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Cognitive-Behavioral Therapy for the Treatment
of Headaches Diagnosed as Common Migraine:
A Minimal-Therapist-Contact Approach
Versus a Clinic-Based Approach

by

Gwendolen M. Richardson

Thesis presented to the School of Graduate Studies
of the University of Ottawa
as partial fulfillment of the requirements
for the degree of Doctor of Philosophy

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ABSTRACT

This study was designed to compare the efficacy of a clinic-based cognitive-behavioral program aimed at stress management to the same approach using a minimal-therapist-contact format for the treatment of common migraine headaches. A total of 48 subjects between the ages of 18 and 50 years, who had been recruited through media advertising and physician referrals completed the program. Following a four week baseline period of recording headache activity subjects were randomly assigned to a waiting list control condition or to one of the two treatment conditions. Treatment was followed by four weeks of recording of headache activity immediately posttreatment and again six months later. A multivariate analysis of variance indicated that there was a significant reduction in headache frequency, duration and peak intensity following treatment for both treated groups. These reductions were maintained at the six month follow-up period. No significant difference was detected between treatment groups, but this finding must be interpreted cautiously because of the very low power in this analysis. Treatment for the minimal-contact group was significantly more cost-effective than for the clinic group. In addition, 47% of the clinic group achieved a 50% or greater reduction in headache activity as did 33% of the minimal-contact group and 18% of the control group. The difference in these proportions was not significant, but again, conclusions must be tentative because of a low power level.

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Finally, and most especially, I wish to express my gratitude to my husband, Ross, whose intellectual stimulation, technical assistance, unwavering support, understanding and continual encouragement were invaluable to me. This thesis is dedicated to him.

CURRICULUM STUDIORUM

Gwendolen Richardson was born in Ottawa, Canada in 1941. She obtained her Registered Nurse's Diploma from the Montreal General Hospital School of Nursing in 1961. In 1981 she received a Bachelor of Arts Degree with concentration in Psychology from the University of Ottawa where she had been on the Dean's Honour Role during each year of her studies. This was followed by an Honours Degree in Psychology awarded by the Faculty of Social Sciences at the same university in 1982. She graduated magna cum laude and was awarded the gold medal for highest standing in her class. The title of her honors thesis was "Validity of a Pain Intensity Rating Scale," and was prepared under the direction of P. J. McGrath, Ph.D.

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CHAPTER ONE

INTRODUCTION

Migraine headaches have been known to mankind for thousands of years. Hippocrates is reported to have used the term hemicrania to describe these headaches in recognition of their tendency to affect one side of the head (Sargent, Green, & Walters, 1973). Over the centuries the expression underwent several modifications, evolving gradually from hemicrania through hemigranea, emigrania, migranea, and megrim to eventually become the now familiar term, migraine (Dalessio, 1980). Although the unilaterality of the pain associated with migraines may have at one time been considered to be the most salient feature of the headache, research reveals that the problem is in fact a complex syndrome involving many symptoms, and that furthermore, the pain is frequently bilateral in nature. Indeed, an exact definition allowing for definitive diagnosis of the migraine syndrome has been a challenge.

Definition

In 1962 the Ad Hoc Committee on the Classification of Headache established 15 diagnostic categories for the major clinical types of headaches based largely on a description of symptomatology. The first three of these categories are pertinent to this investigation: 1) Vascular Headache of Migraine Type, of

which there are five subtypes: classic migraine, common migraine, cluster headache, hemiplegic and ophthalmoplegic migraine, and lower half headache, 2) Muscle Contraction Headache, and 3) Combined Headache: Vascular and Muscle Contraction. The remaining 12 categories consist of headaches due to nasal vasomotor reactions, infections, miscellaneous disorders such as hypoxic states or concussion, traction on intracranial structures, cranial inflammation, disorders of cranial or neck structures, neuralgias or neuritides.

Classic and common migraine, muscle contraction and combination headaches, the types which are most relevant to this study, are defined as follows:

Vascular Headaches of Migraine Type.--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 are preceded by, or associated with, conspicuous sensory, motor, and mood disturbances; and are often familial.

Evidence supports the view that cranial arterial distention and dilatation are importantly implicated in the painful phase but cause no permanent changes in the involved vessel.

(A) "Classic" Migraine.--Vascular headache with sharply defined, transient visual, and other sensory or motor prodromes or both.

(B) "Common" Migraine.--Vascular headache without striking

prodromes and less often unilateral than A and C. Synonyms are: "atypical migraine" or "sick" headache. Calling attention to certain relationships of this type of headache to environmental, occupational, menstrual, or other variables are such terms as: "summer," "Monday," "weekend," "relaxation," "premenstrual," and "menstrual" headache.

Muscle-Contraction Headache.-Ache or sensations of tightness, pressure, or constriction, widely varied in intensity, frequency, and duration, sometimes long-lasting, and commonly suboccipital. It is associated with sustained contraction of skeletal muscles in the absence of permanent structural change, usually as part of the individual's reaction during life stress. The ambiguous and unsatisfactory terms "tension," "psychogenic," and "nervous" headache refer largely to this group.

Combined Headache: Vascular and Muscle-Contraction.-Combinations of vascular headache of the migraine type and muscle-contraction headache prominently coexisting in an attack (p. 717).

A certain lack of precision is evident in this framework, lack of precision that is reflected in such terminology as, attacks are "commonly" unilateral in onset, "usually" associated with anorexia, "sometimes" with nausea and vomiting, "in some" are preceded by---, are "often" familial, and common migraines are "less often" unilateral. Thus, in spite of the Ad Hoc Committee's efforts to establish universally accepted definitions

of these headache types, there is considerable confusion. This is immediately evident when we examine some of the criteria used to establish a diagnosis of migraine in a number of studies conducted following the publication of the suggested classification system.

For example, Lance and Anthony (1966), using some of the Committee's criteria, established a diagnosis of migraine based on recurrent severe headache with gastrointestinal disturbance or focal neurological symptoms or both. Inclusion criteria of a study done by Anderson and Franks (1981) included adolescent or early adulthood onset; frequently one sided, accompanied by prodromal symptoms and severity necessitating bed rest. Blanchard and his colleagues (Blanchard, Andrasik, Evans, Neff, et al., 1985) used any three of the following criteria: (1) headaches usually begin on one side of the head only, (2) headaches usually accompanied by nausea and vomiting, (3) sensitivity to light, (4) one or more first degree relatives have diagnosis of migraine, (5) headache usually described as throbbing or pulsating, (6) independent diagnosis of migraine or vascular headache. Rojahn and Gerhards (1986) used a similar list of criteria from which to choose any three, although they did not include throbbing pain. On the other hand they did include either headache alleviation by carotid artery compression or ergotamine tartrate, or changes in affect in their list of possible choices.

Moreover, to add to the confusion, some investigators have found that there is much overlap in headache symptoms experienced

by individuals diagnosed as migraineurs and those diagnosed as suffering muscle contraction headaches. Other researchers have examined vasomotor responsivity and electromyographic activity and have found, again, that there are few characteristics which distinguish definitively these two types of headaches. A brief review of this research follows.

Symptomatology

Although throbbing pain, unilateral pain and nausea and/or vomiting have traditionally been thought to be typically symptomatic of migraine headaches, research findings do not support a definitive dichotomy between the symptoms of migraine and muscle contraction headaches.

Friedman, von Storch, and Merritt (1954) reviewed and summarized the symptoms experienced by 2000 patients diagnosed as suffering from either one of these two types of headache. Although they present their results as support for the position that migraine presents as a clear-cut and easily definable clinical entity, the presented tabulation of their results suggests there is in fact considerable overlap in symptomatology. The symptoms examined were family history, age at onset of headache, prodromal symptoms, frequency, duration, throbbing pain, associated vomiting. Only one symptom unequivocally differentiated the two types of headaches: headaches that were experienced constantly or daily were always diagnosed as muscle contraction. Otherwise there was no symptom which occurred

exclusively in one or other diagnostic category. They did find, however, that prodromal symptoms, a duration of one to three days, unilateral pain and vomiting were relatively rare in muscle contraction headaches, occurring in only 10% of the patients with this type of headache. But there is a flaw in this study. Because data collection was retrospective rather than prospective, there would not have been an opportunity to control certain important aspects of the research. For example, it is not likely that there would have been a standard interview format for physicians to follow in gathering information about symptoms. For reasons such as inexperience, or time pressure some physicians may have conducted a less thorough enquiry than others; others may have fallen prey to the cognitive processing phenomenon known as confirmatory bias and therefore may have pursued their examination in an inadvertently biased manner. Patients' own biases may also, on occasion, have led to an incomplete reporting of their symptoms. Thus the lack of control in data collection may have resulted in an inaccurate representation of symptomatology in this investigation.

Ziegler, Hassanein, and Hassanein (1972) attempted to clarify the differentiating features of these two types of headaches by doing an empirically based factor analysis. A 27 symptom questionnaire was first administered to 289 headache sufferers and then subjected to principal components analysis. Their results were surprising. Although it was expected that symptoms considered to be classical symptoms of migraine-

throbbing, unilateral pain, and associated nausea and/or vomiting - might have been represented by one factor, this was not the case. Rather it was found that the first factor was characterized by visual and motor preheadache symptoms, the second factor was characterized by unilateral pain, pain above the eye and scalp tenderness, and the third factor was comprised of nausea before and during the headache. The authors postulate that perhaps these findings suggest there are several types of migraine headaches. It must be kept in mind, however, that factor analysis is a technique which is often somewhat arbitrary and therefore can be unreliable, depending as it does on the specific population sampled, the rotation technique used, and the researcher's judgment as to the best solution.

✓ In another study Philips (1977) examined the degree to which prodromal symptoms and/or vomiting were associated with unilateral (considered to be diagnostic of migraine) as opposed to bilateral head pain in 597 headache patients. Contrary to expectations, she found that, in fact, these two symptoms were more frequently correlated with bilateral than unilateral pain.

Waters (1975) was also interested in the rate of concurrence of three traditionally accepted symptoms of migraine: prodromal symptoms, unilateral pain, and nausea and/or vomiting. (Prodromal symptoms were stated by the Ad Hoc Committee as being the feature which distinguishes classic from common migraine.) Using an epidemiological approach he found that of the population who had experienced headache the previous year in a community in Wales,

62% of the men and 73% of the women had experienced at least one of the migraine symptoms. He further found that the three symptoms occurred together no more frequently than could be expected from chance alone.

In a 1981 study using the McGill Pain Questionnaire (Hunter & Philips, 1981) it was found that there were differences in how muscle contraction and migraine patients described their pain. Although both groups were similar in the sensory descriptors chosen, the migraine subjects chose more affective terms to describe their headaches than the muscle contraction patients. However, Bakal (1982) suggests that this may be due to greater severity of headaches diagnosed as migraine rather than to a difference in the type of headache per se, a hypothesis supported by at least one other group of researchers (Blanchard, Andrasik, Arena, & Teders, 1982).

Another study which examined symptomatology was conducted by Bakal and Kaganov (1977). They had 56 muscle contraction, migraine, or combined muscle contraction/migraine patients complete daily records of headache activity for a period of two weeks. Results revealed that 40% of both migraine and muscle contraction patients had throbbing headaches and that 52% from each group had associated visual disturbances. Both groups were also similar in pain location. Nausea and vomiting however, did differentiate the groups, occurring more often in migraine subjects (72%) than in muscle contraction subjects (36%). But it is evident that even these symptoms are not unequivocally

characteristic of only one type of headache.

In another investigation by these two researchers (Bakal & Kaganov, 1979) a retrospective questionnaire was used to determine the frequency of various symptoms experienced by migraineurs and other headache sufferers. It was found that all subjects reported the same symptoms, whether these were considered musculo-skeletal symptoms (i.e. location of pain being neck, top of head, back of head or forehead, pain being described as tightness or pressure, dull and aching), vascular symptoms (i.e. location being eyes or temples, unilateral, throbbing or pulsating pain, light sensitivity, and visual disturbances) or autonomic symptoms (i.e. nausea and vomiting). What did differentiate the migraineurs from other headache sufferers was not the type of symptom but the extent to which the symptoms were present across the attacks, that is symptoms occurred with greater frequency in the migraineurs than in other headache sufferers. Additionally, the authors noted that symptoms considered diagnostic of muscle contraction headaches such as pain in the neck or top of the head and feelings of tightness or pressure were experienced more frequently by migraineurs than several of the more traditional migraine symptoms such as throbbing pain, unilateral pain, and visual disturbances. Similar results were found in a survey of a community population (Kaganov, Bakal, & Dunn, 1981), in a retrospective analysis of symptoms experienced by 50 headache patients in a medical practice (Featherstone, 1985) and in another, large scale,

retrospective study involving 600 patients in a neurology clinic in Australia (Drummond, 1985a). An inherent weakness in these studies, though, is their use of retrospective questionnaires leading one to question the precision of the data.

Olesen (1978) also found that migraine patients do not consistently suffer the so-called classical symptoms of migraine with each headache attack. In a study noteworthy for its prospective rather than retrospective collection of data, 750 patients were seen in a headache clinic while they were experiencing an acute migraine attack. It was found that throbbing pain, unilateral pain, and visual disturbances were as frequently absent as they were present in any given attack.

Summarizing these studies it would seem that there is much overlap in the symptomatology of the migraine and muscle contraction headaches. For this reason a number of researchers (Bakal, 1982; Bakal & Kagnov, 1979; Drummond, 1982; Philips, 1978; Waters, 1975) have suggested that the traditionally accepted dichotomy between these two types of headaches is not warranted and that it would be more helpful to regard them as being qualitatively similar, differing mainly along a continuum of severity. But this still leaves a dilemma, for the researcher at least. If one adopts a single continuum model one must then develop a classification system of severity in order to achieve homogeneity within and between groups. Which symptoms must be present to consider the problem severe, and how frequently must these symptoms be associated with each headache? Moreover,

clinically, it is apparent that patients diagnosed as migraine sufferers do not experience the same configuration of symptoms with each headache. Symptoms vary considerably among patients both within and across attacks. Finally, the findings of statistical differences in the frequency of occurrence of certain symptoms between migraine and muscle contraction headaches could be consistent with both a single continuum model and a separate disorder model, since different physiological mechanisms underlying headaches could give rise to similar symptomatology. Furthermore, as medical diagnosticians well know, the absence of certain symptoms does not necessarily mean the absence of a particular disease entity (Sackett, Haynes, & Tugwell, 1985).

It is unlikely that any one symptom will reliably differentiate headache types, but perhaps one strategy that could be adopted would be to define certain criteria and then use sensitivity/specificity analyses as described by Sackett et al. (1985) to determine what percentage of cases would be correctly classified using these criteria.

Vasomotor Responsivity

It has been postulated that migraineurs are afflicted with an inherent vasomotor dysfunction (Dalessio, 1963, 1980; Montagna, Zucconi, Zappia, & Liguori, 1985), whereas this is not a feature of muscle contraction headaches. A number of researchers have investigated this possibility by comparing temporal artery activity as well as other cardiovascular

variables in migraineurs, muscle contraction headache sufferers and non-headache individuals.

Early research by Tunis and Wolff (1953) compared the temporal artery pulse waves of 10 migraine patients during and between headaches to the pulse waves of 10 non-headache controls. They reported that the temporal artery was more dilated in migraineurs during headache-free intervals than in non-headache controls and that this dilation increased during the headache phase. The opposite condition was found with muscle contraction patients; that is, the temporal artery was reported to be more vasoconstricted during headache free periods in muscle contraction patients than in controls and this vasoconstriction was found to increase during headaches (Tunis & Wolff, 1954).

But Martin and Mathews (1978) found that inhaling a vasodilator exacerbated tension headaches on 43% of occasions and concluded, therefore, that tension headaches, as well as migraines, are associated with vasodilation. This conclusion seems unwarranted, however, in view of several methodological deficiencies in their study, such as the lack of fixed diagnostic criteria for subject selection, the lack of statistical analysis of the data and the lack of explanation for the failure of the vasodilator to exacerbate headaches on 57% of occasions.

A number of experiments have indicated that while measures of cardiovascular activity at rest are similar for migraineurs and muscle contraction patients (Arena, Blanchard, Andrasik, Appelbaum, & Meyers, 1985; Drummond, 1985b; Ellersten &

Hammerborg, 1982), these variables change differentially according to diagnostic category in response to various laboratory stimuli (Arena et al., 1985; Drummond, 1982, 1985b; Drummond & Lance, 1984; Ellersten & Hammerborg, 1982; Pratt, 1985).

Some researchers, for example, have reported that migraineurs exhibit vasoconstriction in response to a variety of stimuli. For example, in response to a non-aversive 80 db white noise stimulus Bakal and Kaganov (1977) found a slight tendency towards a decrease in temporal artery pulse velocity in both migraine and muscle contraction headache sufferers and an increase in pulse velocity in non-headache controls. They note, however, that the difference between groups of subjects was marginal. One of the strengths of this study is its use of a prolonged adaptation period, but a weakness is the fact that the mean age of the control subjects was almost 9 years younger than either group of headache subjects, a factor which could be influential in the results (Arena, Blanchard, Andrasik, & Myers, 1983).

Price and Tursky (1976), however, report that temporal artery pulse waves produced a large differentiation between migraineurs and non-headache controls. During a single session of one of four possible treatment conditions (digital blood volume feedback, false feedback, a relaxation tape or a neutral tape) during which subjects were asked to try to increase hand temperature it was found that migraine subjects tended to

constrict or not to change over time regardless of condition, whereas non-headache subjects tended to vasodilate over time. Digital pulse waves showed a similar differential response pattern. A confounding factor, though, was the instruction to attempt to raise the temperature of the hand. Because of this it cannot be ascertained whether the differences between groups are a result of differences in vasomotor responsivity or differences in ability to control this function. In any case, Cohen (1978) interprets the findings of this study in relation to Sokolov's theory of the orienting response. On the basis of Sokolov's theory it would be predicted that a person will respond to an orienting stimulus with temporal vasodilation, but will respond to a noxious stimulus with temporal artery vasoconstriction. Cohen speculates, then, that perhaps migraine and muscle contraction patients are hypersensitive to a variety of stimuli, and tend to interpret innocuous stimuli as dangerous or threatening.

Gannon and her colleagues (Gannon, Haynes, Safranek, & Hamilton, 1981) were interested in the effects of stress on vasomotor functioning. They examined the physiological responses of migraineurs, muscle contraction headache sufferers and non-headache controls during rest, stress and post-stress adaptation periods. Conditions of stress included a 1 minute mental arithmetic task and a physical stressor in the form of an inflated occlusion cuff on the subject's arm. It was found that although there were no significant between-group differences in

vasomotor responsivity during baseline or administration of stressors, during the poststress adaptation periods migraineurs exhibited significantly more peripheral vasoconstriction measured in the earlobe than non-headache controls. Unfortunately, the analysis of data from muscle contraction sufferers was not reported. Also, although the mental arithmetic task in this study was apparently assumed to be stressful, whether or not this was the case was not measured.

One innovative study is particularly noteworthy for its attempt to use a condition of relevant, naturalistic situational stress (Goudswaard, Passchier, & Van Boxtel, 1985). Subjects were 74 university students, 37 of whom suffered migraines, 37 of whom were headache free; the stressful situations were comprised of an examination which was part of the students' study program and a one and a half hour intelligence test. Numerous physiological variables were measured and compared. It was found that while the controls reacted to these conditions of stress with an increase of temporal artery pulse amplitude, the migraineurs showed no such increase. The authors suggest that the apparent vasoconstriction reported in other research is only a relative phenomenon that results from comparison with the vasodilation exhibited by controls. Unfortunately, no muscle contraction headache sufferers were included in this study. Also, this study would have been even more valuable if there had been an attempt to measure the degree of aversiveness of the stress condition since some individuals find these situations

more of a challenge than a threat^a and hence not necessarily stressful.

Reading (1982) suggested that abnormalities in peripheral vasomotor activity as well as elevated frontalis EMG levels in headache patients might be indicative of high levels of anxiety or other neurotic conditions rather than diagnostic of headache type. In a study to investigate this he reported that following exposure to a series of taxing procedures (mental arithmetic, 90 db white noise, a word recognition test, and two memory tests) there was no difference between a group of migraineurs and a group of anxious non-headache controls (patients who had been referred for behavioral treatment of general anxiety states) on measures of frontalis EMG, and skin conductance. But finger temperature - assumed to be indicative of digital vasomotor activity - did decrease significantly during testing for the migraineurs whereas it did not for the anxious controls. Thus, he concluded, abnormal digital vascular responses do occur in migraine patients in response to stressful conditions and it does not appear that this abnormality is due to elevated levels of anxiety. One drawback of this study is that although there were no differences between the groups in levels of neuroticism and distress as measured by the Eysenck Personality Questionnaire and the Symptom Check List-90, levels of anxiety per se were not compared. Moreover, there was no attempt to control for medication usage which may have been significantly different for the two groups.

Morley (1985) conducted an experiment with classic migraineurs compared to non-headache control subjects, presenting them with various laboratory tasks and conditions, some of which were intended to be stressful (bursts of 90 db noise and stressful imagery). He found some evidence that migraineurs responded to a condition of stress with bilateral temporal artery constriction, but that there was a tendency for the temporal artery on the usual side of headache onset to dilate during the final part of each trial. This points up the importance of the time factor in the measurement of physiological activity and may partly explain why other research has suggested that migraineurs respond with vasodilation rather than constriction in response to a variety of stimuli.

For example, Arena and his co-workers (Arena et al., 1985) compared migraineurs with muscle contraction and combined muscle contraction and migraine headache sufferers in numerous stressful and non-stressful conditions as well as post-adaptation periods. Although there were no non-headache controls used in this research, a particular strength of the study was the matching of subjects on five demographic variables including age and gender. They reported that migraineurs exhibited significantly more cephalic vasomotor dilation than muscle contraction subjects during stressful imagery and during early post-stress adaptation periods and that migraine and combined headache sufferers took longer to return to prestress levels than muscle contraction sufferers.

In another well designed study Drummond (1985b) compared the amplitude of pulsation of the superficial temporal artery, facial temperature, blood pressure, heart rate and respiration rate of subjects with either classic migraine, common migraine, muscle contraction headaches or no headaches during a mental arithmetic stress test and reaction time tests. This research was commendable in that reliability of responses was assessed on three consecutive days and showed that while blood pressure, heart rate and respiratory rate responses were greater during the first than during the next two sessions, temporal artery and facial temperature responses did not alter from one session to the next. In addition, it is one of the few studies that makes a distinction between classic and common migraine. It was found that temporal pulse amplitude increased during stress, that this increase was significantly greater in the classic migraine group than in the common migraine group, and that the increase was significantly greater for both these groups than for the muscle contraction or control subjects. In addition, increases in systolic blood pressure and heart rate during the first session were greater for the migraine groups than the muscle contraction group. However, analysis of individual response patterns showed that only a minority of common migraine sufferers experienced large increases in vasomotor reactivity, as did 3 of the 10 muscle contraction subjects, leading the author to conclude that extracranial arteries dilate readily during stress in only a minority of headache sufferers and that this phenomenon is not an

essential part of the migraine syndrome.

Still other authors suggest there is no evidence for vasomotor abnormality in migraineurs (Andrasik, Blanchard, Arena, Saunders, & Barron, 1982; Hockaday, Macmillan, & Whitty, 1967). A recent controlled study by Passchier, van der Helm-Hylkema, & Orlebeke (1984b) supports this position. In a comparison of migraine, muscle contraction, and non-headache controls during conditions of experimental stress and rest it was found that there were no differences in temporal or digital vascular measures between these three groups of subjects. Their results are consistent with those of several other groups of researchers (Cohen, Rickles, & McArthur, 1978; Anderson, & Franks, 1981; Thompson & Adams, 1984). Although there were no differences between the three groups Passchier et al. do point out that the temporal artery pulse amplitude did increase during stress, a finding consistent with that of Feuerstein, Bush, and Corbisiero (1982) who suggest that dilation rather than constriction is the response of the temporal artery to stress.

The study by Passchier and colleagues (1984b) controlled for the experience of head pain during the experiment and it is of interest to note that no significant differences were measured in absolute pulse amplitudes between those migraineurs who had pain and those who did not. If stress is a factor in increased temporal pulse amplitude in migraineurs one would have expected that pain, because of its inherent stressfulness, would have resulted in increased pulse amplitude. The researchers attempt

to explain this puzzling finding by suggesting that differences in device placement and skin characteristics may have overruled any differences. Alternatively they state that since pain was mainly in the lower ranges, it may not have been sufficient to lead to vasodilation.

The results of these various studies are confusing and in many cases seem to be inconsistent. There are a multitude of factors which can contribute to inconsistencies in psychophysiological research (Sturgis & Arena, 1984). In the studies described these include different diagnostic criteria for subject selection, lack of control of variables such as age that have been shown to affect physiological responses (Arena et al., 1983), failure to take into account medication usage, use of differing experimental conditions, varying amounts of time allowed for adaptation of subjects to equipment and environment, possible carry-over effects from one laboratory condition to the next. In addition, it has been reported that cephalic vasomotor response procedures are particularly difficult to perform reliably (Jessup, Neufeld, & Merskey, 1979). Furthermore, the testing of reactions to stress in the laboratory poses special problems. One explanation for some of the differences in reactivity to stress conditions may be that in those studies which found no differences between groups of subjects the exposure to stress was of minimal duration, whereas in those which did find differences the length of time required for the procedures was considerably longer. It has been argued that the

longer lasting procedures may be more representative of real life stressors (Passchier et al., 1984b).

Thus the evidence for differences in vasomotor function between headache patients of either diagnostic category and headache-free controls remains equivocal. A major problem, however, rests on the original diagnosis of headache type. Headaches are currently categorized according to symptomatology and subjects are assigned to experimental groups accordingly. But the lack of consistency across research groups in symptomatic criteria for diagnoses was discussed earlier. Thus, interpretation of differences in vasomotor function is indeed difficult, based as it is on a system of classification that may be inadequate.

Electromyographic Activity

Traditionally it has been accepted that muscle contraction headaches are characterized by sustained contraction of skeletal muscles. It was therefore expected that this would be reflected in higher levels of electromyographic (EMG) activity in those individuals diagnosed as suffering muscle contraction headaches than in those with migraines.

Interestingly, however, a number of studies have not supported this position. Bakal and Kaganov (1977), in a comparison of migraine patients, muscle contraction headache patients and non-headache controls, found migraine patients to have higher frontalis EMG activity than either muscle contraction

subjects or headache-free controls both between and during headache activity. This finding is consistent with that of other researchers (Pearce, 1977; Philips, 1977; Pozniak-Patewicz, 1976). The study by Pozniak-Patewicz (1976) is of special interest in that muscle activity was recorded with the use of needle electrodes rather than the more usual surface electrodes and therefore may be more accurate. Unfortunately, in this study, though, diagnostic criteria were not specified. The author distinguished between migraine subjects and "cervical migraine" subjects, but it was not clear what the distinction was. Nor was information provided as to adaptation times which could have affected results.

In the examination of muscle activity at sites other than the frontalis muscle Bakal and Kaganov (1977) found both headache groups to have neck EMG activity that did not differ from each other, but was higher than controls, whereas Philips (1978) found no significant differences in neck or trapezius muscle activity between migraineurs, patients suffering muscle contraction headaches, combined migraine and muscle contraction headaches, or non-headache controls.

In contrast to the above mentioned studies, a number of other studies did not find elevated frontalis EMG levels in either migraine or muscle contraction headache sufferers compared to headache-free subjects during baseline recording (Anderson & Franks, 1981; Andrasik, Blanchard, Arena, Saunders, & Barron, 1982; Gannon et al., 1981; Pearce & Morley, 1981; Pritchard &

Wood, 1983; Thompson & Adams, 1984; Van Boxtel, Goudswaard, & Janssen, 1983). An example of one of these studies is an investigation carried out by Passchier et al. (1984b) who compared headache sufferers to non-headache controls during conditions of rest as well as during laboratory stress, and during a headache as well as during a headache-free period. Their use of 25 subjects per group, which is a larger sample size than many researchers use, and therefore increases power, adds strength to their results. In one other study (Cohen et al., 1978) frontal EMG was actually found to be lower in migraine patients than in non-headache control subjects.

Several studies have compared EMG responsivity of individuals with migraine, muscle contraction, combined migraine and muscle contraction headaches or without headaches to various types of stimuli. No significant differences between groups have been found in response to orienting stimuli (Bakal & Kaganov, 1977; Cohen et al., 1978), to painful stimuli (Andrasik, Blanchard, Arena, Saunders, & Barron, 1982; Feuerstein et al., 1982; Gannon et al., 1981), to cognitive tasks (Anderson & Franks, 1981, Andrasik, Blanchard, Arena, Saunders, & Barron, 1982; Cohen et al., 1978; Feuerstein et al., 1982; Passchier et al., 1984b; Pritchard & Wood, 1983), to personalized stress imagery (Andrasik, Blanchard, Arena, Saunders, & Barron, 1982; Passchier et al., 1984b; Thompson and Adams, 1984), or to environmental stress (Goudswaard et al., 1985). This last study, as described under Vasomotor Responsivity, is particularly

noteworthy because of its use of environmental stress in the form of a university exam and an intelligence test as the experimental conditions. As such these results add credence to those studies which have relied on laboratory stress as an analogue for real life stress.

One exception to these findings is an investigation by Cohen and colleagues (Cohen et al., 1983) in which it was found that in response to a mental stress condition patients diagnosed as suffering from either muscle contraction, classic migraine, or mixed headache experienced increased frontalis EMG as compared to controls, but patients suffering common migraine experienced no such increase. This study is exemplary in its differentiation between classic and common migraine and it may be this fact that resulted in its different findings.

With respect to EMG levels during headache, results are conflicting. Bakal and Kaganov (1977) reported that neither migraineurs nor subjects with muscle contraction headaches showed a significant increase in frontalis muscle tension during headaches compared to controls. These results are supported by those of Arena and his colleagues (Arena et al., 1985) and are consistent with those of other investigators who found little or no correlation between the intensity of pain experienced during either type of headache and EMG level (Bakal & Kaganov, 1977; Epstein & Abel, 1977; Haynes, Griffin, Mooney, & Parise, 1975; Martin & Mathews, 1978; Passchier et al., 1984b; Philips, 1978; Van Boxtel & Goudswaard, 1984). In contrast, a few others have

found increased frontalis or temporal EMG activity in muscle contraction headaches in response to either pain or laboratory mental stress (Tunis & Wolff, 1954; Van Boxtel & Van der Ven, 1978; Vaughn, Pall, & Haynes, 1977).

Thus, with few exceptions it would seem that the one symptom traditionally attributed primarily to muscle contraction headaches, is not necessarily a diagnostic feature: elevated EMG levels are as likely to be found in association with migraine as muscle contraction headaches, whether at rest, during headaches, or in response to stressful situations. And furthermore, there will be some individuals diagnosed according to their symptoms as having muscle contraction headaches whose frontalis EMG levels will not be abnormally elevated at all (Philips, 1978). Obviously, those categorized as suffering migraine or muscle contraction headaches are not a homogeneous population with regard to EMG activity. When conflicting results are found in the research on EMG levels they may be at least partly attributable to the same factors that were described in the section on Vasomotor Responsivity: diagnostic inconsistencies, small sample sizes, varying lengths of adaptation periods and possible carry over effects from one experimental condition to another. In addition, EMG levels may be affected by placement of electrodes, the type of electrodes used, the size of contact surface, eyebrow and eyelid activity, swallowing and jaw movement (Chapman, 1986), all factors which confound interpretation of results. However, as pointed out by Philips (1978) the diagnosis

of muscle contraction headache does not depend on objective evidence of muscular abnormalities since this is rarely assessed. Rather the diagnosis is based on a description of the associated pain and Philips suggests that it may be more useful to view migraine and muscle contraction headaches as two different types of pain phenomenon rather than as being either vascular or muscular. By changing the focus in this way, researchers may be more likely to generate hypotheses regarding relationships between the physiological, psychological and behavioral aspects of the experience. It is these functional relationships that are so crucial to the treatment and management of headaches.

To conclude this section on definition, it would appear that an exact definition of the migraine syndrome is indeed difficult and perhaps even impossible at this time. Noting the overlap in symptoms and physiological measures, Bakal (1982) and others (Philips, 1977; Saper, 1986; Waters, 1975) have argued for the adoption of a continuum model of severity in which migraine and muscle contraction headaches are assumed to be qualitatively similar, with symptomatology increasing as a reflection of increasing intensity. Blanchard and Andrasik (1985) have rejected this proposal, pointing out that different rates of success with certain treatments for different diagnostic groups suggest that at least for clinical purposes it would be more useful to retain the traditional model in which migraine and muscle contraction headaches are viewed as dichotomous entities. A subcommittee of the International Association for the Study of

Pain recently developed and presented a multiaxial taxonomy for pain syndromes, in which they, too, maintained the traditional distinction between these two types of headaches, defining migraine and tension (muscle contraction) headaches according to symptomatology in much the same manner as the Ad Hoc Committee had done 24 years earlier (1986).

And so the debate and discussion continue. As yet, there is no physiological or psychological procedure which reliably differentiates headache types. Researchers have been aware of this problem and in many cases have addressed it by having prospective subjects diagnosed by two different people, frequently one being a physician, the other being a psychologist. The problem arises mainly across laboratories when different criteria are used to arrive at the diagnosis. Classic and common migraine seem to be fairly easily distinguishable in that the classic migraine is preceded by relatively definitive prodromal symptoms. And yet, much of the research has unfortunately made no attempt to separate subjects on the basis of this distinction. But particularly problematic is the distinction between common migraine and muscle contraction headaches where, as is evident from the review of the literature, the distinction is often blurred. Without a specific pathognomonic marker of migraine, reliability between diagnosticians is likely to be low. The result of this diagnostic problem is that much of the research is conducted with non-similar groups of patients yielding, therefore, inconsistent and conflicting findings. The research

reported in the remainder of this paper attests to this fact.

Prevalence

Figures vary considerably concerning the prevalence of migraine in the adult population, with percentages generally being somewhat lower for men than for women. For example Ekblom, Ahlborg, and Schele (1978) reported a prevalence of only 1.7% in a population of almost 10,000 18 year old Swedish men; Waters and O'Connor (1975), in a series of three epidemiological studies in Great Britain, found a prevalence of between 23 and 29% in women and between 15 and 20% in men. One of their surveys included people over the age of 75 and in this age group it was found that prevalence rates dropped considerably; for women the rate dropped to 10.3%, for men 4.9%. In a community survey conducted in Jerusalem of approximately 5000 people over the age of 15 prevalence rates were found to be 14.5% for women and 5.1% for men (Abramson, Hopp, & Epstein, 1980). For women the rate was highest between the ages of 35 and 44 (exact figures are not supplied); for both sexes the rate was lowest for those over the age of 65. Interestingly, age was significantly related to migraine only among women.

In the United States the National Migraine Foundation reports almost 12 million people suffer from some form of migraine headache (Adams, Feuerstein, & Fowler, 1980). Unfortunately, it appears that no epidemiological studies have been conducted in Canada.

Several reasons may be cited for the wide discrepancy in prevalence estimates: differences in method of sample selection, differences in methodology of collecting information and lack of consistent consensus for the diagnosis of migraine. In any case migraine does not appear to be related to social class, race, education or intelligence (Harrison, 1975; Holroyd & Andrasik, 1982; Waters, 1971).

The Pathogenesis of Migraine

A number of theories have been postulated to explain the pathogenesis of migraine. For example, the classic vascular theory posits two phases of the migraine attack. In the first stage vasoconstriction of extracranial and intracranial small vessels occurs. The constriction of intracranial blood vessels causes a marked decrease in cerebral blood flow. It is this event which is hypothesized to be responsible for the prodromal symptoms of the classic migraine headache. This is followed by a rebound vasodilation of the vessels, and hence increased regional cerebral blood flow, during which period the pain is experienced (O'Brien, 1973). Edmeads (1979) found, however, that cerebral blood flow remains elevated for several hours or even days after the headache subsides, leading him to suggest that the head pain is more likely to be the result of extracranial vascular dilation which does decline coincidentally with the pain. But since vasodilation by itself is not necessarily a painful phenomenon, the pain is believed to be due to a sterile local inflammatory

reaction in the involved blood vessels (Dalesio, 1980).

The serotonin theory is a further development of the vascular theory. It suggests that a release of serotonin, a vasoactive biochemical, from blood platelets is responsible for the constriction associated with the prodromal stage of the headache. The subsequent depletion of platelet serotonin levels decreases the normal tonus of the arteries resulting in a passive distension of the arterial walls, particularly in the external carotid artery. At the same time neurokinin is synthesized, permeates the vessel walls and perivascular tissue, and reduces the pain threshold of the receptors in the affected vessels (Fanchamps, 1974).

Recent studies, have challenged the causal role of cerebral vasoconstriction in the production of the prodromal symptoms of the classic migraine (Olesen, Lauritzen, Tfelt-Hansen, Henriksen, & Larsen, 1982). In an examination of nine classic migraineurs changes in blood flow were recorded before prodromal symptoms were noted by patients, alterations in blood flow were evident in the sensorimotor cortex after symptoms ascribed to that area had begun, and blood flow disturbances were still present after neurological symptoms had ceased. These findings suggest that blood flow changes may be secondary to alterations in neuronal functioning (Saper, 1986).

The possible role of neuronal factors in migraine attacks has recently been postulated by researchers who suggest that a phenomenon called spreading depression is the mechanism

underlying classical migraine (Lauritzen, 1984). Spreading depression is a response of the cerebral cortex to noxious stimuli whereby there is an intense burst of action potentials of a few seconds duration followed by a maximal decrease in electroencephalographic activity for a few minutes in a region of cortex measuring several millimeters across. This disturbance is then propagated through cortical tissue at the rate of 2-5 millimeters per minute from the point of elicitation, and is followed by a period of reduced blood flow in a pattern sharing many characteristics of the reduced cerebral blood flow observed during the classical migraine attack. Because there are many parallels between the oligoemia following spreading depression and the hypoperfusion during the classical migraine and because the prodromal symptoms of the classical migraine could be explained by the intense neuronal excitation which signals the beginning of the spreading depression it has been suggested that spreading depression may be playing an important role in the manifestation of classical migraine headaches. Moreover, because these cerebral blood flow changes are only infrequently associated with common migraine attacks it is suggested that common and classical migraines may be separate entities (Olesen et al., 1982).

A fourth theoretical explanation of migraine activity is Sicuteri's theory of serotonin depletion whereby a genetic deficiency of serotonin in the brain is postulated to account for a lowering of pain threshold (Sicuteri, 1972; Sicuteri, Anselmi,

& Fanciullacci, 1974). According to this position, under normal conditions serotonin is an inhibiting mediator of pain and so a deficiency of brain serotonin will increase sensitivity to painful stimuli. Thus, this theory holds that the pain of migraine headaches is not a vascular phenomenon as postulated by others, but rather is due to a mechanism mediated at the level of the central nervous system. Factors such as menstruation, fasting, stress or exertion that are frequently triggers of migraine attacks are postulated to exert their effect by altering concentrations of cerebral serotonin.

Others have also advanced a central theory to explain the mechanism of migraine headaches (Blau, 1980; Bruyn, 1980; Lance, Lambert, Goadsby, Duckworth, 1983). For example, Lance and his colleagues propose that primary disturbances begin within the hypothalamus as a result of emotional stress, or physiological changes such as occur for example during hypoglycemia. Impulses from the hypothalamus would then descend to the midbrain altering pain-modulating transmitters as well as causing changes in cerebral and extracranial blood flow.

Other theories give a causal role to platelet abnormalities (Deshmukh & Meyer, 1977; Hanington, 1978), to a possibly defective blood brain barrier enabling serotonin to cross the barrier and cause changes in cerebral circulation (Harper, McCulloch, MacKenzie, & Pickard, 1977), or to stimulation of nociceptive nerve endings in the walls of meningeal vessels (Blau, 1978).

A recent theory developed by Amery (1982) is compatible with, and incorporates many aspects of, the previously mentioned theories. Amery hypothesized that all migraine attacks are preceded by a brief episode of focal cerebral hypoxia. This hypoxia may be the result of either decreased oxygen supply or an increased need for oxygen, either of which may be caused by any one of a number of factors. For example, a decrease in oxygen level may be due to decreased cerebral blood flow as a result of vasomotor spasm, or as a result of the circulation of vasoconstrictors such as serotonin or catecholamines, or as a result of exogenous vasoconstrictive agents such as dietary tyramine.

On the other hand, an increased need for oxygen will ensue in the presence of an increase in brain metabolism. Several factors may increase brain metabolism: drugs such as reserpine, cigarette smoke, certain foodstuffs, REM sleep, autonomic nervous system overactivity. This last factor is of particular interest for this study. Several investigators suggest that migraineurs show a persistent degree of vasoconstriction, even during headache-free intervals, a finding which is interpreted as a sign of excessive sympathetic tone (Appenzeller, 1978; Otis et al., 1979; Price & Tursky, 1976). Migraine headaches are often preceded by a state of arousal or stress during which cerebral metabolism is likely to be increased with a concomitant rise in oxygen consumption. Amery speculates that the chronic vasoconstriction resulting from excessive sympathetic tone in

cerebral circulation in migraineurs may prevent the temporary vasodilation that is the necessary accompaniment to an increased demand for oxygen. Failing the required vasodilation, a condition of hypoxia occurs, with the possible development, then, of a migraine attack. Amery further theorizes that although a condition of hypoxia is a necessary condition for a migraine attack, it is not sufficient in and of itself. Whether a migraine headache will result from the condition of hypoxia or not depends on the complex multitude of vascular and biochemical alterations that follow the hypoxic episode.

Although this is a compelling theory, one weakness is its assumption that migraineurs are in a constant state of relative vasoconstriction. As reported in the section on Vasomotor Responsivity not all researchers have found this to be the case. The absence of this condition, however, may not completely nullify Amery's hypothesis as to the relationship between stress and hypoxia. Possibly a temporary over-reactivity of the sympathetic system could be sufficient to cause a period of hypoxia.

Amery's theory, as well as a number of others include hypotheses as to the mediating processes that might explain the role of stress in migraine headaches. We turn now to clinical studies that have examined the relationship between stress and migraine headaches.

The Role of Stress in Migraine Headaches

Several psychophysiological studies described earlier (Arena

et al., 1985; Cohen et al., 1983; Drummond, 1982; Morley, 1985) indicate that migraineurs tend to show greater cardiovascular or vasomotor responsivity to experimental stress than non-headache controls. This position has not been supported by other previously discussed research (Drummond, 1985b; Feuerstein et al., 1982; Passchier et al., 1984b). In any case, it can be argued that laboratory stress is not representative of the stress found in the world outside the laboratory. Lazarus and Folkman (1984) have defined stress as an interactive phenomenon whereby an environmental situation is appraised by an individual as exceeding his or her resources for coping and therefore endangers his or her physical or psychological well-being. Laboratory stress tends to be simplistic, finite and usually non-relevant to the subject. One noteworthy study, as reported earlier, attempted to correct this situation by using university students with migraines as subjects and measuring physiological variables during an exam and an intelligence test, environmental events which were assumed to be stressful. Unfortunately, there was no attempt to discover whether the students did, in fact, find these situations to be stress-inducing.

The stress of daily living is complex, often of some duration, frequently without simple solutions and most often involves interpersonal situations. Moreover, stress in daily living may lead to widespread effects such as disturbances in sleep and/or eating patterns, and possibly an increase in the use of alcohol, cigarettes or tranquilizers, all of which may in turn

have an effect on migraine headaches. In spite of the fact that stress is frequently cited as a precipitating factor for migraine attacks, there have been relatively few studies that have attempted to study the relationship of daily stress to migraine attacks.

Harold Wolff, undoubtedly strongly influenced by the psychoanalytically oriented psychosomatic theorists in the 1930's believed that situations in which the migraineur felt rage and resentment but was unable to vent these feelings could give rise to a migraine attack (Wolff, 1937). But because his data are based on anecdotal information gained from clinical interviews conducted by himself they are therefore subject to bias.

Selby and Lance (1960) reported that 67% of 500 migraineurs listed emotional upsets as a trigger for their headaches and Amery and Vandenberg (1987) found emotional upset or stress were precipitants for 48.8% of their sample of 217 migraineurs.

Large scale epidemiological studies have also indicated stress is a frequent precipitating factor in migraine attacks (Abramson et al., 1980; Goldstein & Chen, 1982; Nikiforow & Hokkanen, 1978; Parnell & Cooperstock, 1979). The shortcoming of these investigations is the retrospective nature of the questionnaires used.

A study by Henryk-Gutt and Rees (1973) is an improvement over these studies because of the prospective nature of the design used to examine the relationship of migraine attacks to emotional distress. A total of 100 migraineurs were asked to

keep a 2 month record of migraine attacks and their emotional state around the time of the attack. It was found that 54% of migraine attacks experienced by these migraineurs followed emotional stress. The authors also note that migraineurs do not appear to be exposed to different life stresses than non-migraineurs, but that they do experience a greater than average reaction to a given quantity of stress.

Bakal (1982) also recognizes the role of stress in migraine headaches. However, he views stress less as a causal factor in headache onset than as a concomitant variable, and frequently a consequence of chronic headache.

A study by Feuerstein and his colleagues (Feuerstein, Bortolussi, Houle, & Labbe, 1983) suggested that fluctuations in anxiety several days prior to migraine attacks may contribute to subsequent temporal artery variability followed by constriction leading up to head pain. In this study a number of physiological indices as well as anxiety levels were measured for 4 days preceding a migraine headache in 12 migraineurs in an attempt to correlate subjective distress, temporal artery activity and migraine. In an analysis of individual patients, elevations in anxiety (as measured by the State-Trait Anxiety Inventory) were noted 4 days prior to the migraine attack associated with an increased temporal artery variability 3 days prior to the attack and temporal artery vasoconstriction the day preceding the attack. The authors suggest that these results demonstrate that emotional states can set into motion a chain of vasomotor changes

that lead, over a period of days, to a migraine attack. However, it must be kept in mind that there is a deficiency in this study in the lack of control for fluctuations in anxiety levels over longer time periods. Possibly such fluctuations can occur over time without leading to a headache. In addition, it is not clear that the elevation in anxiety level 4 days prior to headache might not have been associated with the novelty of the laboratory situation since there is no indication of an adaptation period to control for this.

A second group of researchers was also interested in the days leading up to a migraine attack, but in this case the investigation centered around stressful events, emotional arousal, and physical activity prior to the headache (Levor, Cohen, Naliboff, McArthur, & Heuser, 1986). Subjects included 33 migraineurs and mixed migraine and muscle contraction headache sufferers who kept a daily diary for four weeks in which they recorded stressful events, emotional state and level of physical activity. Four day cycles were then examined and compared. These 4 day cycles consisted of either a migraine headache day plus three consecutive headache-free days prior to the headache or a non-headache day plus 3 consecutive headache-free days leading up to that non-headache day. Reported findings were that there was a significant elevation of stressful events over the three days leading up to a migraine attack, emotional arousal showed a trend towards significant increase and physical activity declined in the same period. The interpretation of these results

must be tentative, though, since the presentation of data is not complete enough to allow for thorough evaluation. For example, there is no indication of how many 4 day cycles were analyzed. Moreover, the use of repeated univariate analyses of variance may have led to an inflated Type I error rate. In addition, subjects themselves determined whether any headaches they experienced during the recording period were migraine or muscle contraction headaches, but it is not clear what criteria they were using and there was apparently no attempt to validate their self-diagnoses. Finally, the lack of significance with regard to emotional state may be related to insufficient detail in the measurement of this variable. Emotional states were labelled as "feelings" and included highly discrepant feelings such as anger, excitement and boredom; all feelings were then summed for each day giving a global measure of emotional state. Apparently no attempt was made to separate negative from positive feelings, or arousing from depressing emotions.

Whether or not an individual experiences an event as stressful will be influenced by a number of interacting factors, one of which may be personality. It has been suggested that migraine patients may experience more stress in their lives than other people because of a particular personality structure that is different from non-migrainous individuals (Passchier, Van der Helm-Hylkema, & Orlebeke, 1985). A considerable amount of research has been directed towards this hypothesis.

The Role of Personality Factors in Migraine Headaches

In 1954 Friedman et al. published an article in which they stated that the personality make-up of migraineurs is extremely variable and may be influenced by a variety of emotional factors. "Most of these are unconscious and include hostility, identification with a family figure, a wish to remain in a position of dependency, or a desire to gain love, affection, or attention. The most frequent conflicts are apparently concerned with hostile impulses associated with feelings of guilt" (p. 777).

Alpers and Mancall (1971) listed the following personality traits to be found in adult migraineurs: perfectionism, ambitiousness, inflexibility, tension, resentment, repetitiousness, efficiency, poise, and social grace. Early writers have described similar personality profiles (Touraine & Draper, 1934; Knopf, 1935; Wolff, 1937).

But these early descriptions have been based on clinical observation only. Recently a number of researchers, using standardized instruments, have attempted to determine if in fact there is a personality profile that is characteristic of migraineurs.

No evidence for obsessiveness and compulsivity has been found in migraineurs, muscle contraction headache sufferers, or combined migraine and muscle contraction headache subjects when compared to non-headache controls (Arena, Blanchard, Andrasik, & Applebaum, 1986; Passchier, Helm-Hylkema, & Orlebeke, 1984a). Two

strengths of these studies were that both employed a controlled design and sample sizes were relatively large in both (26 - 59 subjects per group). Taking into account problems associated with using subjects referred from a medical practice, Henryk-Gutt and Rees (1973) ruled out selection bias in their study by selecting a sample of 100 migraineurs from a survey of almost 2000 employees in the British Civil Service. In this controlled study they too found no evidence that migraineurs were overly obsessional or ambitious, although they did find an elevated neurotic score on the Eysenck Personality Inventory. They also found elevated hostility scores on the Buss-Durkee Hostility-Guilt Inventory and for women only, elevated scores on anxiety and somatisation scores on the Minnesota Multiphasic Personality Inventory (MMPI).

Results of a well designed study by Blaszczyński (1984) support these findings. His study is noteworthy because of the inclusion of a group of non-headache chronic pain sufferers. He found that these sufferers of non-headache chronic pain obtained the same elevated scores on measures of neuroticism and repressed hostility as the headache sufferers. The author suggests, therefore, that these personality traits may be no more characteristic of headache sufferers than of individuals experiencing any long term chronic pain, a position supported by several other researchers as well (Bakal, 1982; Pearce, 1977; Philips, 1976; Sternbach, Dalessio, Kunzel, & Bowman, 1980).

The elevated neuroticism scores reported by Blaszczyński

(1984) and Henryk-Gutt and Rees (1973), however, were not supported by other research (Passchier et al., 1984a; Philips, 1976). Philips (1976) found no elevations on neuroticism, extraversion or psychoticism on a community sample of 39 migraine, 24 muscle contraction and 5 combined muscle contraction and migraine subjects. These subjects were obtained through a questionnaire distributed to approximately 1500 medical patients who had consulted their physicians for problems other than headache. Philips suggests that elevated neuroticism scores found in other research are representative of only that minority of headache sufferers who seek medical help. But this criticism is not substantiated in the studies of Blaszczyński and Henryk-Gutt and Rees mentioned above, since these researchers used non-clinic subjects.

As mentioned, with regard to the question of chronicity, some have argued that personality deviations from normal in headache populations are the result of living with chronic pain. One group of researchers has argued against this theory, suggesting that characterological traits often found in headache sufferers are likely to have existed before the pain problem arose (Arena, Andrasik, & Blanchard, 1985). In their investigation of this question these authors found that there was no correlation between the percentage of their lives that subjects had had chronic headache and elevations on a number of psychological test measures such as, for example, the MMPI, the Spielberger State-Trait Anxiety Inventory, and the Cox

Psychosomatic Symptoms Checklist. However, the results of this study must be interpreted with some caution. For one thing the authors' definition of percentage of life spent with headaches incorporates only the number of years the individual has suffered headaches. Because of the lack of reference to frequency or severity this definition seems inadequate. Furthermore, as the authors themselves point out, their study simply shows that there is no relationship between percentage of life the patient has suffered headaches and psychological test scores. It says nothing about whether or not psychological test scores were elevated prior to the onset of headaches.

Some studies have found migraineurs to have higher levels of anxiety than non-headache controls (Andrasik, Blanchard, Arena, Teders, et al., 1982; Price & Blackwell, 1980), to be more perfectionistic and success oriented than controls (Anderson & Franks, 1981), and to have scores on a measure of Type A behavior pattern positively correlated with frequency of headaches (Woods, Morgan, Day, Jefferson, & Harris, 1984). On the other hand, other researchers using various personality measures have found no deviation from normal for migraineurs as compared to non-headache controls on such factors as nervousness, aggressiveness, emotional lability and inhibition (Cuypers, Altenkirch, & Bunge, 1981; Hundleby & Loucks, 1985). Different studies yield different results depending on the specific personality factor being measured and so are difficult to compare. Replications using well validated and reliable instruments would be helpful.

Weaknesses in the above studies include the use of assessment strategies of questionable validity as for example in the Hundleby & Loucks study (1985), use of a student population as was done in the research conducted by Woods et al. (1984) which may bias results and the lack of a non-headache control group in the study by Cuyppers et al. (1981).

Studies using the MMPI (Andrasik, Blanchard, Arena, Teders, et al., 1982; Kudrow & Sutkus, 1979; Sternbach et al., 1980) found elevations on various scales, notably hypochondriasis, depression, hysteria, paranoia and psychasthenia. Interestingly, though, the elevations were higher for muscle contraction headache sufferers than for migraineurs, although Sternbach and his colleagues point out that in their study statistically significant differences were not clinically significant. Moreover, as noted by Adams et al. (1980), elevations on these scales are not necessarily specific to migraine; elevations are also to be found, for example, in the profiles of chronic back pain patients. Furthermore, a problem in the use of the MMPI for physical disorders resides in the fact that the hypochondriasis, hysteria and depression scales include items reflecting physical symptomatology. An endorsement of these items by individuals suffering chronic pain may result in spurious inflation of scores on these scales (Merskey et al., 1985).

One interesting investigation compared MMPI profiles of migraineurs before and after treatment using either drug therapy or thermal biofeedback (Sovak, Kunzel, Sternbach, & Dalessio,

1981). Forty-nine subjects all showed a "V" configuration on the hypochondriasis, depression and hysteria scales of the MMPI, that is, higher scores on Scales 1 and 3, hypochondriasis and hysteria, with a relatively lower score on Scale 2, depression. Those whose headaches improved following biofeedback therapy obtained lower scores on the hypochondriasis, depression and hysteria scales following therapy; those whose headaches improved following drug therapy showed no change in MMPI scores following therapy; subjects who did not improve with either type of therapy also showed no improvement in MMPI scores. Since those subjects who improved with drug therapy did not change on MMPI scores, the authors conclude that this may mean that neuroticism (defined as the "V" configuration of the hypochondriasis, depression and hysteria scales) is not a result of the pain experience, but rather is an integral part of migraine etiology. The proposed rationale underlying this conclusion is that successful biofeedback subjects learned not only to regulate sympathetic output, but also to recognize stress clues early, thus enabling them to modify the stress response. However, this interpretation fails to link neuroticism with an inability to recognize clues indicative of stress. Nor was it shown that those subjects who achieved success with biofeedback did in fact learn to recognize symptoms of stress and alter their reactions. Moreover, an unexplained high drop-out rate (31%) from the drug therapy group may be confounding the results of this study.

One other study examined personality variables before and

after treatment (Passchier et al., 1985). In this study migraineurs in three treatment programs (stress-coping, stress-coping with temporal vasoconstriction biofeedback, or stress-coping with finger temperature biofeedback) were compared to a waiting list control on measures of physiological reactivity and personality. Similar programs for tension headache sufferers were also compared to a waiting list control group. Personality factors tested included neuroticism, rigidity, achievement motivation, debilitating anxiety, facilitating anxiety, obsessive-compulsiveness, impulsiveness and defence mechanisms. Questionnaires used were in Dutch and except for the one measuring defense mechanisms were reported to have been validated. Reliability indices were reported for only one of the tests. Achievement motivation was found to be elevated in both headache groups, tension headache patients exhibited greater rigidity than either migraineurs or controls, there was no evidence of neuroticism, obsessive-compulsiveness or an abnormal pattern of defense mechanisms in either headache group. No significant changes in personality were found following 20 sessions of any of the treatment programs. The treatment programs were not well described in this publication. However, it was stated that subjects were trained in behavioural stress-coping techniques. It is perhaps not surprising, then, that personality traits were not affected since this was apparently not the aim of therapy. One would expect that stress management strategies could be learned without altering basic personality

structure.

In sum, empirical evidence does not support the notion of a clearly differentiated migraine personality. Many characteristics such as hypochondriasis, depression, and hysteria, thought to be distinctive of this disorder are to be found to a greater degree in muscle contraction headache sufferers and are seen in other populations as well. There has been no empirical support for other traits such as obsessiveness, compulsiveness or rigidity, once assumed to be part of the so-called migraine personality. Very few studies have shown that hostility, whether expressed or repressed, is correlated with the migraine syndrome. And finally, there has been no attempt yet to correlate personality factors with the degree of stress experienced by individuals who suffer migraine headaches. Thus, the notion that migraine patients may experience more stress in their lives because of certain personality factors has not been addressed.

Depression and Migraine Headaches

Depression is frequently mentioned as a correlate of headache, particularly in those with a history of severe headaches (Cox & Thomas, 1981; Diamond, 1983). MMPI studies as reported above do reveal elevations of the depression scale for migraineurs, muscle contraction or combined migraine and muscle contraction headache sufferers. In addition, in a large community sample, Ziegler, Rhodes and Hassanein (1978) reported levels of depression to be significantly greater in subjects

reporting a history of severe headaches than in headache-free individuals.

One study compared the prevalence of migraine headaches in a sample of 116 patients suffering major depression to the prevalence of migraine headaches reported in four community surveys conducted in the United Kingdom (Garvey, Tollefson, & Schaffer, 1984). It was found that the depressed women had a prevalence of migraine headache similar to that of women in the general population. There was a reported trend for the depressed men to experience a higher prevalence of migraine than men in the general population. This data must be interpreted with some caution, however, because there was no attempt to control for the incidence of depression in the surveys of the general population. Possibly if the subjects in the general population suffering depression had been parcelled out, the numbers experiencing migraine would have changed.

Whether depression plays a role in the development of migraine headaches or whether it is a result of chronic headache is not clear. Diamond (1983) has suggested that depression may develop as a result of frequent, severe migraines over a long period of time and that this depression may manifest itself as daily muscle contraction headaches. This appears to be a clinical observation and as yet is not supported by empirical evidence.

Antidepressant drug therapy has been shown to be useful in the amelioration of both headaches and associated depression

(Carasso, Yehuda, & Streifler, 1979; Sherwin, 1979; Ward, Bloom, & Friedel, 1979). In a study by Couch, Ziegler and Hassanein (1976) involving 110 migraineurs it was found that overall there was only a weak correlation between migraine and depression, although there may have been subgroups of patients with a higher correlation. Following treatment with amitriptyline the change in migraine headache activity was only weakly correlated with change in depression as measured by the Zung Depression Scale. It was concluded, therefore, that amitriptyline's effect on migraine activity is relatively independent of its effect on depression. Although the number of subjects in this study was large, unfortunately the lack of a control group weakens the conclusions. The authors speculate that the mechanism of action of amitriptyline on migraine might be to suppress one of the postulated trigger mechanisms such as serotonin, tyramine, or prostaglandins either by blocking a receptor site related to one of these biochemicals or by increasing availability of monoamine oxidase, an enzyme that has a catalytic effect on these substances. Feinmann (1985) presents two other possible modes of action: tricyclic antidepressants may bind to opiate receptors in the brain, achieving their analgesic effect in this way, or, alternatively, antidepressants may potentiate brain levels of serotonin sufficiently to boost the action of endogenous opiates, thus altering perception of pain.

Mathew (1981) found that migraineurs treated with amitriptyline achieved a significantly higher reduction in

headache activity than a control group of migraineurs treated with abortive ergotamine. But he also found that treatment with amitriptyline resulted in even greater improvement for a group of subjects with mixed migraine and muscle contraction headaches. He noted that pre-treatment depression scores as measured by the Zung Self Rating Depression Scale had been higher for the mixed headache group than for the pure migraine group and suggested that this might have been influential in treatment effects. There are a number of weaknesses in this study that temper any interpretation of results: lack of specification of diagnostic criteria, no indication as to what type of statistical analysis was used, lack of equivalence of treatment and control groups, and no attempt to measure change in depression following treatment.

Looking at the effects of psychologically oriented therapy on headache and depression, Cox and Thomas (1981) treated a total of 14 headache patients; 9 muscle contraction, 1 migraine, and 4 combined migraine and muscle contraction, with a program of relaxation, biofeedback and stress management. Depression levels were measured in these patients using the depression scale of the Symptom Check List-90 prior to, and following treatment. Therapy was reportedly aimed at altering headache activity rather than depression. Results indicated a significant improvement in both headache activity and depression in all subjects. However, it must be noted that the depression scores of only two of the subjects were above normal prior to treatment. The scores of

these two individuals were reported to have decreased to within normal limits following treatment. No significant correlations between headache and depression were observed at any point in this study. Shortcomings in this study include variable treatment length, lack of comparison or control group, and combining data from subjects with different headache diagnoses.

Thus, the correlation between migraine headaches and depression seems to be, at best, somewhat tenuous. Nonetheless, treatment with antidepressant pharmacotherapy appears to be efficacious in decreasing headache symptoms, leading researchers to postulate common underlying physiological mechanisms. Further research into the use of cognitive-behavioural therapeutic approaches for those individuals in whom depression is a factor would be worthwhile given the demonstrated usefulness of this approach for treating both chronic pain and depression (Romano & Turner, 1985). Cognitive-behavioural programs have been developed for the treatment of migraine, but these have not focussed on the concomitant treatment of depression. These programs will be discussed in the following section on treatment.

Treatment

Traditional Treatment

The primary mode of treatment for migraine headache has traditionally been pharmacological, whether it be in the form of abortive, palliative or prophylactic medication (Diamond & Dalessio, 1978). However, there are a number of problems

associated with pharmacotherapy which may result in a reluctance on the part of some patients to resort to this treatment modality.

Abortive medication, in order to be effective, must be taken at the time of the aura preceding the attack. But since common migraines are not preceded by a definitive aura, this type of medication is unsuitable for use with the common migraine. Secondly, migraineurs not infrequently wake up with a migraine attack when it is too late to abort it (Critchley, 1950). And thirdly, there may be undesirable side effects such as malaise, nausea and vomiting associated with abortive medication (Friedman et al., 1954). In addition, ergotamine tartrate and related agents frequently used as abortive medication, may lead to "rebound" headaches, that is, daily, chronic headaches which are drug induced and reflect a state of ergot dependency (Saper, 1986).

Palliative medication, the treatment of choice for most migraine patients (Wilkinson, 1976), is taken during an attack in an attempt to alleviate pain and/or associated nausea. However, many of these analgesics are ineffective, and furthermore, may not be tolerated due to the nausea and/or vomiting associated with migraine activity (Critchley, 1950).

The third category of pharmacological treatment for migraine is prophylactic medication which is prescribed on a daily basis in an attempt to lessen the frequency of the headaches. This type of medication is not acceptable to many because of

undesirable and/or potentially dangerous associated side effects such as drowsiness with the use of amitriptyline (Couch et al., 1976) retroperitoneal or endomyocardial fibrosis as a result of long term use of methysergide (Kudrow, 1978), or bronchospasm or cardiac failure associated with extended use of propranolol, particularly in patients with cardiac disease or congestive heart failure (Critchley, 1978; Dalessio, 1980).

Furthermore, although medication may be effective over a short period of time, there is some evidence that this efficacy is not always maintained over the long term. In a survey questionnaire sent to 1500 migraineurs, respondents were asked to use three categories - excellent, fair, or poor - to rate how effective they found various drugs to be in controlling headaches (Parnell & Cooperstock, 1979). Various forms of abortive medication were rated as excellent by approximately 27% of users. But a high percentage of responders also reported adverse effects from these abortive medications. Analgesics and prophylactics were rated as excellent by approximately 23% and 20% of users respectively, while tranquilizers and mood elevators were rated as excellent by 12%. For most medications much larger percentages of respondents rated the effectiveness of the various drugs to be only poor. This is a retrospective survey and therefore suffers from the limitations inherent in any retrospective method of data collection. Furthermore, the data are purely subjective and global and may, for this reason, be somewhat inaccurate.

Because of the various drawbacks associated with pharmacotherapy, researchers have investigated the feasibility of psychological approaches to be used as an adjunct or an alternative to the medical treatment of migraine headache.

Psychologically Oriented Treatment

Psychotherapeutic approaches to the treatment of pain in general were given considerable impetus by the development of Melzack's gate control theory of pain (Melzack & Wall, 1965) in which psychological components were formally recognized as having a major impact on the experience of pain. This theory states that neural synapses in the spinal cord act like a "gate" which, through the release of neurotransmitters, either facilitate or inhibit the flow of nerve impulses from peripheral somatic receptors to the central nervous system. It is further proposed that descending cognitive and affective influences are able to exert a profound modulating effect on this gating mechanism. This being the case, it was suggested that pain could be treated not only by attempting to manipulate the sensory aspect, but also by influencing motivational-affective and cognitive-evaluative factors. Thus, for example, psychological strategies such as altering the appraisal of the situation, developing a sense of control over the experience, or decreasing associated anxiety could be influential in ameliorating the pain experience. This theory opened the door for a great deal of psychologically oriented research into the area of pain and its management. In

the field of headache research, work has focussed on the effects of psychological factors on physiological parameters of headache, as well as the influence of psychological factors in the reduction of headache activity.

Psychologically oriented interventions for the treatment of migraine headaches have followed two general approaches. One approach has been to remain focussed on physical factors in the pain experience through the use of biofeedback procedures or relaxation training. The second approach has been directed towards those affective and cognitive components described by Melzack as being an integral part of the pain experience, while at the same time incorporating either biofeedback or relaxation strategies as part of a comprehensive package. This is a cognitive-behavioral approach.

In an attempt to assess the relative efficacy of non-pharmacological treatments for migraine headaches, Blanchard and Andrasik (1982) conducted a meta-analysis of relevant outcome studies. They concluded that the combination of thermal biofeedback and autogenic training was significantly better than any other condition except relaxation training. They also concluded that "relaxation training, cephalic vasomotor biofeedback and thermal biofeedback alone do not differ" (p. 868). This seems to suggest that all of these treatments are approximately equally efficacious. Unfortunately, because of their limited number, cognitive-behavioral treatments were not included in this analysis.

We turn now to a review of some of these treatment outcome studies, looking first at those programs aimed at altering physiological responses: relaxation therapies, electromyographic biofeedback, thermal biofeedback and cephalic biofeedback, and then at the more recently developed cognitive-behavioral therapies.

Relaxation Therapies

A state of anxiety and arousal, whether a chronic state within an individual, or in response to stressful events, suggests the involvement of the sympathetic nervous system. It has been postulated that the migraineur suffers an abnormal instability in the autonomic nervous system (Havanka-Kanninen, Tolonen, & Myllyla, 1986; Reading, 1982; Rubin, Graham, Pasker, & Calhoun, 1985) and this may be implicated in migraine attacks. The rationale underlying the use of relaxation therapy is that training in muscle relaxation leads to a calm, relaxed attitude, thus reducing anxiety levels and thereby excessive sympathetic output (Silver, Blanchard, Williamson, Theobald, & Brown, 1979; Mitchell & Mitchell, 1971). Physiological changes which occur during the relaxation response consist of decreased oxygen consumption, respiratory rate, heart rate, and muscle tension as well as increases in skin resistance and electroencephalogram alpha wave activity (Benson, Beary, & Carol, 1974). This lessened activity of the sympathetic nervous system is expected to result in fewer migraine attacks (Silver et al., 1979; Hay & Madders, 1971).

Benson and his colleagues have noted that the relaxation response can be achieved through the use of several methods including autogenic training, progressive muscle relaxation and transcendental meditation. Hypnosis has also been used as a technique to achieve relaxation.

Autogenic training. Autogenic training involves the use of mental imagery and self-talk for the purpose of attempting to influence autonomic nervous system functioning. It was developed by Schultz and Luthe (1969) and consists of the repetition of preselected words and phrases by which subjects suggest to themselves that their limbs are becoming heavy and warm, the warmth is flowing into their hands and that they are becoming increasingly relaxed and comfortable. In conjunction with the autogenic training, biofeedback equipment is usually used to monitor finger temperature in order to allow the individual to become aware of any change in autonomic activity. The expectation is that through the use of these autogenic techniques blood flow into the hands will be increased thus resulting in an increase in finger temperature which would reflect a decrease in sympathetic activity.

Several studies have examined the use of autogenic training in combination with thermal biofeedback for the treatment of migraine headaches. In one of the earliest of these, Sargent, Green and Walters (1973) taught 28 migraine and muscle contraction headache sufferers the hand warming technique with the use of autogenic phrases and imagery. Subjects were seen on

a weekly or biweekly basis for a period of 2 to 4 months and were expected to practise daily at home. Improvement was judged by comparison of the regression lines of three scales - severity of headache, sum of the potency of analgesics used, and number of analgesics used. On this basis 63% of the migraine subjects were judged improved, whereas 33% of the muscle contraction sufferers were considered improved. There are, however, several problems with this study which suggest caution in interpretation of results: differences in duration of treatment for subjects, lack of statistical analysis of the data, and lack of operational definition of the terms improved and unimproved.

Subsequent studies, more tightly controlled and more statistically sophisticated, however, have supported these findings (Andreychuk & Skriver, 1975; Fahrion, 1977; Fried, Lambert, & Sneed, 1977; Mitch, McGrady, & Iannone, 1976; Blanchard, Theobald, Williamson, Silver, & Brown, 1978). However, in all of these studies the effect of the autogenic training has been confounded by the addition of thermal biofeedback. Although it has been suggested that the addition of autogenic training to thermal biofeedback appears to enhance the efficacy of treatment (Blanchard & Andrasik, 1982), this hypothesis has not yet been empirically investigated in a comparison of autogenic training with and without thermal biofeedback.

Only one study has examined the efficacy of autogenic training without the concomitant use of thermal biofeedback,

(Janssen & Neutgens, 1986). In this study patients with either migraine, muscle contraction, or combined migraine-muscle contraction headaches received 12 weeks of either autogenic training or progressive muscle relaxation in small groups. Results indicated that treatment was differentially effective for diagnostic categories. Specifically, both treatments were equally effective for migraineurs, relaxation therapy was superior for muscle contraction headaches and autogenic training was most efficacious for combined headaches. Although this study was admirable for its equivalence of treatment conditions, a major flaw is its employment of only 2 week time periods for recording headache activity for comparison of baseline, posttreatment and three month follow-up periods. This may have led to the exclusion of headaches in their female subjects associated with specific times of the menstrual cycle.

Progressive muscle relaxation. Progressive muscle relaxation is a technique developed by Jacobson in 1938 whereby individuals are taught discriminative control over skeletal muscle groups so that they can achieve very low levels of tonus in each of these groups at will. Jacobson's original procedure was quite lengthy and for this reason most recent research uses an abbreviated version of the technique. There have been few studies in which the usefulness of progressive muscle relaxation has been examined for migraineurs.

In one investigation comparing the relative efficacy of progressive muscle relaxation, a combination of temperature

biofeedback and autogenic training, and a wait list control condition (Blanchard et al., 1978), it was found that both the relaxation and biofeedback subjects improved significantly following treatment, whereas the control subjects did not. Moreover, although relaxation training was more effective than the biofeedback condition in reducing headache activity at the last week of treatment, at 3 months follow-up there were no differences between the two treated groups. This is a well designed study in that careful attention was paid to the equivalence of the two treatment conditions. However, the relatively small number of subjects - 10 per group - may have resulted in the power not being sufficient to detect a difference.

In a later investigation by Blanchard and his colleagues in which larger sample sizes were used (Blanchard, Andrasik, Neff, et al., 1982) 33 muscle contraction, 30 migraine, and 28 combined muscle contraction and migraine headache sufferers were given a 10 session relaxation training program. Analysis of results showed a significant reduction in headache activity for all three types of headaches. In examining the numbers of subjects in each group who achieved a meaningful reduction in headache activity (50% or greater), however, it was found that although 52% of the muscle contraction headache patients achieved this degree of improvement, only 30% of the migraine patients were this successful and only 22% of the combined group.

Warner and Lance (1975) used a very brief variation of

progressive muscle relaxation and combined it with the use of mental imagery for treatment of 13 muscle contraction patients, 8 migraine and 4 combined muscle contraction and migraine patients. Treatment consisted of four 20 minute sessions held at weekly intervals. Patients were instructed to practise daily at home. Questionnaires completed by the patients 6 months later indicated that 18 of the 25 patients had experienced a 50% or greater improvement in frequency. However, because of some discrepancy in the reporting of figures it is impossible to know how many of those who improved were migraine sufferers and how many were suffering from either muscle contraction or combined headaches. Moreover, the retrospective and global nature of the questionnaire used to determine efficacy of treatment may have led to some inaccuracy in the information gathered.

The work of Mitchell and Mitchell (1971) provides results that are somewhat at odds with the previous two investigations. In two studies of 37 migraineurs, they compared the effects of progressive muscle relaxation training, systematic desensitization and a combination of these two treatment modalities plus assertiveness training to a no-treatment control condition. They found that while there was some lowering of migraine frequency and duration in the relaxation group, the reduction in headache activity was neither significant nor significantly different from the control group. Only those in the combined treatment group reported significant improvement. Possibly the fact that the senior author of the research was also

the therapist in this study prejudiced the outcome.

Finally, one group of researchers investigated the use of progressive muscle relaxation administered in a group format, one group being primarily a self-help group, the other being a therapist-assisted group (Williamson et al., 1984). These two groups were compared to what was termed a waiting list control group, although these subjects in fact met for four 1 hour discussion sessions over the 4 week course of the experiment. Results indicated that both groups experienced significant headache improvement compared to the control condition. However, there are several methodological deficiencies in this study, chief of which are the combining of migraineurs, muscle contraction headache sufferers and combined migraine and muscle contraction sufferers in each treatment group and the questionable equivalence of relaxation protocols in the two treatment groups.

Transcendental meditation and hypnosis. One study trained subjects to elicit the relaxation response through the use of transcendental meditation for therapeutic control of headaches (Benson, Klemchuk, & Graham, 1974). Seventeen migraineurs and 4 patients suffering from cluster headaches were taught transcendental meditation techniques during four consecutive lessons and instructed to practise twice daily. Data were gathered from these patients for an initial baseline period of 1 to 3 months and again during a period varying from 4 to 14 months following instruction. Only 3 of the 17 migraineurs experienced

a significant decrease in headache activity, leading the authors to conclude that transcendental meditation is of limited usefulness for the treatment of migraine headache. A major weakness in this research, however, is the differing lengths of time subjects were involved in baseline and data collection following instruction in meditation and lack of an explanation as to how these differences were handled in analysis of data.

Hypnosis, on the other hand, has been shown to be of some benefit in the treatment of migraine (Andreychuk & Skriver, 1975; Graham, 1975; Friedman & Taub, 1984). The study by Friedman and Taub, using 66 migraineurs, compared six treatment conditions and a waiting list control. The treatment conditions consisted of one group which received relaxation training, one which received thermal biofeedback training and four groups which underwent hypnosis. Of these four groups one was comprised of high susceptibility subjects who received hypnosis with thermal imagery, the second included high susceptibility subjects who received hypnosis without thermal imagery, the third and fourth groups were made up of subjects of low susceptibility, one of which included thermal imagery and the other which did not. A strength of this study was its inclusion of a 1 year follow-up period. A weakness is that no attempt was made to separate high and low susceptible individuals in the relaxation and biofeedback groups resulting in non-equivalence in groups. Significant reductions in headache activity and medication usage occurred for subjects following all treatment conditions with no differential

advantage for any one. When the two groups of high susceptible subjects were combined and compared to the two groups of low susceptible subjects at the 1 year follow-up they did find, though, that high susceptibility subjects showed a continued improvement after 6 months, whereas improvement in the low susceptibility individuals tended to plateau or even decrease during the follow-up period. Of note is that the treatment regime required only five clinic sessions for each subject. The additional advantage of the hypnosis conditions was that they required only 3 to 5 minutes of daily home practise as compared to 10 to 20 minutes for the biofeedback and relaxation groups. However, the results of analysis at the 1 year follow-up suggest that perhaps high susceptible individuals are better suited for this treatment modality than are low susceptible individuals. But in an extended follow-up 3 years after treatment it was found that headache parameters had returned to baseline levels, leading the authors to suggest that a yearly reinforcement of the brief procedures might be helpful in the maintenance of treatment gains (Friedman & Taub, 1985).

To summarize, although there is some inconsistency, overall the results of studies investigating the usefulness of the relaxation response used alone in the treatment of migraine headaches suggest it is perhaps not the best strategy. A number of the studies have methodological shortcomings such as the lack of a control group, inconsistent treatment of subjects, use of retrospective data and lack of objective measures of

dependent variables. Of the three studies that are well designed and controlled, two found only a relatively small number of migraineurs or combined muscle contraction and migraine sufferers improved substantially following relaxation training (Blanchard, Andrasik, Neff, et al., 1982; Mitchell & Mitchell, 1971). The third (Blanchard et al., 1978), found a greater proportion of their migraine patients did improve, but given the smaller number of subjects (13) these results may have less reliability. Autogenic training used without biofeedback, and hypnosis have shown promise, but research is insufficient to draw definitive conclusions about their therapeutic efficacy.

Electromyographic Biofeedback (EMG)

The purpose of EMG biofeedback is to teach headache sufferers to reduce the level of muscle activity in the frontalis muscle of the forehead. The underlying assumption, although rarely stated explicitly, is that this lowering of muscle activity in one muscle group will generalize to other muscle groups in the body. The aim of EMG biofeedback, therefore, is to assist the patient in the achievement of a state of relaxation. It follows, then, that the rationale for this treatment modality is the same as that for relaxation training without the use of biofeedback equipment, i.e. a relaxed state will lead to lowered sympathetic output. Because traditionally it has been believed that muscle contraction headaches are associated with sustained contraction of head and neck muscles this treatment modality has been used primarily for muscle contraction headache sufferers

while thermal biofeedback has been the treatment of choice for migraineurs. (However, as documented in the section on definition, recent research has shown that in fact frontalis muscle activity is at least as likely, if not more likely, to be elevated in migraineurs than in muscle contraction headache sufferers.) Thus, although there are several single case studies which examine the use of EMG biofeedback as one component of a treatment package (Feuerstein & Adams, 1977; Feuerstein, Adams, & Beiman, 1976; Medina, Diamond & Franklin, 1976; Sturgis, Tollison, & Adams, 1978) there has been little research into the usefulness of EMG biofeedback as a single treatment strategy for the treatment of migraines.

In comparing EMG biofeedback with relaxation therapy two groups of researchers found no significant difference between these treatment modalities (Daly, Donn, Galliher, & Zimmerman, 1983; Solbach, Sargent, & Coyne, 1984). On the other hand, a third study, in which one or other of these two therapies was administered to 29 migraineurs, 14 combined migraine-muscle contraction sufferers and 59 muscle contraction subjects, relaxation was found to be significantly more efficacious than EMG biofeedback (Hart, 1984). Results may have been attributable in part to the very comprehensive relaxation therapy that included imagery and suggestion along with progressive muscle relaxation as opposed to the biofeedback therapy in which subjects were given very little direction as to how they might achieve a successful outcome. A major drawback of this

investigation is that subjects were drawn from several studies that had involved either EMG biofeedback or relaxation training. Although the author states that the studies shared a common format, it is possible that there was some lack of standardization of procedures.

Two groups of researchers reported that those patients who received relaxation training continued to improve slowly throughout the 6 or 12 month period following treatment, leading the authors to conclude that although relaxation may achieve its effects more slowly than biofeedback, perhaps these effects are more lasting than those achieved through EMG biofeedback (Daly, Zimmerman, Donn, & Galliher, 1985; Lacroix et al., 1983). Two flaws in both of these studies include the retrospective nature of the follow-up questionnaire and the collection of data at follow-up using a different methodology than had been used during the original study.

Other studies have compared EMG biofeedback to other types of biofeedback. For example, Bild and Adams (1980) used EMG feedback training as a control procedure in their evaluation of the efficacy of cephalic blood volume pulse (BVP) biofeedback training in the treatment of migraine headaches. Their results indicated that both groups acquired control over the targeted responses but that BVP feedback was superior to EMG biofeedback, although the differences in dependent variables measured did not always reach significance. Interpretation must be cautious since small sample sizes ($n=6$ or 7) could have led to a relatively high

standard error making reliability questionable.

In another study (Lake, Rainey, & Papsdorf, 1979) in which migraineurs were assigned to either self-monitoring of headaches, EMG biofeedback, digital temperature biofeedback, or digital temperature biofeedback plus four sessions of rational emotive therapy it was found that EMG subjects achieved the targeted response criterion in 85% of trials, and that they reduced headache activity by two-thirds or more of baseline levels. Those in the digital temperature biofeedback groups, either with or without rational emotive therapy, were less successful achieving control over the targeted response, and did not differ from the self-monitoring group in headache activity following training. However, a major confounding variable may have been that 10 subjects were reportedly using vasoconstrictive medication. Furthermore, because of the addition of rational emotive therapy to one of the conditions, treatment groups were not equivalent. Nor was the number of treatment sessions held constant; biofeedback training took place over 8 to 10 sessions, while those receiving rational emotive therapy received three additional sessions.

An investigation by Cohen, McArthur, and Rickles (1980) sought to determine whether positive results attributed to various forms of biofeedback training were specific to the biofeedback procedures employed or to non-specific effects. Forty-two patients suffering either common or classic migraines or mixed migraine-muscle contraction headaches completed training

in one of four biofeedback modalities: frontalis EMG relaxation, finger temperature warming, alpha brain wave enhancement, or vasoconstriction of temporal artery. Besides using four equivalent treatment strategies, these researchers limited the training procedures exclusively to biofeedback in an attempt not to confound treatment with autogenic or relaxation instructions. Analysis of results revealed that all groups had a significant reduction in headache frequency, although no change in intensity or degree of disability. Moreover, physiological changes were small and unrelated to headache outcome. The authors conclude that the biofeedback effect is nonspecific and may be related to a common relaxation effect or a sense of mastery and control.

In conclusion, it would appear that EMG biofeedback is a viable treatment option for migraine headaches. However, the evidence gathered from well designed comparative studies suggests that it may not be the EMG biofeedback itself that is the operative variable, but rather some as yet undefined nonspecific factor, such as, perhaps, self-efficacy beliefs.

Thermal Biofeedback

Thermal biofeedback involves the use of biofeedback equipment to help individuals learn to raise the temperature of their hands. This rise in temperature is accomplished through the dilation of tiny arterioles and capillaries which then allows an increase in blood flow to the hands. One way to achieve this vascular dilation is to lower sympathetic nervous system activity. Thus in learning to increase digital temperature, it

is assumed that the individual is indirectly learning how to exert some control over the functioning of the sympathetic nervous system (Blanchard & Andrasik, 1985). Since migraine attacks are postulated by some to be due to over-reactivity of the sympathetic nervous system, thermal biofeedback training, by enabling migraineurs to learn how to lower sympathetic output, therefore, provides a method whereby headaches can be controlled (Jessup et al., 1979).

For the most part studies comparing thermal biofeedback to other types of biofeedback or to relaxation therapy show no statistical superiority for thermal biofeedback over these other forms of therapy (Andreychuk & Skriver, 1975; Blanchard et al., 1978; Cohen et al., 1980; Daly et al., 1983; Friedman & Taub, 1984; Gauthier, Lacroix, Côté, Doyon, & Drolet, 1985; Lacroix et al., 1983; Lake et al., 1979; Sargent, Solbach, Coyne, Spohn, & Segerson, 1986; Sorbi & Tellegen, 1984).

For example, the study by Cohen et al., (1980) compared four modalities of biofeedback treatment for migraineurs: finger temperature warming, frontalis electromyographic training, alpha brain wave enhancement, and vasoconstriction of the temporal artery. Their results indicated that all types of biofeedback training, with the exception of the alpha group, produced small and statistically significant changes in the predicted directions in the systems for which they received feedback. All groups showed a reduction of 21% to 25% in the number of headaches per week, although there was no change in intensity or duration. A

particular strength of this design, as mentioned earlier, was the careful attempt on the part of the researchers to avoid the use of autogenic or relaxation phrases in their biofeedback training so as not to confound treatment protocol. The fact that treatment gains were modest relative to other studies may be a reflection of this control, since autogenic or relaxation phrases are frequently taught to subjects as a way of helping them learn to alter the physiological processes being monitored.

One study, however, failed to demonstrate improvement in headache activity for those subjects receiving thermal biofeedback compared to subjects receiving progressive muscle relaxation (Attfield & Peck, 1979). Moreover, the biofeedback subjects also failed to demonstrate learning of the hand warming response. In this case, though, treatment took place over only six sessions. Perhaps this is an insufficient number of training sessions to develop control over finger temperature.

Some researchers have questioned the importance of learning to alter finger temperature in the amelioration of headache activity, suggesting that nonspecific effects may be responsible for treatment efficacy. A well designed, carefully controlled double-blind study was conducted by Kewman and Roberts (1980) in an effort to assess the relative contribution of specific and nonspecific effects of temperature biofeedback on migraine headaches. Eleven subjects were trained to increase hand temperature, 12 were trained to decrease hand temperature and 11 control subjects simply monitored headache activity. Neither the

subjects in treatment, nor the two therapists, were told whether subjects were being trained to increase or decrease finger temperature. Rather, subjects were simply told to respond to a tone, a meter, or both, which registered relative changes in finger temperature. All three groups whether treated or untreated, regardless of whether or not they met the learning criterion, and regardless of the direction of temperature changes, showed significant improvement in the number of symptoms experienced during a headache, amount of impairment and the amount of medication intake. There was no significant change in the frequency or duration of attacks. The authors conclude that headache amelioration must be due to nonspecific effects of clinical procedures rather than to the specific effects of temperature alterations.

These results are supported by other investigators who have also found little correlation between changes in skin temperature and migraine parameters (Cohen et al., 1980; Gauthier, Bois, Allaire, & Drolet, 1981; Largen, Mathew, Dobbins, & Claghorn, 1981; Mullinex, Norton, Hack, & Fishman, 1978). In attempting to explain these findings, it has been hypothesized that the effectiveness of this treatment model may be due to a learned ability to stabilize the peripheral vascular system rather than an ability to either increase or decrease hand temperature per se (Gauthier et al., 1981; Feuerstein et al., 1976). This theory is consistent with the contention of Dalessio and others that the vascular system of the migraineur is less stable than that of the

non-migraineur (Blanchard & Andrasik, 1982).

In contrast to the above mentioned research, one group of researchers did report that changes in headache activity were contingent upon direction of temperature change (Turin & Johnson, 1976). These authors found that for 7 migraineurs, headache activity was substantially reduced during training to increase hand temperature whereas it either remained unchanged or increased for 3 subjects who were trained to cool their hands. However, the regular use of ergotamine tartrate by some subjects in this study may have confounded results. Additionally, there was a lack of standardization of treatment protocol; subjects spent varying amounts of time ranging from 6 to 14 weeks in biofeedback training.

A study by Elmore and Tursky (1981) compared two forms of biofeedback - temporal pulse amplitude (TPA) and hand temperature (HTB). Those in the former group were trained to reduce temporal pulse amplitude, while those in the latter group were trained to increase hand temperature. Both groups did learn to control the targeted physiological measures. However, while the temporal pulse group showed significant reductions in two of the six measures of headache activity, the hand temperature group showed no significant reduction in any of these measures. This study raises some interesting questions. The reduction of temporal pulse amplitude suggests a general increase in sympathetic outflow. The rationale for the effectiveness of thermal biofeedback, however, rests on the assumption that it is

beneficial for migraineurs to learn to decrease sympathetic outflow. Moreover, if the reduction of temporal pulse amplitude is indicative of an increase in sympathetic activity one would expect the hand temperature of these patients to be concomitantly decreased. This, in fact, was the case in this study. By the same line of reasoning, one would expect the increased hand temperatures achieved by the hand temperature group to be accompanied by increases in temporal pulse amplitude as a reflection of lowered sympathetic activity. But this did not happen. Instead, temporal pulse amplitude was decreased as the hand temperature group raised their hand temperatures. Similar results were found by other researchers (Sovak, Kunzel, Sternbach, & Dalessio, 1978). These authors suggest, therefore, that the mechanisms regulating the two arterial beds must be different and Elmore and Tursky (1981) suggest that perhaps sympathetic activation may be a more efficacious treatment for migraines than the previously suggested deactivation.

Several studies have combined thermal biofeedback with progressive muscle relaxation therapy. (Blanchard, Andrasik, Neff, et al., 1982; Jurish et al., 1983; Kohlenberg & Cahn, 1981). In the first of these (Blanchard, Andrasik, Neff, et al., 1982) only patients who did not show at least a 60% reduction in headache activity following relaxation training were treated with biofeedback. Fourteen migraine and 14 combined headache migraine and muscle contraction patients were thus given 12 sessions in thermal biofeedback training. Of these, 43% of the migraine and

64% of the combined headache sufferers achieved a 50% or greater improvement in headache activity following this biofeedback treatment. The authors conclude the thermal biofeedback adds a significant increment to the effects obtainable through relaxation therapy alone. However, they did not control for the effects of additional treatment of any type. Thus, an additional 12 sessions of relaxation therapy might have achieved the same enhancement of effects. In the other two studies thermal biofeedback was combined concomitantly with relaxation therapy (Jurish et al., 1983) or with relaxation and cognitive therapy (Kohlenberg & Cahn, 1981) in a self-help format. Jurish et al. reported an overall percent improvement for the combined headache sufferers of 61.5% and for the migraineurs, 45.3% and Kohlenberg and Cahn reported a 62% decrease in headache frequency for 22 migraineurs. But in both of these investigations, because of the combining of strategies, it is impossible to determine how much of treatment efficacy is due to thermal biofeedback.

Thus, thermal biofeedback, with few exceptions, appears to be a useful treatment for migraine headaches. There is, however, no substantial evidence that it is more effective than other modes of therapy, and there is little evidence that its success is contingent upon learning the target response, leading some authors to suggest that the mechanism of action may be non-specific and may be similar for biofeedback and relaxation approaches (Chapman, 1986).

Cephalic Vasomotor Biofeedback

Since the vascular theory of migraine postulates that the painful phase of the syndrome is the result of vasodilation of extracranial arteries (Dalessio, 1980) it was hypothesized that if migraineurs could be taught to voluntarily constrict these arteries they should be able to ameliorate headache activity (Morley, 1985). A limited number of researchers have investigated this hypothesis with the use of cephalic blood volume pulse biofeedback techniques (BVP).

One such investigation was a carefully designed study by Bild and Adams (1980) who compared the efficacy of cephalic blood volume pulse, frontalis electromyographic biofeedback (EMG), and a waiting list control condition for 19 migraine patients. Results indicated that both treatment groups did acquire voluntary control of the targeted response systems. Furthermore, although headache frequency decreased in all groups, this measure only reached significance for the cephalic group. Duration of headaches, disability and intensity declined for both treatment groups, but not significantly. In calculating the numbers of subjects in each group who improved by 50% or more in measures of frequency or weekly duration of headaches, it was found that 6 of the 7 subjects in the cephalic group, 3 of the 6 subjects in the electromyographic group and 1 of the 6 subjects in the waiting list group showed this degree of improvement. Although these data was not analyzed statistically, the authors conclude that cephalic blood volume pulse biofeedback is superior to frontalis

electromyographic feedback in reducing migraine headaches.

These results are consistent with those obtained in other well controlled studies (Cohen et al., 1980; Friar & Beatty, 1976; Gauthier et al., 1985) in which it was found that subjects trained in cephalic blood volume pulse biofeedback were able to reduce the frequency of headaches, although not always the severity. Case studies published by other researchers (Feuerstein & Adams, 1977; Sturgis et al., 1978) are similarly supportive of the efficacy of cephalic biofeedback for migraine headaches.

The study by Friar and Beatty (1976) is interesting in that subjects in their experimental group were trained to vasoconstrict the temporal artery while the control group was trained in digital vasoconstriction. Measurements were taken at both sites for all subjects. Training at the temporal artery site resulted in vasoconstriction not only of the targeted site, but also at the digital site. The reverse was not demonstrated; i.e. those trained in digital vasoconstriction did not exhibit a vasoconstrictive effect at the temporal artery site. Improvement in headache parameters occurred only with successful training in temporal artery constriction, in spite of the coincidental digital vasoconstriction, a finding which seems to undermine the rationale underlying the use of thermal biofeedback. This finding could be interpreted as support for Elmore and Turskey's (1981) hypothesis as described in the section on Thermal Biofeedback, that sympathetic activation rather than deactivation

may be the operant variable mediating treatment efficacy. It will be recalled that in their study of 23 migraineurs those trained in temporal pulse amplitude reduction achieved significant improvement in headache activity while those trained in hand warming showed no significant decrease in headache parameters.

But a study by Gauthier and his colleagues (Gauthier, Doyon, Lacroix, & Drolet, 1983) raises further questions about the mechanism underlying the successful use of cephalic vasomotor biofeedback for the control of migraine headaches. In this study 21 migraineurs were assigned to one of three conditions: temporal artery constriction feedback, temporal artery dilation feedback or a waiting list. They found that both types of biofeedback training were equally effective in the reduction of headache parameters. Moreover, it was found that there was no correlation between outcome measures and the ability to self-regulate the targeted response, leading the authors to speculate, again, that the essential factor could be a decrease in the variability of the blood volume pulse response. A later investigation by Gauthier and his colleagues questioned this position, though, when they found that although changes in headache parameters were correlated with changes in vasomotor variability, blood volume pulse variability was not significantly affected by biofeedback training (Gauthier et al., 1985).

In summary, these studies, while few in number, suggest that cephalic blood volume pulse biofeedback may indeed be an

efficacious therapy for migraine headaches. However, as noted by Jessup et al. (1979) and confirmed by Cohen et al. (1980) it has not yet been demonstrated that there is a significant correlation between physiological changes and symptom amelioration. Possibly, again, we are seeing the results of non-specific effects of treatment.

Cognitive and Cognitive-Behavioral Therapies

Cognitive therapy consists of mental strategies to alter maladaptive attitudes, appraisals and expectations which are postulated to play an important role in both the genesis and the maintenance of the pain experience (Melzack, 1973). Cognitive-behavioral therapies combine cognitive strategies with behavioral techniques such as relaxation, biofeedback, desensitization, or assertiveness training. When used in the therapeutic management of headaches, the goal of both types of treatment is to provide headache sufferers with skills and strategies with which to alleviate maladaptive reactions to antecedent environmental stressful situations that may give rise to headaches. A further objective is to help headache sufferers learn to cope with the distressing cognitive and affective aspects of the headache experience that are likely to exacerbate the pain. Because of the multidimensional nature of pain, the combination of cognitive and behavioral techniques is expected to be more effective than either used alone. Furthermore, since there is no guarantee that any one coping technique will work successfully in all situations, for all individuals, an approach that allows room for

flexibility and thus greater adaptability may be the most effective (Meichenbaum & Turk, 1976). Advocates of this type of therapy criticize the more narrowly focussed therapies such as relaxation and biofeedback for not taking into account the cognitive, affective and behavioral aspects of the pain experience with the suggestion that this may account for the failure of their efficacy for many individuals (Meichenbaum, 1976; Mitchell & White, 1977).

Relatively few studies have attempted to investigate this treatment modality for migraine headaches.

Mitchell and Mitchell (1971) found that a combined treatment package of relaxation, desensitization to distressing objects and events, and assertiveness training was more effective in alleviating migraine headache activity than either relaxation or desensitization alone.

A later investigation (Mitchell & White, 1977) reported a highly successful outcome for migraineurs using a cognitive behavioral approach. A "dismantling" paradigm was used such that subjects were assigned to receive successive components of the treatment package. All 12 subjects recorded headache activity (component 1), 9 subjects received component 1 plus self-monitoring (component 2), 6 subjects received components 1 and 2 plus relaxation and desensitization (component 3), and 3 subjects received components 1, 2, and 3 plus 13 cognitive coping techniques (component 4). The study took place over a period of 50 weeks and each new component was added after a 3 month

interval. Those subjects who received all four components reported a 73% reduction in headache frequency at the end of treatment; this reduction increased to an impressive 83% at the end of a three month follow-up period. Interestingly, this treatment program was based on minimal therapist contact. That is, subjects were seen only once every 12 weeks, at which time they were given taped audio instructions to work through at the rate of two per week. Even so, no attempt was made to control for the greater amount of contact time that subjects received with each additional component. One other problem with a treatment protocol of this duration (48 weeks) is that of compliance. This was not addressed in this publication. One wonders if the program could be successfully applied to larger populations because of the length of time required to complete it.

In another uncontrolled study (Bakal, Demjen, & Kaganov, 1981) it was found that a treatment program consisting of self-monitoring, cognitive coping techniques, relaxation therapy and EMG biofeedback training for patients suffering either muscle contraction, migraine or combined muscle-contraction and migraine headaches effected an average 50% reduction of headache duration and intensity regardless of diagnosis. In this case cognitive coping techniques were designed to deal with the sensations, feelings and cognitions accompanying the headache attacks only. Treatment was not aimed at altering reactions to environmental stressors. It is possible, of course, and indeed quite likely,

that subjects did generalize the application of their newly learned strategies to environmental stressors as well, but this was not investigated.

A cognitive behavioral study, based entirely on a self-help model, was conducted by Kohlenberg & Cahn (1981). In this investigation cognitive techniques were used as an adjunct to thermal biofeedback and relaxation training. One group of migraine sufferers was given a treatment book containing instructions for thermal biofeedback, relaxation and cognitive coping strategies. A group of control subjects was given a popularly available book in which a series of case studies on headache treatment and diagnosis were discussed. Subjects were recruited through newspaper ads and at no time had any personal contact with a therapist. Information was received from, and sent to, subjects by mail. There was a reported 62% decrease in headache frequency after 6 months for those who received the treatment book as compared to a 14% reduction for those who received the control book. However, there were a number of serious methodological deficiencies in this investigation: the lack of a professionally treated control group, the unexplained exclusion of eight subjects with a particularly high frequency of headaches, and, most seriously, a drop-out rate of over 50%.

Knapp and Florin (1981) compared the use of a cognitive therapy for migraineurs without the addition of behavioral components to the same therapy administered in conjunction with cephalic vasomotor biofeedback. Twenty migraine sufferers were

assigned to either a waiting list control condition or to one of four experimental conditions: cephalic vasomotor biofeedback training alone, cognitive therapy alone, five sessions of biofeedback training followed by five sessions of cognitive therapy, or the reverse, five sessions of cognitive therapy followed by five sessions of biofeedback. Nonparametric analysis of results indicated that headache activity improved significantly in all four treated groups. In addition, those who received cognitive therapy reported greater improvement in depression, emotionality and irritability immediately following treatment. At 1 year follow-up, though, these group differences had disappeared (Knapp, 1982). However, the failure to find differences between treatment modalities in this study may have been due to the very small numbers in each group ($n=4$) and therefore a low level of power.

Sorbi and Tellegen (1984), using 21 migrainous subjects also reported that a multimodal treatment program that included a strong cognitive component was efficacious in reducing headache activity. In a comparison of two treatment packages, one comprised of autogenic training and stress-coping training, the other consisting of the same components but supplemented with thermal biofeedback, it was found that equivalent and significant reductions in headache activity were achieved in both groups. These changes were reportedly maintained at a 7 month follow-up. Unfortunately, this was an uncontrolled study. Moreover, because the analysis of data entailed the repeated application of

univariate analyses of variance, the Type I error rate may have been spuriously inflated. No attempt was made to adjust for this.

In a later study these same two authors (Sorbi & Tellegen, 1986) compared the efficacy of cognitive therapy and autogenic relaxation therapy and at the same time compared the effects of treatment on various social behaviors of 29 migraineurs. Although both treatments were equally effective in reducing headache activity, it was found that they had different effects on behavior. Those individuals who received relaxation training were reported to have become more socially withdrawn; i.e. there was a decrease in expression of negative feelings, expression of insecurity, assertion of opinion and interpersonal interest. On the other hand, those in the cognitive program became more socially assertive. There was, however, no evidence that the cognitive therapy, which was aimed at enhancing stress coping capability, differentially enforced active, instrumental ways of coping with stress. But there may be two problems associated with these results. Firstly, no information is supplied on reliability and validity of the questionnaires used to measure social behaviors, and secondly, self-report measures of behavior may not be an accurate reflection of actual behaviors.

Thus, cognitive or cognitive behavioral therapies for the treatment of migraine headache show promise. Whether they are superior to less complex physiologically focussed strategies is not yet clear. It has been suggested by Andrasik and Holroyd

(1980) that physiologically oriented therapies such as biofeedback may exert their effect by leading subjects to develop cognitive and behavioral strategies on their own for the control of headaches. Holroyd and colleagues (1984) have also shown the instrumental role of cognitive variables in the efficacy of EMG biofeedback for tension headache sufferers. If cognitive factors are indeed a mediating variable in the efficacy of treatment for chronic headaches, it seems prudent to develop programs that address this method of coping directly. But the research undertaken thus far to test the efficacy of cognitive-behavioral approaches suffers from numerous methodological flaws: small sample sizes, lack of control groups, high dropout rate, questionable reliability and validity of assessment instruments and inadequacies in statistical analyses.

One further difficulty with cognitive therapies is that, as yet, there is no standardization of treatment protocols across researchers. The wide variety of strategies included or excluded in multifaceted treatment packages, as well as the different techniques used to teach various skills, make the validity of any comparisons questionable.

It is interesting that two of the cognitive-behavioral treatment studies for migraineurs have been either partially (Mitchell & White, 1977) or completely (Kohlenberg & Cahn, 1981) self-help.

Self Help Therapy

Self-help therapies have gained increasing popularity in recent years and programs are available for the treatment of a wide variety of problems. Glasgow and Rosen (1978; 1979) reviewed behaviorally oriented manuals that have been commercially published or empirically evaluated and concluded that self-help therapies are in need of further empirical study; many programs remain inadequately assessed. Where sufficient evidence is available to draw conclusions regarding the effectiveness of self-help therapy, there is considerable variation in clinical efficacy. For example, fear reduction manuals are reported to be moderately beneficial, whereas smoking cessation manuals have been shown to be ineffective.

In the area of migraine headaches, two studies, mentioned above, using a cognitive-behavioral approach in a self-help format have been shown to be effective (Mitchell & White, 1977; Kohlenberg & Cahn, 1981). A third study, described earlier (Williamson et al., 1984) reported group relaxation with a self-help orientation to be as efficacious as a group, therapist-assisted relaxation program, although weaknesses in that study preclude meaningful interpretation of results. The fourth study for migraineurs, one which used biofeedback and relaxation techniques rather than cognitive strategies, also found a self-help approach to be an effective treatment for migraine headaches (Jurish et al., 1983). Forty patients suffering either migraine or combined migraine and muscle contraction headaches received a

thermal biofeedback and relaxation treatment according to either a traditional clinic-based format or a minimal-therapist contact format. Both groups improved significantly and no difference was found between them on four dependent variables measuring headache activity. It was found, though, that a full 78.8% of the minimal-therapist-contact group achieved a 50% or greater reduction in headache activity as compared to 52.4% of the clinic-based group.

These results are in contrast to a study investigating a self-help therapy for muscle contraction headaches. Steger and Harper (1980), in comparing a clinic-based program of EMG biofeedback and stress management with a self-help relaxation program, found the clinic-based therapy to be more effective. However, these results must be treated with some caution since the two treatments were quite different from each other and therefore differing degrees of efficacy may be related to type of treatment rather than locale or amount of therapist contact.

Therapies that are largely home-based may be more efficacious than the traditional clinic-based therapies because it may be easier for response generalization to take place when the techniques are learned at home (Glasgow, Swaney, & Schafer, 1981). The reason for this may be supplied by attribution theory and research. Experimental evidence suggests there is an important role for perceived causality in behavioral change (Kopel & Arkowitz, 1975). Thus, self-attribution, that is perceiving oneself to be the instrument of change in one's own

behavior, results in different subsequent behavioral effects than if one perceives an external agent to be the cause of that initial change in behavior. Self-attributions result in new self-inferences for the individual regarding abilities, which may cut across settings and over time, whereas inferences arising from external attribution are more likely to be specific to the setting and time during which the external conditions are present. Kopel and Arkowitz further suggest that self-attributed behaviors are more likely to be maintained than those attributed to external agents.

In the case of specific individuals there are undoubtedly a myriad of factors that contribute to the efficacy of any given treatment. For example, some individuals may benefit more than others from a home based treatment because of individual differences in preference for involvement in one's own health care (Krantz, Baum, & Wideman, 1980). Krantz et al. have demonstrated that preference for active participation in health care does influence a variety of health and illness related behaviors. In three related studies using the Krantz Health Opinion Survey (KHOS), college students who scored high on preference for behavioral involvement, a subscale of the KHOS, were compared to students who scored low on the same subscale. It was found that high scorers were more likely to be enrolled in a medical self-help course, less likely to have visited the college health clinic during the academic year, more likely to have attempted self-diagnosis in the event of minor illness, and

more likely to choose their own medication if given the opportunity rather than have a nurse choose it for them.

In another study comparing the KHOS to the Multidimensional Health Locus of Control Scale (MHLC) (Wallston et al., 1983), it was found that there was a highly significant negative correlation between the Behavioral Involvement Subscale of the KHOS and the Powerful Others Externality Subscale of the MHLC. That is, persons who prefer active involvement in their own medical care are less likely to believe that their health is controlled by powerful others. At the same time there is a positive correlation between preference for active involvement in one's own care and an internal locus of control orientation.

Several studies investigating interactive effects when subjects are differentiated according to locus of control and placed in different treatment formats have shown that internals prefer situations in which they can assume responsibility and work independently, while externals respond more favourable to a more structured approach (Strickland, 1978). These findings are consistent with those of a recent investigation in which it was found that chronic headache patients with high scores on a measure indicating preference for cognitive structure benefited more from a structured relaxation training program than a relatively unstructured EMG biofeedback program (Hart, 1984). By the same token, those who scored low on preference for cognitive structure had more success in the unstructured biofeedback program than in the more structured relaxation program. In the

same way one might expect subjects who show a high preference for behavioral self-involvement in their medical care would do better in a self-help treatment format than those who show a low preference for self-care.

Moreover, if it can be shown that self-help treatment is at least as effective as the more traditional clinic based treatment for certain disorders and/or certain people, then there may be certain advantages to pursuing this approach. One of the benefits may be enhanced cost effectiveness.

Cost Effectiveness

In attempting to determine which of several alternative treatments is the treatment of choice for a patient population, it is important to ascertain not just the effect of each regimen, but also the cost (Levin, 1975; Posavac & Carey, 1980). This is particularly critical today when rising medical costs are commanding attention and concern. Cost effectiveness can be looked at from two points of view: that of the user of a service and that of the provider.

From the viewpoint of the client one must look at a number of factors. The most salient of these, of course, is the actual bill for services rendered, which for some people, may be partially covered by insurance. Other costs to the individual will be contingent upon the time required to obtain the service. For example, homemakers seeking treatment may need to hire a babysitter; men and women in the work force may lose earnings for

time taken off work; there may also be potential costs in the form of make-up time required to complete work not done while away from the job. Transportation costs to and from the clinic should also be taken into account. Some of these costs are clearly more easily measured than others. It is apparent, also, that there will be considerable variability in the costs to each individual. However, one would expect that a treatment which is primarily home based would result in a lowering of many of these costs.

On the other hand there is the cost of providing the service. Here one would want to consider such items as cost of personnel, facilities, overhead, and equipment. Moreover, costs may vary over the lifetime of a program. For example, start-up costs may be high, but maintenance costs over time may be considerably lower. Although a home based treatment program may have higher start-up costs than a clinic based treatment, one would expect personnel costs to be considerably lower.

Two studies, both done by the same group of researchers, have compared the cost-effectiveness of a home-based, minimal-therapist-contact treatment regime to the same program administered in the more traditional clinic setting with full therapist involvement (Blanchard, Andrasik, Appelbaum, et al., 1985). In the first study in which 53 muscle contraction headache sufferers were treated with relaxation therapy, it was found that the home-based program was more than twice as cost-effective as the clinic-based treatment. In the second study,

conducted by the same group of researchers, 87 migraine and combined migraine and muscle contraction headache sufferers were treated with relaxation and thermal biofeedback. For the migraine patients home-based treatment was four times more cost-effective than clinic-based treatment and for the combined headache subjects home-based therapy was over six times more cost-effective than the clinic-based regime. In both cases cost-effectiveness was determined by calculating the percent improvement in headaches from pretreatment to posttreatment and then dividing this amount by total therapist contact time.

Purpose of the Present Study

The rationale underlying the use of cognitive-behavioral therapy for treatment of migraine headaches is compelling. It is evident that physiological mechanisms are only one factor in the experience of pain; other elements such as cognitions and affect also play an important role (Beecher, 1959; Melzack & Wall, 1983). This being the case a therapeutic approach, such as a cognitive-behavioral one, that addresses these several aspects is likely to be more efficient than an approach which addresses only one variable but leaves others to chance. Investigations have shown a cognitive-behavioral approach to be an effective mode of treatment for migraine headaches. The work by Mitchell and White (1977) described above, has been particularly exciting; migraineurs in their study achieved an 83% reduction in headache frequency at a 3 month follow-up period. Moreover, their

treatment program was a self-help design, with patient therapist contact limited to approximately once every 3 months. The Jurish et al. study (1983) also showed that a behaviorally oriented minimal-therapist-contact program could be highly efficacious, leading to successful treatment outcome for a full 78.8% of subjects in a self-help condition.

These results make self-help programs for migraineurs very appealing, not only for their excellent effectiveness, but also for their cost effectiveness, an especially desirable feature with the ever increasing costs of medical care today. Blanchard, Andrasik, Appelbaum, et al. (1985) reported a combined relaxation and biofeedback program administered to migraineurs in a minimal-therapist-contact format to be fully four times as cost effective as the same program delivered in a clinic-based design.

Thus, for reasons of treatment efficacy and cost-effectiveness, cognitive-behavioral programs administered with minimal therapist contact deserve our attention. Although the results achieved by Mitchell and his colleagues (1977) are especially provocative, their program was unusually and perhaps prohibitively long for most people, requiring as it did, 48 weeks to complete. Other cognitive-behavioral studies have had numerous methodological weaknesses as noted earlier.

Therefore, the purpose of this study was to compare the efficacy of a minimal-therapist-contact cognitive behavioral treatment of headaches diagnosed as common migraine to the same treatment administered in a traditional clinic-based format,

while attempting to remedy a number of the methodological deficiencies of the previously described studies. A sufficient number of subjects were used to enhance external validity. A waiting list control group was used to control for the natural tendency of migraine headache activity to wax and wane. In the minimal-therapist-contact group, telephone contact was maintained on a limited but regular basis in order to lessen the likelihood of drop-out. Appropriate methods of statistical analyses were undertaken to ensure correct interpretation of results. Also, preference for behavioral self-involvement in health care was measured in order to determine if it could be used as an independent variable to predict success in a specific type of treatment.

In addition, cost effectiveness of the two treatment approaches was compared.

Hypotheses

The hypotheses of this study were as follows:

1. Both treatment conditions would result in a significantly greater reduction of headache activity than the control condition. The dependent measures comprising headache activity are operationally defined under Data Analysis.
2. The number of patients who would experience a clinically meaningful reduction in headache activity would be significantly greater in the minimal-therapist-contact treatment condition than in the clinic-based condition. A clinically meaningful reduction

in headache activity was defined as a 50% or greater reduction in the headache index, i.e. a global index of headache activity defined under Data Analysis.

CHAPTER II

METHOD

Subjects

Subjects were recruited through advertisements in local media, through flyers left in the nurses' offices of several government departments, and through physicians' referrals. Approximately 340 people expressed interest in the study and were screened in a standard telephone interview (Appendix A) to see if they met the required diagnostic and other criteria.

Diagnostic criteria were as follows: Paroxysmal headaches plus at least two of the following factors: (a) associated nausea and/or vomiting, (b) throbbing pain, (c) family history of severe chronic headache. Those patients who consistently experienced abrupt visual or motor prodromal symptoms immediately prior to their headaches, a feature of classic, but not common, migraine headaches were excluded. Three people who reported only occasionally experiencing prodromal symptoms were allowed to remain in the study.

Other criteria were as follows:

1. Age 18 to 50 years. The lower age was arbitrarily chosen as defining adulthood for this study. Above age 50 physiological changes associated with aging may confound treatment effects (Blanchard, Andrasik, Evans, & Hillhouse, 1985; Sturgis & Arena, 1984).

2. Recurrent headaches for the past three months or longer. This was intended to rule out subjects whose headaches were caused by a transient stressful situation.

3. Headaches occurring with a minimum frequency of twice per month. Anything less than this would make it difficult to assess the effect of therapy.

4. Not to have started or terminated prophylactic headache medication within the previous one month. Being on prophylactic medication is an exclusion criterion because usage of this type of medication would make it difficult to interpret treatment outcome. Recent discontinuation is also an exclusion criterion because the placebo effect of recent cessation of prophylactic medication may be influential in headache activity (Bakal, 1982).

5. Not suffering from any major neurological or psychiatric disorder which might confound results. The presence of major neurological disorders was determined by a questionnaire completed by the patient's personal physician (Appendix B). The possible existence of major psychiatric disorders was ascertained by administration of the Brief Symptom Inventory and the Beck Depression Inventory, Short Form.

6. Not to have received cognitive or behavioral therapy within the previous five years for treatment of headaches or management of stress. These people may have responded differently to treatment than those who had had no previous treatment of this sort in that they may have been able to learn the skills more

easily than others or conversely, if psychological therapy was ineffectual before they may have been more resistant to this treatment program.

7. Females not to be currently taking the birth control pill or other hormone therapy since migraine activity may be exacerbated by the ingestion of oral contraceptives in women (Dalessio, 1980; Welch, Darnley, & Simkins, 1984).

A total of 67 individuals passed the telephone screening interview. Those people who had not been physician-referred were asked to arrange an appointment with their own physicians in order that a brief questionnaire concerning inclusion/exclusion criteria could be answered and a headache diagnosis supplied (Appendix B). For those who had been physician-referred this questionnaire had already been completed at the time of their referral.

It is possible that the diagnostic criteria listed above could have resulted in the inclusion of people who suffered either common migraine headaches, severe muscle contraction headaches, or a combination of both. As will be recalled from the discussion of the definition of migraine, there seems to be considerable overlap in symptomatology and physiological characteristics related to these three types of headaches. Several researchers have suggested that differences may be quantitative rather than qualitative, with migraine headaches being at the more severe end of a continuum. Others find it more clinically helpful to continue to treat these headaches as

distinct and separate entities. At this point in time the issue remains unresolved. Therefore, in this study it was decided that homogeneity could best be achieved by including only subjects who not only met the criteria as described above, but who also received a diagnosis of common migraine from their physicians. It was anticipated that those subjects who were diagnosed as suffering migraine headaches would be similar in that they would be most likely to be at the severe end of the continuum, if indeed muscle contraction and migraine headaches are on a single continuum.

Fifty-three subjects met all of the above criteria and were accepted into the study to begin baseline recording of headache activity.

Dropouts

Two subjects were deleted from the study following baseline, one because of an insufficient number of headaches, the other because all his headaches were self-diagnosed as sinus headaches.

Three subjects dropped out during treatment, one because she felt the program was not appropriate for her, the other two because of time pressures and other commitments. Two of these subjects were in the clinic-based treatment condition, the third was in the minimal-contact treatment condition. This is a dropout rate of 6%. Thus, 48 individuals completed the treatment or waiting period.

Those 17 subjects who were assigned to the waiting list

control condition recorded headache activity for 4 weeks following their waiting period and then were randomly assigned to one or other treatment condition. During this treatment period one of these people dropped out for apparent lack of interest, and another had bands put on his teeth and could therefore no longer be considered part of the study, since bands designed to change the jaw alignment may have an effect on head pain and would therefore confound treatment effects (Carlsson & Gale, 1976).

Three subjects were unable to be located at the 6 month follow-up period, leaving 43 subjects who completed the 4 weeks of recording 6 months following treatment.

Demographic Data

See Table 1 for compilation of demographic data. Of the 48 patients who completed the treatment or waiting period, there were 7 men and 41 women, ranging in age from 23 to 48 years (mean 36.6 years). Family income ranged from less than \$10,000 to over \$50,000 (mean \$30,000 to \$40,000), and highest level of education achieved ranged from "some high school courses" to a master's or doctoral degree (mean "some university courses"). Number of years suffered from migraines, i.e. chronicity, ranged from 2 to 40 years (mean 16 years).

Insert Table 1 about here

Therapists

Therapists were two female graduate students, one at the doctoral level, one at the master's level. Supervision was provided by a registered psychologist. Because of time constraints for the master's level therapist, two-thirds of the subjects were seen by the doctoral student. Each therapist saw an approximately equal number in each experimental condition.

Procedure

Following receipt of the physician's questionnaire indicating a diagnosis of common migraine, a therapist met with each subject to be sure the individual understood the nature of the study and to obtain a signed consent form (Appendix C). At this time the importance of not altering the type of medication the individual was currently using was reiterated. Amount of abortive or palliative medication required could be adjusted according to need though.

Several questionnaires were administered during this visit:

1. The Behavioral Involvement scale of the Krantz Health Opinion Survey (Appendix D), a scale which is reported to have a test-retest reliability of .71 and an internal consistency coefficient of .74 (Krantz et al., 1980). These authors also reported three related studies done with university students which provided evidence of predictive, discriminant and construct validity. This scale was used in order to determine if preference for involvement in one's own health care would be

correlated with outcome, particularly in the minimal-contact treatment condition.

2. The Brief Symptom Inventory (Appendix E), which has also been demonstrated to be a valid, reliable instrument (Derogatis & Melisaratos, 1983). Test-retest reliability for the global symptom index was reported to be .90; internal consistency coefficients for the nine dimensions of the scale ranged from .71 to .85. Reported validity studies showed high convergence between the subscales of the BSI and similar scales of the MMPI (.32-.55); principal component analysis provided evidence of construct validity; several criterion-oriented validity studies were also reported to have shown predictive validity. This was one of the tests used to determine the presence of severe psychiatric disorder. On this instrument the individual's score on the Global Symptom Index, the most sensitive single indicator of distress level, was used to detect severe psychiatric problems. The cut-off point was set at 2.5 standard deviations above the mean. Although this is higher than that suggested by the authors of this test as being indicative of psychiatric disorder (they suggest a cut off score at almost 1.5 standard deviations above the mean), it was found that the lower cut-off score would have excluded too many people who did not appear in reality to have notable adjustment problems. Two prospective subjects were excluded on the basis of their scores on this Inventory and were advised to consider more in-depth therapy than would be offered in this study.

3. The Beck Depression Inventory Short Form (Appendix F), an instrument which has been shown to have a Pearson correlation of .61 with a clinical depth-of-depression rating scale which was extensively used in the development of the long form of this inventory and a correlation of .96 with the total depression score of the long form (Beck & Beck, 1972). This was the second test used to determine the presence of serious psychological problems. Two subjects who obtained a score of 17 or over, indicative of severe depression, were excluded from the study and were encouraged to seek professional help.

4. The Derogatis Stress Profile (Appendix G), a recently developed self-report scale designed to measure stress. The subscales making up the three stress domains measured by this instrument are reported to have test-retest reliabilities ranging from .82 to .89 and internal consistency coefficients from .83 to .88 (Derogatis, 1987). Factor analytic studies provide evidence of construct validity. A preliminary study to determine predictive validity with a small sample of diabetics suggested that the instrument shows promise of having good predictive validity, although the research investigating this property is as yet somewhat limited. The purpose of the administration of this questionnaire was to compare the amount of stress the individual was experiencing prior to beginning the program with the amount experienced following treatment. It yields five measures: environmental stressful events, personality characteristics that affect one's coping with stress, the nature and magnitude of

emotional responses to stressful events, a total stress score, and finally, a subjective stress score that provides a measure of the subject's self-appraisal of the amount of stress being experienced.

5. A Demographic and Headache History Questionnaire (Appendix H). This questionnaire included a retrospective estimate of frequency, duration and intensity of headaches during the previous month, information which was used to determine a subjective measure of severity which was then used as a blocking variable to ensure that chance factors did not result in any one of the experimental conditions having an inordinate proportion of subjects suffering particularly severe headaches. In addition there were several questions concerning how frequently headaches had interfered with various activities (work, school, caring for home and/or family, leisure) during the previous month. To take into account the fact that one or two of these categories of activities might not be applicable to all subjects, scores for each category were totalled and then converted to a standardized score out of 100.

A credibility questionnaire (Appendix I) was administered to each subject immediately prior to beginning the 3rd therapy session. This time frame was chosen so that subjects would have an opportunity to become acquainted with the procedures involved. When, as is frequently the case, the credibility questionnaire is administered before treatment begins it may be that what is being evaluated is credibility of therapy rationales rather than

credibility of the actual program itself (Glasgow & Rosen, 1978). This questionnaire was used to determine if both treatment conditions were equally credible.

During the initial visit subjects were taught by means of instructions, role playing and feedback how to keep daily headache diaries (Appendix J). Diaries are described in more detail below. Sufficient diaries were supplied to last for 4 weeks and baseline recording began. Completed diaries were returned weekly in stamped, addressed envelopes. During this period subjects were phoned approximately every 10 days to encourage compliance. Daily diary recording continued during the treatment phase of the program, for 4 weeks following the waiting period for the control subjects, for 4 weeks posttreatment, and again for 4 weeks 6 months following completion of treatment.

At the end of the 4 week baseline recording period subjects were categorized as more or less severe according to the subjective measure of severity which, as described above, was calculated from information obtained from the Demographic and Headache History Questionnaire. Within these blocks they were then randomly assigned to a minimal-therapist-contact treatment condition, a clinic-based treatment condition or a waiting list control condition. Subjects were then assigned on an alternate basis to one or other of the two therapists. Those who were assigned to a treatment condition were seen by their therapist, a rationale for treatment was provided (Appendix K), and therapy was begun immediately. Details of each treatment condition are

outlined below. Subjects who were assigned to the waiting list condition were told that they would be contacted when an opening became available for treatment and they then waited for 8 weeks.

All contact time with each subject, whether in person or by phone was recorded. In addition, time spent trying without success to reach each individual was recorded.

The Headache Diary

This diary (Appendix J) is similar to that used by numerous headache researchers and was adapted from the work of Epstein and Abel (1977). It has been shown to be a valid instrument for the measurement of headache activity for both children (Richardson, McGrath, Cunningham, & Humphreys, 1983) and adults (Blanchard, Andrasik, Neff, Jurish, & O'Keefe, 1981). For this study the diary was in the form of printed pads of a size small enough to fit into a man's shirt pocket or a lady's purse. They were designed in this way in order to encourage prospective rather than retrospective recording. Each pad consisted of 28 pages, with each week being a different colour to enable the subject to see easily when it was time to mail in the completed pages. A number of indices were recorded on these diaries, including headache intensity, time of onset and termination of each headache, suspected triggers, amount of time spent doing homework assignments each day, and for half the subjects, medication usage.

Headache Intensity

This was recorded 4 times daily (at breakfast, lunch, supper and bedtime). By choosing these specific break times during the day it was hoped that subjects would be encouraged to comply with recording requirements. Collins and Martin (1980) compared hourly and four-a-day ratings and found that little information is lost when the less demanding four-a-day ratings are used. Intensity was rated on a 6-point scale: 0 - No headache; 1- Headache - I am only aware of it if I pay attention to it; 2- Headache - but I can ignore it at times; 3 - Headache I can't ignore it, but I can do my usual activities; 4 - Headache - It's difficult for me to concentrate. I can only do easy activities; 5 - Headache - such that I can't do anything.

Headache Onset and Termination

In addition to recording at the four specified times, subjects were asked to record the time any headaches began and when these headaches terminated.

Suspected Triggers

Subjects were also asked to record suspected trigger factors for each headache. This was done in order to help determine the proportion of headaches perceived to be stress-related and whether this proportion was decreased by treatment. Unfortunately, it turned out to be impossible to analyze this data because so frequently subjects declared they did not know what the trigger was. Of a total of 721 headaches experienced during baseline by the entire sample, the trigger was stated to

be unknown for 42% of them.

Homework Assignments

Subjects were required to record the amount of time spent (a) practising relaxation, (b) doing written assignments associated with skills being taught throughout the program, (c) reading the instruction manual, and (d) listening to instruction tapes. There were two reasons for doing this: firstly to encourage compliance to assigned homework, and secondly, to determine how much home practice contributed to treatment efficacy. Subjects were urged to complete this section of the diary honestly without attempting to please the researcher. It was explained that because this was a research project it was more important that data be accurate rather than that subjects be seen to be compliant.

Medication Usage

Due to an oversight this data was not collected on everyone. Only slightly more than half the subjects ($n = 28$) recorded daily medication intake including type of medication, strength and dosage.

The major limitation of the headache diary is that it consists entirely of self-report measures of a subjective experience. A measure of social validation was therefore provided using the method described by Blanchard and his colleagues (Blanchard et al., 1981). That is, in order to determine if changes reported by subjects were readily detectable by a significant other person, at the termination of treatment

each person was asked for the name and address of a significant other person to whom a social validation questionnaire could be mailed. The importance of not discussing this form with the significant other was explained to the subjects. The questionnaire included a 100 millimetre analog scale which was anchored by "unchanged or worse" on the left-hand side and "markedly improved or cured" on the right-hand side (Appendix L). Each significant other person was asked to mark a point on the scale indicating how much improvement he or she perceived in the subject's headaches. Scores were then determined by measuring the number of millimeters from the left-hand edge to the point where the individual had marked the line. In the original development of this scale a significant Pearson product moment correlation of .44 was found between percent improvement calculated from headache diaries and the global rating obtained from the significant others.

Description of the Three Conditions

Clinic-Based Condition

Subjects were seen weekly for eight 60 minute sessions. The cognitive-behavioral approach consisted of the following components: an educational phase emphasizing the control that people can have over their perceptions of, and reactions to, environmental and interpersonal events; teaching subjects how to use cognitive and somatic reactions as cues to recognize maladaptive responding and to identify the relationship between

situational variables and this responding; and finally, teaching the following cognitive and behavioral skills: cognitive restructuring, thought stopping, attention diversion, imagery, pain transformation, behavior rehearsal, assertiveness, and problem solving (see Appendix M for details of each session). Homework, designed for the purpose of helping subjects learn and practice the skills being taught, was assigned after each session and was discussed at each subsequent session. As well, progressive muscle relaxation was taught throughout the program by the use of audio tapes which were given to each subject for daily home practice. The method used was based on Bernstein and Borkovec's (1973) adaptation of Jacobson's (1938) original training program. During weeks one and two, 14 muscle groups were tensed and relaxed; during weeks three and four, certain muscle groups were combined so that there were now eight consecutive tensings and relaxings; during weeks five and six, the same eight groups of muscles were relaxed without first tensing; and during the final 2 weeks subjects were asked to follow the same procedure daily, but mainly by recall, listening to the tape only once each week. In addition, cue controlled relaxation was introduced during session six of the program. This is a technique which is designed to help the individual achieve a relaxed state very quickly in everyday situations in response to a self-produced cue (Bernstein & Borkovec, 1973). As well, implementation of all techniques and skills into daily living, including those times when the individual was experiencing a

headache, was encouraged.

Each subject also received one chapter per week of a treatment manual and weekly audio tapes of instructions on cognitive-behavioral techniques. This was the same written and audio material that was given to the minimal-therapist-contact subjects and this procedure was followed in order that the two treatments would be equivalent in this regard. It was explained to the subjects in the clinic-based treatment condition that this material was identical to that which was given personally by the therapist, but that it might be useful should they wish to review any topics that had been covered during sessions. The printed forms for doing weekly homework assignments were included with each chapter of the manual.

Minimal-Therapist-Contact Condition

In this condition subjects received the same components of treatment as in the traditional clinic-based treatment but in this case therapy was administered by means of a self-help manual and tape recorded instructions. The manual and audio tapes contained exactly the same information but because it was presented in both the audio and visual modes individuals were able to choose the mode most appealing to them. Some persons reported that they occasionally chose to follow both at the same time. The manual, as mentioned, also contained the necessary forms for doing homework assignments. The relaxation exercise, which was identical to that which subjects in the clinic condition received, was provided on the second side of each tape.

Before beginning treatment each subject was seen for approximately one half hour in the clinic so that the procedure could be explained. In order that progression through the program would occur at the same rate as for the clinic-based subjects, one chapter and one audio tape were mailed to the subject each week for the next 8 weeks. Subjects were supplied with sufficient stamped, addressed envelopes so that completed homework assignments and headache diaries could be mailed back to the therapist on a weekly basis. Subjects were contacted by phone approximately every 10 days to encourage compliance, to discuss homework assignments and to clarify any concepts with which the individual might have been having difficulty. At the beginning of the 5th week the individual was once again seen in the clinic. The purpose of this visit was to enhance compliance, to lessen the possibility of dropout and to encourage the individual in their efforts (see Appendix P for a schedule of this treatment condition).

Wait List Control Condition

Because migraine headache activity tends to wax and wane it is important to control for the passage of time. Therefore, after the control subjects had completed 4 weeks of baseline recording they were told that an opening was not yet available for treatment. They then waited for a period of 8 weeks, following which they were asked to complete another 4 weeks of recording of headache activity. While it would have been desirable for purposes of experimental design to not treat these

individuals in order that they could have ^Abeen used as a control group for the 6 month follow-up period, for ethical reasons this was not felt to be appropriate. Therefore, after their 4 weeks of recording following the waiting period they were randomly assigned to a treatment condition and therapy proceeded in the manner described above according to which condition they were assigned.

Follow-Up

Subjects were recontacted by mail 6 months following treatment and asked to complete several questionnaires and 4 weeks of daily headache diaries in order that maintenance or changes in treatment gains could be examined. Questionnaires included The Derogatis Stress Profile, a questionnaire concerning how much headaches were interfering with activities (Appendix Q) and a questionnaire indicating the individual's use of the various coping skills and strategies that had been taught (Appendix R).

Compliance

Compliance to regular recording in headache diaries, to returning data, and to completing homework exercises was encouraged in several ways:

1. Subjects recorded in their diaries only 4 times a day during usual break times when the number of concurrent activities would be at a minimum. (This was with the exception of the

recording of time of onset and termination of specific headaches.)

2. The importance of daily recording at specified times, rather than on a recall basis was explained and emphasized to each subject.

3. Each subject was phoned approximately every 10 days during those times when they were not being seen for treatment.

4. Recording reminders in the form of colorful stickers were given to each subject to post in appropriate places, for example on the dresser mirror, at their table place, on their bedside table.

5. Subjects were provided with sufficient stamped, addressed envelopes in order that they could easily send in collected data on a regular basis.

6. It was hoped that compliance to both practice of relaxation and completion of homework assignments would be encouraged by asking subjects to record in their diaries the amount of time spent on each of these aspects of treatment. However, in order to discourage the recording of practice or homework that did not actually take place, the importance of honesty in this regard was explained.

Data Analysis

Dependent Variables

Data from the headache diaries yielded a number of measures that were used in analyzing the outcome of this study. The

dependent variables were as follows:

1. Peak headache intensity for each week. This was the highest intensity rating for the week and was used as a measure of maximum amount of incapacitation experienced by the individual for that week. It was averaged for each 4 week period.

2. Duration. Duration of all headaches was summed for each 4 week period.

3. Frequency. This was the total number of headaches experienced for each 4 week period. Headaches that appeared to endure for more than 1 day were counted as separate headaches. Thus, for example, a headache that appeared to last for 2 days was counted as 2 separate headaches. This was done because of the difficulty of knowing whether in fact the same headache had continued throughout a period of sleep or whether one headache had ended and another one had begun the next morning. Therefore, for the sake of consistency it was decided to always consider headaches on consecutive days as being separate.

4. Medication index. This variable was a measure of the amount and potency of analgesics used throughout each period of 4 weeks. Potency for each medication was rated according to the following scale:

1. Those containing acetylsalicylic acid or acetaminophen up to 325 mg.

2. Those containing acetylsalicylic acid or acetaminophen between 326 and 500 mg.

3. Those containing codeine 1/8 gr.

4. Those containing codeine 1/4 gr.
5. Those containing codeine 1/2 gr.
6. Demerol.

The medication index was calculated by multiplying each analgesic by its potency value and then summing these amounts for each 4 week period.

Blocking by Severity

As previously noted, a retrospective measure of headache activity was used to categorize subjects into two groups - more or less severe - before they were randomly assigned to treatment. However, it was discovered that there was considerable discrepancy between these estimates and the actual severity as measured during the 4 week baseline period. Using sensitivity and specificity tables as described by Sackett et al. (1985) it was found that the positive predictive value of the retrospective estimate of severity was only 65%. That is to say, 65% of the subjects whose retrospective estimates of headache frequency, duration and intensity indicated their headaches were relatively more severe, were indeed found to fit into the more severe category when their headache activity was prospectively measured during 4 weeks of baseline recording. Conversely, 35% of the retrospective estimates did not agree with the prospective measure. This could mean one of two things: either the retrospective estimates were inaccurate, or there was a variation in headache activity over the two time periods sampled. Since there was no way of knowing which of these two possibilities was

true without asking subjects to do long term recording before beginning treatment, it was decided to assume the former. Thus, for statistical analysis the retrospective estimate of severity was ignored and subjects were blocked on severity as determined by information obtained from the 4 week baseline recording period.

For purposes of this study severity is measured by the headache index. This measure, used by a number of researchers, is a reflection of frequency and duration, as well as intensity. It is calculated by summing all the intensity ratings for the four week period, and dividing by 28, to give an average daily score with a range of 0 to 20 (Blanchard & Andrasik, 1985). Because it is comprised of a number of aspects of headache activity it can be conceived of as a global index of headache severity. Blocking by severity in this manner allows for examination of the possible interaction between severity and response to treatment.

Method of Data Analysis

Analysis of covariance was considered as a possible means of controlling for initial differences in headache severity but was rejected for a number of reasons and a post hoc blocking procedure as described above was used instead. The reasons for this decision and its implications are discussed in Appendix U.

The following analyses were conducted:

1. Multivariate analysis of variance to examine differences between the control and treated groups on the dependent

variables.

2. Multivariate analysis of variance to examine changes in the dependent variables at a 6 month follow-up period.

3. Comparison of cost-effectiveness of the two types of treatment using a t test for independent groups.

4. Comparison of credibility ratings for treatment groups using a t test for independent groups.

5. Comparison of the amount of time subjects spent doing homework assignments and practising relaxation in each of the treatment groups using a t test for independent groups.

6. Pearson product moment correlations to correlate percent improvement scores with estimated improvement by a significant other for each subject as a measure of validity for the headache diaries.

7. Multivariate analysis of variance to examine changes in stress levels following treatment.

8. Multiple regression to determine if certain variables predicted improvement in headache activity. The variables used were (a) score on the Behavioral Involvement Scale, (b) baseline headache index, (c) chronicity, i.e. the number of years the individual had suffered migraines, and (d) amount of time spent doing homework assignments and practising relaxation.

9. Analysis of variance to determine if there were changes in the amount of disability experienced at 6 months follow-up. Disability was defined as the frequency with which subjects found it necessary to curtail various activities due to headaches.

10. Examination of frequency with which subjects used the various coping strategies that had been taught.

11. Chi-square analysis to determine if there was a significant difference between groups in the number of subjects who achieved a clinically meaningful reduction in headache activity. A clinically meaningful reduction was defined as a 50% or greater improvement in the headache index from baseline to posttreatment.

CHAPTER III

RESULTS

Multivariate analysis of variance was the primary method of analysis for this study. When using this type of analysis several issues need to be considered: assumptions of normality and homogeneity of variance must be met, a condition of multicollinearity must not be present, and because of the sensitivity of MANOVA to outliers, they must be deleted. These issues have been evaluated and are presented in Appendix S. Correlations between dependent variables and the blocking variable, severity, are presented in Appendix T.

All statistical analyses were done using SPSSX computer programs.

The results of this study are divided into four sections:

1. Evaluation of the three group controlled outcome study.
2. Evaluation of effects of treatment at a six month follow-up period.
3. Evaluation of cost effectiveness of the two types of treatment.
4. Examination of a number of issues related to treatment outcome.

Evaluation of the Three Group Controlled Outcome Study

In these analyses the control group, minimal-therapist-

contact group and clinic-based group were compared for differences occurring from baseline to the posttreatment or postwait period, depending on group assignment. Table 2 illustrates the mean values and standard deviations for the three main dependent variables for the 4 week baseline period and the 4 week posttreatment or postwait period. Single factor analyses of variance showed that there were no significant differences between groups at baseline on any of the dependent variables.

Insert Table 2 about here

Initially a 2x2x3 repeated measures multivariate analysis of variance was conducted using scores on peak intensity, duration and frequency as dependent variables and severity (less severe, more severe), time (baseline, posttreatment or postwait period) and group (control, minimal-contact, clinic) as the independent variables. Results are presented in Table 3. The analysis yielded a significant multivariate group by time interaction, Pillai - 0.43, $F(6,80) = 3.62$, $p < .001$, and a significant main effect for time, Pillai - 0.54, $F(3,39) = 15.14$, $p < .001$. Interactions involving the blocking variable, severity, were not significant.

Insert Table 3 about here

Subsequent univariate analyses of the group by time

interaction revealed a significant difference in peak intensity, $F(2,41) = 4.53$, $p < .05$, and frequency, $F(2,41) = 6.40$, $p < .005$. The difference in duration was not significant. However, in order to protect against an inflated Type I error, which may result from doing these repeated analyses of variance on the same data, the predetermined alpha level was divided by 3 (3 univariate tests). Setting the alpha level at .05 and dividing by 3 lowers the acceptable level to .017. By this more conservative standard the changes in both variables remain significant (frequency, $p = .004$ and peak intensity, $p = .017$).

Post hoc comparisons of cell means using Tukey's Honestly Significant Difference Test were then undertaken to determine between which groups the differences were to be found on these two variables, frequency and peak intensity (see Table 4). Using a critical value of $q_{.05} = 3.33$ for frequency it was found that significant differences existed between the control group and either treatment group at the posttreatment or postwait period ($p < .05$), but not between the two treatment groups. Similarly for peak intensity, using a critical value of $q_{.05} = 3.30$, it was found that a significant difference existed between the control group and either treatment group ($p < .05$), but not between the two treated groups.

Insert Table 4 about here

The fourth dependent variable, medication index, was treated

separately because, as noted in the Method section, only half the subjects recorded medication usage. Table 5 shows baseline and posttreatment or postwait means and standard deviations for these 28 subjects. Analysis of variance indicated that there were no significant differences between groups at baseline on this measure.

Insert Table 5 about here

A 3x2 repeated measures analysis of variance comparing differences in medication index between the three groups (control, minimal-contact, clinic) over time (baseline, posttreatment or postwait) indicated that the group by time interaction was significant, $F(2,25) = 4.14$, $p < .05$, as was the main effect of time, $F(1,25) = 4.50$, $p < .05$ (see Table 6).

Insert Table 6 about here

Post hoc analysis of the group by time interaction for the medication index using Tukey's Honestly Significant Difference Test with a critical value of $q_{.01} = 4.33$ showed that the difference between the control group and the minimal-contact group was significant at the posttreatment or postwait period ($p < .01$). But neither the difference between the control group and the clinic group, nor the difference between the two treated groups was significant (see Table 7).

Insert Table 7 about here

Summarizing these results, it can be seen that there were significant differences between the groups at the posttreatment or postwait period in two of the variables measured, frequency and peak intensity. On both variables, frequency and intensity, both treated groups were significantly different from the control group, but not from each other. Subjects in each group responded similarly regardless of whether headaches were categorized as more severe or less severe.

Similarly, there was a significant difference between the groups on medication index at the posttreatment or postwait period. In this case, the minimal-contact group was significantly different from the control group, but the clinic group was not.

Evaluation of Effects of Treatment at Six Months Follow-Up

The control group could not be followed at the 6 month follow-up period since, for ethical reasons, these subjects were randomly assigned to a treatment group and treated following their 8 week period of waiting. The following analyses, therefore, compare the two treated groups only. Data from control subjects following their treatment were not added to the data from the original two treated groups. Since these people had had to wait longer for treatment and had done an extra 4

weeks of recording of headache activity, it was suspected that they might now be different from the other two groups.

Again, the three main dependent variables were peak intensity, total duration and frequency and subjects were blocked for severity using the headache index. Table 8 shows the means and standard deviations for the three main dependent variables for the baseline, posttreatment and follow-up periods.

Insert Table 8 about here

The three dependent variables were subjected to a 2x2x3 repeated measures multivariate analysis of variance with the blocking variable (less severe, more severe), group (minimal-contact, clinic), and time (baseline, posttreatment, follow-up) comprising the independent variables. The results are presented in Table 9. Although there were no significant interactions, the multivariate main effect for time was significant, Pillai's $\lambda = 0.82$, $F(6,19) = 14.13$, $p < .001$.

Insert Table 9 about here

Subsequent univariate trend analyses, presented in Table 9, revealed significant linear effects for all three dependent variables; peak intensity $F(1,24) = 8.46$, $p < .01$; duration $F(1,24) = 21.96$, $p < .001$; frequency $F(1,24) = 45.98$, $p < .001$. The quadratic trend was significant only for frequency, $F(1,24) =$

7.07, $p < .05$. These results, including the quadratic function for frequency, remain significant even when the more conservative alpha level of .017 (.05/3) is adopted (linear trend for peak intensity $p = .008$, duration $p = .000$, frequency $p = .000$; quadratic trend for frequency $p = .014$).

Further MANOVAs comparing baseline to posttreatment and posttreatment to follow-up revealed that the significant change occurred in the first time period, Pillai - .679, $F(3,24) = 16.99$, $p < .001$, but that no further significant change was detected during the second time period.

In sum, these results indicate that the two treated groups did not differ in how they changed. Furthermore, significant changes occurred in all three variables, peak intensity, frequency and duration from baseline to posttreatment, but not during the second time frame, from posttreatment to follow-up.

The failure to find a difference between these two groups, however, must be interpreted with caution. Because of the very small effect size and the relatively small sample size the power in this analysis is very low. Using Cohen's (1969) formulae it was found that effect size was .10 for peak intensity, .05 for duration and .09 for frequency. With the alpha level set at .05 and a sample size of 14 per group, using Cohen's tables the power level was determined to be only between 6% and 8%.

The fourth dependent variable, medication index, was again treated separately. Table 10 shows baseline, posttreatment and follow-up means and standard deviations for this variable.

Insert Table 10 about here

A 2x3 repeated measures analysis of variance using group (minimal-contact, clinic) and time (baseline, posttreatment, follow-up) as independent variables indicated that although the group by time interaction was not significant, the main effect of time was, Pillai - .43, $F(2,14) = 5.32$, $p < .05$ (see Table 11).

Insert Table 11 about here

Subsequent univariate F tests (Table 11) showed the linear function to be significant, $F(1,15) = 6.21$, $p < .05$, while the quadratic function was not significant. Dividing alpha by 2 to control for inflation of Type I error rate ($.05/2 = .025$) leaves the linear function still significant ($p = .025$).

Here too, additional analyses revealed that the significant change occurred during the baseline to posttreatment period (main effect for time, $F(1,15) = 9.22$, $p < .01$, but that there was no significant change from posttreatment to follow-up.

Cost Effectiveness of the Two Types of Treatment

Cost effectiveness was examined at the posttreatment period for the two treated groups. Cost effectiveness was determined by first calculating percent improvement in overall headache activity using the change in headache index from baseline to

posttreatment, then dividing this figure by therapist contact time in minutes. Contact time included the amount of time spent with each subject, whether on the phone or during personal contact, as well as the number of minutes spent trying unsuccessfully to reach subjects by phone. This latter aspect of time was deemed important since it did constitute use of the therapist's time, and it was frequently a factor in the minimal-contact group. Average contact time for subjects in the clinic-based group was found to be 7.2 hours, for those in the minimal-contact group 2 hours. In three instances the subject's headache index was higher at posttreatment than at baseline. This resulted in a negative percent improvement score and therefore a negative cost effectiveness index. In these cases the index was converted to zero indicating that treatment was not at all cost effective. The cost effectiveness index was .36 for the minimal-contact group and .10 for the clinic group. Using a t test for independent groups this was found to be a significant difference, $t(28) = 2.80$, $p < .01$ (see Table 12).

Insert Table 12 about here

Examination of a Number of Issues Related to Treatment Outcome

Credibility Ratings

A credibility index was obtained for each subject by summing the individual's ratings on each of the five questions comprising

the credibility questionnaire (Appendix I). Total possible score was 25. These scores were then compared for each treatment group. Using a t test for independent groups it was found that there was no significant difference in credibility ratings between the two groups. Both groups found treatment to be credible: minimal-contact group, mean 19.7, standard deviation 3.1; clinic group, mean 21.1, standard deviation 2.8.

Homework

Comparison of the two treated groups, using a t test for independent groups, revealed no significant differences in the amount of time spent doing homework assignments or in practising relaxation. Over the course of the 8 week treatment program the minimal-contact group spent an average of 17.38 hours engaged in these two aspects of homework (mean per week, 2.17 hours), the clinic group spent an average of 18.55 hours (mean per week, 2.32 hours).

Social Validation

Social validation is a technique developed by Blanchard and his colleagues as an attempt to provide a measure of validity for the headache diaries (Blanchard et al., 1981). An estimate of global improvement was first obtained from a significant other person for each subject using the questionnaire described in the Method section (Appendix L). This measure was then correlated with percent improvement in the headache index from baseline to posttreatment for all subjects in the two treated groups. Negative percent improvement scores obtained for 3 subjects whose

headache indices were higher at posttreatment than at baseline were converted to zero indicating no improvement at all. This was done so that this measure of improvement would more closely resemble the scale used by the significant other in which becoming worse was equated with no change and was scored as zero. Average percent improvement estimated by significant others was 45.43%; average percent improvement as calculated from the headache diaries was 42.45%. The obtained Pearson product moment correlation, although low, was statistically significant, $r = .38$, $p < .05$.

Changes in Stress Levels

Since the aim of treatment was to help migraineurs learn to control levels of stress that might be either triggering migraine attacks or contributing to exacerbation of the pain of the headaches, it was deemed desirable to measure stress levels before and after treatment. Two scores on the Derogatis Stress Profile were used for this purpose, total stress score and subjective stress score. The former, total stress score, is a global measure consisting of 11 subscale scores which measure situations in the individual's home, work and health environments which contribute to stress, personality characteristics that are relevant to stress related disorders, and the tendency to certain emotional response patterns. The subjective stress score, on the other hand, is the individual's subjective representation of how much stress he or she is currently experiencing.

The total stress score and subjective stress score were

treated as dependent variables and subjected to a 2x3 repeated measures multivariate analysis of variance using treatment group (minimal-contact, clinic) and time (baseline, posttreatment, follow-up) as the independent factors. Table 13 illustrates means and standard deviations for both the dependent variables for the three 4-week time periods.

Insert Table 13 about here

The results of analysis, shown in Table 14, indicate that the group by time interaction was not significant. However, a significant main effect was found for time, Pillai - 0.66, $F(4,21) = 10.32$, $p < .001$.

Insert Table 14 about here

Subsequent univariate F tests as summarized in Table 14 reveal significant linear and quadratic trends for both total stress score and subjective stress score as follows: total stress score linear function $F(1,24) = 10.01$, $p < .005$; total stress score quadratic function $F(1,24) = 11.18$, $p < .005$; subjective stress score linear function $F(1,24) = 17.21$, $p < .001$; subjective stress score quadratic function $F(1,24) = 22.57$, $p < .001$. Dividing the predetermined alpha level of .05 by 2 to protect against an inflated type I error rate still finds these changes to be significant at $p < .025$ (total stress score linear

function $p = .004$, quadratic function $p = .003$; subjective stress score linear function $p = .000$, quadratic function $p = .000$).

Further 2x2 MANOVAs examining the changes in these same measures from baseline to posttreatment and then from posttreatment to follow-up show that changes were significant over the first time period, Pillai - 0.64, $F(2,25) = 22.15$, $p < .001$, but not for the second time period from posttreatment to follow-up.

In summary, examination of these results indicates that significant changes occurred in stress levels as measured by both total stress score and subjective stress score, over treatment and that these changes were maintained at a 6 month follow-up period.

Variables Predicting Improvement

A question of interest was whether certain variables would predict improvement following treatment. A standard multiple regression analysis was performed using percentage of change in headache index from baseline to posttreatment as the dependent variable and the four following measures as the independent variables: (a) preference of the individual to be involved in his or her own health care as determined by their score on the Behavioral Involvement scale of the Krantz Health Opinion Survey. (b) chronicity, i.e. the number of years the individual had suffered migraines, (c) the amount of time spent doing homework assignments including practising relaxation, and (d) severity of headaches as measured by the headache index at baseline. The

first variable, preference for self-involvement in one's own health care was of interest because of its demonstrated association with a variety of health and illness related behaviors where subjects were given an opportunity for self-help (Krantz et al., 1980). The use of the remaining three variables in the regression equation was based on clinical judgment. Chronicity and severity could be predictive of outcome since it was felt that headaches of long duration and/or greater severity might be more resistant to treatment. In addition, homework time could be important since it is generally assumed that the learning of new skills requires practice for successful implementation. Only four variables were used because it has been suggested that a minimum requirement is to have four to five times more subjects than variables in order that the regression solution will be meaningful (Tabachnick & Fidell, 1983). In this case there were 15 subjects per group.

Pearson product moment correlation values are presented in Table 15. When both treatment groups were combined no significant predictors were noted. When type of treatment was taken into account there were still no significant predictors for the minimal-contact group including the variable of particular interest, reported preference for self-involvement in health care. For the clinic-based group when all four variables were entered into the equation, the regression was not significant. However, when homework time was deleted because of its very low correlation with improvement ($r = -.02$), leaving only preference

for self-involvement in health care, chronicity of headache problem and severity of headaches at baseline as predictor variables, the regression was significant, $F(3,11) = 3.90$, $p < .05$. Of these three independent variables only one was significant in the prediction of improvement - number of years suffered migraine headaches ($t = 2.60$, $p < .05$). Surprisingly, this was a positive correlation, i.e. the greater the number of years suffered migraines, the greater the improvement in headache activity following treatment. Although the correlation between baseline headache index and percent improvement was significant ($r = -.44$, $p < .05$), it did not contribute significantly to regression. There was, however, a trend towards significance ($t = 2.07$, $p < .10$) suggesting that there is a tendency for those whose headache activity is greatest at baseline to improve the least with treatment.

For the clinic-based group 52% of the variance in percent improvement was accounted for by the three independent variables listed above that resulted in a significant regression, i.e. preference for self-involvement in health care, chronicity and severity of headaches at baseline. However, caution must be exercised in interpreting these results because of the small sample size. The value of R^2 tends to be spuriously inflated with small sample sizes (Tabachnick & Fidell, 1983). In this case the sample included only 15 subjects. When adjustment is made for the expected overestimation, the amount of variance that is accounted for by the three variables entered into the equation

drops to 38%.

Insert Table 15 about here

Degree of Disability

The degree of disability subjects were experiencing was defined as the frequency with which various activities had to be curtailed due to headaches. In order to determine if treatment would effect a change in disability, disability scores were obtained from retrospective questionnaires administered at baseline (Appendix H) and at follow-up (Appendix Q). For the minimal-contact group the disability index dropped from 60.21 at baseline to 51.00 at follow-up, while for the clinic group it dropped from 59.80 to 51.87. Table 16 illustrates these means along with standard deviations at baseline and follow-up.

Insert Table 16 about here

These scores were subjected to a 2x2 repeated measures univariate analysis of variance. Disability score was the dependent variable, treatment group (minimal-contact, clinic) and time (baseline, follow-up) were the independent variables. Results, shown in Table 17, indicate that the group by time interaction was not significant, but the main effect of time was, $F(1,27) = 6.05$, $p < .05$. Thus, it can be concluded that there was no difference between the groups in their responses on this

variable and subjects in both groups reported headaches to be interfering with activities significantly less 6 months following treatment than before treatment.

Insert Table 17 about here

Use of Coping Strategies

Table 18 tabulates the frequency of use of the various coping strategies that were taught during the treatment programs. These were obtained from a retrospective questionnaire (Appendix Q) administered at the 6 month follow-up period in which subjects were asked to indicate how often they had used each strategy during the previous month. Values listed are the average weekly use for each subject. Strategies are grouped so that some strategies include several techniques. Thus, relaxation strategies include four types of relaxation techniques: progressive muscle relaxation including tensing and relaxing major muscle groups, progressive muscle relaxation without tensing muscles first, cue controlled relaxation and relaxation of facial muscles only. Imagery techniques include four types of imagery. 'Other Strategies' include attention diversion, thought stopping, observation of pain as a scientific phenomenon, mental activities and behavior rehearsal.

Insert Table 18 about here

As can be seen from Table 18, strategies were reported to have been used approximately equally by both groups. The average weekly frequency of use of all strategies combined is 21.4 for each subject in the minimal-contact group and 20.92 in the clinic group. A t test for independent groups showed that these were not significantly different from each other.

Achievement of 50% Reduction in the Headache Index

A different, and perhaps more stringent, way to examine the efficacy of treatment is to look at the frequency with which individual subjects achieve a specific degree of improvement over the course of treatment (Hugdahl & Ost, 1981). Recently, some researchers in this field have suggested that a 50% improvement rate in the headache index is clinically meaningful (Blanchard et al., 1982; Daly et al., 1985; Jurish et al., 1983). Accordingly a chi-square analysis was conducted to determine if there was a significant difference between the two treated groups and the control group on this variable at the posttreatment or postwait period. Results, presented in Table 19, show that 18% of the control group achieved a 50% reduction in headache activity as did 33% of the minimal-contact group and 47% of the clinic group. The chi-square analysis indicates that the difference between the groups was not significant. Power analysis using Cohen's (1969) formulae and tables, however, revealed that with the small effect size obtained (.07), the power was only approximately 32%, and therefore this lack of difference must be interpreted cautiously.

Insert Table 19 about here

Summary of Results

The main findings in these analyses were that there was a significant reduction in headache frequency, duration and peak intensity following treatment for both treated groups. Medication usage was also shown to be lowered for those subjects in both treatment groups who recorded this variable, although the difference between the clinic-based group and the control group did not reach significance. Analyses indicated that significant changes in headache parameters occurred during treatment; any changes that occurred during the 6 months following treatment were non-significant. Moreover, there was no significant difference detected between treatment groups. That is, on the dependent variables measured, the minimal-therapist-contact group and the clinic-based group responded in a similar way to treatment. Treatment for the minimal-contact group, however, was significantly more cost effective than for the clinic group.

Stress levels were decreased significantly and equally for both treatment groups following therapy, changes that were maintained at follow-up.

Credibility ratings were the same for both treated groups, as was the amount of time spent doing homework assignments or practising relaxation.

Using a measure of social validity, the headache diaries were found to be valid.

Only one of four variables examined, the number of years suffered migraines, was a significant predictor of percent improvement, and this variable was significantly correlated with the dependent variable only for the clinic-based group. None of the four independent variable was a significant predictor for the minimal-contact group.

At a 6 month follow-up subjects in both treated groups were experiencing significantly less disability, as measured by the frequency with which activities had to be curtailed due to headaches, than they had been experiencing at baseline.

Also at the 6 month follow-up period individuals in both treated groups reported using the coping strategies they had learned with equal frequency.

Nonparametric analysis indicated no significant difference between the groups in the numbers of subjects who achieved a 50% or greater reduction in headache activity.

Discussion of these findings will be presented in the following chapter.

CHAPTER IV

DISCUSSION

The First Hypothesis

The first hypothesis of this study stated that both treatment conditions would result in a significantly greater reduction of headache activity than the control condition. As can be seen from the Results section this hypothesis was supported.

When compared with the control group, subjects in both treatment programs achieved a significant reduction in frequency and peak intensity of headaches. The difference in duration was not significant. These results were similar whether headaches were more severe or less severe. Furthermore, there was no significant difference between the two treated groups.

An examination of percent change in these variables will make interpretation of the results more meaningful. When scores for those subjects with either more or less severe headaches were averaged the percentage of change in peak intensity from baseline to posttreatment was 26% for the minimal-contact group and 12% for the clinic group. That is, on the intensity scale according to which subjects rated headaches from 0 to 5, peak intensity for the minimal-contact group dropped almost a full point, from 3.75 to 2.79, whereas for the clinic group intensity dropped approximately 1/2 a point from 3.65 to 3.20. What this means is

that following treatment the pain of the worst headaches was less intense and therefore less incapacitating.

Percent change in duration was 18% for the minimal-contact group and 36% for the clinic group. That is, on average each subject in the minimal-contact group suffered headaches for a total of approximately 102 hours for the 4 weeks before treatment and only 84 hours for the 4 weeks following treatment. On average those in the clinic group experienced headaches for a total of approximately 112 hours for the 4 weeks prior to treatment and this decreased to 71 hours for the 4 weeks after treatment.

Frequency of headaches was the variable most favorably affected by treatment. The minimal-contact group achieved a 28% reduction, decreasing from approximately 14 headaches for the 4 weeks preceding treatment to 10 headaches following treatment, while the clinic group achieved a full 46% reduction, decreasing from approximately 15 headaches for the 4 week pretreatment period to 8 headaches posttreatment. In all cases the percent improvement was greater, although not significantly so, for those who suffered less severe headaches than for those for those with more severe headaches.

When the influence of the control group was removed from analysis and the two treated groups were analyzed separately, the changes in all three measured aspects of headache - peak intensity, duration and frequency - were statistically highly significant following treatment.

No further change in these headache parameters took place during the 6 month follow-up period. That is, treatment gains were maintained, but were not enhanced with the passage of time.

These results compare favorably with some other studies that have used a cognitive-behavioral approach for treatment of migraine headaches and less favorably with others. Intensity cannot be compared because of different ways of measuring this variable in each study. For example, in this study the measure of intensity referred to peak headache intensity per week, in the study by Bakal et al. (1981) intensity was combined with duration, in Sorbi and Tellegen's studies (1984, 1986) intensity was an average measure for each headache.

Duration was measured by two groups of researchers. In the study by Knapp and Florin (1981) a 75% decrease in duration was found posttreatment. But because analysis grouped together non-equivalent treatments of cognitive coping and cephalic vasomotor biofeedback, interpretation of their results must be cautious. The two studies by Sorbi and Tellegen (1984, 1986) reported no significant change in duration for the first study in which cognitive coping was combined with relaxation, but a 19% decrease in the second study where cognitive therapy was used alone without behavioral adjuncts. Thus, the decreases in duration obtained in the present study - 18% for the minimal-contact group and 36% for the clinic group - are comparable or better than their results.

Frequency has been reported to have decreased by anywhere

from 62% to 83% by some researchers (Knapp & Florin, 1981; Kohlenberg & Cahn, 1981; Mitchell & Mitchell, 1971; Mitchell & White, 1977) and by lesser amounts in the studies by Sorbi and Tellegen: 53% for the program combining relaxation and cognitive coping (1984) and 30% for the program using cognitive therapy alone (1986). It would appear that the studies reporting the greater treatment gains are those in which there are serious methodological flaws: inappropriate combining of groups in the data analysis (Knapp & Florin, 1981), very large dropout rate (Kohlenberg & Cahn, 1981) or small sizes (Mitchell & Mitchell, 1971; Mitchell & White, 1977). The results of the present study compare favorably with those of the more methodologically sound studies conducted by Sorbi and Tellegen (1984; 1986): a 28% reduction in frequency for the minimal-contact group and a 46% reduction for the clinic group.

Medication usage, a dependent variable that was measured for half the subjects, was found to be significantly decreased following treatment for those in the minimal-contact program. Although the use of medication also decreased for those in the clinic-based group, this reduction was not significantly different from the controls. Again, when the influence of the control group was removed from analysis, it was found that the reduction achieved by both treatment conditions was significant and this reduction was maintained at the 6 month follow-up period. The measurement of medication usage took into account the number of analgesic pills ingested or injections received as

well as the potency of these medications. It was found that whereas the control group increased their intake of medication by 14% while they were waiting for therapy, the subjects in the minimal-contact treatment program decreased their medication intake following treatment by 33% and those in the clinic-based program lowered their intake by 28%.

In a comparison with the Sorbi and Tellegen studies (1984, 1986), it is evident that these decreases are considerably less than their first study in which a combined program of relaxation training and cognitive therapy resulted in a 71% decrease in medication intake, but are similar to their results for cognitive therapy alone which led to a 28% reduction. However, it must be kept in mind that the measures are not identical since in this study potency was taken into account whereas in their studies medication usage was a simple pill count.

The results of the present investigation indicate that improvement in headache activity for those subjects in the two treated groups was not due to these people resorting to a greater reliance on medication. The 14% increase in the medication index for the control group while they were waiting for treatment is of note. It will be recalled from Table 19 in the Results section that 3 of the control subjects showed an improvement of at least 50% even before receiving any treatment. An examination of individual diaries indicates that these 3 subjects all increased their medication intake during the waiting period. Possibly this factor was at least partly responsible for their decrease in

headache activity. Medication usage seemed to be of particular importance for the subjects of this study. Many individuals remarked during the initial interview that they were unhappy with the amount of medication they consumed and would like to explore other means of controlling headaches with a view to reducing medication usage. It is apparent that many were successful in attaining this goal.

Cost Effectiveness

It was found that cost effectiveness was considerably superior for the minimal-contact treatment over the clinic-based treatment. The former condition was fully three and a half times more cost effective than the latter. This is comparable to results obtained by Blanchard and his colleagues (Blanchard, Andrasik, Appelbaum, et al., 1985) who reported a program consisting of relaxation therapy and thermal biofeedback to be four times more cost effective for migraineurs when administered in a self-help format than when delivered in a more traditional clinic-based manner. In the present study subjects in the clinic-based program required an average of 7.23 hours of therapist time whereas those in the minimal-therapist-contact program required only 2 hours. At the current rate of fees for therapy recommended by the Ontario Psychological Association (\$92. per hour) this amounts to a cost of \$665. for the clinic patient and a cost of only \$184. for the minimal-contact patient, a difference of \$481. This is of considerable importance in

light of recent concern about ever-increasing health care costs. In addition, the saving in therapist time means that the therapist could see more patients, an advantage that is likely to be particularly beneficial in institutional settings such as hospitals where there are often long waiting lists for psychological services.

In this study the treatment programs were administered by graduate level psychology students. It is possible that the minimal-contact program could be at least partially administered by a technician, trained by, and under the supervision of, a registered psychologist, leading to an even greater savings in psychologists' time and health care dollars. This, however, awaits further research.

This greater cost effectiveness of the minimal-contact condition was achieved without adversely affecting the dropout rate (1 dropout in the minimal-contact group as compared to 2 in the clinic condition), without any loss of credibility (both treatment programs were rated equally credible), and without any effect on the amount of time spent doing homework assignments (both groups spent an equal amount of time practising relaxation and doing homework assignments).

Changes in Stress Levels

It would appear that the aim of the treatment programs, i.e. to help migraineurs learn to control levels of stress, was achieved. As measured by the Derogatis Stress Profile,

individuals did learn to control at least some of the environmental and internal factors that were contributing to stress. Following treatment global scores reflecting three components of stress - environmental events, personality mediators and emotional responses - were significantly decreased. In addition, the subjective experience of stress was significantly less. However, these changes, although significant, were relatively small: for total stress score the minimal-contact group achieved a 9% reduction, the clinic group a 13% decrease; for subjective stress score the percent changes were 14% and 15% respectively. It is interesting to note, moreover, that the initial scores on these two measures of stress were only slightly above the mean. The mean is 50 for both scales; on the Total Stress scale baseline scores were 56.08 and 56.33 for the minimal-contact group and clinic group respectively and on the Subjective Stress scale they were 52.62 and 50.67. Following therapy these scores ranged from 44.20 to 48.15. Henryk-Gutt and Rees (1973) state that migraineurs are not exposed to more life stresses than others. This appears to be confirmed by these total stress scores. But they also report that migraineurs experience significantly more subjective symptoms of emotional distress than do non-headache individuals. The subjective stress scores as measured by the Derogatis Stress Profile used in this study would seem to contradict this notion. These relatively normal scores also do not support the speculation of Cohen (1978) that migraineurs tend to be overly sensitive to a variety of

stimuli, interpreting innocuous stimuli as dangerous or threatening.

The fact that baseline subjective stress scores are within normal limits may cause one to question the role of stress in the migraine syndrome. It could be argued that the assessment instrument used in this study, the Derogatis Stress Profile, was insufficiently specific and therefore not sensitive enough to the individual's perception of stress. On this instrument subjective stress is a global measure in which subjects are asked to indicate what their current level of stress is by placing a mark on a 100 millimeter analog line. Perhaps a more detailed questionnaire concerning subjective stress would have yielded different results. And yet, the close relationship of scores on the Total Stress scale and the Subjective Stress scale do not support this argument. The Total Stress scale includes a number of items that do reflect subjective experience, for example, "I am frequently frustrated in my work," "Sometimes I feel tense and anxious for no apparent reason," "Doing my job gives me a good feeling about myself." It would have been expected, therefore, that if subjects were experiencing more inner distress it would have been reflected, if not in a higher score on the Subjective Stress scale than on the Total Stress scale, then at least in a higher than normal score on both measures.

Another explanation for the role of stress in migraineurs in spite of their relative normalcy in reported levels of stress could be that a vasomotor dysfunction in migraineurs leads to a

physiological reaction in response to even normal levels of stress that is different from non-headache individuals. It has been suggested that the cephalic vasomotor system of migraineurs may be especially reactive to stress (Adams et al., 1980; Williamson, 1981), although, as will be recalled from the section on Vasomotor Responsivity, studies in this area of research are as yet inconclusive. In particular, there is a paucity of research related to naturalistic, environmental stress. The one study that did expose subjects to real-life stressors as opposed to laboratory stressors found that whereas non-headache controls reacted to conditions of stress with an increase in temporal artery pulse amplitude, the migraineurs showed no such increase (Goudswaard et al., 1985). If it is the case that even normal levels of stress tend to precipitate a migraine attack then the aim of a cognitive-behavioral approach to therapy would be to help migraineurs bring these levels of stress to a point below the normal.

The changes in stress levels in this study were similar following both treatment programs; unfortunately they were not measured for the control group following their waiting period.

For the two treatment groups the reduction in stress levels continued to be maintained at 6 months follow-up. Examination of Table 13 which illustrates these results suggests, though, that at the time of follow-up stress levels were beginning to increase slightly, although not significantly. It would be of value to follow these people for a longer period of time to see if this

trend continued. If it did, it would be worthwhile to examine the status of headaches at this time as well. A concomitant increase in headache activity would help establish more definitively the link between stress and migraines. Should such a correlation be found, the possibility of a booster session in stress management might be considered, in order to prevent relapse.

It may be, though, that the observed change in direction of stress levels at the 6 month follow-up is merely a temporary anomaly, since it is apparent that at the time of follow-up the subjects were continuing to use the skills they had been taught. On a questionnaire enquiring as to how frequently the various techniques had been used during the previous month, subjects reported that indeed they were using numerous strategies on a relatively frequent basis; on average each subject reported using the techniques a total of 21 times per week. All subjects used a variety of strategies; of the 16 techniques taught, each individual reported using anywhere from 3 to 10. This tends to support the position set forth by Meichenbaum and Turk (1976) and Mitchell and Mitchell (1971) that teaching a variety of skills enables individuals to be flexible in their use of coping strategies, choosing the techniques that are most individually suitable and most appropriate for any given situation. It is interesting to note that, overall, the various forms of relaxation were the most frequently used strategy, although Blanchard and Andrasik (1985) have pointed out that relaxation

alone is not very effective for migraineurs. All subjects, without exception, reported using at least one of the relaxation strategies in their coping efforts. In addition, all but one subject reported using cognitive restructuring as a method of preventing or alleviating stress. Perhaps this is not surprising since both of these techniques, relaxation and cognitive restructuring, were given special and on-going emphasis throughout the program.

Minimal-Therapist-Contact Versus Clinic-Based Therapy

On all dependent measures used, subjects in both treatment groups responded similarly. Self-attribution theory as discussed in the Introduction, would have led one to expect those in the minimal-contact program to show greater improvement than those in the clinic-based treatment program. This theory suggests that in a self-help type of program individuals are likely to perceive themselves to be the agents of change in their behaviour and this self-inference regarding newly developed abilities is more likely to lead to generalization over situations and time than changes which are attributed to an external agent, in this case, a therapist (Kopel & Arkowitz, 1975). But, this theory did not seem to be applicable in this study. It may be that because of the way in which the programs were presented people in both groups felt themselves to be involved in a self-help program. When subjects in the clinic-based program were introduced to the program, emphasis was placed on the necessity of they themselves

doing the majority of the work; the therapist was there to teach and guide them, but the learning and development of the skills would be up to them. Consequently, they may, in fact, have perceived themselves rather than the therapist to be the primary agent of change. Thus, it may have been that self-attribution did occur, although not just for the minimal-contact subjects as would have been anticipated, but for subjects in both treatment conditions. The administration of self-efficacy questionnaires following both forms of treatment might have helped to shed some light on the question of self-attribution.

A second explanation for the similarity in outcome for the two treatment programs may be simply the low power. With a power level of less than 10% the chances of finding a difference are indeed minimal. Thus it is conceivable that there is a difference in efficacy between the programs, but it was not detected in this analysis. But according to Cohen's tables (1969), in order to reach a more acceptable power level of 70 or 80 with the small effect size achieved in this study (less than .10) a sample size of 300 to 400 subjects per group would be needed (p.304)!

Factors Related to Improvement

Not everyone improves with cognitive therapy, as has been demonstrated in this, as well as in other studies. In their experience with muscle contraction headache sufferers Blanchard and Andrasik (1985) have found that some patients seem to be more

"psychologically-minded" than others and these people tend to do well with cognitive therapy. Others tend to resist the notion that psychological factors or stress play a role in their headaches, and these people seem to do better with physiologically oriented therapies such as relaxation or biofeedback. However, this is anecdotal data only at the moment and awaits empirical verification.

Bakal (1982), too, has noted in his studies of patients with migraine, muscle contraction, or combined headaches, that some do very well with a cognitive approach while others show no improvement. He reports that treatment outcome was not predicted by diagnosis, pain location, symptomatology, sex, age or chronicity. The one factor that did seem to be of predictive value was the episodic nature of the headaches. Those patients with continuous or near-continuous pain during waking hours derived little benefit from a cognitive-behavioral approach to treatment.

In a recent investigation of the cognitions of headache sufferers (Demjen & Bakal, 1986) it was shown that the thoughts of those with more severe symptoms are predominantly related to the headaches themselves rather than to environmental issues and that, additionally, these people tend to deny non-pain related feelings and concerns. This tendency to denial may contribute to their not doing well in cognitive therapy and the suggestion was made that if the individual could first be helped to modify the pain-related distress, thereby bringing the pain cycle under some

control, they then might be better able to deal with broader psychodynamic issues. In the present study pain related thoughts and feelings were dealt with concomitantly with environmental stressors. In the cognitive restructuring exercises it was suggested to subjects that they conceptualize their headaches as stressful experiences and apply the same skills that they were learning to use to cope with stressful environmental situations. Whether or not this was a contributing factor to successful outcome was not examined, however.

In the examination of specific variables that might predict improvement it had been expected that subjects who had a high preference for behavioral self-involvement in their health care might show more improvement in a self-help treatment format than those who showed a low preference for behavioral self-involvement. This proved not to be the case. In the minimal-therapist-contact group the correlation between percent improvement and score on the Behavioral Involvement scale ($r = .28$) was not significant. It is of interest, nonetheless, that this correlation is considerably higher than the correlation between percent improvement and behavioral involvement score for those in the clinic group ($r = .07$). It is possible that with a larger sample size the correlation in the minimal-contact group might become significant. According to power tables in Cohen (1969) a product moment correlation of .28 has only about a 19% chance of being significant when the alpha level is set at .05 and there are only 15 subjects. Therefore, it would probably be

worthwhile to assess this variable, preference for self-involvement in health care, in a future study using a self-help paradigm with a larger number of subjects.

In the clinic group one variable significantly predicted percent improvement and this was chronicity, i.e. the number of years the individual had suffered migraines. But the direction of the correlation between improvement and chronicity was surprising; those who improved the most were those who had suffered migraines the longest. It is unclear as to why this should have been the case. Perhaps those who had suffered the longest were the most motivated and therefore developed more skill at using the various stress reducing strategies. Once again, however, one must interpret these findings with caution because of the relatively small number of subjects in the group ($n = 15$).

The Second Hypothesis

The second hypothesis of this study was not supported. This hypothesis stated that the number of patients who would experience a clinically meaningful reduction in headache activity would be significantly greater in the minimal-contact treatment condition than in the clinic-based condition. A clinically meaningful reduction in headache activity was defined as a 50% or greater reduction in the headache index following treatment. The chi-square analysis indicated that the difference between groups was not significant. One reason for this negative finding may

have been the low power level (32%) which means that even though a difference may have existed the probability of rejecting the null hypothesis was low. Therefore interpretation of these results must be tentative.

Examining specific proportions, it can be seen that the number of subjects who experienced a clinically significant reduction in headache activity according to the above definition was in fact greater in the clinic-based treatment condition (47%) than in the minimal-contact condition (33%). The success rate for the clinic group was somewhat higher than the 40% success rate obtained for migraineurs treated in a clinic setting in the study by Jurish and her colleagues (Jurish et al., 1983), but the success rate for the minimal-contact group was considerably lower than their reported 70% success rate for this group. It was also lower than a comparable, expanded version of the Jurish et al. study in which it was reported that 55% of migraineurs in a minimal-contact group achieved a 50% or greater reduction in headache activity (Blanchard and Andrasik, 1985). Several explanations, although speculative in nature, might be put forward for the lesser reductions achieved by those in the minimal-contact group in the present study.

1. The therapeutic regime designed by Jurish and her colleagues was a behavioral program: subjects were taught relaxation and thermal biofeedback. The present study was more cognitively oriented: subjects were taught relaxation, but rather than thermal biofeedback they were taught numerous stress management

techniques, several of which were quite psychologically-oriented, requiring some degree of insight. Blanchard and Andrasik (1985) note that certain headache sufferers are resistive to cognitive therapy procedures and consequently do poorly with this approach. Possibly if these individuals were to be seen on a regular basis, as would happen in a clinic-based program, this resistance could be spotted and overcome. In a minimal-contact approach this resistance would be more difficult to detect, and even if detected would be more difficult to deal with, given the infrequent personal contact between therapist and client. It is worth noting that in this study the three individuals whose headaches were worse following treatment were all from the minimal-contact group. Possibly this was partially due to a certain resistance in these subjects to the cognitive orientation of the approach.

2. A second factor that might have been playing a role in the comparatively low percentage of subjects in the minimal-contact condition who achieved a 50% reduction in headache activity is the time element. It may be that the large number of strategies which were taught over a relatively short space of time was too much to be absorbed and integrated in a self-help type of format. At least 2 subjects in the minimal-contact condition did remark about half-way through the program that they felt somewhat overwhelmed by the number of skills to be learned. Perhaps when a large amount of information is presented by a therapist, rather than being learned on one's own, it is more manageable. Although

a similarly large number of skills was incorporated in the self-help program developed by Mitchell and White (1977), their treatment program took place over a full 48 weeks. In a study comparing a multimodal program of therapy for muscle-contraction headache sufferers to a program consisting of only one component of the more comprehensive package, it was found that the unimodal program was as efficacious as the multimodal treatment (Bell, Abramowitz, Folkins, Spensley, & Hutchinson, 1983). The authors speculate that because of time constraints the addition of extra therapeutic skills in the comprehensive program may have resulted in diminishing returns. Goldfried (1977) has also suggested that subjects' inability to master several techniques may lead to a relative inefficiency of combined approaches. While it is conceivable that extending the duration of the program might result in a greater number of subjects in the minimal-contact condition achieving a 50% reduction in headache activity, certain disadvantages might ensue. For example, an extension in program length could lead to an increase in the number of dropouts. It could also result in a decrease in cost-effectiveness due to the increased number of therapist contacts necessitated by such a change.

3. The inclusion of thermal biofeedback training in the self-help program developed by Jurish and her colleagues could also have been a factor in the larger number of subjects in their study achieving a 50% reduction in headache activity, but for a reason unrelated to the therapeutic modality per se. In their

study subjects were each given a thermistor in order that they could practice lowering finger temperature at home. As they became successful in this endeavour they would, of course, receive positive reinforcement in the form of the lower temperature readings on the thermistor. In a cognitively oriented program positive reinforcement is also important, but in this case reinforcement takes the form of self-praise and self-encouragement. The fact that this is neither concrete nor visible, and that it originates from within the individual rather than from an external source such as a significant other or a piece of equipment, may make it less effective as a reinforcer. Moreover, it seemed to be difficult for many of the individuals in this study to praise themselves at all. Often they made remarks such as, "I'm not used to telling myself I'm doing a good job," or "I find it hard to give myself a pat on the back - it just doesn't seem right." In the clinic-based program the therapist was able to help clients regularly and directly with this reticence. In the minimal-contact program a reluctance to engage in self-encouragement was not always as evident and even when it was uncovered, the occasions for dealing with it were relatively infrequent because of the fewer number of client-therapist contacts.

But, this way of analyzing data, i.e. defining a successful outcome as the achievement of a certain percentage of improvement and then determining the number of individuals who meet that criterion, may be inappropriate, in any case. It could be

argued that arbitrarily defining a 50% improvement rate as the criterion for a clinically meaningful reduction in headaches is not suitable for everyone. For example a person with a very high level of headache activity might find that a lower percentage of improvement is very meaningful for him or her. Perhaps what is more important is the change in quality of life as a result of a decrease in headache activity, whether that be a small or large reduction. That is to say, perhaps a clinically meaningful reduction has to be defined on an individual basis in terms of something other than percentage of reduction in headache activity. Thus, to judge the success of a program solely on the basis of the number of subjects achieving a certain percent reduction in headache activity may be misleading.

One way of examining quality of life for headache sufferers would be to attend to the affective qualities of the pain experience itself. In some instances headache parameters such as intensity, frequency and duration may not be significantly decreased by treatment, but emotional reactivity may be altered so that the pain experience becomes more tolerable and less disruptive. Turskey, Jamner and Friedman (1982) have developed a Pain Perception Profile which measures several components of pain, including the reactivity dimension, and they report that scores on this scale may vary independently of intensity ratings.

Another way of looking at quality of life is to determine the degree of disability that individuals experience as a result of headaches. This was done in this study. Degree of

disability was operationally defined as the frequency with which activities related to leisure, work, school or caring for the home or family had to be curtailed because of headaches. It was found that 6 months following treatment there was a 15% decrease in this measure of disability for subjects in both treatment groups. This was a significant reduction and suggested that quality of life had indeed improved.

Limitations and Strengths

There are several limitations in the present study, two of which pertain to information which was not collected on the headache diaries. One of these is the lack of inclusion in the diaries of a measure of emotional reactivity associated with each headache as described above. Although disability, that is, the degree to which activities must be curtailed due to headaches, may be a reflection of emotional reactivity, it is not a direct measure. Some subjects did comment that although they did not notice a big decrease in headache activity, they did feel that they were coping with them more satisfactorily so that they were less distressing. In addition, the data concerning the degree to which headaches restricted various activities and the frequency with which coping strategies were being used at the 6 month follow-up period were collected through retrospective questionnaires. It would have been preferable to collect this data in a prospective manner as part of each entry in the diaries. This additional recording was not requested for reasons

of compliance. It was felt that compliance to regular and accurate recording four times a day would best be achieved by designing the diaries so that they would be small enough to be easily carried in pocket or purse and by not asking subjects to record an inordinate amount of information. If the diaries were too large or too complex, or if recording became too time consuming, it was felt that subjects might be less conscientious in the fulfillment of this requirement of the study.

As with any program that incorporates the teaching of a number of skills it is impossible to know which are differentially responsible for treatment efficacy. Thus, the very factor that constitutes one of the strengths of a cognitive-behavioral program, that is, the inclusion of a variety of strategies and techniques in order to allow for flexibility and adaptability of individual subjects, is the same factor that becomes its weakness from a research point of view. One way of handling this problem would be to use a dismantling paradigm similar to that used by Mitchell and White (1977). The researcher could start with a large group of subjects learning the most basic skill. After a certain amount of time some of these subjects would then be dropped out of treatment, but continue to be followed while the rest of the group learned the next skill. Again after a certain time period some of this group would then be dropped out of treatment, but continue to be followed while a third skill was added to the repertoire of the rest of the group, and so on until a portion of the original

group had been given the entire package. This method would allow for examination of the contribution of each successive skill to the efficacy of treatment. In order to determine whether it was the addition of specific skills that contributed to treatment efficacy or simply the addition of a greater number of skills allowing for increased flexibility on the part of individuals, the research could be replicated adding the various skills in varying order. The difficulty, however, with such an elaborate design would be in recruiting a sufficient number of subjects so that power would remain at an acceptable level at each stage of the study.

Another, related problem lies in knowing whether subjects in fact learned the techniques taught and were using them correctly. Although this can and has been done for relaxation training (Beiman, Israel, & Johnson, 1978; Benson et al., 1974; Borkovec & Sides, 1979; Paul & Trimble, 1970), as yet there is no objective, reliable method for measuring this in relation to more cognitively oriented coping strategies. In this study one of the reasons for the discussion of homework, whether in person for the clinic-based subjects, or by phone for the minimal-contact subjects, was to attempt to ascertain whether subjects were learning and applying the skills correctly. If individuals were having difficulty with certain strategies or if the therapist perceived a problem this was discussed and rectified. However, this was a rather inadequate means of determining mastery, and lacked objectivity and precision.

A further weakness in this study as it was conducted was the unequal case loads for the two therapists. Because subjects were so unevenly distributed it was impossible to compare therapist effectiveness. Thus, treatment efficacy may be the result of the skills of one particular therapist and may not be externally valid. This will have to be investigated in future replications of the study. Moreover, because the therapist who saw the majority of subjects was the principal investigator, the question of experimenter bias is of some concern. The results of the research, however, help to mitigate this concern. Given that the control group did not receive any treatment, placebo or otherwise, they could not be influenced by inadvertant negative expectancy messages from the therapist regarding outcome. Additionally, the fact that both treatment groups achieved the same results suggests that therapist expectancy was not playing a differential role. Moreover, since the second hypothesis was not only not supported, but the results of this particular analysis went in a direction opposite to what was predicted, it can be concluded that experimenter bias was not an influential factor.

Caution must be extended, too, in generalization of these results. Although some of the subjects in this study were physician-referred, most were volunteers who responded to community advertisements. Whether this reflects the same population as would be referred from physicians is not clear. This may have ramifications for treatment efficacy, particularly for a minimal-therapist-contact program. It is quite possible

that people who volunteer for a program such as this are those who tend to be interested in being involved in their own health care; they may be different from those who seek help through their physicians and therefore may respond differently to therapy. The distribution of scores on the Behavioral Involvement scale may be a reflection of a particular interest in self-help type of treatment programs. The minimum possible score on this scale was 9, the maximum 54. With the exception of two relatively low scores (one of 16, one of 17), scores ranged between a low of 25 and a high of 52 with the average being 39.6. Unfortunately, there are no norms with which to compare these scores, but the distribution does appear skewed in the direction of greater interest in self-involvement in health care.

A number of experimental design features strengthen the results of the study. Most importantly, the two treatment protocols were identical: the clinic-based program followed exactly the manual used for the minimal-contact subjects. Both groups received the manual and the instruction tapes so that they had equal opportunity for review of information being taught. The flow of material received by the minimal-contact group was controlled by mailing to them only one chapter per week. Thus, subjects in both groups had access to successive lessons at the same rate. Moreover, the regular contact of the therapist with those in the minimal-contact group to discuss homework assignments ensured that they were progressing through the program at the same specified rate as those in the clinic-based

group.

Two other features adding strength to the results of this research are the inclusion of a waiting list control group so that there was some control for the natural tendency of migraine headaches to wax and wane, and the low dropout rate so that interpretation of results is meaningful.

Finally, the rationale of the treatment program used in this study was based on the postulation that stress can be a precipitating factor for migraine attacks and can exacerbate the experience of pain. The study demonstrated treatment efficacy and at the same time showed that stress levels were reduced following treatment. This finding would have had additional credence had there been a comparison with the control group before they received treatment. That successful treatment is associated with alterations in stress levels does not prove a cause-effect relationship, but it does lend support to the postulation that stress can be implicated in migraine attacks and therefore adds validity to the use of a cognitive behavioral program aimed at stress management for migraineurs.

Summary and Conclusions

In conclusion, the comprehensive cognitive-behavioral program developed for treatment of migraine headaches in this study has been shown to be effective whether administered in a traditional clinic-based framework or a minimal-therapist-contact format. Peak intensity of headaches, duration and frequency were

significantly decreased as was medication usage. Moreover, analysis of data collected at a 6 month follow-up period showed that treatment gains were maintained .

Cost effectiveness, an important and pragmatic consideration in any treatment program, was decidedly superior for the minimal-therapist-contact condition. It was fully three and a half times more cost effective than the clinic-based condition. Given the equivalent outcomes of the two methods of administration, the savings in cost for the patient (or the health care organization) and the savings in time for the therapist, clearly indicate that the minimal-contact program is to be recommended.

The rationale underlying the development of this cognitive-behavioral treatment program was that maladaptive reactions to environmental stressful situations may give rise to migraine attacks, and further, that distressing cognitive and affective variables are likely to exacerbate the experience of pain associated with the headaches. Treatment was therefore aimed at helping migraineurs enhance their ability to control emotional reactivity to the stresses of daily living and increase their capacity to cope effectively with the stress of the headaches themselves. Subjects were first educated as to the role of psychological factors in the precipitation and exacerbation of headaches. They were then taught how to recognize early signs of stress through self-observation of cognitive, behavioral and emotional responses. And, finally, numerous cognitive and behavioral strategies were presented for practice and

incorporation into their daily living experiences. The goal was to help these people learn to adopt cognitive, affective and behavioral responses that would be incompatible with excessive physiological arousal; to help them adopt a calmness in attitude, outlook and style of responding to situations perceived to be stressful. This goal was achieved. A multidimensional self-report measure of stress indicated that following treatment these subjects were successful in lowering levels of stress. Furthermore, these reduced levels of stress were being maintained 6 months following treatment.

The apparent usefulness of teaching many coping skills in order to allow for adaptability and flexibility was confirmed in an examination of the number of strategies that subjects were continuing to use 6 months later. It was reported that each individual had used anywhere from 3 to 10 of the 16 techniques taught in the previous 4 week period.

The one predictor variable that was of particular interest in this study, preference for involvement in one's own health care, did not predict improvement in the minimal-therapist-contact condition. However, this may have been due to the small number in the group and it is recommended that this personality characteristic be examined in future studies adopting a self-help format.

The number of patients who experienced a 50% or greater reduction in headache activity was greater in the clinic-based condition than in the minimal-contact program, contrary to

expectations. Several speculative reasons were put forth for this finding including possible client resistance to a cognitive approach that was not able to be adequately dealt with in the minimal-contact group, the large number of strategies to be learned which may have seemed overwhelming for those working primarily on their own, and possibly a lack of sufficient positive reinforcement for those who had little therapist contact. However, in spite of these findings, it was shown that quality of life did improve significantly for subjects in both forms of treatment as evidenced by a significant decrease in the frequency with which various activities had to be curtailed due to headaches.

To conclude, a cognitive-behavioral program aimed at stress management has been shown to be a viable treatment for migraine headaches, whether delivered in a traditional clinic-based format or the more cost effective minimal-therapist-contact approach.

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Table 1

Characteristics of the Sample

Characteristic	Group		
	Control	Minimal- contact	Clinic
Sex			
Female	16	13	11
Male	1	2	4
Age in years			
$\bar{X}$	38.0	34.4	34.4
Range	31-48	23-47	24-47
Chronicity			
$\bar{X}$	15.6	18.0	16.5
Range	2-40	3-35	4-34
Education			
$\bar{X}$	6.6	7.0	7.5
Range	3-9	4-9	4-9
Income			
$\bar{X}$	4.7	4.5	4.6
Range	1-6	2-6	2-6

Note. Education and income were measured according to the following scales:

(table continues)

Table 1 (continued)

Education	Income
1. Less than Grade 8.	1. Less than \$10,000.
2. Grade 8.	2. \$10,000 - \$20,000.
3. Some high school courses.	3. \$20,000 - \$30,000.
4. Grade 12	4. \$30,000 - \$40,000.
5. Grade 13.	5. \$40,000 - \$50,000.
6. Diploma from college or training school.	6. Over \$50,000.
7. Some university courses.	
8. Bachelor's Degree.	
9. Master's or Doctoral Degree.	

Table 2

Mean Scores on Three Dependent Variables at Baseline and
Posttreatment or Postwait for Three Groups

Group	<u>n</u>	Baseline		Posttreatment	
		$\bar{X}$	SD	$\bar{X}$	SD
Peak intensity					
Control					
More severe	9	4.18	.52	4.09	.61
Less severe	8	3.30	.82	3.16	.37
Minimal-contact					
More severe	7	4.10	.27	3.36	.75
Less severe	8	3.44	.90	2.30	1.38
Clinic					
More severe	7	3.60	.57	3.49	.63
Less severe	8	3.26	.75	2.75	1.23
Total duration					
Control					
More severe	9	229.68	99.94	231.44	110.85
Less severe	8	77.31	35.18	79.79	62.15
Minimal-contact					
More severe	7	156.67	54.77	138.33	84.20
Less severe	8	54.20	32.91	35.51	26.39

(table continues)

Table 2 (continued)

Group	n	Baseline		Posttreatment	
		$\bar{X}$	SD	$\bar{X}$	SD
Total duration					
Clinic					
More severe	7	138.61	42.79	107.87	57.57
Less severe	8	89.19	38.01	39.69	28.83
Frequency					
Control					
More severe	9	19.78	8.00	18.67	8.65
Less severe	8	10.75	5.75	11.13	8.46
Minimal-contact					
More severe	7	21.00	5.89	16.29	7.65
Less severe	8	8.88	4.76	5.38	4.24
Clinic					
More severe	7	19.00	5.35	12.14	4.95
Less severe	8	12.38	5.37	5.00	3.38

Table 3

Repeated Measures Comparison of the Effects of Two Types
of Treatment and a Waiting List Control Condition on
Headache Parameters at Posttreatment

Effect	Multivariate F	Univariate F
Severity x Group x Time	.15	
Severity x Time	.85	
Group x Time	3.62***	
Peak intensity		4.53*
Duration		2.87
* Frequency		6.40**
Time	15.14***	

* $p < .017$ (.05/3). ** $p < .005$. *** $p < .001$.

Table 4

Tukey Post Hoc Comparisons of Headache Frequency and Peak Intensity for Three Groups .

Groups	Variable	Difference between means
Control versus minimal-contact	Frequency	4.65*
	Peak intensity	.86*
Control versus clinic	Frequency	6.85*
	Peak intensity	.56*
Minimal-contact versus clinic	Frequency	2.13
	Peak intensity	.30

Note. More and less severe groups combined.

* $p < .05$.

Table 5

Mean Scores on Medication Index at Baseline and Posttreatment or Postwait for Three Groups

Group	<u>n</u>	Baseline		Posttreatment or postwait	
		$\bar{X}$	SD	$\bar{X}$	SD
Control	11	46.8	42.8	53.2	47.8
Minimal-contact	8	41.5	52.5	28.0	46.4
Clinic	9	58.2	77.4	42.1	56.6

Table 6

Repeated Measures Comparison
of the Effects of Two Types of
Treatment and a Waiting List
Control Condition on Medication
Index at Posttreatment

Effect	Univariate F
Group x time	4.14*
Time	4.50*

* $p < .05$.

Table 7

Tukey Post Hoc Comparisons of Medication Index for Three Groups

Groups	Variable	Difference between means
Control versus minimal-contact	Medication index	2.52*
Control versus clinic		11.10
Minimal-contact versus clinic		14.10

* $p < .01$.

Table 8

Mean Scores on Three Dependent Variables at Baseline, Posttreatment and Follow-Up for Two Treatment Groups

Group	n	Baseline		Posttreatment		Follow-up	
		$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
Peak intensity							
Minimal-contact							
More severe	6	4.12	.29	3.53	.64	3.47	.50
Less severe	8	3.44	.90	2.30	1.38	2.95	1.17
Clinic							
More severe	7	3.60	.57	3.49	.63	3.03	.38
Less severe	7	3.16	.74	2.86	1.30	3.13	.96
Total duration							
Minimal-contact							
More severe	6	152.53	58.78	153.30	81.39	120.22	65.85
Less severe	8	54.20	32.91	35.51	26.39	42.19	23.78
Clinic							
More severe	7	138.61	42.79	107.87	57.57	90.79	31.82
Less severe	7	92.14	40.05	43.93	28.32	50.04	18.83
Frequency							
Minimal-contact							
More severe	6	20.67	6.38	17.50	7.61	14.33	6.50
Less severe	8	8.88	4.76	5.38	4.24	5.25	1.83

(table continues)

Table 8 (continued)

Group	n	Baseline		Posttreatment		Follow-up	
		$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
Frequency							
Clinic							
More severe	7	19.00	5.35	12.14	4.95	11.86	2.67
Less severe	7	12.71	5.71	5.43	3.41	5.86	1.77

Table 9

Repeated Measures Comparison of the Effects of Two Types
of Treatment on Headache Parameters at Posttreatment and
Follow-up

Effect	Multivariate F	Univariate F
Severity x Group x Time	.25	
Severity x Time	.76	
Group x Time	1.12	
Time	14.13**	
Peak intensity		
Linear trend		8.46*
Quadratic trend		3.37
Duration		
Linear trend		21.96**
Quadratic trend		.91
Frequency		
Linear trend		45.98**
Quadratic trend		7.07*

* $p < .017$ (.05/3). ** $p < .001$.

Table 10

Mean Scores on Medication Index at Baseline, Posttreatment and Follow-Up for Two Treatment Groups

Group	<u>n</u>	Baseline		Posttreatment		Follow-up	
		$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
Minimal-contact	8	41.5	52.5	28.00	46.43	25.00	35.53
Clinic	9	58.2	77.44	42.11	56.59	51.11	77.56

Table 11

4

Repeated Measures Comparison of the Effects of Two Types
of Treatment on Medication Index at Posttreatment and
Follow-up

Effect	Multivariate F	Univariate F
Group x Time	.68	
Time	5.32*	
Linear trend		6.21**
Quadratic trend		3.81

* $p < .05$. ** $p < .025$ (.05/2).

Table 12

Cost Effectiveness of Minimal-Contact Treatment Versus
Clinic-Based Treatment

		Cost effectiveness index		t test
Treatment	<u>n</u>	<u>$\bar{X}$</u>	SD	
Minimal-contact	15	.36	.35	2.80*
Clinic	15	.10	.07	

* $p < .01$.

Table 13

Mean Scores on Two Measures of Stress at Baseline, Posttreatment and Follow-Up for Two Treatment Groups

Group	n	Baseline		Posttreatment		Follow-up	
		$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
Total stress score							
Minimal-contact	12	54.67	7.73	49.67	9.05	50.50	6.84
Clinic	14	51.64	7.42	44.86	7.16	46.93	8.41
Subjective stress score							
Minimal-contact	12	56.83	5.69	48.67	5.37	50.33	6.32
Clinic	14	57.07	7.33	48.21	4.15	51.00	5.02

Table 14

Repeated Measures Comparison of the Effects of Two
Types of Treatment on Two Measures of Stress at
Posttreatment and Follow-up

Effect	Multivariate F	Univariate F
Group x Time	.21	
Time	10.32***	
Total stress		
Linear trend		10.01**
Quadratic trend		11.18**
Subjective stress		
Linear trend		17.21***
Quadratic trend		22.57***

*** $p < .001$. ** $p < .005$.

Table 15

Correlations Between Four Predictor Variables and Percent Improvement in Headache Index for Two Treatment Groups

Group	Predictor variables	Correlation with percent improvement
Minimal-contact	Preference for self-involvement	.28
	Chronicity of headaches	-.07
	Homework time	.20
	Headache severity at baseline	-.24
Clinic	Preference for self-involvement	.07
	Chronicity of headaches	.56*
	Homework time	-.02
	Headache severity at baseline	-.44*

* $p < .05$.

Table 16

Mean Scores on Disability Measure at Baseline and
Follow-up for Two Treatment Groups

Group	<u>n</u>	Baseline		Follow-up	
		$\bar{X}$	SD	$\bar{X}$	SD
Minimal-contact	14	60.21	16.88	51.00	21.03
Clinic	15	59.80	15.90	51.87	12.67

Table 17

Repeated Measures Comparison
of the Effects of Two Types of
Treatment on Disability at
Follow-Up

Effect.	Univariate F
Group x time	.03
Time	6.05*

* $p < .05$.

Table 18

Frequency of Use of Coping Strategies at Follow-up

Strategies	Group	Mean frequency of use per week
Relaxation strategies	Minimal-contact	7.10
	Clinic	7.52
Cognitive restructuring	Minimal-contact	2.82
	Clinic	3.15
Imagery	Minimal-contact	3.10
	Clinic	2.43
Problem solving and assertiveness	Minimal-contact	3.05
	Clinic	2.89
Other strategies	Minimal-contact	5.34
	Clinic	4.92
All strategies combined	Minimal-contact	21.41
	Clinic	20.92

Table 19

Percent of Subjects in Each Group Who
Achieved Successful Outcome Following
Treatment or Waiting Period

	Control	Minimal- contact	Clinic
Success	n=3 (18%)	n=5 (33%)	n=7 (47%)
Non-success	n=14 (82%)	n=10 (67%)	n=8 (53%)
	100%	100%	100%

Note. Success is defined as 50% or more reduction in headache index from baseline to posttreatment or postwait. Non-success is defined as less than 50% reduction.

Appendix ATelephone Screening Interview

1. Age:
2. Frequency of headaches (must be at least 2/month):
3. Duration (must be 3 months or longer):
4. Headaches paroxysmal (onset relatively sudden rather than slow, gradual):
5. Positive family history of severe chronic headache:
6. Headaches usually associated with loss of appetite &/or nausea &/or vomiting:
7. Pain usually described as throbbing, pulsating, rather than steady, band-like pressure or tightness:
8. Headaches usually preceded by visual or motor prodromata:
9. Prophylactic medication - currently on, or has been on within the past one month:
10. Currently on the birth control pill or hormone therapy:

(cont...2)

-2-

11. Previous psychological therapy for headaches:

- cognitive-behavioral?
- relaxation?
- biofeedback?
- other?

12. Majority of headaches seem to be stress-related:

13. Willing to come once a week on a regular basis during the 8 week treatment period - probably daytime appointments:

and fill out diaries daily - 4 weeks before treatment, during treatment, posttreatment, and 6 months following treatment:

14. Type of medication may not be changed once accepted into study - although may continue to use same medication when needed. Would be willing and able to go along with this:

15. Name:

Address:

Postal Code:

Phone number: daytime:

evening:

Best time to reach them:

Physician's Letter and Questionnaire

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OTTAWA, ONTARIO
K1N 6N5 Canada

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ECOLE DE PSYCHOLOGIE

SCHOOL OF PSYCHOLOGY

September, 1984

Dear Doctor,

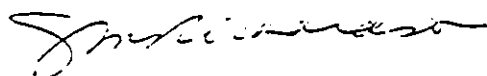
Your patient has expressed an interest in taking part in a study being conducted at the University of Ottawa under the direction of P.J. McGrath, Ph.D., to investigate the effectiveness of a stress management course for treatment of migraine headaches.

In order to satisfy standardization requirements for the study, certain inclusion/exclusion criteria must be met. To this end, would you please be good enough to complete the attached brief questionnaire regarding this patient. Your patient will then mail it back to me. The questionnaire includes a paragraph to be signed by your patient authorizing you to release this information to me.

If you would like further information, please feel free to phone me at the University (231-4022) or at home (224-7709).

Thank you.

Yours truly,



(Mrs.) G.M. Richardson, R.N., B.A.



P.J. McGrath, Ph.D.

Patient's Name: _____

Doctor's Name: _____

Date: _____

I hereby authorize the above named doctor to answer the following questionnaire on my behalf to be used only for research purposes by Gwendolen Richardson at the University of Ottawa. I understand strict confidentiality will be maintained.

Patient's Signature

- | | <u>YES</u> | <u>NO</u> |
|--|------------|-----------|
| 1. Headaches are paroxysmal in nature (onset relatively sudden rather than slow, gradual). | _____ | _____ |
| 2. Positive family history of severe chronic headache (parents, siblings, grandparents, aunts, uncles, cousins). | _____ | _____ |
| 3. Headaches are usually associated with anorexia and/or nausea and/or vomiting. | _____ | _____ |
| 4. Pain is usually described as throbbing, pulsating, rather than as a feeling of steady, band-like pressure or tightness. | _____ | _____ |
| 5. Headaches are usually preceded by visual or motor prodromata. | _____ | _____ |
| 6. Patient is currently, or has been on prophylactic medication within the past one month. | _____ | _____ |
| 7. Patient suffers from any other neurological disorder. | _____ | _____ |

continued . . .

- 2 -

- | | <u>YES</u> | <u>NO</u> |
|---|------------|-----------|
| 8. Migraine type headaches occur an average of two or more times per month. | _____ | _____ |
| 9. Headaches have been present for three months or longer. | _____ | _____ |
| 10. HEADACHE DIAGNOSIS: _____ | | |

Signature of Physician _____

To The Patient:

Please mail this questionnaire as soon as possible to:

Mrs. G.M. Richardson
School of Psychology
University of Ottawa
651 Cumberland
Ottawa, Ontario
K1N 6N5

Consent Form

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OTTAWA, ONTARIO
K1N 6N5 Canada

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ECOLE DE PSYCHOLOGIE

SCHOOL OF PSYCHOLOGY

Consent Form

A study is being conducted at the University of Ottawa under the direction of Dr. P. J. McGrath, Psychologist, to investigate the effectiveness of a specific type of psychological treatment for adults who suffer migraine headaches.

The form of treatment being investigated is designed primarily to help you learn to deal effectively with stressful events in your life that may be influential in triggering migraine attacks.

Some people will be seen individually on a weekly basis over a two month period at the University, while others will receive treatment mainly through the use of a manual and audio tapes at home. Because individuals must be randomly assigned, there can be no choice as to the condition to which any given person will be appointed. Treatment will begin as soon as possible, sometime within the next four months. All subjects will be required to keep a daily record of headaches for one month, beginning now. Subjects may also be required to keep a daily record of headache activity for an additional four weeks before beginning treatment. As well, daily records must be kept during treatment and one month following treatment. During the two month treatment period subjects in treatment will be required to complete daily homework assignments.

All subjects will be re-contacted six months after treatment and asked to keep daily records for another four week period.

There are no known negative effects from the treatment to be used in this study.

It will not be necessary for you to discontinue any medication you are accustomed to taking for the relief of pain when you have a headache. However, we ask that you do not begin to take any new medication for your headaches during the course of this study.

Any personal information given by you to the researcher will be kept confidential.

You may withdraw from this study at any time.

I am informed of, and agree to participate in this study.

Signature

Date

Witness, Principle Investigator

Behavioral Involvement Scale

Name: _____ Date: _____

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

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

- | | Strongly Disagree | Moderately Disagree | Slightly Disagree | Slightly Agree | Moderately Agree | Strongly Agree |
|---|-------------------|---------------------|-------------------|----------------|------------------|----------------|
| 1. It is better to rely less on physicians and more on your own common sense when it comes to caring for your body. | 1 | 2 | 3 | 4 | 5 | 6 |
| 2. Except for serious illness, it's generally better to take care of your <u>own</u> health than to seek professional help. | 1 | 2 | 3 | 4 | 5 | 6 |
| 3. If it costs the same, I'd rather have a doctor or nurse give me treatments than to do the same treatments myself. | 1 | 2 | 3 | 4 | 5 | 6 |

(cont...2)

	Strongly Disagree	Moderately Disagree	Slightly Disagree	Slightly Agree	Moderately Agree	Strongly Agree
4. It is better to rely on the judgements of doctors (who are experts) than to rely on "common sense" in taking care of your own body.	1	2	3	4	5	6
5. Learning how to cure some of your illnesses without contacting a physician is a good idea.	1	2	3	4	5	6
6. Recovery is usually quicker under the care of a doctor or nurse than when patients take care of <u>themselves</u> .	1	2	3	4	5	6
7. It's almost always better to seek professional help than to try to treat yourself.	1	2	3	4	5	6
8. Learning how to cure some of your illnesses without contacting a physician may create more harm than good.	1	2	3	4	5	6
9. Clinics and hospitals are good places to go for help since it's best for medical experts to take responsibility for health care.	1	2	3	4	5	6

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LEONARD R. DEROGATIS PhD
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INSTRUCTIONS:

Below is a list of problems and complaints that people sometimes have. Please read each one carefully. After you have done so, please fill in one of the numbered circles to the right that best describes HOW MUCH DISCOMFORT THAT PROBLEM HAS CAUSED YOU DURING THE PAST WEEK INCLUDING TODAY. Mark only one numbered circle for each problem and do not skip any items. If you change your mind, erase your first mark carefully. Read the example below before beginning, and if you have any questions please ask the technician.

SEX

MALE
☐

FEMALE
☐

NAME: _____

LOCATION: _____

EDUCATION: _____

MARITAL STATUS: MAR _____ SEP _____ DIV _____ WID _____ SING _____

DATE		
MO	DAY	YEAR

ID. NUMBER

AGE

VISIT NUMBER: _____

EXAMPLE

HOW MUCH WERE YOU DISTRESSED BY:

1. Bodyaches

NOT AT ALL	A LITTLE BIT	MODERATELY	QUITE A BIT	EXTREMELY
②	①	③	④	⑤

HOW MUCH WERE YOU DISTRESSED BY:

1. Nervousness or shakiness inside
2. Faintness or dizziness
3. The idea that someone else can control your thoughts
4. Feeling others are to blame for most of your troubles
5. Trouble remembering things
6. Feeling easily annoyed or irritated
7. Pains in heart or chest
8. Feeling afraid in open spaces
9. Thoughts of ending your life
10. Feeling that most people cannot be trusted
11. Poor appetite
12. Suddenly scared for no reason
13. Temper outbursts that you could not control
14. Feeling lonely even when you are with people
15. Feeling blocked in getting things done
16. Feeling lonely
17. Feeling blue
18. Feeling no interest in things
19. Feeling fearful
20. Your feelings being easily hurt
21. Feeling that people are unfriendly or dislike you
22. Feeling inferior to others
23. Nausea or upset stomach
24. Feeling that you are watched or talked about by others
25. Trouble falling asleep
26. Having to check and double check what you do
27. Difficulty making decisions
28. Feeling afraid to travel on buses, subways, or trains
29. Trouble getting your breath
30. Hot or cold spells
31. Having to avoid certain things, places, or activities because they frighten you
32. Your mind going blank
33. Numbness or tingling in parts of your body
34. The idea that you should be punished for your sins
35. Feeling hopeless about the future

	NOT AT ALL	A LITTLE BIT	MODERATELY	QUITE A BIT	EXTREMELY
1	①	②	③	④	⑤
2	①	②	③	④	⑤
3	①	②	③	④	⑤
4	①	②	③	④	⑤
5	①	②	③	④	⑤
6	①	②	③	④	⑤
7	①	②	③	④	⑤
8	①	②	③	④	⑤
9	①	②	③	④	⑤
10	①	②	③	④	⑤
11	①	②	③	④	⑤
12	①	②	③	④	⑤
13	①	②	③	④	⑤
14	①	②	③	④	⑤
15	①	②	③	④	⑤
16	①	②	③	④	⑤
17	①	②	③	④	⑤
18	①	②	③	④	⑤
19	①	②	③	④	⑤
20	①	②	③	④	⑤
21	①	②	③	④	⑤
22	①	②	③	④	⑤
23	①	②	③	④	⑤
24	①	②	③	④	⑤
25	①	②	③	④	⑤
26	①	②	③	④	⑤
27	①	②	③	④	⑤
28	①	②	③	④	⑤
29	①	②	③	④	⑤
30	①	②	③	④	⑤
31	①	②	③	④	⑤
32	①	②	③	④	⑤
33	①	②	③	④	⑤
34	①	②	③	④	⑤
35	①	②	③	④	⑤

HOW MUCH WERE YOU DISTRESSED BY:		NOT AT ALL	A LITTLE BIT	MODERATELY	QUITE A BIT	EXTREMELY
36. Trouble concentrating	36	0	1	2	3	4
37. Feeling weak in parts of your body	37	0	1	2	3	4
38. Feeling tense or keyed up	38	0	1	2	3	4
39. Thoughts of death or dying	39	0	1	2	3	4
40. Having urges to beat, injure, or harm someone	40	0	1	2	3	4
41. Having urges to break or smash things	41	0	1	2	3	4
42. Feeling very self-conscious with others	42	0	1	2	3	4
43. Feeling uneasy in crowds	43	0	1	2	3	4
44. Never feeling close to another person	44	0	1	2	3	4
45. Spells of terror or panic	45	0	1	2	3	4
46. Getting into frequent arguments	46	0	1	2	3	4
47. Feeling nervous when you are left alone	47	0	1	2	3	4
48. Others not giving you proper credit for your achievements	48	0	1	2	3	4
49. Feeling so restless you couldn't sit still	49	0	1	2	3	4
50. Feelings of worthlessness	50	0	1	2	3	4
51. Feeling that people will take advantage of you if you let them	51	0	1	2	3	4
52. Feelings of guilt	52	0	1	2	3	4
53. The idea that something is wrong with your mind	53	0	1	2	3	4

Appendix FBeck Depression Inventory, Short Form

Name: _____

Date: _____

On this questionnaire are groups of statements. Please read the entire group of statements in each category. Then pick out the one statement in that group which best describes the way you feel today, that is, right now. Circle the number beside the statement you have chosen. If several statements in the group seem to apply equally well, circle each one.

Be sure to read all the statements in each group before making your choice.

A.

- 3 I am so sad or unhappy that I can't stand it.
- 2 I am blue or sad all the time and I can't snap out of it.
- 1 I feel sad or blue.
- 0 I do not feel sad.

B.

- 3 I feel that the future is hopeless and that things cannot improve.
- 2 I feel I have nothing to look forward to.
- 1 I feel discouraged about the future.
- 0 I am not particularly pessimistic or discouraged about the future.

C.

- 3 I feel I am a complete failure as a person (parent, husband, wife).
- 2 As I look back on my life, all I can see is a lot of failures.
- 1 I feel I have failed more than the average person.
- 0 I do not feel like a failure.

D.

- 3 I am dissatisfied with everything.
- 2 I don't get satisfaction out of anything anymore.
- 1 I don't enjoy things the way I used to.
- 0 I am not particularly dissatisfied.

E.

- 3 I feel as though I am very bad or worthless.
- 2 I feel quite guilty.
- 1 I feel bad or unworthy a good part of the time.
- 0 I don't feel particularly guilty.

cont...2

- 2 -

F.

- 3 I hate myself.
- 2 I am disgusted with myself.
- 1 I am disappointed in myself.
- 0 I don't feel disappointed in myself.

G.

- 3 I would kill myself if I had the chance.
- 2 I have definite plans about committing suicide.
- 1 I feel I would be better off dead.
- 0 I don't have any thoughts of harming myself.

H.

- 3 I have lost all my interest in other people and don't care about them at all.
- 2 I have lost most of my interest in other people and have little feeling for them.
- 1 I am less interested in other people than I used to be.
- 0 I have not lost interest in other people.

I.

- 3 I can't make any decisions at all anymore.
- 2 I have great difficulty in making decisions.
- 1 I try to put off making decisions.
- 0 I make decisions about as well as ever.

J.

- 3 I feel that I am ugly or repulsive looking.
- 2 I feel that there are permanent changes in my appearance and they make me look unattractive.
- 1 I am worried that I am looking old or unattractive.
- 0 I don't feel that I look any worse than I used to.

K.

- 3 I can't do any work at all.
- 2 I have to push myself very hard to do anything.
- 1 It takes extra effort to get started at doing something.
- 0 I can work about as well as before.

L.

- 3 I get too tired to do anything.
- 2 I get tired from doing anything.
- 1 I get tired more easily than I used to.
- 0 I don't get any more tired than usual.

M.

- 3 I have no appetite at all anymore.
- 2 My appetite is much worse now.
- 1 My appetite is not as good as it used to be.
- 0 My appetite is no worse than usual.

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DSP

Name: _____ Age: _____ Sex: M _____ F _____ Date: _____

I.D. No.: _____ Location: _____

Marital Status: Single _____ Married _____ Separated _____ Widowed _____ Divorced _____

Education: _____ Job Description: _____

INSTRUCTIONS

Below are a series of statements that describe the way some people feel about themselves. Please read each statement carefully and select one of the numbered descriptors below to indicate the extent to which the statement is true of you. Consider yourself as you typically behave or feel, and place the descriptor number in the open block to the right of the statement. If you change your mind, erase your first selection completely. If you have any questions, ask the technician.

DESCRIPTORS:

- 0 = Not at all true of me
1 = Slightly true of me
2 = Moderately true of me
3 = Very true of me
4 = Extremely true of me

- | | |
|---|---|
| 1. I feel there is never enough time to get things done. ☐ | 18. I have a satisfying sex life. ☐ |
| 2. I rarely have feelings of being trapped or caught in life. ☐ | 19. I have no problems with control of my temper. ☐ |
| 3. I feel rules were made to be broken. ☐ | 20. I am usually worried about something. ☐ |
| 4. I take some time out almost every day just to relax. ☐ | 21. I smoke too much. ☐ |
| 5. I laugh easily. ☐ | 22. I rarely feel lonely. ☐ |
| 6. My job provides me many opportunities for challenging and satisfying activities. ☐ | 23. When I eat, I usually take my time. ☐ |
| 7. When I am on vacation with my family I don't have as much fun as I think I should. ☐ | 24. I frequently say I am going to spend less time on work, but I don't seem to be able to. ☐ |
| 8. I get into frequent arguments. ☐ | 25. Most things I do I see as a challenge. ☐ |
| 9. I rarely feel tense and under pressure. ☐ | 26. I am not very interested in hobbies or sports. ... ☐ |
| 10. I rarely exercise. ☐ | 27. I seem to be more focused on the future than the present. ☐ |
| 11. I feel no interest in things. ☐ | 28. My full range of talents are not utilized on my job. ☐ |
| 12. I would like to be with my family more, but I can never seem to find the time. ☐ | 29. I have a good relationship with my wife/ husband (or unmarried partner). ☐ |
| 13. I never worry about being a "workaholic." ☐ | 30. Sometimes I just feel like hitting somebody. ... ☐ |
| 14. I believe that if you don't beat the other guy to the punch, he will beat you. ☐ | 31. I rarely feel nervous or uptight. ☐ |
| 15. I never sit still for very long. ☐ | 32. I am in good physical shape. ☐ |
| 16. I am not very good at telling funny stories or jokes. ☐ | 33. I sometimes have feelings of worthlessness. ☐ |
| 17. I get great pleasure from the people I work with. ☐ | 34. I rarely feel pressed for time. ☐ |

DESCRIPTORS:

- 0 = Not at all true of me
1 = Slightly true of me
2 = Moderately true of me
3 = Very true of me
4 = Extremely true of me

- | | |
|--|--|
| 35. The more things I achieve in life the less I seem to enjoy them. ☐ | 57. Every day I must get something tangible accomplished or I don't feel good about myself. ☐ |
| 36. I tend to be impatient. ☐ | 58. I feel the most important thing in life is that you achieve something with it. ☐ |
| 37. I sometimes just "tune out" of work and get involved in other things. ☐ | 59. The idea of meditation or relaxation training has not had much appeal for me. ☐ |
| 38. Sex is an important part of life for me. ☐ | 60. I believe you can get a lot of help from others in getting the job done in life. ☐ |
| 39. I am frequently frustrated in my work. ☐ | 61. There are significant parts of my job that are frankly dull and boring. ☐ |
| 40. Interacting with my family and friends is a great source of enjoyment for me. ☐ | 62. I don't interact much with friends or neighbors. ☐ |
| 41. I rarely have angry thoughts about people. ☐ | 63. I rarely clench my fists during conversation. ☐ |
| 42. When I know I have something unpleasant to do I worry about it for a long time. ☐ | 64. I rarely let things get me anxious or tense because I know they always get worked out somehow. ☐ |
| 43. I don't take antacids for heartburn or gas. ☐ | 65. I am very careful about my diet. ☐ |
| 44. I usually have plenty of energy. ☐ | 66. I sometimes have thoughts of ending my life. ☐ |
| 45. I enjoy being under pressure and doing a good job on many projects at the same time. ☐ | 67. When I have an appointment I rarely arrive late or at the last minute. ☐ |
| 46. I really look forward to my vacations. ☐ | 68. Once I get started on a project, I don't like to stop until I am finished. ☐ |
| 47. I make a serious effort to achieve a balance between work and fun. ☐ | 69. I believe competition builds character and is good for you. ☐ |
| 48. It is not difficult for me to unwind after work. ☐ | 70. I have trouble relaxing. ☐ |
| 49. I really believe it is lonely at the top. ☐ | 71. I believe life is a struggle and you don't get anything for free out of it. ☐ |
| 50. Doing my job gives me a good feeling about myself. ☐ | 72. When I wake up in the morning, I really look forward to going to work. ☐ |
| 51. I have a good balance between family activities and work activities. ☐ | 73. I really enjoy going to parties and meeting people. ☐ |
| 52. I get easily annoyed or irritated. ☐ | 74. If someone expresses a stupid idea, I rarely publicly disagree. ☐ |
| 53. I frequently have the feeling that something bad is going to happen to me. ☐ | 75. Sometimes I feel tense and anxious for no apparent reason. ☐ |
| 54. I believe having good health is more important than anything. ☐ | 76. I take tranquilizers to relax or sleep. ☐ |
| 55. Sometimes I feel hopeless about the future. ☐ | 77. I rarely blame myself unduly for things that go wrong. ☐ |
| 56. When I am driving the car, I almost never rush through traffic. ☐ | |

Please indicate what you believe your current level of stress to be by placing an "X" on the line below.

Totally Free of Stress

Extremely Highly Stressed

Appendix HDemographic and Headache History QuestionnaireYou and Your Headaches

1. Name: _____
 2. Date: _____
 3. Age: _____ 4. Sex: _____
 5. Occupation: _____
 6. Highest level of education completed: (please check one)
 - less than Grade 8 _____
 - Grade 8 _____
 - some high school courses _____
 - Grade 12 _____
 - Grade 13 _____
 - diploma from college or training school _____
 - some university courses _____
 - Bachelor's Degree _____
 - Master's or Doctoral Degree _____
 7. Family income: (please check one)
 - less than \$10,000. _____
 - \$10,000. - \$20,000. _____
 - \$20,000. - \$30,000. _____
 - \$30,000. - \$40,000. _____
 - \$40,000. - \$50,000. _____
 - over \$50,000. _____
 8. How many years have you suffered migraine headaches? _____
 9. Has anyone else in your family had migraine headaches?
 - Yes _____ No _____
- If yes, what is the relationship of that person to you?
- parent _____
 - brother or sister _____
 - grandparent _____
 - aunt or uncle _____
 - cousin _____
 - son or daughter _____

(cont...2)

- 2 -

10. What previous treatment have you tried for your headaches?
medications Yes _____ No _____
self-help books Yes _____ No _____
others (please list) _____

11. Do you work outside the home? Yes _____ No _____
If yes, do you work part time? _____ or full time? _____
12. If you work outside the home, how much time would you estimate you lose from work each month because of your headaches? _____
13. Do you attend school? Yes _____ No _____
If yes, do you attend part time? _____ or full time? _____
14. If you attend school, how often do you miss classes because of a headache? (please check one)
once a month or less _____
2 - 3 times a month _____
once a week or more _____
15. How often do your headaches interfere with your leisure activities? (please check one)
once a month or less _____
2 - 3 times a month _____
once a week or more _____
16. How often do your headaches interfere with activities associated with caring for your home and/or family? (please check one)
once a month or less _____
2 - 3 times a month _____
once a week or more _____
17. How many headaches have you had in the past one month? _____
18. What was the average duration of the headaches you experienced during the past one month? (i.e. on average, how long did each headache last?) _____

(cont...3)

- 3 -

19. Using the following scale (1 - 5) please estimate, on average, how severe your headaches were during the past one month. (please check one)

1. My headaches were such that I was only aware of them if I paid attention to them. _____
2. My headaches were such that I could ignore them at times. _____
3. My headaches were such that I couldn't ignore them, but still I could do my usual activities. _____
4. My headaches were such that it was difficult for me to concentrate. I could only do easy activities. _____
5. My headaches were such that I couldn't do anything. _____

Appendix ICredibility Questionnaire

Name: _____ Date: _____

This is a questionnaire designed to determine how people feel about the headache treatment program at the beginning of the program. Please check one response for each question.

1. How logical does this type of treatment seem to you?
not at all logical _____
a little logical _____
moderately logical _____
quite logical _____
very logical _____
2. How confident are you that this treatment could be successful in improving your migraine headaches?
not at all confident _____
a little confident _____
moderately confident _____
quite confident _____
very confident _____
3. How confident would you be in recommending this treatment to other people who suffer migraine headaches?
not at all confident _____
a little confident _____
moderately confident _____
quite confident _____
very confident _____
4. Do you think that this treatment should be made available to other people who suffer migraine headaches?
absolutely not _____
no _____
perhaps _____
yes _____
very definitely _____
5. How confident are you that you will be able to learn the skills being taught in this program?
not at all confident _____
a little confident _____
moderately confident _____
quite confident _____
very confident _____

Appendix JHEADACHE DIARY

Name: _____

Date: _____

Meds.INTENSITY

Breakfast	
Lunch	
Dinner	
Bedtime	

1. If you had a headache today,
 - a) What time did it start? _____
 - b) What time did it end? _____
 - c) What do you think caused it? _____
2. Number of minutes spent today:
 - a) Reading instruction manual _____
 - b) Listening to instruction tapes _____
 - c) Doing homework assignments _____
 - d) Practising relaxation _____

Appendix K

Rationales for Treatment

Rationale for Minimal-Therapist-Contact Condition

Research has shown that in individuals who are susceptible to migraine headaches many attacks are triggered by strong emotional reactions to stressful events in one's daily life. It is expected, therefore, that learning how to alter one's reactions to everyday stress and strain will lead to a decrease in headache activity.

Treatment will take place mainly at home with the use of audio tapes and a manual because research suggests that skills that are primarily self-taught at home are likely to be at least as effective as those taught by someone else whom you see in an office or a clinic.

Rationale for Clinic-Based Condition

Research has shown that in individuals who are susceptible to migraine headaches many attacks are triggered by strong emotional reactions to stressful events in one's daily life. It is expected, therefore, that learning how to alter one's reactions to everyday stress and strain will lead to a decrease in headache activity.

Appendix LSocial Validation Questionnaire

Mrs. G. M. Richardson,
 School of Psychology,
 University of Ottawa,
 Ottawa, Ontario K1N 6N5

Dear _____,

Your name has been given to me by _____
 in order that I could send you this form to complete.

I am interested in knowing whether or not you notice a
 difference in _____'s headaches.

At the bottom of this letter is a line marked "unchanged or
 worse" at the left hand edge, and "markedly improved" at the
 right hand edge. Would you please mark a point on this line to
 indicate whether or not you think _____'s headaches
 have improved and, if so, by how much.

For example, if you think the headaches have not improved
 you would put your mark at the left hand edge of the line, if you
 think they have improved moderately you would put your mark in
 about the middle of the line, if you think they have improved a
 very great deal you would put your mark at the right hand edge.

Perhaps you think the headaches have improved just a little
 - then your mark would go near the left hand edge according to
 just how much you think the improvement is. Similarly, if you
 think they have improved quite a lot, your mark would be nearer
 to the right hand edge.

Please do not discuss your ratings with _____.

Please return this form as soon as possible in the enclosed
 stamped, addressed envelope.

Thank you.

Yours truly,

G. M. Richardson

unchanged _____ markedly

Appendix M

Clinic-Based Condition

<u>Week Number</u>	<u>Contact Time</u>	<u>Content</u>
1	60 min..	Rationale and explanation of treatment. Role of internal dialogue, thoughts, beliefs, attitudes, expectations in feelings of stress. Introduction of Stress Logs (Appendix N). Introduction to relaxation. Homework assignments: 1. Diary recording. 2. Relaxation practice daily. 3. Record in Stress Log at least twice.
2	60 min.	Review homework. Cognitive appraisal, internal dialogue and cognitive restructuring. Introduction to Thought Record (Appendix O). Homework assignments: 1. Diary recording. 2. Relaxation practice daily. 3. Record in Thought Record at least twice.
3	60 min.	Review homework. Role of maladaptive beliefs or attitudes underlying internal dialogue. Further elaboration of cognitive restructuring. Homework assignments: 1. Diary recording. 2. Relaxation practice. 3. Record in Thought Record at least twice, also once when subject has a headache.
4	60 min.	Review homework. Thought stopping. Attention diversion. Homework assignments: 1. Diary recording. 2. Relaxation practice. 3. Record in Thought Record at least twice including use of new techniques.

(cont...2)

-2-

Week Number	Contact Time	Content
5	60 min.	Review homework. Imagery. Pain transformation. Mental activities. Behavior rehearsal. Homework assignments: 1. Diary recording. 2. Relaxation practice. 3. Record in Thought Record at least twice including use of new techniques.
6	60 min.	Review homework. Assertiveness, aggression, passivity and their relation to feelings of stress. Cue controlled relaxation. Homework assignments: 1. Diary recording. 2. Relaxation practice. 3. Record in Thought Record at least twice paying particular attention to situations in which subject displays either aggressive or passive behavior. 4. Use cue controlled relaxation many times daily.
7	60 min.	Review homework. Problem solving. Technique for relaxing facial muscles. Homework assignments: 1. Diary recording. 2. Relaxation practice. 3. Record in Thought Record at least twice including use of problem solving.
8	60 min.	Review homework. Emphasis on application of strategies to pain experience. Summary emphasizing self-control. Homework assignments: 1. Diary recording for last week plus four additional weeks. 2. Incorporation of strategies into daily living on on-going basis.

[illegible]

Thought Record

Situation	Tension Level (0 - 10)	Thoughts	Revised Thoughts	Praising Yourself	Tension Level (0 - 10)
- I have a report to be finished by tomorrow.	8	- I'll never get this finished. - I can't do a good job in this space of time. - I can't do it tonight - I have other plans.	- Wait - I'm feeling panicky - that only makes things worse - I'll take some slow deep breaths - try to relax - I'll give it all my attention in the time I have left and just do the best job I can.	- Good! - That's better! - I'm feeling a little calmer now. - I'm in control!	4

Appendix PMinimal-Therapist-Contact Condition

<u>Week Number</u>	<u>Contact Time</u>	<u>Content</u>
1	30 min. in clinic	Rationale and explanation of treatment. Instructions for use of manual, instruction tapes, and relaxation tapes. Discussion re importance of completing homework assignments. Arrange dates for phone contacts and appointment for Week 5. Give subject 4 weeks of diaries and mailing envelopes.
2 (approx. 10 days later)	15 min. phone	Answer any questions that have arisen. Review homework. Encouragement to comply.
3	no contact	
4	15 min. phone	Answer questions. Review homework. Encouragement.
5	60 min. in clinic	Answer questions. Clarify concepts as necessary. Review homework. Give subject 4 weeks of diaries and mailing envelopes.
6	15 min. phone	Answer questions. Review homework. Encouragement.
7	no contact	
8	15 min. phone	Answer questions. Review homework. Instructions re completing 4 weeks of diaries posttreatment.

Appendix QYour Headaches and Your Activities

Name: _____ Date: _____

1. Do you work outside the home? Yes _____ No _____
If yes, do you work part time? _____ or full time? _____
2. If you work outside the home, how much time would you estimate you lost from work in your last full month of work because of your headaches? _____
3. Do you attend school? Yes _____ No _____
If yes, do you attend part time? _____ or full time? _____
If yes, what month was your last full month of classes? _____
4. If you attend school, how often did you miss classes during the last full month of classes because of a headache? (please check one)
once during the month _____
2-3 times during the month _____
once a week or more _____
5. How often have your headaches interfered with your leisure activities during the past month? (please check one)
once during the month _____
2-3 times during the month _____
once a week or more _____
6. How often have your headaches interfered with activities associated with caring for your home and/or family during the past month? (please check one)
once during the month _____
2-3 times during the month _____
once a week or more _____

Appendix RYour Use of Coping Strategies

Name: _____ Date: _____

Below is a list of the various coping strategies you have learned for coping with the minor and major strains of everyday living. Beside each one please place one of the following numbers to indicate how much you would estimate you have used the technique during the past month:

- 0 = not at all
- 1 = once during the month
- 2 = 2-3 times during the month
- 3 = once a week
- 4 = 2-6 times a week
- 5 = once a day or more

1. Progressive muscle relaxation of all the major muscle groups whereby muscles are first tensed and then relaxed. _____
2. Progressive muscle relaxation of all the major muscle groups without tensing them first. _____
3. Cue controlled, brief relaxation. _____
4. Relaxing facial muscles by putting a twinkle in your eyes and smiling inwardly. _____
5. Changing negative thoughts to positive. _____
6. Attention diversion (e.g. diverting attention to your breathing, to your muscles, to a task, etc.) _____
7. Thought stopping. _____
8. Imagery by creating a scene in your imagination. _____
9. Imagery by recall (e.g. a book, movie, concert) _____
10. Repetitive imagery. _____

(cont...2)

- 2 -

11. Conversion of pain to something more tolerable. _____
 12. Observation of pain as a scientific phenomenon. _____
 13. Mental activities (e.g. mental arithmetic, making mental list of things to be done, etc.) _____
 14. Behavior rehearsal. _____
 15. Assertive rather than passive or aggressive behavior _____
 16. Problem solving. _____
- Others - please list _____
- _____
- _____
- _____
- _____
- _____

Appendix S

Evaluation of Assumptions

Using the Kolmogorov-Smirnov test of normality, the distribution of baseline scores on each of the dependent variables in each of the groups was found to be not significantly different from normal.

The Box's M test for homogeneity of variance-covariance matrices was used for each multivariate analysis. Because this test is notoriously sensitive, an alpha level of $p=.001$ was established as the criterion for significance (Tabachnick & Fidell, 1983). The assumption of homogeneity was met in all cases.

Inspection of the Pearson correlation matrix for dependent variables at baseline indicated that multicollinearity was not a problem. Values in excess of .99 would reveal nearly redundant variables and therefore a condition of multicollinearity (Tabachnick & Fidell, 1983). In this case correlations ranged from $r = .30$ to $r = .81$.

For the detection of outliers, baseline scores on the three main dependent variables, peak intensity, total duration, and frequency, were converted to standardized z-scores. Using a standardized score of ± 3.00 as a cut-off point, as has been suggested by some researchers (Tabachnick & Fidell 1983), one outlier was identified and deleted from all analyses. It was apparent on examination of headache diaries that this was a subject whose headaches were continuous rather than paroxysmal, so that, in fact, she was not properly representative of the population in any case.

Appendix TCorrelations Between Dependent Variables and Blocking Variable at Baseline

Whole Sample (n=47)					
	Peak intensity	Duration	Frequency	Headache index (severity)	Medication index (n=29)
Peak intensity	1.00	.36*	.30*	.55**	.28
Duration		1.00	.81**	.91**	.32
Frequency			1.00	.69**	.38*
Headache index (severity)				1.00	.37*
Medication index					1.00

*p < .05. **p < .01.

Control Group (n=17)					
	Peak intensity	Duration	Frequency	Headache index (severity)	Medication index (n=11)
Peak intensity	1.00	.50*	.26	.65**	.30
Duration		1.00	.81**	.94**	.68*
Frequency			1.00	.77**	.57
Headache index (severity)				1.00	.74**
Medication index					1.00

*p < .05. **p < .01.

Minimal-Contact Group (n=15)					
	Peak intensity	Duration	Frequency	Headache index (severity)	Medication index (n=8)
Peak intensity	1.00	.53*	.47	.64**	.18
Duration		1.00	.81**	.91**	.84**
Frequency			1.00	.84**	.73*
Headache index (severity)				1.00	.62
Medication index					1.00

* $p < .05$. ** $p < .01$.

Clinic-Based Group (n=15)					
	Peak intensity	Duration	Frequency	Headache index (severity)	Medication index (n=10)
Peak intensity	1.00	-.26	.19	.40	.52
Duration		1.00	.72**	.73**	-.51 ¹
Frequency			1.00	.66**	-.04
Headache index (severity)				1.00	-.05
Medication index					1.00

* $p < .05$. ** $p < .01$.

Appendix UThe Use of Blocking Instead of Analysis of Covariance

Analysis of covariance was considered as a possible means of controlling for initial differences in headache activity but was rejected for several reasons. Covariance requires that there be homogeneous within-group regression, an assumption which one might expect to be violated in a study such as this. As well, if indeed there was an interaction between amount of headache activity, i.e. severity, at baseline and response to treatment; its presence would be able to be assessed directly with the use of a randomized block design. Although these two problems could have been handled by the use of the Johnson-Neyman technique of analysis of covariance, there were two additional reasons for rejecting this type of analysis. Firstly, once the dependent variable scores have been adjusted for a covariate there may be some difficulty in interpretation since analysis is then based on scores that no longer reflect the observed differences, but rather the differences that would have occurred if the subjects had all had the same scores on the covariate. The second reason is a theoretical issue. The experimenter must decide whether or not it is theoretically logical to adjust scores on the dependent variables by an amount that is directly proportional to scores on the control variable. Perhaps subjects with high scores should be boosted more or less than the linear regression line dictates. A similar question must be asked in relation to low scores on the dependent variables. Whereas the application of covariance

implies a commitment to a theoretical position on this point, the use of a blocking procedure requires no such theoretical stance (Keppel, 1973).

For these reasons it was decided to control for severity by using a post hoc blocking procedure as described in the Method section rather than analysis of covariance.

This decision led to considerable variability in variances between groups, as can be seen in an examination of Table 2.

Nonetheless, when the three dependent variables were submitted to MANOVA at baseline it was found that the assumption of homogeneity using Box's M was not violated ($p < .003$). Because this test is notoriously sensitive to heterogeneity, the null hypothesis should be rejected only if Box's M is significant at $p < .001$ (Tabachnick & Fidell, 1983).

Moreover, it has been shown that even extremely wide discrepancies in group variances have only a minimal effect on the Type I error rate, particularly when the sample sizes are equal (Cohen, 1965; Keppel, 1973). In this study, sample sizes, although not equal, were very nearly so. In any event, when it is the larger groups which produce the larger variances, as was the case in this study, a conservative alpha level will be produced, so that the test of mean differences, when rejected, can be rejected with confidence (Tabachnick & Fidell, 1983).

Finally, Pillai's criterion of significance was used rather than Wilk's lambda because it is more robust when there is variability in the variance-covariance matrices. When using this

test here is little inflation of Type I error rate even with large variability in variance-covariance matrices (Olson, 1976).