Treatment Integrity and Cost-Effectiveness of Home Vs. Clinic Relaxation Training for Tension Headaches

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A Dissertation submitted to the Department of Psychology in partial fulfillment of the requirements for the Degree of Ph.D.

ISBN 0-315-51599-6

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BY

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A thesis submitted to the Faculty of Graduate Studies of the University of Manitoba in partial fulfillment of the requirements of the degree of

DOCTOR OF PHILOSOPHY

ACKNOWLEDGEMENTS

I would like to thank Fran Silva for organizing and maintaining the computers in working order. His willingness to be of service at any time is greatly appreciated.

I would also like to thank Dr. Brian Anderson. His referral of patients, and services in diagnosing tension headaches, were an integral part of the present research.

I am indebted to Dr. John Walker for consenting to be my on-site supervisor and helping me through many of the trying moments of the study. His assistance in recruiting patients was indispensable.

Thank you to my examination committee, Drs. Stephen Holborn, Rayleen DeLuca, Garry Martin, Ranjan Roy, and John Walker for reading and evaluating my dissertation, and participating in my orals. Their suggestions were relevant and manifested a better paper.

I would like to express my appreciation to Dr. Barry Mallin for his extensive time and effort in preparing the figures for the manuscript, and to Kathy Weir for her invaluable assistance in setting up the program which allowed me to type and complete this project.

Special thanks are offered to Dr. Stephen Holborn, not only for his advisory role in the completion of the dissertation, but for his guidance, patience, understanding, and friendship throughout my graduate career.

Thank you to my parents for absolutely everything.

Finally, to my wife Lynne, thank you for giving so much to help me fulfill a dream.

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Abstract

The present research utilized treatment integrity procedures to enable reliable comparisons of the relative efficacy and cost-effectiveness of live-clinic and taped-home relaxation training procedures, for the treatment of tension headaches. Previous research assessing relaxation training for headaches has failed to assess treatment integrity, i.e., the extent to which the therapist implemented the relaxation procedure as described, and the degree to which the patients complied with the therapist's instructions. Procedural reliability was assessed in the study as follows. A trained observer scored the live-clinic relaxation training procedure from audiotapes. The observer also scored the corresponding tapes utilized for successive stages of home relaxation training. Objective compliance with the taped-home relaxation training was assessed using a computer-based method. Briefly, this method entails the patient's squeezing of a hand control (which was recorded by the computer) each time instructed to tense a muscle. Cost-effectiveness was examined as a ratio of degree of improvement per amount of therapist contact for each patient. A single-case replication design with three tension headache sufferers in each of two experiments was employed. Experiments I and II were the same except that while the relaxation training was done live in the hospital setting for Experiment 1, the patients used solely tapes of the relaxation exercises in their homes for Experiment 2.

The dependent variables were taken from patients' self-report of daily headache data. The results indicated that; a) headache frequency decreased in 5 out of the 6 patients, with improvements ranging from 60.6% to 92.0%, the sixth patient improved his headache pain intensity by 54.1%, b) patients who had the highest compliance rates generally improved the most, and c) home-based relaxation training was as effective, and therefore more cost-effective than live-clinic relaxation training.

Treatment Integrity and Cost-Effectiveness of Home vs. Clinic Relaxation Training for Tension Headaches

Headaches have been described as one of humanity's most common physical discomforts. They can be mild and self-limiting, or they can be severe and require medication to limit the discomfort (Martin, 1983). DeLozier and Gagnon (1975) reported that headaches are one of the 14 principal problems presented by people seeking outpatient medical care (cf. Blanchard and Andrasik, 1982). Diamond (1987) indicated that approximately 155 million work days are lost annually in the United States because of headaches. He also reported that muscle contraction is the cause of headache in 90% of patients. Other researchers have argued that approximately 80% of headaches are muscle contraction or tension headaches (e.g., Teders et al., 1984). Still other investigators have suggested that only 40% can be classified as tension related (Anderson, Lawrence, and Olson, 1981). Obviously, there would seem to be inconsistency in the diagnosis of tension headaches.

In 1962, the Ad Hoc Committee on Classification of Headache, from the National Institute of Neurological Diseases and Blindness, described muscle contraction headache as:

> "Ache or sensations of tightness, pressure, 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, l. 1)."

The Committee further described vascular headaches of the migraine type as:

> "Recurrent attacks of headache, widely varied in intensity, frequency, and duration. The attacks are commonly unilateral in onset; are usually associated with anorexia and, sometimes with nausea and vomiting; in some cases are preceded by, or associated with, conspicuous sensory, motor, and mood disturbances; and are often familial (p. 717, l. 15)."

More recently though, muscle contraction headaches have been characterized as having a slow onset (Blanchard and Andrasik, 1982), as a dull ache, with a band or caplike pressure or tightness over the entire head (Blanchard, Ahles, and Shaw, 1979); as a band-like tightness or pressure around the head or stiffness or soreness in the neck (Williamson, 1981); as aches or sensations of tightness in the cephalic and/or occipital region with presence of sustained muscle contraction (Thompson, 1982); and as preceded or associated with anxiety or tension (Diehr et al., 1982).

In contrast, migraine headaches have typically been characterized by sudden onset with intense unilateral

throbbing pain (Blanchard and Andrasik, 1982); by unilateral pain at onset which may become generalized to the whole head (Blanchard et al.,1979); by severe throbbing pain that has a unilateral or one-sided locus at onset but which may radiate to other areas (Williamson, 1981); and by pain in and around the eyes with acute visual change and flushing (Diehr et al., 1982).

Self-reports have been used to differentiate migraine and tension headache sufferers with success. Blanchard, Andrasik, Arena, et al., (1983) provided evidence to suggest that the use of headache histories to determine headache type is the best single predictor of improved headache activity based on nonpharmacologic treatment effects. All subjects received relaxation training, but based on headache history, subjects diagnosed as suffering from tension headache also received EMG biofeedback while migraine headache sufferers also received thermal biofeedback. The results indicated that based on the level of improvement for each headache type, 87.5 to 95.2% of patients were correctly classified. However, they also determined that a combination of headache histories, headache diaries, psychological tests and psychophysiological measures presented a consistently, but only slightly superior, method of predicting improvement (90 to 100% of patients were classified correctly). Thus, it does appear possible for headache histories to facilitate a differential diagnosis between tension and migraine headaches (see Appendix A for

an indepth discussion on the difficulties in diagnosing headache type).

Relaxation Training

Historically, the treatment of tension (the focus of the present study) and migraine headaches has been considered an aspect of inquiry falling within the domain of the medical profession. However, many physicians have considered most headaches to be a manifestation of psychological variables (Bakal, 1975). Indeed, within the past 15 years, behaviorally oriented clinicians have accumulated a sizeable body of literature on the assessment and treatment of headaches (Blanchard et al., 1979). Based on this research, it appears that relaxation training procedures have been effective in reducing both tension and migraine headache symptoms (Blanchard, Andrasik, Neff, et al., 1983; Fichtler and Zimmerman, 1973; Jurish, et al., 1983; Tatso and Hinkle, 1973). Carney (1983) reported that about 60% to 70% of the patients receiving relaxation training for tension headaches were able to reduce headache activity by at least 50%. An important question might be to ask why the success rate for relaxation training is not higher. One reason is that relaxation training may not be the most appropriate change agent (see discussion on the appropriateness of relaxation training, as suggested by Lake (1981), in Appendix B). Another explanation may be that in order to determine its actual effectiveness, relaxation training must be implemented properly. That is, treatment

integrity must be assessed and insured. Two components to treatment integrity are important. The first is that the experimenter must implement the procedure as described (procedural reliability), and the second is that the subjects must adhere to the experimenter's instructions (compliance). The actual value of relaxation training may not have yet been determined because the relevant research to date has not been precise enough in its descriptions, and reliable enough in its implementations of treatment. An obvious area of inquiry then, would be to examine the degree of procedural reliability evident in the research.

Procedural Reliability

Peterson, Homer, and Wonderlich (1982) argued that accurate and reliable descriptions and observations of the independent, as well as the dependent variables are necessary to establish a functional relationship between the two variables, thereby fostering internal validity. While much attention has been afforded to accurate assessment of dependent variables, procedures designed to determine the accuracy of manipulation of independent variables are generally lacking. In other words, it is necessary not only to provide a study that is technologically sound (Baer, Wolf, and Risley, 1968), but also to provide objective assessments to indicate the reliability or consistency with which the treatment procedures actually were implemented.

Accurate determination of the functional relationship

between the independent and dependent variables is necessary to specify the precise behavioral change agent. For example, Billingsley, White, and Munson (1980) argued that without procedural reliability checks, when unexpected changes occur, or when expected changes are absent, replication and practical utility have been sabotaged, thus questioning the validity and clinical significance of the study (see Appendix C for a further discussion on the need for procedural reliability assessments).

Several researchers have been concerned, conceptually, with treatment integrity, with reference to the treatment of headaches. Hillenberg and Collins (1983), for example, argued that procedural differences across relaxation training studies severely limit the potential for replication. In Hillenberg and Collins' (1982) review of relaxation training research, 26 distinctly different relaxation approaches were reported. Of the studies reported, 10 gave no indication as to the type of procedure employed. In addition, most of the other studies reported that a modified version of a specific relaxation approach was used, but descriptions of these modifications were missing.

While accurate descriptions of the implementation of the independent variable are required, the extent to which these procedures are performed in accordance with their descriptions must be assessed. Two procedural issues already discussed must be noted. The first is that

reliability checks must insure that the performed procedure does not omit anything from the described procedure, and the second is that the manipulation must not include anything more than has been described (Peterson et al., 1982). Training observers to monitor the integrity with which the independent variable is manipulated, in much the same way that the accuracy of dependent measures are obtained, has been one solution to assessing the functional relationship between the independent and dependent variables (Peterson et al., 1982).

Examination of tension headache studies quickly reveals the absence of treatment integrity checks. Another component of relaxation training and tension headache research that has not received adequate treatment integrity attention, but which is often recommended, is the use of home practice of relaxation exercises (Hillenberg and Collins, 1983).

Home Practice

The use of home practice is a procedural recommendation for nearly all of the studies employing relaxation training (Flanders and McNamara, 1987). Carney (1983) has argued that a majority of nonresponders to relaxation therapy are patients who fail to practice relaxation on their own. Turner and Chapman (1982) have pointed out that behavioral interventions emphasize regular home practice. Beaty and Haynes (1979) have suggested that home practice may account for some of the intervention effects. Hillenberg and

Collins (1982) reviewed relaxation training studies between 1970 and 1979 from 12 different journals. They found it surprising that only 60% (48 out of 80) of the studies reported some type of home practice given that Bernstein and Borkovec (1973) specifically stated,

> "The importance of practicing cannot be over emphasized to the client...relaxation is a skill which must be practiced if it is to improve (p. 30, column 2)."

Hillenberg and Collins (1982) did report that there had not been any empirical evidence to support the use of home practice as a critical component of relaxation training. However, in 1983, these authors conducted a study that indeed indicated that home practice, twice daily concurrent with sessions one to seven, contributed to the efficacy of progressive relaxation training for subjects reporting general anxiety and tension problems. Analysis of the data indicated that, relative to the no home practice group and wait-list control group, the home practice group showed a significant improvement in both anxiety and tension levels, as well as in the percentage of subjects who improved; at least during the 2 weeks following relaxation training.

However, while home practice of relaxation appears to be an important component of relaxation training, objective assessment of compliance with this prescription is notably lacking. Just as objective measures should be used to determine the accuracy with which the independent variable

(relaxation) is implemented, objective assessments should also be conducted to measure the rate of compliance to instructions to practice relaxation at home.

Compliance

Several authors have noted the importance of evaluating compliance with relaxation training for headaches (e.g., Blanchard and Andrasik, 1982; and Turner and Chapman, 1982). For example, if a particular intervention is ineffective, we cannot say whether the problem was a faulty technique, or whether the patient's use of the technique was faulty. Lichstein and Hoelscher (1986) argued that decisions as to relaxation efficacy are questionable if the evaluator is unaware of level of relaxation practice.

While self-report measures of compliance provide some information, a direct measure of relaxation practice would obviously be preferable (Taylor et al., 1983). Hillenberg and Collins (1982) noted the necessity of objective compliance measures. They stated that the actual rate of compliance on the part of the subjects is one of the major problems encountered in studies that assign home practice. Of the 48 studies they reviewed that reported home practice, 39 did not assess compliance in any way, nine used only self-reported compliance assessment, and there were no studies that conducted objective compliance assessments (see Appendix D for a further discussion on the problems associated with self-reported compliance, and the need for more objective measures).

Collins et al. (1982) and Hillenberg and Collins (1982; 1983) have suggested one method of obtaining objective compliance measures of home relaxation. Their procedure involves the presence of cue tones on taped relaxation exercises. The subject is asked to practice the exercises and to record when and how many tones were heard. These responses are then compared to a master list and compliance is assessed. This procedure is an improvement over self-report measures, but it is not necessarily an accurate measure of compliance with relaxation practice. While listening to the tape is objectively assessed, doing the exercises may not be. To wit, it is possible for the subject or client to engage in any activity that does not interfere with hearing the tone on the tape, for example, eating a snack or maybe even reading a book or watching television (see Appendix D for a further discussion on compliance). Thus, while objective compliance measures have been improved, there is still a need for more accurate measurement. One obvious goal of obtaining objective compliance measures would be to assess the "true" value of the use of home practice of relaxation training. A second goal would be to determine the relative effectiveness of the home use of relaxation training as compared to therapist-delivered relaxation training.

Self vs. Therapist-Delivered Relaxation Training

Several authors have suggested that a comparison between self and therapist-delivered relaxation training is

required. Blanchard and Andrasik (1982) recommended that self-administered treatments be compared to comparable clinic-administered treatments to evaluate their relative efficacy and cost-effectiveness (see Appendix E for a discussion on the need to provide individuals with a self-help approach to treating headaches).

Teders et al. (1984) compared a therapist-directed, clinic-based relaxation treatment to a minimal-contact, home-based treatment. The results were positive in that the minimal therapist contact group had tension headache improvement rates that approached or equaled those in the therapist directed group, and that the minimal therapist contact group was more cost-effective. However, methodological concerns regarding procedural reliability and compliance leave the reader unclear as to the functional relationship between the independent (relaxation training) and dependent (headache rates) variables. Briefly, although Teders et al. (1984) reported where a detailed description of their relaxation procedure could be found, they did not formally attempt to determine whether or not the independent variable was manipulated appropriately. Thus, we are unsure of the extent to which their reported procedures were followed. In addition, although home practice was assigned for both groups, only the minimal contact group had access to the relaxation tapes after the first week. Beginning at week two, the clinic based group practiced without the benefit of tapes. Therefore, the quality of practice may

have been hindered. Thus, the two treatment conditions were not identical and comparison of mode of delivery is difficult. Also, the only measure of home practice compliance that was obtained was the subjects' self-recordings of the time of day they practiced and the degree of relaxation they achieved.

These self-reports were then used to indicate that compliance rates between the two groups were very similar. As Taylor et al. (1983) have indicated, compliance to instructions to practice is overreported. An interesting point here is that overreporting of practice may not necessarily be consistent across time or subjects. It is a problem worth investigating in its own right. In any case though, it is impossible to determine the actual rate of compliance. If one group tended to practice much more than the other group, the conclusions that were deduced are questionable (See Appendix E for further discussion on home-based relaxation training).

Summary

Although, the literature describing the differential assessment of tension and migraine headaches is ambiguous, it is sometimes possible to differentially diagnose tension and migraine headaches along a severity continuum via self-report (Martin, 1983). In spite of procedural reliability issues, relaxation training appears to be somewhat effective in reducing both migraine and tension headache activity. While about 60% to 70% of the patients receiving relaxation

training for tension headaches improve at least 50% in headache symptoms, procedural reliability issues should be considered before dismissing relaxation training as only partially effective. Further research demands careful documentation and assessment of the independent variable manipulation and objective compliance measures of training or practice in the home, if the effectiveness of relaxation training is to be ascertained.

Thus, the purpose of Experiment 1 was to assess the "true" potential of live-clinic relaxation training for tension headaches using objective procedural reliability (in the clinic) and compliance checks (in the home). The purpose of Experiment 2 was to assess the "true" value of a taped-home relaxation training procedure, that used objective procedural reliability checks for the tapes, and compliance checks for practicing, for the treatment of tension headaches. An overall goal of the proposed research was to compare the relative cost-effectiveness of the home versus clinic use of relaxation training.

The treatment integrity issues of assessment of independent variable manipulation and objective compliance measures were managed by having a trained observer monitor the relaxation training procedure implemented in the clinic setting, and by having a computer assess compliance in the home setting. Briefly, for the latter method, the patient lay on a pressure mat that monitored the length of the session. Also the patient squeezed a hand control each time

he or she was instructed to tense a muscle. Thus, information about session length and whether or not the patient was tensing and releasing the hand control in synchrony with the taped instructions was gathered. Although it was still possible for patients to tense and release the hand control without doing so for the other muscle groups, it was more likely that they would comply with this procedure than other procedures to insure compliance because the patients had to spend the entire session on the mat, and had to listen to the whole tape continuously to remain in synchrony with the instructions.

Method

Methodological Features Common to Both Experiments

Subjects. Tension headache patients were selected for the present study based on Blanchard, Andrasik, Arena, et al's. (1983) headache history form. A qualified neurologist from the department of Neurology at the St. Boniface General Hospital was consulted to confirm a tension headache diagnosis and to exclude those people who exhibited pain originating from physical (hypertension, anemia, infectious diseases) and/or neurological (tumors or strokes) factors (Thompson, 1982). As will be recalled, Blanchard, Andrasik, Arena, et al. (1983) found that headache histories are the best single predictor of headache type (87.5 to 95.2% correct classifications). Thus, a copy of the headache history (see Appendix F) employed in that study was used to select six tension headache sufferers (three for each of

experiments 1 and 2) who had responded to an advertisement placed in a local newspaper. A seventh patient, diagnosed as experiencing primarily migrainous type headaches, was also recruited because of the lack of tension headache patients at the time. Information on him and his data is presented in Appendix G. Only patients who had partners who were willing to aid in data collection were utilized in the present study. Finally a letter indicating general health status was requested from each patients' family doctor.

While approximately 100 people were screened, only 6 patients were utilized because of the difficulty locating appropriate tension headache sufferers. Some applicants appeared to be experiencing moderate levels of migraine and/or cluster headaches. Other candidates were believed to be exhibiting different psychiatric symptoms; e.g., depression or anxiety, that might have contaminated the data. Some potential patients could not commit themselves to 12 to 20 weeks of uninterupted participation, and still other applicants did not have a significant other to provide corroborative data on the patient's headaches.

The patients were randomly assigned to the two experiments. The patients were not given a choice as to whether they could participate in the live-clinic or the taped-home portions of the study. As there were only three computers to assess compliance, the first three patients that met the inclusion criteria were placed in Experiment 1. The next three patients to meet the requirements were placed

in Experiment 2. The rational for having two experiments was to first determine the effect of treatment integrity checks on relaxation training for tension headaches in a live-clinic setting. If the data indicated that the results were at least approximating the effectiveness of previous research, then Experiment 2 was to assess the value of an improved method of relaxation training applied to tension headache patients in a taped-home setting.

Setting, Apparatus, and Materials. Live relaxation exercises were conducted in a small private office in the McEwen Building (Department of Psychiatry) at the St. Boniface General Hospital in Winnipeg, Manitoba. A reclining chair was used for relaxation training in the clinic. Taped relaxation training was conducted in the patient's own home. The most comfortable sitting or lying furniture was used for the home relaxation exercises. Headache diaries (see Appendix H) enabled self-report of headache activity. EMG equipment and assessments were conducted in the biofeedback room, somewhat larger than the relaxation training room, also located in the McEwen Building at the St. Boniface General Hospital. Frontal EMG was recorded using an Autogen 1700 biofeedback unit. The surface active electrodes were placed approximately 2.5 cm. above the center of each eyebrow while the ground electrode was positioned between and slightly above the active electrodes. EMG levels (in micro-volts) were sampled via observation of the V.U. meter every 15 seconds for 10

minutes following a 10 minute adaptation period. Interobserver reliability for the EMG observations, ranged from 87.5% to 100%, with a mean of 94.5%.

Compliance measures were assessed using a Commodore Vic 20 computer programmed to receive and record amount of time spent practicing and adherence to the tense-release cycle presented on the audio tapes. The patient sat or lay down on a Radio Shack pressure mat that enabled measurement of the length of time the person engaged in the exercise. In addition, the patient was instructed to squeeze and release a hand control device in unison with each tense-release cycle presented on the relaxation tape. Each squeeze and release of the hand control was transmitted to and recorded by the computer.

Design. Baseline length was a major concern because the present study dealt with a population experiencing a clinical problem with accompanying pain. Since a multiple baseline design could have meant baseline lengths of up to 10 weeks for some of the patients, it was decided to use a single-case A-B-C replication design wherein A = Baseline, B = Relaxation Training, and C = Maintenance. Each patient started baseline at different times; i.e., as they became available for the experiment they participated in. In addition, baseline lengths were staggered such that each patient monitored their headaches for 4 to 6 weeks, followed by at least 6 weeks of relaxation training, and finally, 4 to 6 weeks of maintenance, respectively.

Dependent Measures. Throughout the study, each patient recorded the requested information in their headache diaries four times daily at approximately breakfast, lunch, supper, and bedtime. The headache diary included information about headache frequency, duration (in hours), and intensity. Intensity was based on Huskisson's (1983) visual analogue scale. The scale ranges from severe pain to no pain. In addition, the number of verbal comments about headache activity to a significant other, and medication dosage were recorded daily. These reports were given to the therapist or research assistant (a hospital volunteer) once per week. Each patient also had his or her EMG responses recorded once per week by a research assistant trained in EMG procedures. At this time, the assistant also answered questions arising from difficulties with the headache diaries. Thus, headache activity was monitored continuously during the entire study.

Validity of Subject Recording. In order to gather collateral information on changes with treatment, the partner completed a weekly rating scale assessing how much the headaches had interfered with the patient's functioning; i.e., changes in daily routine such as sleep patterns, absences from work, irritability, and the frequency of verbal comments about headaches (see Appendix I). With the exception of one patient in each experiment, the partner's recording provided little helpful information (see Appendix J).

Baseline. At the initial meeting, patients were told

individually that following a 4 to 6 week monitoring period, which included weekly EMG assessments, a relaxation procedure would be implemented in an attempt to decrease headache activity. They were instructed to maintain their headache diaries for the entire study. They were also told their partners were to complete their rating scales continuously.

Procedure. The relaxation training procedures for the two experiments contained subtle differences, and will therefore be described in their respective experiments.

Maintenance. Maintenance of training was assessed for each patient following the completion of relaxation training. All patients were instructed to continue practicing relaxation once per day. As will be described later, by the end of Bernstein and Borkovec's tenth session, the patient should be able to relax completely, simply by counting, and the procedure should not take longer than a minute or two. Thus, in an effort to train coping skills in the face of stressful situations in the natural environment, all patients were instructed to employ the counting procedure when they found themselves to be unduly tense, or when they felt that a headache was evolving. The rationale provided to the patients was: inducing relaxation at these times will help to further reduce headache symptoms in the future. Each patient continued to record their daily headache activity and to report for EMG measures weekly for 4 to 6 weeks following training. Follow-up measures of

headache activity and EMG responses for 3 weeks duration will be conducted at approximately 1 year following the completion of the maintenance phase.

Procedural Reliability. The research assistant monitored all of the audio-tapes of the therapist's adherence to the relaxation script for Experiment 1 (the live-clinic patients), to assess the accuracy of the independent variable manipulation. The observer monitored the home practice tapes for sessions one, four, six, eight, nine, and 10, as the standardized procedure requires that different muscle groups be used at these times, so that the verbal content of the tape changes. The observer only had to monitor the home practice tapes in Experiment 2 as there were no clinic procedures to conduct. The observer checked to determine if key words such as; "relax", "tense", "calm", etc., or key phrases such as; "now tense your left hand and forearm", or "now relax your forehead completely" were included or omitted from the instructions. Any deviations from the script (either omissions or extras) were recorded as an error. Thus, the number of errors were described as a ratio of total obtained errors, over the total number of key words in the script, for each of omissions and extras, and then multiplied by 100 to obtain a percentage. A numerator of '0' would represent a perfect score in each case. The percentage scores provided an indication of the integrity with which the independent variable was manipulated. The results of this reliability check indicated that the

presentation of the treatment regimen was appropriate 90.75% to 100% of the time, with a mean of 95.25%. These ranges represent the data for all patients for all tapes. As the script was taken from the home tapes, these tapes were 100% accurate.

Instruction to the Patient (Home Computers). The patients were informed as to the purpose of the computers, an obtrusive measure, in an effort to improve compliance. Each of the patients received the home computers and were told that the purpose of the computer was to help give the therapist an idea of whether or not the patient was practicing appropriately. They were further instructed that they were to squeeze the hand control in unison with each muscle the tape told them to tense. It is the squeeze of the hand control that is recorded by the computer.

Compliance. As described previously, to obtain objective compliance measures, the computer recorded the length and time of the home session as well as each squeeze and release of the hand control. The computer output was then compared to the length of session and timing of the tense-release cycles on the tape, and an objective measure of compliance was obtained. But as indicated previously, although the computer does not insure that patients will comply with instructions in the home, this procedure is more likely to objectively assess compliance than other procedures because the patient would have to remain on the pressure mat for the entire session, and would have to

listen to the tape continuously in order to remain in synchrony with the tense and release cycles in the instructions.

During the maintenance phase, the computers were removed from the home to further enhance generalization of coping skills to the natural environment. Self report was the only method of assessing compliance at this point. At the end of the study, each individual patient's percentage of compliance to instructions for relaxation training and practice was compared directly to their overall improvement in headache activity.

Social Validity. A social validation questionnaire (see Appendix K) was distributed to all six participants in the study. Subjective ratings of satisfaction with the treatment procedures and outcomes provided an indication of the overall effectiveness of live-clinic and taped-home relaxation training. Patients were also asked to have significant others in their home environment rate their satisfaction with observed changes in the patient's headache activity (see Appendix L).

Experiment 1

Subjects

Experiment 1 included one female patient, Sheila, age 24 years, and two male patients, Richard and Andy, ages 33 and 48 years, respectively. Sheila had a headache history of approximately 6 years. Richard and Andy had experienced headaches for approximately 7 and 23 years, respectively.

All three patients were diagnosed as experiencing tension headaches.

Procedure

Relaxation Training. All patients were instructed to continue recording in their headache diary and to report for the EMG assessments once per week. Training was to be conducted twice per week, over a period of 5 weeks. The relaxation training phase typically lasted longer than 5 weeks because of missed sessions. Richard's and Sheila's relaxation training phase lasted 6 weeks each and Andy's lasted 8 weeks. Thus, there were 10 training sessions for each patient following baselines of approximately 5 weeks.

Bernstein and Borkovec's (1973) standardized relaxation training procedure was implemented in the present study. Briefly, the patient progressed through 10 sessions of systematically tensing and relaxing different muscle groups. The procedures used in the hospital setting were taken from the script used to make the audio-tapes for home practice (see Appendix M). The only variation was that during home practice, the patient tensed and released their dominant hand to manipulate a hand control in conjunction with each different muscle group in order to assess compliance. Relaxation training in the clinic included corrective feedback (instructions) for responses that were performed incorrectly or inappropriately. Feedback was provided to maximize relaxation treatment effects and to more closely approximate clinical relaxation training procedures.

Home Practice. Based on the notion that home practice is essential for relaxation training to be effective, home practice was assigned to each patient during the training phase of the study. Each patient was provided with taped relaxation exercises and was instructed to practice training at least once per day.

Results

The headache index, as described by Blanchard, et al. (1982) is the most commonly used measure of headache activity because it combines frequency, duration, and intensity. Experiment 1, however, showed that intensity and duration were relatively stable and did not affect the overall headache activity rating. Therefore, only headache frequency and headache-free days per week are reported here.

Results were graphed and analyzed via visual inspection of data arising from a single-case replication research design (Kazdin, 1982). Individual data were examined for each patient to evaluate the relative effectiveness of live-clinic relaxation training, for tension headaches, when treatment integrity issues are addressed. In reading the graph, the left ordinate represents the headache frequency measure and the right ordinate, the headache-free days measure.

As can be seen in Figure 1, Richard's headache frequency immediately decreased from the baseline to treatment phases, with consistent improvement, stabilizing between 0 and 1 headaches per week when he was placed in the

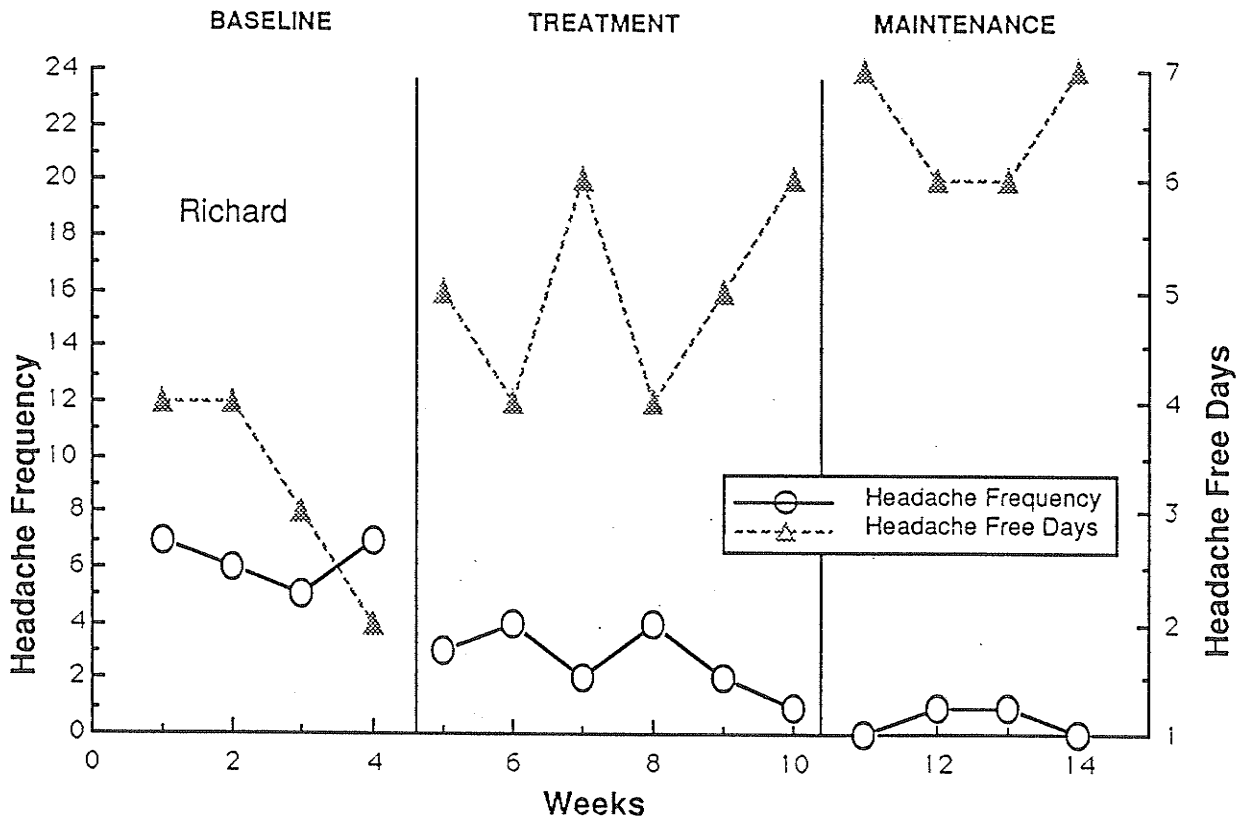

Figure 1. Headache Frequency and Headache-Free Days per Week During Baseline, Treatment (Relaxation Training), and Maintenance Phases for Richard.

maintenance phase. His mean headache frequencies during the three phases were 6.25 headaches per week during baseline, 2.7 headaches per week during relaxation training, and .5 headaches per week during maintenance. Richard's overall mean weekly headache frequency improved by 92% from the baseline to the maintenance phases.

His number of headache-free days, following a decreasing trend during baseline, immediately increased when the treatment was implemented. Although somewhat variable initially, his number of headache-free days continued on an increasing trend by the end of the treatment phase, and stabilized at 6 to 7 headache-free days per week during the maintenance phase. Richard's mean number of headache-free days per week during the three phases of the study were; 3.3 days per week during baseline, 5.0 days per week during the relaxation training phase, and 6.5 days per week during the maintenance phase. He experienced a 97% increase in headache-free days from baseline to maintenance.

Sheila's headache frequency, as displayed in Figure 2, was quite stable during baseline, averaging 16.6 headaches per week. Her number of headaches per week decreased dramatically during relaxation training. Her mean weekly headache frequency during this phase was 9.5. Her headache frequency fluctuated slightly between 5 and 8 headaches per week during the maintenance phase, with a mean weekly headache frequency of 6.4 headaches per week. Sheila's

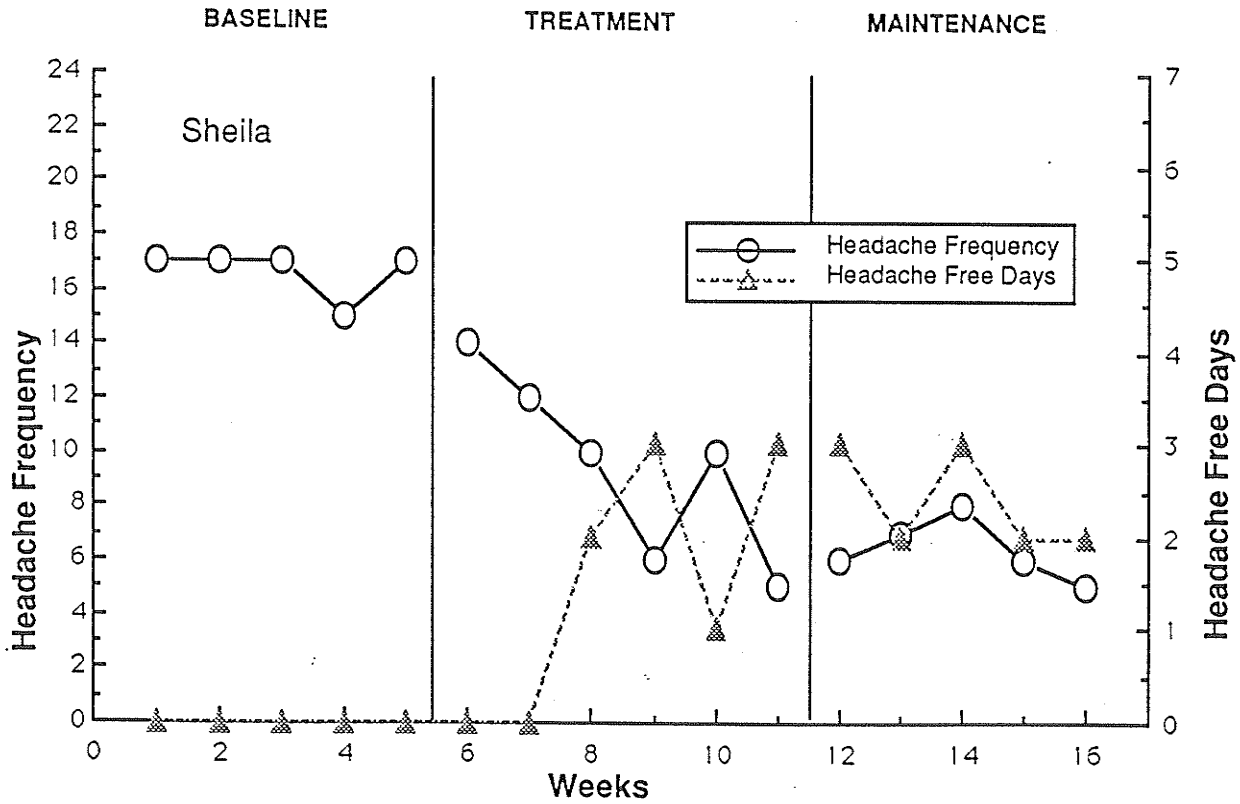

Figure 2. Headache Frequency and Headache-Free Days per Week During Baseline, Treatment (Relaxation Training), and Maintenance Phases for Sheila.

overall mean weekly headache frequency improved by 61.4% from the baseline to the maintenance phases.

While Sheila did not experience any headache-free days during baseline, she suddenly became headache-free for approximately 1.5 days per week following the second week of the treatment phase. During the maintenance phase, Sheila averaged 2.4 days per week without a headache, an improvement of 60% over the relaxation training phase.

In Figure 3, while Andy's headache frequency initially decreased over the first 4 weeks, it increased again in the last 2 weeks of baseline. His mean weekly headache frequency was 11.0 during baseline. His number of headaches remained relatively stable, but at a lower level than during baseline, during the first 4 weeks of relaxation training, and then gradually decreased during the final 4 weeks of treatment. He averaged 5.9 headaches per week during this phase of the program. His headache frequency remained stable at a low level during the maintenance phase, with a mean weekly headache frequency of 3.0 headaches per week. Andy's overall mean weekly headache frequency improved by 72.8% from the baseline to the maintenance phases.

It can also be seen in Figure 3 that Andy's total number of headache-free days per week during baseline was somewhat variable, averaging 1.3 days per week without a headache. After an initial decreasing trend in headache-free days, he dramatically improved over the final 5 weeks of relaxation training to obtain an overall mean of 2.8

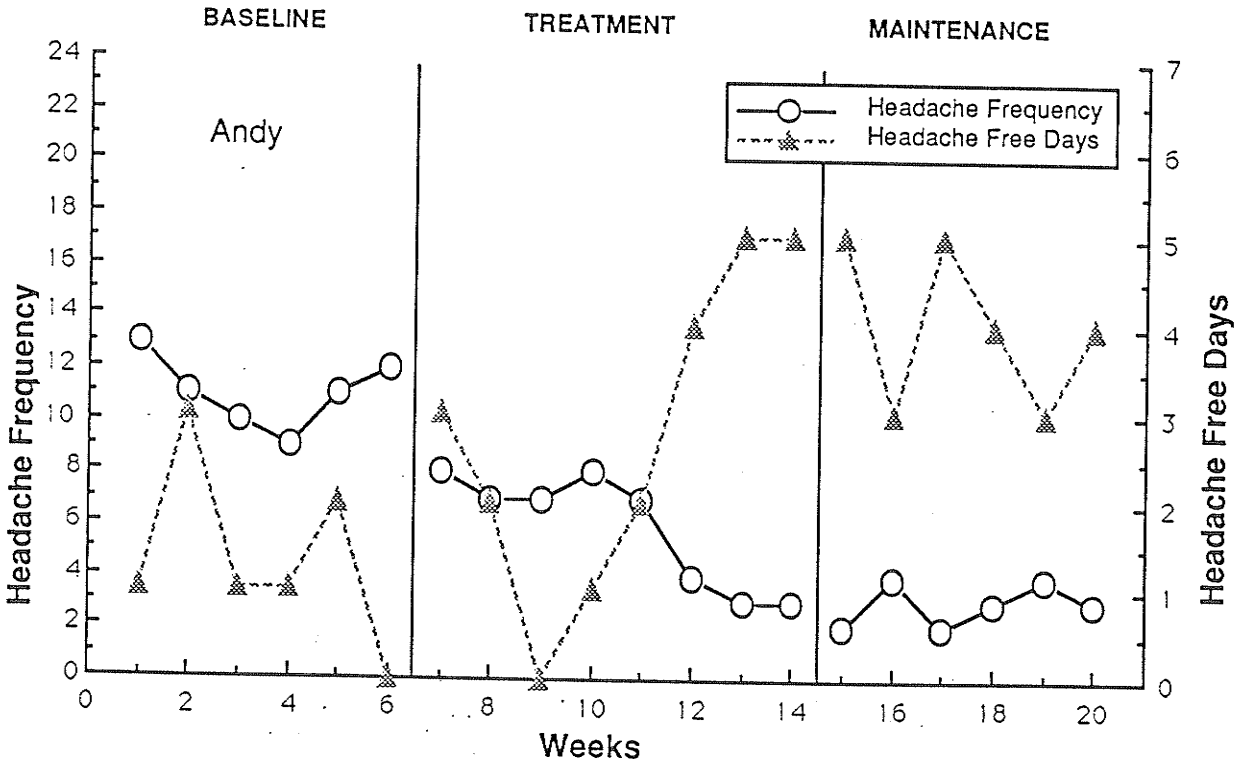

Figure 3. Headache Frequency and Headache-Free Days per Week During Baseline, Treatment (Relaxation Training), and Maintenance Phases for Andy.

headache-free days per week during treatment. Although Andy's total number of headache-free days per week was variable during maintenance, it was improved. He averaged 4.0 headache-free days per week. He obtained a 207.7% overall improvement in headache-free days from the baseline to the maintenance phases.

Based on the headache diaries, Table 1 presents the average amount of medication consumed (in type and dosage) and number of comments per week per phase for each patient.

Table 1

Average Medication and Number of Comments per Week per Phase for Each Patient

	Baseline	Relaxation Training	Maintenance
Richard			
Medication (Tylenol-regular strength throughout study)	1.5	1.2	0.3
Comments	5.3	2.3	0.8
Sheila			
Medication (Tylenol-regular strength throughout study)	7.6	0.0	0.0
Comments	3.6	0.0	0.0
Andy			
Medication (Tylenol 1, 2, and 3 during baseline-Tylenol 1 thereafter)	15.5	7.1	7.8
Comments	0.5	0.3	0.3

As can be seen in Table 1, Richard's medication intake decreased from 1.5 to 0.3 tablets per week from the baseline to the maintenance phases. His number of comments fell from 5.3 to 0.8 comments per week over the same time period. Sheila's medication usage dropped from 7.6 to 0.0 tablets per week and her number of comments fell from 3.6 to 0.0 comments per week by the end of the maintenance phase. Andy's medication dosage was reduced from 15.5 to 7.8 tablets per week (with a corresponding decrease in medication strength following baseline), and his number of comments was reduced from 0.5 to 0.3 comments per week from the baseline to the maintenance phases.

Average duration per headache per week, average intensity per headache per week, and EMG for each patient remained relatively unchanged throughout the entire study, regardless of any changes in the other dependent measures. Therefore, these data are not reported here. Refer to Appendix N for further information.

The compliance data (described in more detail following the results of Experiment 2) indicated that those who complied the most, improved the most. Richard's headache frequency improved by 92%, while he practiced appropriately 73% of the time. Andy's headache frequency improved by 72.8%. He practiced appropriately 36.7% of the time. Sheila's headache frequency decreased by 61.4%, while she practiced appropriately 8.1% of the time.

Experiment 2

Subjects

Experiment 2 included one male patient, Dave, age 29 years, and two female patients, Sara and Lynn, ages 18 and 42 years, respectively. Dave's headache history was of approximately 5 years duration, Sara's headache history was of 2 years duration, and Lynn's headache history was of approximately 20 years duration. All three patients were diagnosed as experiencing tension headaches.

Procedure

Relaxation Training and Home Practice. After approximately 5 weeks of baseline, each patient received 6 relaxation training tapes. These tapes followed the same standardized relaxation training procedure and script as for Experiment 1 except for one variation. Each patient was instructed to tense and release a hand control in conjunction with each different muscle group in order to objectively assess compliance. Patients were also instructed to listen to the tapes sequentially for a period of 5 weeks. The prescribed time period for each tape was as follows: Each patient was to practice the first tape daily for the first 1.5 weeks, the second tape for the next week, the third tape for the next week, the fourth tape for another .5 of a week (the 4 week mark), the fifth tape for another half of a week, and the sixth tape for the last half week (the 5 week mark). The relaxation training phase actually lasted longer than 5 weeks because the patients

preferred to continue using various tapes for longer than the prescribed time period. Lynn's relaxation training phase lasted 6 weeks and Dave's and Sara's lasted 8 weeks each. All patients continued recording in their headache diary, and reported for their EMG assessments once per week.

Results

Intensity and duration for Lynn and Sara were a constant. Thus, headache frequency and headache-free days per week were the only two dependent measures graphed, as opposed to the headache index. Frequency, headache-free days, and duration were a constant for Dave. Therefore, intensity was the only dependent measure graphed for him. The data were analyzed in the same manner as for Experiment 1.

As can be seen in Figure 4, Dave's headache intensity was relatively stable and averaged a 3.7 pain rating per headache per week during baseline. His pain intensity then proceeded in a decreasing fashion during the relaxation training phase, and averaged a 2.8 pain rating per headache per week. It is important to note that Dave began relaxation practice sessions twice per day, once in the evening and once before bed, during week 5 of the treatment phase. His headache pain intensity ratings began to decrease quite rapidly at this point, primarily because of the lowered ratings he obtained in the evenings. Dave's pain intensity continued to decline slightly during the maintenance phase, averaging a 1.7 pain rating per headache

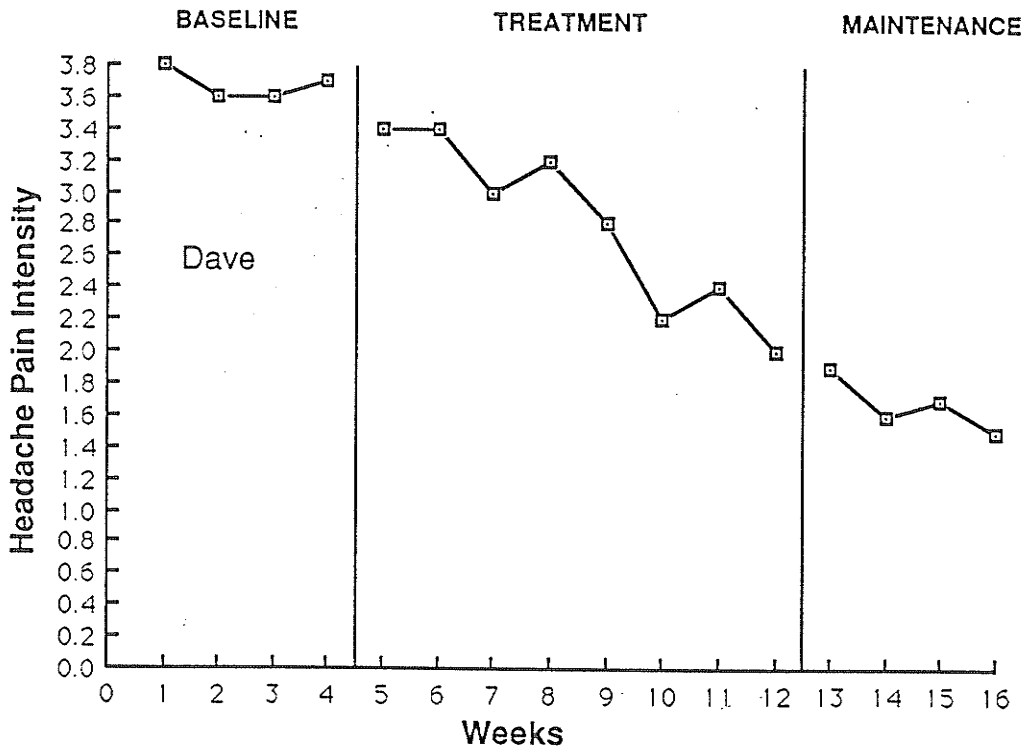

Figure 4. Mean Headache Pain Intensity Rating per Week During Baseline, Treatment (Relaxation Training), and Maintenance Phases for Dave.

per week. His overall mean weekly pain rating per headache improved by 54.1% from the baseline to the maintenance phases.

In Figure 5, Lynn's headache frequency showed a slightly declining trend throughout baseline, averaging 10.8 headaches per week. She then experienced a dramatic shift in level, followed by a sharply declining trend in frequency during relaxation training, where she obtained an overall mean headache frequency of 4.0 headaches per week. Her headache frequency remained low and stable with a mean of 1.4 headaches per week during the maintenance phase of the study. Lynn's overall mean weekly headache frequency improved by 87.0% from the baseline to the maintenance phases.

Lynn experienced very few headache-free days during baseline. She averaged .8 days per week without a headache. While her frequency of headache-free days was variable during the initial 3 weeks of relaxation training, the final 3 weeks of treatment produced her most dramatic improvement. Her mean number of headache-free days during relaxation training was 3.2 days per week. Her number of headache-free days remained at a high, relatively stable level, averaging 5.6 days per week during maintenance. Lynn experienced a 600% overall improvement of headache-free days from the baseline to the maintenance phases.

As can be seen in Figure 6, Sara's headache frequency formed an increasing trend during baseline. She averaged

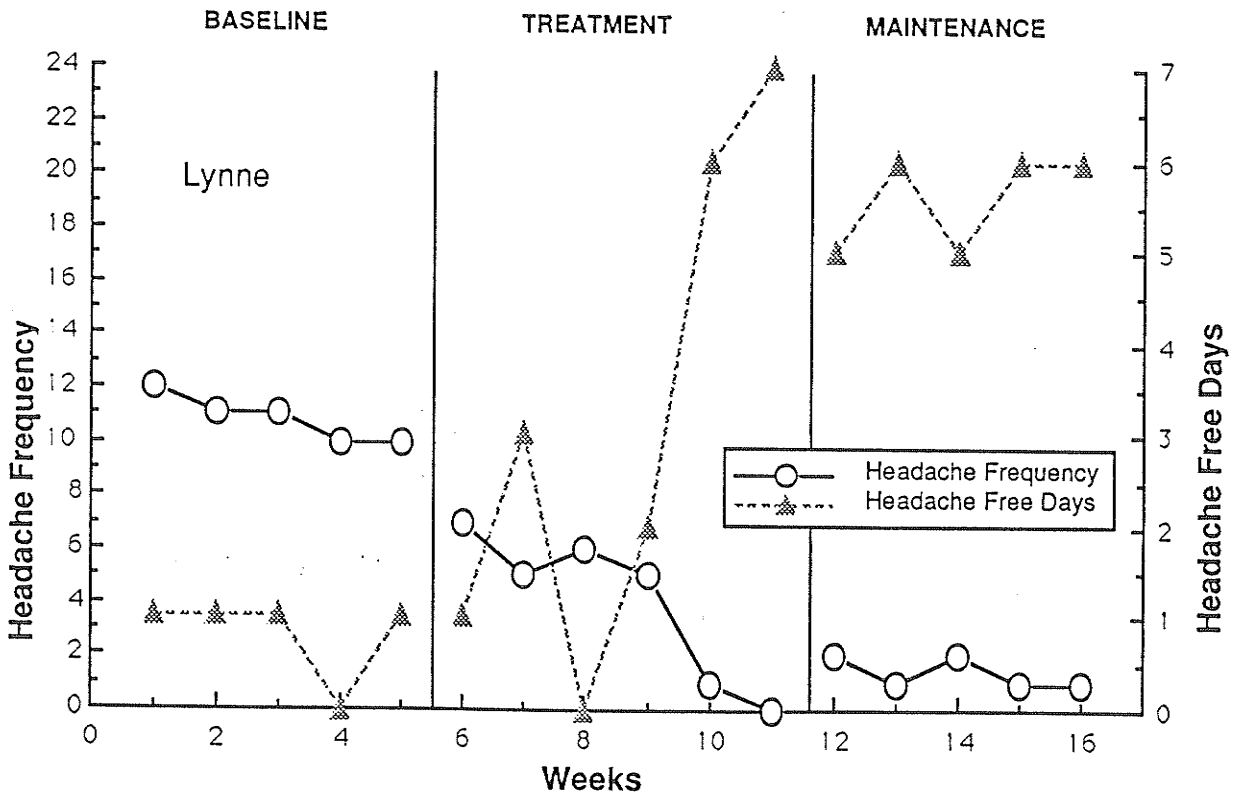

Figure 5. Headache Frequency and Headache-Free Days per Week During Baseline, Treatment (Relaxation Training), and Maintenance Phases for Lynn.

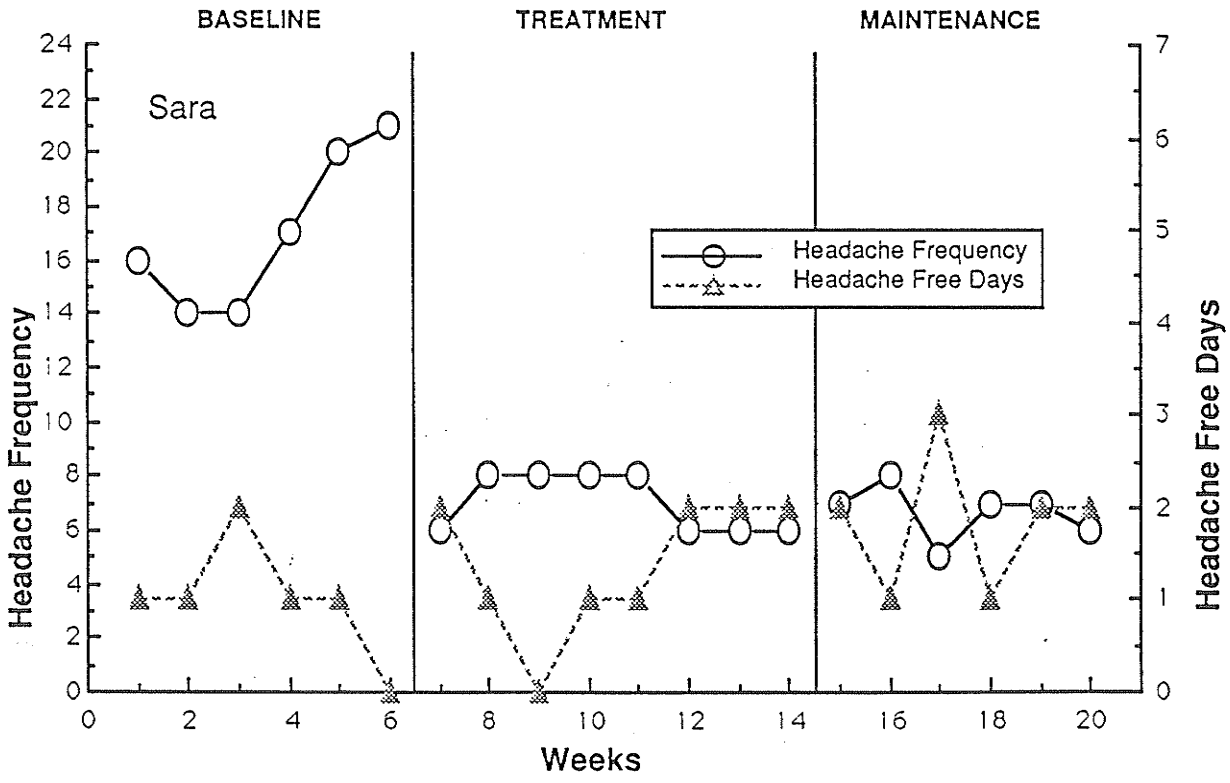

Figure 6. Headache Frequency and Headache-Free Days per Week During Baseline, Treatment (Relaxation Training), and Maintenance Phases for Sara.

17.0 headaches per week during baseline. Her headache level immediately dropped and stabilized during relaxation training, with a mean of 7.0 headaches per week. Her headache frequency remained low and stable during the maintenance phase of the study, averaging 6.7 headaches per week. Sara's overall mean weekly headache frequency improved by 60.6% from the baseline to the maintenance phases.

Although Sara's data are somewhat variable, her mean number of headache-free days per week for the baseline phase was 1. Her average for the relaxation training phase was 1.4 headache-free days per week, and her average for the maintenance phase was 1.8 headache-free days per week. These averages represent a low but increasing trend in headache-free days from the baseline to the maintenance phases.

Based on information from the patients' headache diaries, Table 2 presents the average amount of medication consumed (in type and dosage) and number of comments per week per phase (baseline, treatment, and maintenance) for each patient.

Table 2

Average Medication and Number of Comments per Week per Phase for Each Patient

	Baseline	Relaxation Training	Maintenance
Dave			
Medication (Flexeril-20mg/tablet throughout study)	7.0	7.0	7.0
Comments	12.0	11.6	10.5
Lynn			
Medication (Frosst 222 throughout study)	14.0	7.5	2.6
Comments	12.8	5.2	1.0
Sara			
Medication (Tylenol 1 until end of treatment-then regular strength)	18.0	4.3	1.8
Comments	12.3	5.6	3.9

As can be seen in Table 2, Dave's medication intake did not decrease at all, and his number of comments fell only from 12.0 to 10.5 comments per week from the baseline to the maintenance phases. Lynn produced a drop in medication usage from 14.0 to 2.6 tablets per week, and a decrease from 12.8 to 1.0 comments per week by the end of the maintenance phase. Sara's medication dosage was reduced from 18.0 to 1.8 tablets per week from the baseline to maintenance phases (with a corresponding decrease in medication strength beginning with the last week of the treatment phase), while

her number of comments fell from 12.3 to 3.9 comments per week by the end of the program.

Dave's average frequency per week, Lynn's and Sara's average intensity per headache per week, and each patient's average duration per headache per week and EMG levels remained relatively unchanged throughout the entire study, regardless of any changes in the other dependent measures. These data are reported in Appendix O.

The compliance data (described in more detail under the compliance heading) generally indicated that those who complied the most, improved the most. Lynn's headache frequency improved by 87%, while she practiced appropriately 54.1% of the time. Sara's headache frequency improved by 60.6%. She practiced appropriately 20.4% of the time. Dave's headache pain intensity decreased by 54.1%, while he practiced appropriately 80.6% of the time.

Compliance. In analyzing the compliance data, it is important to mention that all patients reported practicing relaxation training, but for one reason or another, not always with the computer. Nevertheless, the following is an account of the computer generated compliance data for each patient. It is important to note that for all sessions recorded by the computer, each patient was on the pressure mat for the entire session. While the percentages were obtained based on the instruction to practice at least once per day, Dave was instructed to begin practicing twice per day during week 5 of the relaxation training phase (see

later discussion for more detail). There is of course no way to objectively assess the validity and accuracy of practice sessions, if indeed there were any, away from the computer.

Appropriate practice was defined based on two different criteria. It should be noted that perfect compliance was neither expected nor required for a session to be considered as involving reasonable practice. Since there is no relevant literature to draw from, clinical judgement dictated that the criteria should be strict, but not impossible. The criteria were applied only to those practice sessions that appeared on the computer printout.

The first criterion was that the patient needed to have squeezed and released the hand control correctly within approximately 75% of the total number of muscle groups for that session; i.e., four +/- one for four muscle groups, eight +/- two for eight muscle groups, 14 +/- four for 14 muscle groups, or 32 +/- eight for 32 muscle groups, depending on the session. The second criterion was that the synchrony of the tense/release cycle was considered correct if it was within 3 seconds for each muscle group. In other words, if the tensing part of the muscle group was 25 seconds, that muscle group would have been considered correct if the patient tensed anywhere from 22 seconds to 28 seconds. Table 3 uses these two criteria when describing the results for each patient.

Table 3

Relationship Between Improvement in Frequency[a] and Compliance (Amount of Appropriate Practice) for Each Patient

	Improvement in Frequency	Improvement in Intensity	Appropriate[b] Practice Sessions
Richard	92.0%	-----	73.0% (27 of 37 sessions)
Lynn	87.0%	-----	54.1% (20 of 37 sessions)
Andy	72.8%	-----	36.7% (18 of 49 sessions)
Sheila	61.4%	-----	8.1% (3 of 37 sessions)
Sara	60.6%	-----	20.4% (10 of 49 sessions)
Dave	-----	54.1%[a]	80.6% (58 of 72 sessions)

[a] Intensity instead of frequency for this patient.

[b] Sessions that met both criteria, as described above.

Considering first those patients who improved in frequency, generally the more the practice the greater the improvement. Since Dave was the only patient for which headache intensity changed, with treatment, analysis of the relationship between compliance rate and improvement in headache intensity was not possible.

Cost-Effectiveness. Cost-effectiveness was analyzed by a comparison of the number of therapist contact hours needed to arrive at the obtained change in headache frequency (headache intensity for Dave) for each patient of both experiments. The formula for the present study was similar

to the one used by Blanchard, Andrasik, Appelbaum, et al. (1985); i.e., cost-effectiveness = percent change in headache frequency (intensity for Dave) from the mean of the last 3 weeks of baseline to the mean of the last 3 weeks of maintenance / total number of therapist contact hours for each patient. The average number of therapist hours for each patient in experiments 1 and 2 were 6.4 hours and 1.75 hours, respectively. The individual quotients for the patients in both experiments were then compared, with the larger numbers indicating better cost-effectiveness. Cost-effectiveness will also be assessed at the 1 year follow-up. The formula will be the same as above except that change in headache frequency from baseline to follow-up will be used.

For experiment 1, Richard's quotient was 13.89, Sheila's was 9.57, and Andy's was 10.74. For Experiment 2, Dave's quotient was 31.75, Lynn's was 49.79, and Sara's was 37.45. Relaxation training at home was shown to be much more cost-effective (almost three times more) than relaxation training conducted in the hospital setting.

Clinical significance, however, is an important issue when discussing a treatment's cost-effectiveness. For example, when the live training produced an improvement of 88.89%, the taped home training would have had to improve headaches by only 24.31% in order for the two procedures to be equally cost-effective. An improvement of only 25% is considered a failure in the recent headache literature, and is certainly not clinically significant. If, however, we

compare similar improvement rates between experiments, Richard (88.89%) to Lynn (87.12%) for example, we find quotients of 13.89 and 49.79, respectively, indicating that the home practice of relaxation training is 3.58 times as cost-effective as the clinic relaxation training procedure.

Social Validity. Table 4 presents the patients' and their significant others' (number in brackets) degree of satisfaction with improvement in headache frequency (freq), duration (dur), intensity (int), and medication (med), as well as their level of satisfaction with the treatment procedures based on the effort required. The scale ranges from 1 to 7, 1 being completely unsatisfied and 7 being completely satisfied.

Table 4

Satisfaction With Improvement and Treatment for Each Patient

	Satisfaction with improvement in				Satisfaction with treatment value based on effort
	freq	dur	int	med	
Richard	6 (5)	6 (5)	6 (4)	5 (3)	6 (6)
Sheila	5 (5)	5 (4)	5 (4)	6 (6)	5 (5)
Andy	6 (5)	5 (5)	4 (4)	5 (5)	6 (6)
Dave	1 (3)	1 (3)	5 (4)	1 (1)	7 (4)
Lynn	7 (6)	4 (4)	7 (6)	7 (6)	7 (7)
Sara	5 (5)	5 (5)	5 (5)	6 (6)	5 (5)

As can be seen in Table 4, the patients' levels of satisfaction with headache improvement ranged from 1 to 7. The 1s appeared in the areas of frequency, duration, and medication for Dave, and the 4s appeared only in the areas of intensity and duration for Andy and Lynn, respectively. The partners' satisfaction levels also ranged from 1 to 7. Other than Dave's partner's ratings, the only less than medium satisfactory improvement occurred in Richard's medication dosage. Overall, the patients' and their partners' rated their reaction to the treatment procedure and its outcome as mostly satisfied. It is interesting to note that although five out of the six patients' headache diaries did not indicate any improvement in duration or intensity, they later subjectively inflated their ratings of satisfaction on these measures. Dave's ratings seemed to more closely resemble his headache diary ratings.

Discussion

The inclusion of treatment integrity procedures; i.e., procedural reliability and compliance checks, has enabled the "true" value of relaxation training for tension headaches to be more closely approximated in the current research. Briefly, both procedures appear to have produced positive results. The recent literature has indicated that about 60% to 70% of the patients receiving relaxation training for tension headaches improve by at least 50% in headache symptoms (Carney, 1983), and that a 50% improvement rate, without a corresponding rise in headache medication,

is clinically significant (Blanchard and Schwarz, 1988). In the present study, all of the people suffering from tension headaches improved by at least 54.1% and by as much as 92%, an amount equal to or greater than the previous literature suggests, and all without a corresponding rise in headache medication. In fact, all of the patients, except for Dave, decreased their headache medication. Thus, each of the patient's headache activity improvements can be considered clinically significant.

In addition, it will be recalled that, based on the compliance data, further improvement should be expected with more practice. Despite the promising results of the compliance data, caution must be exercised in generalizing results from the present study for two reasons. First, the diagnostic criteria were relatively restrictive in relation to those of previous research, and second, only five patients contributed data to the analysis between improvements in headache frequency and compliance. (Dave's data could not be used in the compliance analysis because headache intensity, rather than headache frequency, was the dependent measure showing change.) Further research with less stringent inclusion criteria and more patients is necessary to establish the generalizability of the benefits of greater compliance to treatment.

Of special importance is the finding that taped-home relaxation training was as effective as live-clinic relaxation training. In both cases, however, the success of

the treatment seemed to depend on the amount and appropriateness of home practice: Those who complied the most, improved the most. It is important to note that Dave had been practicing his relaxation exercises before going to bed. While he was able to report a decrease in pain intensity at that time, it was short-lived because of the immediacy with which he fell asleep. He was therefore, during week 5 of the phase, instructed to include a second practice session earlier in the evening, to further reap the benefits of relaxation training. Thus, in addition to increased practice, timing of the practice session may be a crucial factor in improving headache activity.

Cost-effectiveness needs to be considered when discussing relative effectiveness. Therapist time and headache improvement were the only factors considered in calculating cost-effectiveness, since the patients in both procedures used the computers and audiotapes for home practice.

Caution is advised, however, when interpreting the cost-effectiveness data. Despite the existence of a pool of dependent measures, only headache frequency, was included in the analysis. The rationale for using only the measures that were affected by the treatment is based on the relative stability of the unchanged measures; e.g. duration and intensity. That is, these measures did not affect the overall headache activity rating. Thus, using headache frequency as the outcome standard, taped-home relaxation

training is 3 to 4 times as cost-effective as the clinic relaxation training procedure.

Baer, Wolf, and Risley (1987) discussed the "effective" dimension of applied behavior analysis as consisting of two components. The first is simply the outcome changes as defined by the dependent measures. The patients in the present study obtained a 54.1% to 92% reduction in headache activity. The second factor is the extent to which all of the consumers involved were satisfied with all of the procedures and the treatment outcome. The present paper assessed the latter concept for the patients and their significant others. As previously described, the results of the survey generally indicated that the treatment, it's procedures, and it's impact on the patients and their partners were effective according to the criteria set out by Baer et al. (1987). An interesting point here is that while duration and intensity did not change for five of the six patients, their subjective ratings of satisfaction nevertheless indicated that they were pleased with the changes in those measures.

Further comments on the social validation questionnaire were provided by two of the patients. Lynn, who was overweight, indicated that as a result of using less medication "which caused gastric discomfort", she ate less and managed to lose 35 pounds. Furthermore, she believed that her pulse rate decreased as a result of the weight loss. In addition, following the completion of the program,

she reported being able to drastically reduce her almost constant state of tension by simply relaxing the affected muscles.

Comments from Dave were also noted. He began experiencing headaches following a car accident in 1983. The pain disappeared completely following 6 months of physiotherapy. He gradually began feeling head and neck pain again after approximately 10 months, until it became severe 3 months later. The pain has been severe until now, and has included constant muscle tension throughout his entire body. He reported that he has received a variety of treatments; e.g., physiotherapy, medication, dental, acupuncture, and chiropractic.

He indicated that as the relaxation program progressed, however, he became more aware of his muscles and how his physical tension was affecting his posture and headaches. He further reported that because he had been experiencing headaches for approximately 5 years, he did not expect to be "cured" during the short duration of this program. He also stated that he considers the relaxation training program a success because he can now make the distinction between feeling tense and feeling relaxed, and that is a very important step to recovery. He plans to continue practicing the relaxation exercises.

Another potential component of the effectiveness dimension involves the ability of a treatment to provide long-term changes. Blanchard, et al. (1988) indicated that

the effects of the behavioral treatment of headache seem to endure. Reports of prospective follow-up studies of up to 4 years in duration have been reviewed by Blanchard (1987) and Blanchard, Andrasik, Guarnieri, Neff, and Rodichok (1987). Although these authors state their conclusions are tentative, it appears that relief from relaxation training for tension headaches is maintained for as long as 4 years. Follow-up data are to be collected at 1 year post-maintenance in the present research.

Describing headache duration and intensity in the form of means for each headache serves only to hide the fact that the patients' total pain duration and total intensity decreased along with the frequency of their headaches. In other words, while the patients' average duration and intensity of pain per headache per week remained constant, they experienced fewer headaches, and thus, a concommitent decrease in overall discomfort. Therefore, the lack of change in average headache duration and intensity in any of the patients does not present a significant dilemma, although further decreases in the frequency of headaches would of course be desirable.

Turning to EMG measures, the lack of effect on this dependent variable must be addressed. There does not appear to be a one-to-one relation between measures of frontalis EMG and muscle-contraction headaches (Lacroix, Clarke, Bock, and Doxey, 1986). In addition, treatment outcome for muscle contraction headaches is likely to be influenced by

psychological and/or social factors, in lieu of and as well as, changes in frontal muscle activity (Abramowitz and Bell, 1985). Thus, it appears that the data on the relationship between frontalis EMG and tension headache activity are ambiguous (see Appendix P for more information).

Despite the promising results and implications for clinical practice and research obtained in the present study, that is, higher practice rates produce greater improvements in headache activity, it should be remembered that relaxation training is typically only one part of the therapeutic process in the treatment of tension headaches. It is therefore expected that "treating the whole patient", not only the presenting headache problem but also the other psychological and/or social problems that may be contributing to the headache problem, should likely produce superior results (Blanchard and Andrasik, 1985; Blanchard, Andrasik, Evans, Neff, et al., 1985; and Holroyd and Penzien, 1986).

It is important to understand (as further described in Appendix B) that relaxation training may not be sufficient in reducing headaches to a zero frequency. The clinical treatment of headaches in general should include a number of steps to treat the whole patient. Williamson Davis, and Prather (1988) described three phases that are required to assess all of the potential determinants of a headache. These are; a) stimulus control procedures (the assessment of environmental situations that reliably precede headaches, b)

organismic factors (implementing a treatment such as relaxation, with compliance assessments), and c) contingency management (modification of the contingencies a patient faces during and after a headache, such as events that provide an opportunity for secondary gain to be in operation).

There appears to be widespread agreement then that relaxation training is a necessary but not sufficient factor in the treatment of tension headaches. In a related argument, Holroyd and Penzien (1986) stated that for research purposes, treatment outcome has not correlated well with treatment procedures or research designs, but has varied reliably with client variables such as age, gender, referral source, sample size, and dropout rate. Age was the most influential variable with studies whose subjects had a mean age of less than 35 years reporting significantly better results (55% reduction compared to 34% reduction in headache activity). In a summary of treatment results from their own center, Blanchard, Andrasik, Evans, and Hillhouse (1985) found that only 18.2% of subjects over 60 years of age were clinically improved after treatment. The treatment consisted of combinations of biofeedback and relaxation therapy. The challenge of fully understanding these results, however, may lie in the ability of treatment integrity procedures to help ensure that relaxation training has been implemented according to protocol, and that subjects have complied with instructions to practice at

home. Interestingly, the present study provided data to indicate that while the mean age of the patients was less than 35 years old, all of the patients improved by at least 54.1%, and by as much as 92%, equal to or greater than the 55% reduction typically obtained. In addition, two of the patients were 41 and 48 years old, respectively, and they improved by 72% and 87%, respectively, compared to the 34% improvement usually achieved by patients over 35 years of age. Thus, age did not appear to be the most influential variable. More importantly, the treatment procedure of home practice of relaxation training, specifically the amount of appropriate practice, is what seemed most influential in improving headache activity.

Compliance to practice, indeed a crucial issue in the effectiveness of relaxation training, has been described by Diamond (1987) in relation to "locus of control". Patients with an internal locus of control were more likely to adhere to compliance regimens for practicing relaxation training than patients with an external orientation. Flanders and McNamara (1987) reported that higher "self-motivation", measured by the Self-motivation Inventory, enhanced compliance with relaxation practice. My clinical impression was that the present patients who practiced more, and consequently improved their headache problem more, were the ones with past histories that enabled better self-control. The basic premise of the research though, is that compliance to practice is a necessary component for the "true"

effectiveness of relaxation training to be realized. While the present study was able to objectively assess compliance rates, and possibly obtain better than usual compliance because of the obtrusive manner in which it was assessed, it fell short of ensuring compliance. Indeed, compliance to relaxation training instructions, based on criteria that did not demand perfection to begin with, ranged from 8.1% to 80.6%, with a mean of 45.5%.

The success of treatment need not rely upon an individual's initial quality of self-control, or level of "motivation" to comply. In fact, relaxation training is a time consuming procedure that requires a lot of effort to become skilled. A decrease in headache activity, as a reinforcer, which is usually quite delayed, is simply not enough to enhance compliance to practice relaxation. Future research should program for compliance. Reinforcement contingencies should be implemented for the appropriate practicing of relaxation training. With improved assessment of, and programming for compliance to treatment, then the full impact of relaxation training for a clinical problem; e.g., headaches, may be finally known.

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Appendix A

Difficulties Diagnosing Headache Type

Ziegler (1985) reported that there are two problems in differentially diagnosing headaches. The first is to what extent an individual attack of headache can be so identified, and the second is to what degree an individual can be identified as having a disease entity, e.g., migraine versus muscle contraction headache. He further stated that in many migraine headache patients, intense unilateral pain is not associated with nausea, and conversely, in severe attacks of pain with nausea, the pain is not unilateral. A diagnosis of mixed headache can be questioned if, when studied carefully, the occurrence of one or the other type of headache is exceedingly large. A diagnosis of muscle contraction headache is also problematic. Muscle contractions in the neck and scalp muscles are no greater in these patients than in those who are diagnosed as having migraine.

Blau (1987) has discussed the confusion between diagnosing tension versus muscle contraction headaches. Muscle contraction may not be the cause of pain in tension headaches; Muscle contraction and tension headaches may be distinct entities. While he described tension headaches as not unilateral, uninfluenced by analgesics, worsened by emotion, and without physical signs, a muscle headache is described as localized, eased or abolished by analgesics,

tender in the localized area, and worsened with movement of the affected muscle.

While migraine and tension headaches have traditionally been considered distinct entities, current reports have argued that there is evidence to indicate that the physiological indices of headaches better fit a continuum model in which more severe headaches gain an increasing number of vascular components which then allow for a migraine headache diagnosis (Martin, 1983). Saper (1982) has also taken the position that both migrainous and muscular-like headaches can occur independently along a continuum. In this vein, Thompson and Adams (1984) have stressed that there are quantitative rather than qualitative differences in symptomatology between muscle contraction and migraine headache populations. Similarly, Bakal and Kaganov (1977) reported that patients with muscle contraction headaches present symptoms characteristic of migraines during severe attacks. They also related that headaches associated with visual disturbances and throbbing pain were as characteristic of muscle contraction headaches as of migraines. Recently, Andrasik, Blanchard, Arena, Saunders, and Baron (1982), and Williamson (1981) have indicated that physiologically, migraineurs do not necessarily evidence greater cardiovascular responsiveness than muscle contraction and no-headache controls; and that muscle contraction headache patients do not always evidence greater facial/shoulder EMG responsiveness than migraine and

no-headache controls. Diehr et al. (1982), and Hunter and Philips (1981) have provided information to suggest that particular headache symptoms like pressure, anxiety, progression of pain, throbbing, tightness, nagging, heaviness, and tiring are reported by people who have been diagnosed or assessed as having tension headaches, and also by those who have been assessed as having migraine headaches.

On the other hand, psychophysiological response patterns (EMG, heart rate, skin temperature, and skin potential) have been used to differentiate migraine and tension headache sufferers under stressful conditions. Cohen, et al. (1983) have found that EMG and heart rate response patterns are different between tension and migraine headache groups during a stressful task. That is, compared to migraine headache patients, who showed the reverse, muscle contraction headache patients' EMGs were most responsive and heart rates were least responsive while performing a stressful task. However, when the headache groups were compared after relaxation, their response patterns were quite similar to each other but consistently different from the no-headache controls. Conversely, however, Blanchard and Andrasik (1985) wrote that for most subjects, EMG responses during stressful conditions do not differ between headache and nonheadache controls.

Appendix B

Appropriateness of Relaxation Training

One explanation may be that the treatment is not completely appropriate or effective. Lake (1981) convincingly argued that any headache could be treated with relaxation training, if it could be determined (through a behavioral analysis) that the headaches are related to stressful events in the environment. Where the analysis indicates that the headaches are not related to stressful events, relaxation training may not be appropriate. Presumably, relaxation training should not be effective 100% of the time.

Appendix C

A Need for Procedural Reliability Assessments

Williamson, et al. (1988) argued that procedural reliability checks are important when trying to ensure the integrity with which a treatment is implemented. In some cases, dependent variables do not change as planned, and procedural reliability assessments have not been conducted. Thus, the experimenter will not be able to accurately determine whether this lack of effect was due to the subject's past behavioral history, reinforcer effectiveness, or any number of other uncontrolled variables including the improper administration of the independent variable (Peterson et al., 1982). Ultimately, this negative outcome may result in the applied community's erroneous decision to reject or abandon an otherwise powerful treatment technique.

Yeaton and Sechrest (1981) argued that strong treatments may prove ineffective if they are not administered as intended. Vermilyea, Barlow, and O'Brien (1984) pointed out that treatment effectiveness is difficult if not impossible to interpret if the program is not administered according to protocol.

A variation of this argument is also a critical issue. Treatment results may be enhanced because of inconsistent procedural manipulations across phases. For example, in the area of relaxation research, providing accidental, unplanned cognitive restructuring for a live-clinic group but not for a taped-home group may result in better performance measures

for the clinic group. In the final analysis then, if treatment integrity were not assessed, then it would be erroneously concluded that live relaxation training conducted in the clinic is superior to taped relaxation training at home.

Appendix D

Some Problems with Self-Reported Compliance

The recent literature suggests that self-report is the typical method of assessing compliance. Anderson et al. (1981) conducted compliance assessments by having subjects record the date and time of each of their practices on a standard recording sheet.

The practice sheets were brought to each therapy session and were checked by the therapist. The authors further stated that all of the subjects reported practicing the relaxation procedure at least once a day. To better insure that their subjects would practice each day, Tatso and Hinkle (1973) had them write down the time of day and the approximate length of time involved with each practice. Teders et al. (1984) instructed their subjects to record the approximate time of day they practiced and the degree of relaxation they achieved. The authors then claimed that these recordings served as an indication of treatment compliance.

Thus, self-reporting of compliance is frequently employed. Indeed, it is often necessary in the assessment of behaviors that require situational specificity in the natural environment where it would be difficult to utilize trained observers (Arkowitz, 1981; p.313; Ciminero, Nelson, and Lipinski, 1977, p.219). However, common objections to the use of self-report are "deficiencies of reliability and validity, contamination by faking and bias, low correlations

with concurrent behavioral and physiological measures, and error associated with such response sets as acquiescence and social desirability" (Nietzel and Bernstein, 1981, p.231). Another criticism is that self-reports are potentially reactive to, for example, therapist expectations.

In other words, subjects' self-reporting of compliance may differ significantly from their actual compliance. Indeed, Taylor, Agras, Schneider, and Allen (1983), Hoelscher, Lichstein, and Rosenthal (1984), and Hoelscher, Lichstein, Rosenthal (1986) determined that subjects tended to overreport their practice of relaxation compared to the authors' "objective" assessment of compliance. Hillenberg and Collins (1982) argued that given the potential biases in self-reported relaxation practice, firm conclusions about the effectiveness of home practice could not be made.

Advocating objective compliance measures, Collins et al. (1982) have argued that potentially effective treatments might be discarded, or ineffective treatments may be retained due to inadequate or inaccurate compliance data. In one study, subjects reported practicing on the average of just under 60% of the assigned exercises. By using what Hillenberg and Collins (1983) described as an objective compliance measure, only about 60% of these reported practices could be objectively determined to have occurred. In another study, Taylor et al. (1983) attempted to objectively assess compliance with relaxation instructions by using a specially designed electronic device. Unbeknown

to the subjects, the tape recorder they used contained a microelectronic unit that received and recorded the length of time the tape was played. In similar studies, Hoelscher et al. (1984), Hoelscher et al. (1986), and Lichstein and Hoelscher (1986) used a relaxation assessment device to objectively assess compliance. These authors used a digital stopwatch that was unobtrusively placed inside the subjects' tape recorders to monitor the amount of relaxation practice at home. While both of these methods objectively measure the playing of practice tapes, and as the authors themselves mention, they do not measure relaxation practice. With these methods, the subject or client does not even have to be in the same room as the tape recorder. That is, compliance would be recorded as long as he or she turns the machine on and off at the right time. Furthermore, if compliance to practice is a necessary component of relaxation training, it may be more important to utilize obvious measures where there would be implied contingencies to comply.

Appendix E

The Self-Help Approach to Headache Treatment

Blanchard and Andrasik (1985) submitted that given the cost of individual treatment sessions, alternative delivery systems need to be designed to reduce costs. Larsson, Daleflod, Hakansson, and Melin (1987) and Larsson, Melin, Lamminen, and Ullstedt (1987) argued that in the interest of public services, there is a need to develop more cost-effective programs for so frequent a health problem as headaches. Despite the apparent success of many relaxation programs, increased access and more cost-effective procedures would be of great value to the communities served by mental health professionals (McCready, Berry, and Kenkel, 1985).

Jurish, et al. (1983) pointed out that the advantages of self-help treatments include reduced cost, greater availability, and a possible solution to the problem of transfer of training from the clinical setting to the patient's natural environment. Teders et al. (1984) have indicated that the cost of health care is extreme and on the rise. They further explain that if behavioral medicine is to succeed, despite the current cost-cutting that is taking place, techniques must be both effective and efficient.

Blanchard, Andrasik, Appelbaum, et al. (1985) compared the relative efficacy and cost-effectiveness of a minimal-therapist-contact relaxation training procedure with a clinic-based relaxation training procedure. Their results

indicated a general equivalency in terms of headache reduction for both procedures, with the former being more cost-effective. Two issues warrant discussion, however. While the authors reported where a detailed description of both procedures could be found, they did not provide any indication of either procedural reliability or compliance checks. As previously mentioned, Vermilyea et al. (1984) argued about the difficulty in interpreting results if it is unknown whether or not the procedures were administered according to protocol.

An interesting study by Tobin, Holroyd, Reynolds, and Baker (1986) found the Teders et al. (1984) minimal-contact, home-based procedure less effective than their own similar procedure which combines relaxation training with training in coping skills to manage headache related stress. Again, however, no treatment integrity measures were reported. If the group that used the Teders et al. (1984) procedure received inappropriate training, or complied less with instructions to practice, one would expect them to improve less.

Williamson, et al. (1984) argued that while individualized training in relaxation has been effective, less intensive more cost-effective methods need to be studied. They compared a self-help relaxation group to a therapist-assisted relaxation group, and both to a waiting list control group for the treatment of headache. Individuals in the self-help group were provided with a copy

of a commercially available self-help program on relaxation. They were instructed to read the book and practice relaxation on their own, following which they were to meet as a group and discuss learning to relax and the use of relaxation to control headaches and other somatic disorders. No actual relaxation practice sessions were allowed during the group meetings. Subjects in the therapist-assisted group were trained in a modified version of Bernstein and Borcovec's (1973) relaxation procedure. They practiced relaxation as a group and discussed the rational and use of the procedure. The subjects in this group were also provided with audiotapes of the relaxation procedure and instructed to practice at least once daily. The results indicated that the therapist-assisted group improved more than the self-help group, who improved more than the waiting list control group.

While this design is laudible in that it enables a comparison of two less intrusive and more cost-effective procedures than individual relaxation training, there is no indication of whether the procedures were implemented according to protocol (procedural reliability), or whether the subjects complied with the instructions to practice. Again, without this information, the results are only tentative. In addition, while the therapist-assisted group received audiotapes for practice, the self-help group did not. Providing tapes to the latter group would not involve

more therapist time, and may be all that was necessary to improve their performance as well.

Appendix F

Headache History

SUNY - Albany Headache History

HEADACHE HISTORY

1. Do you have more than one kind of headache? _____

   (If yes, go to question 5 first and obtain a full description of each kind of headache. Then take the history of each kind separately).

2. When did headaches first become a problem for you? ____

   _____

   (Be sure to get chronological age; also age at which they first sought medical attention for headaches).

   a. Was the onset of the headaches associated with any particular physical event (illness, injury, etc.) or psycho-social event? (menstruation, pregnancy, etc.) (If yes, obtain details).

   _____

   _____

   _____

   b. Had you had headaches prior to this time? If yes, obtain details.

   _____

   _____

   _____

3. What has been the history of your headaches? (constant, increasing, decreasing, episodic, fluctuating). _____

   _____

   _____

   _____

   a. Have there been periods when headaches were more frequent or less frequent? (If yes to either, obtain details). _____

   _____

   _____

   _____

b. What has been going on then, psychologically and physically?

c. Have there been periods of months or years with almost no headaches? (Obtain details).

d. What kinds of treatment(s) (meds and otherwise) and diagnostic work have you received for your headaches? (neurological exam, EEG, Brain Scan, CT Scan, X-Rays).

(Drugs, other treatment, neurological exam, EEG, Brain Scan, X-trays, etc).

e. What diagnoses have you been given by physicians of your headaches?

4. What has been the recent (past year) frequency of your headaches?

5. Describe your headache for me in detail.

_____

_____

_____

_____

a. Where on your head do they seem to start? _____

_____

b. How do they progress or change over time? (area and intensity) _____

_____

_____

Area of head _____

Time Course _____

Regularity (do they generally follow same pattern)?

_____

Description of the pain itself (Dull ache, intense throbbing, burning, sharp, etc.)_____

_____

_____

Phenomenology (sensations, perceptions, thoughts, self-statements)

_____

_____

_____

c. How long do they last _____

_____

d. What can cause them to stop? (medication, sleep)

e. What helps ease pain? (Meds, lying down, dark, quiet, ice, heat)

f. What things make them worse (particularly coughing or muscle straining) (coughing, muscle strain, noise, light, tension)

g. What happens during the headache? _____

(nausea, vomiting, sensitivity to light, dizziness, blurred vision, tearing in eye, drooping eye lid, other physical or psychological symptoms - irritable, crying).

h. (For female patients) Are headaches associated in any way with your menstrual cycle? _____

i. Do they tend to start at any particular time of the day? _____

j. What is their time course during the day? (minutes to peak intensity) _____

k. Do you have any kind of warning signs that a headache is about to start (such as visual disturbances or other things? - flashing lights, tunnel vision, sound, tingling)?

_____

_____

l. What kinds of things (physical or psycho-social) are happening to bring on a headache? (Things which immediately precede or which occur concurrently)?

_____

_____

_____

m. What kinds of thoughts do you have when you become aware that a headache is beginning? (internal vs external)? _____

_____

_____

6. Consequences of headache and pain complaining behavior:
a. When you have a headache, what do you do? (bed, meds, ice, heat)

_____

_____

_____

_____

(Take aspirin, go to bed, etc?)

b. Do you headaches ever cause you to go to bed? _____

_____

c. Do you headaches ever cause you to leave work (school) or not go to work (school)? _____

_____

Details (including days per year) _____

_____

_____

d. Do you headaches ever cause you to slow down or become less efficient or less effective? _____

_____

Details _____

_____

e. Do you ever have to forgo activities (outings, parties, sex) because of your headaches? _____

_____

Details _____

_____

f. Can members of your family (parents, spouse, children) tell when you have a headache? _____

How can they tell? (mood, facial expressions).____

_____

g. What do your parents (spouse, children, significant other) do when you have a headache? _____

_____

(1) Do they express concern? _____

(2) Do they offer help? _____

_____

(3) Do they do things for you or help out in some way? _____

_____

_____

h. Do you do things to try to prevent having headaches? _____

_____

i. Have your headaches ever interfere in a very major way with any aspect of your life? _____

Details_____

_____

7. Some kinds of headaches tend to run in families. These next questions are about your family's headaches.

a. Did either of your parents have a problem with headaches? _____

i) If yes, were you ever told what kind of headaches he/she had? _____

_____

ii) If yes, did he/she ever have "sick headaches, that is, headaches so bad he/she had to go to bed? _____

_____

iii) Anything else about parent's headaches (aura, one-sided, entire head). _____

_____

_____

b. Did any of your grandparents have a problem with headaches? _____

_____

i) If yes, what do you know about this problem? (sick, one-sided, entire head)? _____

_____

c. Did any of your aunts and uncles ever have headaches? _____

_____

i) Describe relation (maternal, paternal, by marriage) and other information _____

_____

d. Do you have siblings? _____Do any of them have problems with headaches? _____

_____

i) If yes, what do you know about his/her headaches? _____

_____

e. If patient has children, do any of your children (or grandchildren) have headaches? _____

i) When did they start? _____

_____

ii) Do you know any diagnosis? _____

_____

iii) Describe these headaches _____

_____

_____

_____

f. If married, does your spouse have headaches? _____

_____

i) If yes, what kind? _____

_____

_____

_____

8. Now I need some information on your current life situation.

a. If married, how would you describe your marriage?

_____

_____

_____

b. Are you getting along well? _____

c. Are there any problems? _____

i) If yes, ask for some details (communication, financial) _____

_____

d. How is your sexual relationship? _____

Are there problems? _____

_____

e. Do you have any problems with your in-laws? _____

_____

_____

_____

Or with your parents? _____

_____

_____

(If patient has children, regardless of marital status)

f. Are there any problems with your children? _____

_____

_____

9. If not married, are you currently involved in some sort of relationship? _____

_____

a. Are you getting along well? _____

_____

b. Are there any problems? _____

i) If yes, ask for some details _____

_____

_____

c. Is there a sexual aspect to your relationship? ____

_____

_____

i) If yes, are there any problems here? _____

_____

d. Do you have any problems with your parents? _____

_____

_____

10. Do you have some close friends? _____

How many really close friends? _____

Have there been any difficulties in friendships _____

_____

_____

11. (If patient works or attends school). How are you getting along with your job (school work)? _____

_____

a. Are there any problems? _____

_____

i) Especially with supervisors (or teachers)?

_____

ii) (If yes) how are you handling these problems?

_____

_____

b. Do you feel under a lot of pressure in your job (or school work)? _____

_____

i) Does this seem related to headaches? (How)

_____

_____

12. The next few questions may seem somewhat strange, but bear with us.

a. What is today's date _____ The Day of the week _____

b. Do you remember my name? _____

c. I am going to say some numbers, listen carefully, then repeat them back to me (give digits approximately one per second, do not repeat).

i) 5-0-2 ii) 6-9-4 iii) 6-4-3-9
iv) 7-2-8-6 v) 4-2-7-3-1 vi) 7-5-8-3-6

d. Who is the President of the U.S.? _____

e. Who is the Governor of New York? _____

f. Have you ever had any unusual/strange experiences?

_____

g. Have you ever heard things other people could not hear or heard things when no one was there? _____

_____

h. Have you ever seen things that other people could not see? _____

_____

i. Do you ever believe you have special powers? _____

_____

j. Have you ever felt or thought people were out to get you? _____

_____

k. Have you ever been very depressed? _____

i) If yes, are you depressed now? _____

ii) If yes, check further (sleep, appetite, concentration, low energy, lack of interest, suicide ideation/attempts) _____

_____

l. Have you ever been really "speeded up", a great deal of energy, didn't need much sleep? _____

_____

m. Have you ever had a problem with alcohol _____ or with other drugs? _____

_____

13. Have you ever received any psychiatric of psychological treatment for mental or emotional problems? _____

_____

a. If yes, obtain brief details including current status of treatment _____

_____

_____

14. Have you ever had any major illnesses/operations?

_____

Obtain details _____

_____

_____

_____

_____

15. Have you ever had any special difficulties with:

a. your eyes? _____

If yes, were headaches associated in any way?

_____

Obtain details _____

_____

b. your ears? _____

If yes, were headaches associated in any way?

_____

Obtain details _____

_____

c. your throat? _____

If yes, were headaches associated in any way?

_____

Obtain details _____

_____

d. allergies? _____

If yes, were headaches associated in any way?

_____

Obtain details _____

_____

16. Are you currently taking any medication for headaches?

_____

If yes, obtain brand names and dosages and how much they help _____

_____

_____

_____

17. Are you taking any other prescription drugs regularly?

_____

_____

Appendix G

Information on the Patient Suffering Migraine Headaches

Brad is the 16 year old male patient who did not receive a tension headache diagnosis. He had been experiencing headaches for 9 years. The neurologist indicated that he suffered from chronic background headaches, many of them migrainous in nature. It was decided to include this patient because relaxation training has also been effective in reducing headache activity for migraine sufferers (Blanchard, Andrasik, Neff, et al., 1983).

Brad was administered the taped-home relaxation training procedure, but unfortunately, his mean headache frequency was 7.0 headaches per week during all three phases of the study. The treatment procedure was unable to produce any change in his headache frequency at all. Brad did not experience any headache-free days during any of the phases of the study.

At least two alternative explanations provide possible reasons for why relaxation training was not effective for Brad. The first is that he is the only patient that the neurologist was unable to diagnose as suffering mainly from tension headaches. His diagnosis was of the mixed headache variety, the majority of which were migraine. The second possibility has to do with his compliance to practice relaxation training.

Although the computer indicated that he practiced 59.5% of the time (22 out of 37 sessions), not all of these sessions were practiced appropriately. He manipulated the hand control less than within the criterion of 75% of the total number of muscle groups, for example, eight +/- four for eight muscle groups, in seven of 10 sessions. In addition, his tense/release cycle was significantly out of synchrony with the taped instructions (not within the 3 second criterion level) in the other 12 sessions. Therefore, appropriate relaxation practice only occurred in three of the 37 sessions, or 8.1% of the time.

As Brad did not improve at all, it is important to note that this patient was in the taped-home relaxation training group and may not have become proficient, and thus not been able to reap the benefits of relaxation training. It was therefore decided to provide him with the opportunity to experience live relaxation training. Unfortunately, his headache activity remained absolutely unchanged, despite live relaxation training and obtaining a compliance ratio of 71.4% (25 of 35 sessions appropriately practiced) for home practice.

Despite the lack of improvement, however, Brad indicated that he did indeed learn how to relax. He reported feelings of excitement and pleasure at being able to completely relax himself while giving blood one day. Thus, while he learned the art of relaxation, he remained powerless in being able to reduce his headaches. Following

the completion of the second treatment application, the patient was given the options of a referral back to the neurologist, the opportunity to engage in whatever kind of therapy he and his family thought best, or undergoing a more thorough behavioral assessment. The assessment would include the three phases described by Williamson et al. (1988). Briefly, these phases include; a) stimulus control procedures, b) organismic factors, and c) contingency management. He has decided to seek help elsewhere for the time being.

Appendix H

Headache Diary

DAILY HEADACHE DIARY DATE ________________ NAME ________________

HEADACHES	DURATION IN HOURS	INTENSITY	MEDICATION DOSAGE	NUMBER OF COMMENTS
1				
2				
3				
4				

DAILY HEADACHE DIARY DATE ________________ NAME ________________

HEADACHES	DURATION IN HOURS	INTENSITY	MEDICATION DOSAGE	NUMBER OF COMMENTS
1				
2				
3				
4				

DAILY HEADACHE DIARY DATE ________________ NAME ________________

HEADACHES	DURATION IN HOURS	INTENSITY	MEDICATION DOSAGE	NUMBER OF COMMENTS
1				
2				
3				
4				

Appendix I

Partner Diary

WEEK OF _____ PARTNERS RATING OF PATIENT'S HEADACHES PATIENT'S NAME _____

DAYS ABSENT FROM WORK _____

(CIRCLE APPROPRIATE NUMBER)

SLEEP LOST 1------2------3------4------5------6------7
NONE SOME LOTS

NUMBER OF COMMENTS 1------2------3------4------5------6------7
FEW MEDIUM LOTS

IRRITABLE 1------2------3------4------5------6------7
NOT IRRITABLE SOMEWHAT IRRITABLE VERY IRRITABLE

WEEK OF _____ PARTNERS RATING OF PATIENT'S HEADACHES PATIENT'S NAME _____

DAYS ABSENT FROM WORK _____

(CIRCLE APPROPRIATE NUMBER)

SLEEP LOST 1------2------3------4------5------6------7
NONE SOME LOTS

NUMBER OF COMMENTS 1------2------3------4------5------6------7
FEW MEDIUM LOTS

IRRITABLE 1------2------3------4------5------6------7
NOT IRRITABLE SOMEWHAT IRRITABLE VERY IRRITABLE

Appendix J

Results from Partners' Diaries

Table 5 represents Richard's, Sheila's, and Andy's partner's mean weekly ratings for the respective patient's headaches for baseline treatment and maintenance (the numbers representing days absent are the total number during a phase). Only Richard's partner's ratings showed evidence of improvement. The partners' ratings for Sheila and Andy did not change significantly across the different phases of the study. The numbers representing sleep lost, number of comments, and irritable, range from one to seven, the latter indicative of a higher degree.

Table 5

Results from Headache Diaries from Each Patient's Partner

	Baseline	Treatment	Maintenance
Richard			
days absent	2.5	0.0	0.0
sleep lost	2.5	1.5	1.0
number of comments	3.5	3.7	1.3
irritable	2.0	3.5	1.5
Sheila			
days absent	0.0	0.0	0.0
sleep lost	2.6	2.5	2.4
number of comments	1.0	1.0	1.0
irritable	2.2	3.2	1.6
Andy			
days absent	2.0	1.5	2.0
sleep lost	1.5	1.5	1.5
number of comments	1.0	1.0	1.0
irritable	2.0	2.5	2.3

As can be seen from Table 5, Richard's partner indicated that his days absent decreased by 100% to 0 days

during the maintenance phase. The amount of sleep he lost decreased from 2.5 during baseline to 1 during maintenance, an improvement of 60%. His number of comments decreased by 62.8%, from 3.5 during baseline to 1.3 during maintenance. His irritability fell from 2 during baseline to 1.5 during maintenance, a decrease of 25.0%. The data for Sheila and Andy did not change significantly.

Table 6 represents the respective partner's mean weekly ratings for Dave's, Lynn's, and Sara's headaches for each phase of the program (the numbers representing days absent are the total number during a phase). The partner's ratings for Lynn showed an improvement in headache activity while the ratings for Dave and Sara did not change significantly. The numbers representing sleep lost, number of comments, and irritable, again range from one to seven, the latter indicative of a higher degree.

Table 6

Results from Headache Diaries from Each Patient's Partner

	Baseline	Treatment	Maintenance
Dave			
days absent	0.0	0.0	0.0
sleep lost	3.0	2.8	2.8
number of comments	2.5	2.1	2.3
irritable	3.3	3.0	3.3
Lynn			
days absent	0.0	0.0	0.0
sleep lost	3.6	2.8	1.4
number of comments	5.2	2.2	1.2
irritable	2.6	2.8	1.0
Sara			
days absent	0.0	0.0	0.0
sleep lost	1.0	1.5	1.0
number of comments	2.7	3.0	2.5
irritable	2.0	2.3	1.6

As can be seen in Table 6, Lynn did not miss any work during the study. Her amount of sleep lost, however, fell from 3.6 during baseline to 1.4 during maintenance, an improvement of 61.1%. Her number of comments decreased by 76.9%, from 5.2 during baseline to 1.2 during maintenance. Her irritability dropped from 2.6 during baseline to 1.0 during maintenance, a decrease of 61.5%. The data for Dave and Sara did not change appreciably.

Appendix K

Patient's Social Validation Questionnaire

For Patients

Please rate the statements below according to the following scale:

1-------2-------3-------4-------5-------6-------7

completely unsatisfied — medium satisfaction — completely satisfied

	Rating
1. How satisfied are you with the improvement in your headache pains.	_____
2. How satisfied are you with the improvement in the number of headaches you get?	_____
3. How satisfied are you with the improvement in the length of time your headaches last?	_____
4. How satisfied are you with the decrease in medication that you take for your headaches?	_____
5. Given the effort you had to put into the procedure ,how satisfied are you that the relaxation training was worth it?	_____

Please provide additional comments (use back of page if necessary).

Appendix L

Partner's Social Validation Questionnaire

For Patient's Significant Other

Please rate the statements below according to the following scale:

1-------2-------3-------4-------5-------6------7
completely unsatisfied — medium satisfaction — completely satisfied

	Rating
1. How satisfied are you with the improvement in the patient's headache pains?	_____
2. How satisfied are you with the improvement in the number of headaches the patient gets?	_____
3. How satisfied are you with the improvement in the length of time the patient's headaches last?	_____
4. How satisfied are you with the patient's decrease in the medication they take for their headaches?	_____
5. Given the effort the patient put into the procedure, how satisfied are you that the relaxation training was worth it?	_____

Please provide additional comments (use back of page if necessary).

Appendix M

Relaxation Training Script

Each subject participated in 10 relaxation training sessions. In each of sessions one, two and three, the subject systematically tensed and released 16 different muscle groups. For each of sessions four and five, the subject tensed and released seven different muscle groups. Sessions six and seven involved the tensing and releasing of four different muscle groups. Only relaxation recall was used in session eight, and both relaxation recall and counting in session nine. The tenth session consisted solely of counting (Bernstein and Borkovec, 1973).

Sixteen muscle groups:

1. dominant hand and forearm.
2. dominant biceps.
3. nondominant hand and forearm.
4. nondominant biceps.
5. forehead.
6. upper cheeks and nose.
7. lower cheeks and jaws.
8. neck and throat.
9. chest, shoulders, and upper back.
10. abdominal or stomach region.
11. dominant thigh.
12. dominant calf.
13. dominant foot.
14. nondominant thigh.
15. nondominant calf.
16. nondominant foot.

Seven muscle groups:

1. dominant, hand, forearm and biceps.
2. nondominant hand, forearm and biceps.
3. forehead, upper cheeks, nose, lower cheeks, and jaw.
4. neck and throat.
5. chest, shoulders, upper back, and abdomen.
6. dominant thigh, calf, and foot.
7. nondominant thigh, calf and foot.

Four muscle groups:

1. dominant and nondominant hands, forearms, and biceps.
2. forehead, upper cheeks, nose, lower cheeks, jaws, neck and throat.
3. chest, shoulders, upper back, and abdomen.
4. dominant and nondominant thighs, calves, and feet.

Brief Description of Scripts for Sessions One to Ten.

Sessions one to three. First, tense your right hand and forearm. Make a fist, make it as tight as you can. Feel the tension in your hand, and over your knuckles, and in your lower arm. Concentrate on what that tension feels like, very tight... Now, let it relax completely, let your hand relax.... let your forearm relax... notice the difference between how it felt tense, and how it feels as it's relaxing.... Let the tension disappear completely. Feel the tension disappear.... Feel your hand, your knuckles, and your lower arm becoming relaxed. Let them relax completely.

This script is used twice for each muscle group and lasts approximately 40 minutes.

Sessions four and five. The script for these sessions is the same as for sessions one to three except that the muscles are combined into seven groups. Each sessions lasts approximately 25 minutes.

Sessions six and seven. The script here is again the same except that the muscles are combined into four groups. Each sessions last approximately 15 minutes.

Session eight. The script for session eight uses the same four muscle groups as sessions six and seven, but only involves recall, and is as follows.

First, I'd like you to focus all of your attention on the muscles in your arms and hands. Try very carefully to identify any feelings of tightness or tension that might be

there now. Notice where that tension is and what it feels like... Now relax. Just try to recall what it was like when you relaxed these muscles. Just let them go and let them become more and more relaxed... Let all of the tension that might have been there disappear.... and let your arms and hands relax completely... Let your arms and hands totally relax....

The same script is used for the other three muscle groups (twice for each group) and the session lasts approximately 15 minutes.

Session nine. The script for session nine uses the same four muscle groups as session eight, but each muscle is only relaxed once. The counting procedure is then used following the fourth muscle group. The session last approximately 8 minutes.

The counting procedure is as follows. As you remain completely relaxed now, I'm going to count from one to 10. As I count, I'd like you to allow all of the muscles all through your body to become even more relaxed.... Just focus your attention on all of the muscles in your body, and notice them as they become even more and more completely relaxed, as I count from one to 10.... One.....two.... noticing the arms and hands becoming more and more relaxed now... three.... four.... focusing on the muscles of the face and neck as they become even more completely relaxed... five.... six.....allowing the muscles in the chest, shoulders, back, and abdomen to relax even more completely

now... seven.... eight.... noticing the muscles of the legs and feet becoming even more and more completely relaxed.... nine.... and ten.

Session ten. The script for session 10 involves only the counting alone portion of session nine and lasts approximately 2 minutes.

Appendix N

Table 7 represents the average duration, intensity, and EMG levels (in microvolts) for Richard, Sheila, and Andy, across the baseline, treatment, and maintenance phases.

Table 7

Average Duration, Intensity, and EMG Levels for Each Patient

	Baseline	Relaxation Training	Maintenance
Richard			
Duration	1.6	1.5	1.3
Intensity	1.5	1.5	1.3
EMG	2.2	1.5	1.7
Sheila			
Duration	1.3	1.6	1.3
Intensity	3.1	2.9	3.1
EMG	2.8	2.6	3.0
Andy			
Duration	2.7	1.8	2.1
Intensity	2.5	2.3	2.3
EMG	1.5	1.5	1.6

As can be seen from Table 7, neither of the patients' headache duration, intensity, or EMG levels changed significantly during the course of the program.

Appendix O

Table 8 represents the average headache frequency and duration, and EMG levels (in microvolts) per week for Dave, and the average headache duration and intensity, and EMG levels for Lynn and Sara, per week, across the baseline, treatment, and maintenance phases.

Table 8

Dependent Measures that did not Change Significantly

	Baseline	Relaxation Training	Maintenance
Dave			
Frequency	7.0	7.0	7.0
Duration	15.5	16.1	16.1
EMG	3.1	2.9	3.3
Lynn			
Duration	2.8	2.1	2.6
Intensity	2.2	1.4	2.3
EMG	3.0	3.5	2.8
Sara			
Duration	2.7	4.0	4.2
Intensity	2.9	2.7	2.4
EMG	5.6	5.5	6.3

As can be seen from Table 8, Dave's headache frequency, duration, and EMG levels did not change significantly, and Lynn's and Sara's headache duration, intensity, and EMG levels did not change significantly during the course of the program.

Appendix P

Relationship Between Frontalis EMG and Tension Headache

The relationship between frontal EMG and tension headache is ambiguous. For example, Williamson et al. (1984) argued that tension headache subjects who showed the greatest physiological changes (EMG reduction, lowered heart rate, and reduced skin potential responses), apparently indicative of relaxation, tended to respond most favorably to treatment. Also, Ahles, Sikora, Sturgis, and Schaefer (1986) found that tension headache subjects experienced significantly higher frontal EMG measures, at least during a headache, than no-headache controls.

In another study, Lacroix et al. (1986) reported that the assumption that muscle-contraction headaches stem from excessive activity in the frontalis muscles is questionable. While subjects in all three experimental groups (relaxation, biofeedback, and combined relaxation and biofeedback) significantly improved in headache activity, only those subjects who experienced initially high EMG baselines learned how to decrease EMG levels with training. Since medium and low EMG level patients also improved in headache activity, there does not appear to be a one-to-one relation between frontalis EMG and muscle-contraction headaches.

Ramirez (1985), in a critical analysis of the model of tension headache, found that while some subjects exhibited elevated frontalis EMG during a headache, others did not. In addition, he also wrote that resting frontalis EMG and

the incidence of headache for some people is independent. In general, while it appears that relaxation training is effective in reducing muscle-contraction headache activity, the association between tension headache and frontalis EMG activity is not as strong as is often assumed. Although muscle tension may contribute to muscle-contraction headache, other factors, e.g., psychological and/or social events, independent of whether or not they produce muscle tension, are likely important.

Abramowitz and Bell (1985) found that although EMG level and headache activity were associated following biofeedback, their pretreatment relationship was weak. In addition, lowered EMG levels with treatment was not enough to explain headache improvement. Subjects who experienced greater improvement in headache activity during biofeedback did not necessarily produce a greater reduction in EMG levels. Other factors besides frontal EMG (social, psychological, and physiological) need to be assessed in terms of their impact on tension headaches.

An interesting study by Traue, Gottwald, Henderson, and Bakal (1985) revealed that tension headache subjects showed less head and hand movements, less facial activity, less affective expressiveness, more facial tension, a greater attenuation of bodily and facial responses, and greater EMG reactivity, in both the frontalis and the trapezius muscles, to a psychosocial stressor than headache-free controls. The authors suggest that 'behavioral inhibition' (a

psychological variable) is an area that needs further examination when researching the treatment of tension headaches.

Borgeat, Hade, Elie, and Larouche (1984) taught tension headache and headache-free controls subjects to increase their frontal muscle tension using biofeedback. The authors further assessed the effects of three different frontal muscle contraction periods (1 minute, 2 minutes, and 3 minutes) on post-training EMG and subjective pain levels. Their results indicated that both groups were able to raise their EMG levels equally, regardless of length of contraction period. The longer the contraction period, however, the lower were the subsequent EMG levels, for both groups, following training. Interestingly, the headache subjects reported more head pain than the headache-free subjects, significantly so after the 2 minute contraction. An important point is that not all headache subjects felt pain, and that some headache-free subjects did feel pain. It does not appear then that increased frontal muscle activity alone can account for tension headaches.

In a later study, Borgeat, Elie, and Larouche (1985) tested the hypothesis that subjects who display a positive relationship between head pain and voluntary muscle tension increases would react more positively to EMG biofeedback. In fact, however, the authors found that those subjects reporting a positive association between voluntary muscle contractions and head pain did not differ significantly in

terms of overall headache activity when compared to those patients whose muscle contraction-head pain association was not positive. The authors also pointed out that there was apparently no relationship between the subjects' clinical headache improvement and their learning of EMG lowering. Again, other factors besides EMG activity are likely accounting for tension headaches.

Thus, based on the above review, it is not necessarily surprising that EMG failed to improve in the six subjects whose headache activity decreased. The treatment outcome for muscle contraction headaches is likely to be influenced by a host of psychological and/or social factors in addition to frontal muscle activity.

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April 12, 1989

To Whom It May Concern:

Mr. Alan Gutkin has my permission to use our Headache History, which is copyrighted, for inclusion in the bound manuscript of his dissertation.

Yours truly,

Edward B. Blanchard, Ph.D.
Professor

EBB/ssa