding their physiological
performance that was directly reflective of muscle tension
levels. The importance of supplying accurate information is
made clear upon review of a 1980 study conducted by Jeffrey
Cram. Cram's study offers compelling evidence that the
efficacy of biofeedback in the treatment of tension headache
results from the subjects' acquisition of finer muscle
regulation skills. Cram compared posttreatment headache
levels of three groups. The first group was trained to
reduce frontalis muscle tension through the use of
contingent biofeedback. The second group was trained to
maintain a constant level of frontalis muscle tension
through the use of contingent feedback. The third group was
instructed to meditate on a non-contingent feedback tone. The latter group was intended to control for the effects of self-monitoring of headache activity, therapist-client relationship variables and the spontaneous development of cognitive strategies to reduce tension headache. Both of the groups that received contingent biofeedback training demonstrated significant reductions in headache activity. The third group that received instructions to meditate on a non-contingent feedback tone failed to demonstrate reductions in tension headache activity. The author concludes:

The primary similarity between the two EMG biofeedback procedures in this study would appear to be the biological information inherent in the feedback itself. This information could allow for reduction in the noise of excessive variation in the neuromuscular system and thus help to bring the system under better control. This finer level of regulation, then, would be associated with reduction in headache pain (p. 708-709).

While it is probably true that subjects in the Holroyd et al. (1984) study did not experience headache reduction as a function of their biofeedback training, it would be ill-advised, on the basis of Cram's 1980 study to conclude that the treatment effects of biofeedback result solely from the cognitive variables that accompany it.
Purpose

To date, the studies which have examined the relationship between locus of control, biofeedback and headache reduction have failed to offer clarification in three areas. Statements of purpose in the present study derive from these three areas.

1. None of these studies analyzed the sub-categories of external locus of control: powerful-other and chance externals. It is reasonable to expect that powerful-other externals would demonstrate some efficacy in the reduction of muscle tension when aided by the 'powerful-other machine.' Chance externals on the other hand, would not be expected to be able to utilize the biofeedback, consequently their frontalis muscle tension should randomly fluctuate revealing no systematic pattern. Because other researchers have not addressed this in their data analyses, much valuable information has been lost. The present study performed an analysis on each of the dimensions of externality (powerful-others and chance) in an effort to clarify understanding of the way locus of control impacts biofeedback training.

2. None of the studies included a measure of subjects' ability to reduce frontalis muscle tension with the feedback portion of the machine turned off. That is, none of these studies included a measure of the subjects'
acquisition of self-controlled muscle tension reduction. It is reasonable to expect the difference between powerful-other externals and chance externals in the ability to reduce muscle tension to diminish without the powerful-others being aided by feedback from the machine. The internals should be able to maintain muscle tension reduction skills without the aid of biofeedback. Thus, of the three types of locus of control, internals, powerful-other externals and chance externals, internals should evidence the greatest degree of self-controlled muscle relaxation. This is potentially valuable clinical information as it documents resilience, or lack of it, in the skill of muscle regulation as a function of locus of control. By including a self-control condition the present study made possible examination of muscle regulation that was acquired by subjects as a function of locus of control.

3. The active components of biofeedback have yet to be clearly defined. By using contingent biofeedback and keeping a detailed record of each subject's muscle tension levels in two conditions, training and self-control, coupled with the measurement of locus of control once before training and once after the self-control condition (using forms A and B of a standard version of Wallston and Wallston's, 1978, MHCL Scale), the present study attempted to identify the amount of variance in headache reduction that is accounted for by each of these variables singularly,
as well as the amount of combined variance accounted for by these two variables. This helped to determine the relative importance of locus of control and increased skill in muscle regulation in the reduction of tension headache. Additionally, the degree to which biofeedback performance was dependent upon subjects' locus of control was investigated.

Hypotheses

H₀₁ Powerful-other externals will be able to significantly reduce frontalis muscle tension when aided by biofeedback.

H₀₂ Chance externals will not be able to significantly reduce frontalis muscle tension with the aid of biofeedback.

H₀₃ Internals will be able to significantly reduce frontalis muscle tension with the aid of biofeedback.

H₀₄ In the training condition, there will not be a significant difference between internals and powerful-other externals but both will differ from chance externals.

H₀₅ Internals will be able to reduce frontalis muscle tension without biofeedback, that is, in the self-control condition.

H₀₆ Neither powerful-other externals nor chance externals will be able to reduce frontalis muscle tension in the self-control condition.

H₀₇ Locus of control as measured after the self-control condition will not change significantly from the measure
Method

Subjects

The subject sample was comprised of 18 undergraduate psychology students at a large midwestern university. They ranged in age from 19 to 40 years. Subjects were identified as having tension headache according to the 1962 Ad Hoc Committee on Classification of Headache. Identification as a tension headache sufferer was made on the basis of subjects' responses to a screening questionnaire (Appendix A). This questionnaire was designed to reveal subjects whose headaches were clearly of the muscle contraction or tension variety and to eliminate subjects who suffered from migraine headache or combined migraine-tension headache. Potential subjects were given Wallston and Wallston's (1978) MHLC Scale, Form A (Appendix B). Six internals (two males and four females), six powerful-other externals (six females), and six chance externals (two males and four females), were selected randomly from the group of individuals identified as having tension headache. Two internal category subjects dropped out of the study in the first week and were randomly
replaced with two new subjects having a locus of control identical to the subjects lost.

**Materials**

Frontalis muscle tension levels were measured using an Autogen 1700 EMG biofeedback unit. The equipment was new and recently calibrated by the manufacturer.

A screening questionnaire including headache pain and history was used to identify subjects suffering from tension headache versus migraine or combination headache. The headache portion of the questionnaire was designed according to the diagnostic criteria for tension headache suggested by the Ad Hoc Committee on Classification of Headache (1962) (Appendix A).

The subjects' health locus of control was established using Wallston and Wallston's (1978) MHLC Scale. Sub-scale highest scores on the MHLC Scale served to identify subjects' characteristic locus of control in the domain of health-related behavior as internal, powerful-other external or chance external. Form A was used for pre-training assessment of health locus of control and Form B was used for posttraining assessment (Appendix B). Verbal permission to use the MHLC Scale was given by Kenneth Wallston, Ph.D., in a phone call on April 3, 1987.

Each subject was given a headache diary booklet at the beginning of each week. This booklet contained instructions
for its use followed by several pages, each identical, consisting of four questions which measured the intensity, frequency, duration and medication intake associated with each headache (Appendix C).

Procedure

A call for subjects who have frequent headaches was issued. This was accomplished by contacting instructors of undergraduate psychology courses for permission to recruit subjects from their classes. The experimenter met with the class on an appointed day. During this initial contact the student was informed that a study using biofeedback as a treatment for headache was being conducted for people frequently troubled by headaches. A sign-up sheet was passed in the class for individuals interested in attending a group meeting designed to provide further information. All persons attending the group meeting were given the screening questionnaire and Wallston and Wallston's MHLC Scale (1978). Only those persons identified as having tension headache were included in the group from which a random selection of six internals, six powerful-other externals and six chance externals was drawn. During the group meeting the potential subjects were informed that not all persons could be accommodated in the treatment but that a specified number would be randomly selected. Selected subjects were later contacted and invited to participate. The chosen subjects were
asked to attend a group meeting for the purpose of introduction to the study. The two internal replacement subjects were introduced to the study in a separate meeting later that week. All people attending the initial group meeting were notified regarding inclusion status in the study.

Pre-Training - Session 1

During the initial introductory meetings each subject was given a headache diary booklet and verbal instructions for proper use of the diary. Subjects were told to record all headache activity in the diary for the next week. Subjects were told biofeedback is one of the most popular treatments for tension headache and that they would be receiving biofeedback training in the next several weeks and that this could help reduce their tension headaches. Subjects were also told that it is very important to get an accurate record of their headache activity before beginning biofeedback training in order to identify baseline headache activity. Following a brief description of the extent and duration of involvement required of the subjects, informed consent forms (Appendix D) were signed and scheduling for the Session 2 group meeting was made.

Pre-Training - Session 2

The headache diary from the previous week was collected and checked for proper recording. Verbal feedback was given
to the subjects regarding the accuracy or inaccuracy of their recording methods. New headache diary booklets were issued for the subjects' use during the next week. They were identical to the first diaries. This procedure permitted the experimenter to record data at a later time. During this session thermal biofeedback using an Autogen 2000 biofeedback unit was demonstrated. The use of thermal biofeedback was intended to prevent any contaminating effects resulting from pre-training exposure to EMG biofeedback. Two EMG training sessions were then scheduled for each subject for the next week.

Training

At the beginning of each week of training, the headache diaries were collected and new ones issued. Recordings from the first two weeks were used to compute a baseline pre-training headache index. This measure was reflective of the average intensity, frequency and duration of subjects' headache activity for the two week baseline period.

Each subject was exposed to eight biofeedback training sessions, two a week for a period of four weeks. This number has been suggested by Pinkerton, Hughes and Wenrich (1982) as producing maximal treatment efficacy. The biofeedback technician was blind to the subjects' identified locus of control. By the fifth training session subjects' biofeedback-assisted ability to reduce frontalis
muscle tension as a function of locus of control should have stabilized. For this reason, measurements were taken on sessions five, six, seven and eight only, in an effort to acquire a mean training change score for each subject that was an accurate reflection of the subject's response to training.

EMG Recording Procedure

EMG electrodes were attached to subjects using a frontalis placement. Instructions were then read to the subjects (Appendix E). A two minute period followed the instructions during which the biofeedback portion of the machine was not turned on. This period was to allow for electrode stabilization. Following this two minute period the experimenter turned on the feedback and the training period began. The training period lasted for 15 minutes. Readings from this 15 minute period were taken on minutes one, three and five; the average of these constituted "score A". This was followed by readings taken on minutes 11, 13 and 15; the average of these constituted "score B". Score B was then subtracted from the score A deriving the Biofeedback Training Change Score.

Self-Control Recording Procedure

Each subject returned for two sessions following the training phase. At the beginning of each self-control
session, EMG electrodes were attached to the subjects using frontalis placement. Subjects were told they were to try to reduce frontalis tension just as they learned to do when the machine was giving them feedback. However, no feedback was given during the posttraining phase. This period lasted for 15 minutes with readings taken on minutes one, three and five; the average of these constituted "score C". This was followed by readings on minutes 11, 13 and 15; the average of these constituted "score D". Score D was then subtracted from score C deriving the Self-Control Change Score.

Self-Control Headache Diary Procedure

Following each of the two self-control sessions, subjects' headache diaries were collected. The index of pre-training headache activity and the index of self-control headache activity were entered into an equation (Blanchard et al., 1985), yielding a percent improvement score for each subject in the following manner:

\[
\frac{\text{Baseline H. A. Index} - \text{Post-Training H. A. Index}}{\text{Baseline H. A. Index}} \times 100
\]

(See Appendix F for Sample Headache Diary)

Final Study Session

Following termination of the study, referrals for continued treatment of headache were specified for subjects by providing them with referral sources available in the
community.

Results

The data from this study were analyzed in a number of ways in an effort to identify the active components of biofeedback treatment. Paired t-tests were used to compare the success of each of the three locus of control groups in reducing frontalis muscle tension across sessions of both the biofeedback and self-control treatment conditions. A one-way analysis of variance (ANOVA) was used to determine differences in frontalis muscle tension reduction in both biofeedback training and self-control sessions among the three locus of control groups. Finally, a stepwise multiple regression equation was calculated using locus of control, biofeedback training scores and posttraining (self-control condition) scores to predict headache improvement.

Frontalis Muscle Tension Reduction

The results of the paired t-test analyses comparing frontalis muscle tension levels, in microvolts (mV), from the beginning of the training session to the end of the session across all four biofeedback training sessions are presented for each locus of control group in Table 1. No significant difference was found between the beginning and ending mV level means for any of the three groups. In other words, none of the groups were able to significantly reduce
Table 1

Paired t-tests for Beginning and Ending Frontalis mV Levels Across Four Biofeedback Training Sessions of Locus of Control (LOC) Groups

<table>
<thead>
<tr>
<th>LOC Group</th>
<th>M pre-mV measure</th>
<th>SD</th>
<th>M post-mV measure</th>
<th>SD</th>
<th>diff.</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal</td>
<td>77.6</td>
<td>79.1</td>
<td>72.7</td>
<td>81.4</td>
<td>5.0</td>
<td>1.3</td>
<td>.240</td>
</tr>
<tr>
<td>Chance</td>
<td>91.8</td>
<td>94.9</td>
<td>84.2</td>
<td>73.3</td>
<td>8.6</td>
<td>.5</td>
<td>.633</td>
</tr>
<tr>
<td>Powerful</td>
<td>154.7</td>
<td>52.8</td>
<td>114.9</td>
<td>67.8</td>
<td>39.8</td>
<td>1.9</td>
<td>.116</td>
</tr>
</tbody>
</table>

frontalis muscle tension from the beginning of a biofeedback training session to the end of the training session when means were compared across all four biofeedback training sessions.

Paired t-test analyses comparing frontalis muscle tension from the beginning of the self-control session to the end of the session across both self-control sessions is presented for each locus of control group in Table 2.

No significant difference was found between the beginning and ending mV level means for any of the three groups. As in the biofeedback training condition above, no group was able to significantly reduce frontalis muscle tension from the beginning of the self-control session to the end of the session when means across the two sessions were compared.

Comparisons among LOC groups in ability to reduce...
Table 2

Paired t-tests for Beginning and Ending Frontalis mV Levels Across Two Self-Control Sessions of LOC Groups

<table>
<thead>
<tr>
<th>LOC Group</th>
<th>pre-mV M</th>
<th>SD</th>
<th>post-mV M</th>
<th>SD</th>
<th>diff.</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal</td>
<td>78.2</td>
<td>81.0</td>
<td>59.5</td>
<td>79.4</td>
<td>18.7</td>
<td>.68</td>
<td>.529</td>
</tr>
<tr>
<td>Chance</td>
<td>177.1</td>
<td>124.7</td>
<td>134.5</td>
<td>81.2</td>
<td>42.6</td>
<td>1.90</td>
<td>.121</td>
</tr>
<tr>
<td>Powerful</td>
<td>112.0</td>
<td>59.3</td>
<td>112.5</td>
<td>73.5</td>
<td>-.6</td>
<td>-.04</td>
<td>.971</td>
</tr>
</tbody>
</table>

Frontalis muscle tension during the four biofeedback training sessions and the two self-control sessions were made using two separate one-way ANOVA's. No significant differences among groups were found for either condition: $F(2,15) = 1.494$, $p = .256$ and $F(2,15) = .920$, $p = .420$ respectively.

Locus of Control

Each subject's self-reported locus of control was identified prior to and after hypotheses testing using Forms A and B respectively of the MHLC questionnaire (Wallston & Wallston, 1978). The LOC findings were tested for reliability in this sub-group of the population. Cronbach alpha coefficients were .87 for LOC Form A and .83 for LOC Form B. Both are highly acceptable coefficients for an instrument of 18 items using 18 subjects. Subjects tended
to remain in the same LOC category on pre-test and post-test measures. Only two subjects changed categories from Form A to Form B locus of control questionnaire administration. This was so little change in LOC categories that it did not warrant statistical analysis.

Headache Reduction Prediction

Using locus of control categories, mean change scores across biofeedback training sessions, and mean change scores across self-control sessions, a stepwise multiple regression equation was calculated to determine which variable would best predict significant improvement in headache reduction. None of these variables were significant predictors.

Discussion

The hypotheses that frontalis muscle regulation is acquired as a function of locus of control were not supported. Study results indicated that significant frontalis muscle tension reduction was not accomplished by any treatment group, indicating that biofeedback learning did not occur. As predicted, the chance locus of control group (CLOC) was not able to significantly reduce frontalis muscle tension with the aid of biofeedback (H02). However, the predictions that the powerful-other locus of control group (PLOC) and the internal locus of control group (ILOC) would be able to significantly reduce frontalis muscle
tension when aided by biofeedback (H01, and H03 respectively) were not supported. These results were unexpected, and in contradiction to the body of previous research which finds internals to be superior to externals in ability to gain biofeedback control over the frontalis muscle (Jordon & Schallow, 1975; Reinking, Morget & Tamayo, 1975). In addition, none of the groups were able to significantly reduce frontalis mV levels in the self-control condition. The inability to reduce frontalis tension levels without the aid of biofeedback predicted for PLOC and CLOC (H05) was supported by the findings. However, the prediction that ILOC would be able to reduce frontalis mV levels in the self-control condition (H05) was not supported by the data.

What factors can explain the inability of any LOC group to significantly reduce frontalis muscle tension in either experimental condition? Examination of the data suggests that within each LOC group there were large differences among individual subject's mV level change scores in most of the biofeedback training and self-control sessions. Examples of the range of within group change score are: in biofeedback training session number five, the six individual ILOC change scores ranged from 0.0 mV to 92.5 mV; in biofeedback training session number six, the six individual PLOC change scores ranged from -.2 mV to 286.7 mV; and in biofeedback training session number seven, the six
individual CLOC change scores ranged from -1.78 mV to 254.1 mV. These examples reflect large within-group differences in mV change and are representative of the variance found across the various training and self-control sessions. Within each LOC group some individuals experienced considerable frontalis muscle tension reduction while others experienced very little, indicating much variability in both response to biofeedback training and in the self-control condition within each group. The most parsimonious explanation for the one-way ANOVA results (Ho4) may be that large within-group variance compounded by small sample size has obscured any differences between groups. In essence, because of the size of the SD, mean change scores do not reflect the significant change of specific individuals. Unfortunately, none of the designated state variables, such as sex or age, predicted subjects’ ability to reduce frontalis tension level. If the identification of small sample size is a major factor in failure to achieve statistically significant findings, a larger sample size should yield different results. It is clear that a larger sample size would be necessary to adequately evaluate the role of LOC in learning frontalis muscle tension reduction.

Biofeedback training change scores as used in this study may also have influenced frontalis muscle tension reduction results. As the change scores were collected on biofeedback training sessions 5-8 only, it is possible that
these scores do not reflect biofeedback learning that occurred for some subjects during training sessions 1-4. It is well known that individuals learn at different rates, and so it is theoretically possible that by session five, specific members of each LOC group may have already acquired biofeedback skills or be approaching maximum biofeedback learning thresholds. If this were the case, those individuals' change scores on sessions 5-8 may not be large. It is even possible that if frontalis muscle relaxation were already learned during training sessions 1-4, rapid drops in frontalis mV levels could occur during the two minute electrode stabilization period. In other words, there may have been individual temporal differences in learning biofeedback which were not a function of locus of control. It is recommended that in future research where change scores are used to measure biofeedback learning, data be collected across all training sessions so that group mean change scores reflect all learning accomplished by all individuals.

Locus of Control

In addition to the previously discussed issue of sample size, within-group variance may have been affected by the procedure employed to assign subjects to LOC groups. A subject was assigned as having a "characteristic locus of control" of internal, powerful-other external or chance
external based on his or her highest score on the MHLC Scale. Although this score indicated a subject's characteristic LOC regarding health-related behavior, it did not take into account that same subject's scores on the other two dimensions of LOC. An examination of LOC results indicates that many of the subjects whose highest score occurred on the chance or powerful-other dimensions, and so were designated as members of those LOC groups, also had moderate scores (a score of 15 or above out of a possible 36) on the internal dimension, while most of the subjects labeled internals had lower scores (below 15) on both chance and powerful-other dimensions. This suggests the possibility that instead of ending up with LOC groups that are "purely" internal, chance, or powerful-other in membership, each of the 3 groups may have included subjects with one of various possible "patterns" of "high" or "low" sub-scale scores. Though the single highest score method assured that subjects representing internality and both types of externality were grouped together, potential sub-category influences within each LOC group were not taken into account. Identification of these sub-categories would add clarity to conclusions made regarding the interaction between LOC, biofeedback training and headache reduction. It is suggested that in the future research, single highest scores not be the method employed to designate group membership. One possible solution would be to do median
splits on all three sub-scales and classify potential subjects into one of the various "types" based on their score being above ("high") or below ("low") the median of the scales. This method would identify sub-types with the various mixtures of internality and externality, and the advantage is that the mixture would be known so that its effect on the study results could be examined. "Pure types", reflective of high scores on one sub-scale and low scores on the other two sub-scales could be selected, but this would require a much larger number of subjects from which to draw the desired sample.

Notably, the single highest score method used in the current study resulted in a stable LOC group membership of subjects between pre- and post-biofeedback training using the MHLC Form A and Form B (H07). The two subjects whose LOC scores, and thus group affiliation, changed from Form A to Form B included one chance subject and one powerful-other subject. Both of these subjects changed in the direction of internality. Examination of the data revealed that with one exception, all measures of internality increased between Form A and Form B for subjects in the chance and powerful-other groups. One can only speculate on how these LOC group trends might have affected group data results on other measures, such as frontalis muscle tension reduction and headache reduction. Certainly if the study CLOC group and
PLOC group were comprised of many individuals whose sub-type LOC scales were high on both externality and internality and the study ILOC group were high on internality only, any type of comparisons between groups is further complicated.

**Predicting Headache Reduction**

The hypothesis that self-controlled frontalis tension reduction was the best predictor of headache reduction (Hos) was not supported. A stepwise regression equation found that none of the identified predictor variables, biofeedback training change scores, self-control change scores, or locus of control category, were successful in predicting headache reduction. This finding was further evaluated by a post hoc enter regression equation which identified that these three variables combined accounted for only 2% of the variance of headache improvement. This certainly explains why none of the variables was a significant predictor. However, examination of the individual data on headache percent improvement scores clearly suggests substantial reduction in the headache index score for individual subjects in each LOC group. Two-thirds of the internals reported more than an 80% improvement, and a fifth subject in that group reported a 35% improvement. Two-thirds of the chance externals reported improvement between 20% and 42% and all but one of the powerful-other externals reported a headache percent improvement score.
between 32 and 69. Since the percent improvement score is a reflection of difference in subjects' headache intensity, frequency and duration before biofeedback training and after training, these findings suggest considerable reduction in actual headache activity during that period. Though none of the identified predictor variables successfully predicted headache improvement, it is clear that individual improvement occurred. Although the issue of demand characteristics affecting report of headache activity cannot be completely ruled out, headache recording used behavioral rating procedures designed to minimize this effect.

As with the muscle tension reduction data discussed above, the data on headache activity demonstrated much variability with LOC groups. Individual baseline headache index scores (within groups) ranged as widely as 381 to 5732 and individual within-group posttraining headache index scores ranged as widely as 534 to 4535. Because most of this variability was accounted for by the "duration" component of the equation (number of minutes a headache lasted), post hoc regression equations were run using only the "intensity" component of headache improvement in an attempt to link predictors with what appeared to be the most stable component of the headache improvement score. Because of the large within-group variance of LOC groups, LOC was entered into the post hoc equations as a raw score rather
than a category. The post hoc enter regression equation found that when the dependent variable was limited to intensity of headache data (as opposed to the full headache index score), 40% of the variance was accounted for by the three predictors: biofeedback training change scores, self-control change scores and raw LOC scores. This analysis approached significance ($F = 3.0618, p = .063$). When a stepwise regression equation was then calculated for decrease in headache intensity, LOC was a significant predictor ($F = 9.3368, p = .0075$) and accounted for 37% of the variance. When the data was examined in this way, it supported Holroyd et al.'s (1984) finding that LOC is more predictive of reduction in headache than success at biofeedback.

The results of this study provide some support for the early research in this area (Andrasik & Holroyd, 1980; Phillips, 1977) which questioned the existence of a one-to-one relationship between levels of muscle tension and headache activity and suggested that factors in addition to muscle tension (for example, cognitive variables such as LOC) are involved in symptom reduction and maintenance. Although this study was not able to establish definitively the relationship between LOC and frontalis muscle tension reduction as discussed, it raises many important questions for future research. In addition, it is clear from this study that a much larger sample size is required to explore...
phenomena with such large inter-subject variance. Larger sample size is therefore recommended for future research.
APPENDIX A

SCREENING QUESTIONNAIRE
Screening Questionnaire

Demographic Data

Name:
Address:
Phone:
Age:
Sex:
Height:
Weight:

College Classification (circle one please)
   Freshman
   Sophomore
   Junior
   Senior

College Major, if you have decided upon one

Financial Resources (check one please)
   _____ supported entirely by parents or spouse
   _____ partially supported by parents or spouse
   _____ entirely self-supporting

If you have a job, what is the average number of hours per week you work? ____________

Does the time of day you work change from week to week?
   Yes
   No

Were either of your biological parents bothered with
frequent headaches? (circle those applicable)

Mother
Father
Don't know

How many brothers and sisters do you have? (do not include brothers and sisters of step-parents)

___ Brothers
___ Sisters

How many (if any) of your brothers and/or sisters are bothered with frequent headaches?

___ Brothers
___ Sisters

What number child are you in birth order? _________

Are you a smoker? (circle one)

Yes
No

Please list any medications you take on a regular basis:

__________________________

__________________________

__________________________

__________________________

If you use medication for headache pain, what type do you prefer? _________________________

Headache Questionnaire

1. On the average, how many times a week do you have a
headache? (circle one, please).

a) less than once, on an average.
b) one time, on an average.
c) two times, on an average.
d) three times, on an average.
e) four times, on an average.
f) five times, on an average.
g) six times, on an average.
h) seven times, on an average.
i) eight times, on an average.
j) nine times, on an average.
k) ten or more times, on an average.

2. This is a list of places where headaches usually start. Please circle the one (or ones) that most apply to you.

a) Somewhere in back of neck or back of head area.
b) On top of head and/or the forehead area on both sides.
c) Behind one eye.
d) On one side over the temple area.
e) On one side of the face.

3. Circle the letter that most clearly describes the sensations that are most typical of your headaches:

a) a feeling of throbbing and/or pulsating occurring on one side.
b) a feeling of tightness and/or pressure creating a
sensation like a band around your head or a tight cap.

4. Would you describe your headache pain as mostly,
   a) a dull ache
   b) a sharp pain

5. Have you ever been examined by a physician for your headaches?
   a) yes
   b) no

6. If the answer to number 5 was "yes", what was your physician's diagnosis? (Briefly describe)
APPENDIX B

MHLC FORMS A AND B
Form A

This is a questionnaire designed to determine the way in which different people view certain important health-related issues. Each item is a belief statement with which you may agree or disagree. Beside each statement is a scale which ranges from strongly disagree (1) to strongly agree (6). For each item we would like you to circle the number that represents the extent to which you disagree or agree with the statement. The more strongly you agree with a statement, then the higher will be the number you circle. The more strongly you disagree with a statement, then the lower will be the number you circle. Please make sure that you answer every item and that you circle only one number per item. This is a measure of your personal beliefs; obviously, there are no right or wrong answers.

Please answer these items carefully, but do not spend too much time on any one item. As much as you can, try to respond to each item independently. When making your choice, do not be influenced by your previous choices. It is important that you respond according to your actual beliefs and not according to how you feel you should believe or how you think we want you to believe.

1. If I get sick, it is my own behavior which determines how soon I get well again.

    1 2 3 4 5 6
2. No matter what I do, if I am going to get sick, I will get sick.  1 2 3 4 5 6
3. Having regular contact with my physician is the best way for me to avoid illness.  1 2 3 4 5 6
4. Most things that affect my health happen to me by accident.  1 2 3 4 5 6
5. Whenever I don't feel well, I should consult a medically trained professional.  1 2 3 4 5 6
6. I am in control of my health.  1 2 3 4 5 6
7. My family has a lot to do with my becoming sick or staying healthy.  1 2 3 4 5 6
8. When I get sick, I am to blame.  1 2 3 4 5 6
9. Luck plays a big part in determining how soon I will recover from an illness.  1 2 3 4 5 6
10. Health professionals control my health.  1 2 3 4 5 6
11. My good health is largely a matter of good fortune.  1 2 3 4 5 6
12. The main thing which affects my health is what I myself do.  1 2 3 4 5 6
13. If I take care of myself, I can avoid illness.  1 2 3 4 5 6
14. When I recover from an illness,
it's usually because other
people (for example, doctors,
nurses, family, friends) have
been taking good care of me.

15. No matter what I do, I'm likely
to get sick.

16. If it's meant to be, I will
stay healthy.

17. If I take the right actions,
I can stay healthy.

18. Regarding my health, I can
only do what my doctor tells me
to do.
Form B

This is a questionnaire designed to determine the way in which different people view certain important health-related issues. Each item is a brief statement with which you may agree or disagree. Beside each statement is a scale which ranges from strongly disagree (1) to strongly agree (6). For each item we would like you to circle the number that represents the extent to which you disagree or agree with the statement. The more strongly you agree with a statement, then the higher will be the number you circle. The more strongly you disagree with a statement, then the lower will be the number you circle. Please make sure that you answer every item and that you circle only one number per item. This is a measure of your personal beliefs; obviously, there are no right or wrong answers.

Please answer these items carefully, but do not spend too much time on any one item. As much as you can, try to respond to each item independently. When making your choice, do not be influenced by your previous choices. It is important that you respond according to your actual beliefs and not according to how you feel you should believe or how you think we want you to believe.

1. If I become sick, I have the power to make myself well again.  
   1 2 3 4 5 6
2. Often I feel that no matter what I do, if I am going to get sick, I will get sick.

3. If I see an excellent doctor regularly, I am less likely to have health problems.

4. It seems that my health is greatly influenced by accidental happenings.

5. I can only maintain my health by consulting health professionals.

6. I am directly responsible for my health.

7. Other people play a big part in whether I stay healthy or become sick.

8. Whatever goes wrong with my health is my own fault.

9. When I am sick, I just have to let nature run its course.

10. Health professionals keep me healthy.

11. When I stay healthy, I’m just plain lucky.

12. My physical well-being depends on how well I take care of myself.

13. When I feel ill, I know it is because I have not been taking care of myself properly.

14. The type of care I receive from
other people is what is responsible for how well I recover from an illness.

15. Even when I take care of myself, it's easy to get sick.

16. When I become ill, it's a matter of fate.

17. I can pretty much stay healthy by taking good care of myself.

18. Following doctor's orders to the letter is the best way for me to stay healthy.
APPENDIX C

HEADACHE DIARY
HEADACHE DIARY

Instructions: It is always best if you can describe your headache while you are having it. So please make an effort to carry your booklet with you at all times. If for some reason you cannot get to your booklet when you are having the headache, please fill out the information to the best of your memory as soon as possible. The more careful you are in recording this information, the more we will be able to help you. Thank you.

1. Circle the number that describes your headache pain.
   aware of pain intense, incapacitating when attention 1 2 3 4 5 6 headache. Among the most devoted painful I have had

2. Circle the day

3. About how many minutes did your headache last?
   ____________________ (Please state in terms of hours and minutes if headache lasted more than 1 hour).

4. If you took medication for this headache, please record the total number of pills taken.________
APPENDIX D

CONSENT FORM
Consent Form

Information

You are invited to participate in a research study investigating the reduction of tension headache using electromyogram biofeedback as a treatment. If you agree to participate, you will be one of 18 subjects who will be participating in this research.

As a participant in this research you will be asked to:

1. Fill out a questionnaire which includes basic demographic data and questions regarding your headache pain and history. This takes approximately 15 minutes and will be filled out the first time you come in.

2. Answer a questionnaire on the way you view certain important health-related issues. This takes approximately 15 minutes and will be filled out the first and last times you come in.

3. Keep track of your headache activity on special forms we will give you. This will take a few minutes a day.

4. Attend an eight week biofeedback training program. The first two weeks involve establishing an accurate record of your headache activity and will take approximately one half-hour for each of the two weeks. The next four weeks will involve two twenty minute sessions per week, and the final two weeks will involve approximately 15-30 minute sessions once a week. The sessions will
We know that tension headaches are caused by muscles in the head and neck cramping up. This happens when a person is feeling uptight. One way to get rid of the headaches is to take medicine which helps the muscles to un-cramp. Another way that prevents the headache is to help you learn to monitor building levels of muscle cramping, and a way that can be done is by learning about your own levels of muscle tension. That is what we will be doing in the biofeedback training sessions. There are no known risks involved in the use of biofeedback. A person trained in the use of biofeedback will be administering the training sessions. You are invited to ask questions at any time about the study and its procedures and report any study related problems to the researchers. There is no monetary compensation for participation in this study.

Consent

I have been given an opportunity to ask questions about this study; answers to such questions (if any) have been satisfactory. The information in the study records will be kept confidential and will be made available only to persons conducting the study unless I specifically give my permission in writing to do otherwise. If the results of this study are published, I will not be identified.
In consideration of all of the above, I give my consent to participate in this research study. I understand that I may drop out or withdraw from the study without fear of changing the investigator's interest or the quality of care which I may seek or receive in the future from the researchers participating in the study.

I acknowledge receipt of a copy of this informed consent statement.

Subject's Signature __________________________  Date ____________
Signature of Witness __________________________
Signature of Investigator ______________________
APPENDIX E

EMG RECORDING INSTRUCTIONS

TO THE SUBJECT
EMG Recording Instructions to the Subject

If you learn to relax your forehead muscles, you may be able to use this technique to help you reduce headache pain. Lie back with your arms at your sides. It is important to remain as still and quiet as possible so that the machine will work effectively. Now, close your eyes and try to become as relaxed as possible -- especially letting the muscles of your forehead relax. The more relaxed your forehead muscle becomes, the slower the clicks coming from the machine will be. No one can tell you how to relax your forehead muscles: but through a process of trial and error you will find that you can slow down the clicking sound. There will be a short period for you to continue relaxing before the clicks are turned on.
APPENDIX F

SAMPLE HEADACHE DIARY DATA
Sample Headache Diary Data for One Subject

**Monday**

**Total**

A. Intensity per H.A.: 5, 5, 2 = 12

B. Frequency per day: 1, 1, 1 = 3

C. Duration per H.A. (in minutes): 35, 20, 60 = 115

D. Total number of pills taken per day: 6

Total H.A. index for day = 12 + 3 + 115 + 6 = 136

**Tuesday**

Total H.A. index for day = A+B+C+D = 170

**Wednesday**

Total H.A. index for day = A+B+C+D = 105

**Thursday**

Total H.A. index for day = A+B+C+D = 35

**Friday**

Total H.A. index for day = A+B+C+D = 90

**Saturday**

No Headache activity = 0

**Sunday**

No Headache activity = 0

Total Headache Index for Week 1: 136 + 170 + 105 + 35 + 90 + 0 + 0 + 0 = 536

Total Headache Index for Week 2:

Mon + Tue + Wed + Thur + Fri + Sat + Sun = 250
Baseline Headache Index = Week 1 + Week 2

\[ 536 + 250 = 786 \]

Post Training (Self-Control Condition) Headache Index will be computed in exactly the same way: for purposes of demonstration will equal 150.

Formula for % improvement score =

\[ \frac{\text{Baseline H.A. index} - \text{Post Training H.A. index}}{\text{Baseline H.A. index}} \times 100 \]

The above example would be: \[ \frac{786 - 150}{786} \times 100 \]

\[ \frac{636}{786} \times 100 = 80.9\% \]
References


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