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## *Review Article*

# Meta-analysis of non-medical treatments for chronic pain

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**Summary** A meta-analysis was conducted on 109 published studies which assessed the outcome of various non-medical treatments for chronic pain. Of these studies, 48 provided sufficient information to calculate effect sizes. The remainder were examined according to proportion of patients rated as improved. Studies were compared as a function of type of treatment, type of pain, and type of outcome variable. In general, effect sizes were positive and of modest magnitude indicating the short-term efficacy of most treatments for most types of pain. This finding suggests that the effectiveness of treatments may be attributable not to the differences between treatments, but to the features they have in common. Mood and number of subjective symptoms consistently showed greater responses to treatment than did pain intensity, pain duration, or frequency of pain, indicating the importance of using a multidimensional framework for pain assessment. This finding also suggests that the benefit of psychological approaches to pain management may lie in reducing the fear and depression associated with pain, rather than relieving the pain itself. The present study also highlights the advantages of meta-analytic reviews.

**Key words:** Chronic pain; Meta-analysis; Medical treatment; Non-medical treatment

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## Introduction

Growing concern over the side effects of pharmacological and surgical treatments for chronic pain has spurred an interest in non-medical interventions for such conditions. These interventions include physical therapy, transcutaneous electrical nerve stimulation, and a variety of psychological approaches to pain management. Such a diverse array of treatments, presenting complaints and outcome measures, makes reviewing this area challenging. Some of these difficulties were described by Turner and Chapman [12,13] in their review. As a result of these difficulties, they were able to state only that biofeedback training was not appreciably better than relaxation training for alleviating pain due to headache. They were not able to draw firm conclusions regarding other forms of treatment. A meta-analytic review of headache treatments by Blanchard et al. [1]

reported similar results. In addition, they stressed the importance of baseline or control group data in pain studies, noting that the absence of these data made it difficult to evaluate the effectiveness of treatment. Trifiletti [11] found no definitive evidence in the literature to support the consistent effectiveness of any treatment and appealed for use of more sensitive multidimensional approaches in future pain studies. This paper attempts to address the above appeals for multidimensional and control group data by using meta-analytic procedures to appraise the status of non-medical treatments for chronic pain.

Meta-analysis refers to the statistical analysis of the summary findings of individual experiments [e.g., 2,3,6,10]. Thus, meta-analysis is a technique which organizes and extracts information differently than the traditional narrative review. In fact, the surge of interest in meta-analysis grew out of dissatisfaction with the narrative review. Tradi-

tional review articles seldom critically evaluated the findings of previous reviews in the same area. Most reviewers focused their discussions on a subset of the studies in the area, and these subsets were not always representative of the studies in the area being reviewed. Finally, indices used for determining the magnitude of study findings were sometimes crude and often failed to assess the impact of particular study characteristics on the results [2,4,6,10]. Meta-analysis was developed to overcome these problems.

There are several meta-analytic techniques which have been used to aggregate study findings (see refs. 2, 3, 6, 7 for a discussion of the various types). One of the most widely used procedures to estimate effect size in clinical research is Glass' delta. Delta is most simply defined as

$$\Delta E-C = (M_E - M_C) / S.D._C \quad (1)$$

where  $M_E$  represents the mean of the experimental group,  $M_C$  is the mean of the control group, and S.D. is the standard deviation of scores in the control group. There are several variations on this basic equation [see 2] which allow for correction of bias, estimation of effect size from  $t$ ,  $F$  or  $r$  statistics and estimation of effect size from studies in which there is no control group. The appeal of this standardized effect size measure is that results from studies using diverse methods can be aggregated, and control group data can be estimated, thus allowing systematic appraisal of the methods and procedures of various studies.

Thus, the present analysis will allow systematic comparison of outcome on a variety of dependent variables across several types of pain and treatments in an effort to determine which are generally more effective for certain types of chronic pain.

## Method

To be included in the present analysis, studies had to meet the following criteria: (a) describe and evaluate a non-medical treatment for chronic pain; (b) appear in a professional journal between 1950 and 1984; and (c) be conducted with a

clinical population. Analogue studies, case histories which were used primarily to describe a treatment, surgical and pharmacological interventions, and acupuncture were excluded.

One hundred and nine studies met the above criteria (see Appendix A). Studies were coded by 3 independent raters. Variables coded included type of pain, type of treatment, type of dependent variable, mean age of subjects, mean duration of pain, and sample size. A list of the variables coded under the first 3 categories can be found in Table I. Other variables monitoring the quality of the studies were also coded (e.g., sample size, external validity and suitability of statistical tests). These variables bore little relation to outcome, however, and are not reported.

Interrater reliabilities were obtained on a random sample of 36 studies. Cohen's kappa coefficients ranged from 0.86 to 0.92 between pairs of raters on each variable coded. Reliabilities reflect agreement among raters on categories of pain, type of treatment and numeric values of the dependent measures.

An effect size was computed using the formulas outlined by Glass et al. [2] when possible. When experimental and control group means and standard deviations were available, effect size was calculated as described in eqn (1). For studies in which no control group was reported, a standard deviation for the above equation was estimated from studies which included a no-treatment, wait list, minimal contact or psychological placebo. Observed control group standard deviations were regressed on observed experimental group standard deviations for the various experimental conditions. For example, S.D.s for control conditions in biofeedback studies were regressed on S.D.s of experimental groups in those studies to obtain an estimate of  $S_C$  as follows (see Glass et al. [2]):

$$S_C = b_0 + b_1 \quad (2)$$

When means and S.D.s were not available, effect size was calculated from significance tests as follows (see Glass et al. [2]):

$$\Delta E-C = t \sqrt{(1/N_E) + (1/N_C)} \quad (3)$$

TABLE I  
CATEGORIES OF DEPENDENT VARIABLES

Type of pain	Treatment	Dependent measure
Back or neck	Autogenic	Activity level
Cancer	Biofeedback	Duration
Dental or facial	Cognitive	EMG or temperature
Iatrogenic, phantom	Hypnosis	recordings
limb or stump	No treatment	Frequency
Joint	Operant	Improvement rating
Migraine headache	Other	Index score
Mixed group	Package	Intensity
Mixed headache	Pill placebo	Medication intake
Other	Relaxation	Mood
Tension headache	Transcutaneous electrical	Other
	nerve stimulation (TENS)	Number of subjective symptoms (such as
	Wait list	inflammation, tenderness, swelling, stiffness)

where  $t$  is the value of the  $t$  statistic,  $N_E$  is the number of observations in the experimental group and  $N_C$  is the number of observations in the control group.

Each study provided several effect sizes. Although these effect sizes were likely to be correlated, only one study provided the information necessary to correct for non-independence of effect sizes, as suggested by Strube [9]. Therefore, effect sizes were not corrected for possible interdependence.

#### *Effect size sample*

Of the 109 studies included in this analysis, 48 provided sufficient information to calculate effect sizes. This alone indicates substantial reporting problems in the pain literature. The average sample size for these studies was 52.92 (range = 4–676). The average age of subjects was 34.51 years (range = 12–65) and the average duration of pain was 9.4 years (range = 2–19). The number of studies investigating each type of treatment, pain complaint and outcome measure is detailed in the tables.

Effect size estimates were calculated for each treatment. Generally, these effect sizes are tested for their departure from zero, thus providing a statistical base from which to draw inferences. The extreme diversity of the types of pain studied, types of treatments used, the number of independent measures reported, and the non-indepen-

dence among multiple effect sizes from the same study make significance testing hazardous (number of studies in various categories ranged from 1 to 24). Therefore, effect sizes will only be discussed in terms of their relative magnitude.

#### *Type of treatment effects*

The overall mean effect sizes for the treatments are presented in Table II. All effect sizes represent comparison of the treatments to estimated outcome effects of no-treatment control groups.

In the reviewed studies, all treatments were reported as extremely successful when compared with the estimated outcome effects of no-treatment control groups. In general, patients who

TABLE II  
EFFECT SIZES AS A FUNCTION OF TYPE OF TREATMENTS

Treatment	Mean effect size	S.D.	No. of studies
Autogenic	2.74	1.95	2
Biofeedback	0.95	1.16	24
Cognitive	0.76	0.31	4
Hypnosis	2.67	—	1
Operant	0.55	0.09	3
Package	1.33	1.59	11
Pill placebo	2.23	2.13	3
Relaxation	0.67	0.82	7
TENS	0.46	0.07	2

TABLE III  
EFFECT SIZES AS A FUNCTION OF TYPES OF PAIN

Type of pain	Mean effect size	S.D.	No. of studies
Back or neck	0.97	0.64	6
Cancer	0.42	—	1
Dental	1.21	1.45	10
Joint	1.05	1.05	8
Migraine headache	0.54	0.36	13
Mixed group	1.16	1.05	11
Mixed headache	0.41	0.31	2
Other	0.83	—	1
Tension headache	0.96	1.45	12

received autogenic training, pill placebo, package, or biofeedback training reported the most favorable outcomes. In contrast to Blanchard et al.'s [1] review of headache studies, we found pill placebo to be more consistently effective than biofeedback or relaxation training. Consistent with their study, we found autogenic training to be slightly better than pill placebo. Package treatments which allow patients to choose from a diverse array of pain management strategies were also relatively effective. Effect sizes for operant training and TENS were no larger than the estimated effect size for control conditions. Although the hypnosis study included in this sample produced a large effect size, it is difficult to draw conclusions about hypnotic treatment based on one study.

#### *Type of pain*

In order to determine the influence of the type of pain on outcome, studies were recategorized according to the pain treated. The effect sizes presented in Table III averaged outcome for type of pain across treatments and dependent measures. Groups composed of patients with dental pain or joint pain showed the largest effect sizes, as did groups that included a mix of patients with different pain complaints.

#### *The type of outcome measure*

In order to determine if the effect of therapy varied systematically with the source of the outcome measure (intensity, mood, etc.), studies were reclassified by type of outcome measure used.

These results are presented in Table IV. In brief, there was extreme variability on all outcome measures except number of symptoms (inflammation, swelling, tenderness, etc.), EMG recordings, and mood. These 3 dependent variables consistently showed improvement. Perhaps the genuine efficacy of the treatments reviewed here lies in their ability to reduce the fear and depression associated with pain, rather than to change the pain itself. Reductions in fear are often accompanied by reports of decreased physical symptoms and decreased muscle tension.

#### *Percentage improved sample*

The remaining 61 studies did not provide sufficient information to allow confident calculation of effect sizes. When outcome data were available, patients reporting a 25% or greater reduction in any of the outcome measures listed in Tables I and IV were counted as improved. Generally, such data were not reported and therefore, in most cases, the individual investigator's improvement ratings were used. For these studies, the subjects rated as having 'some,' 'moderate' or 'complete' improvement were coded as 'improved' in our analysis. Subjects reporting 'little improvement' or 'no improvement' were rated as 'not improved.' The average age of the patients in these studies was 39.54 years (range = 11–67), the average number of patients per study was 84.7 (range =

TABLE IV  
EFFECT SIZES AS A FUNCTION OF OUTCOME MEASURES

Outcome measure	Mean effect size	S.D.	No. of studies
Activity level	1.48	1.86	6
Duration	1.42	2.42	7
EMG or temperature recordings	0.67	0.40	5
Frequency	0.75	0.78	18
Improvement rating	0.81	—	1
Index score	1.18	1.31	21
Intensity	0.75	1.05	25
Medication intake	1.21	1.88	6
Mood	1.91	0.92	9
Other	3.80	3.11	2
Subjective symptoms	1.12	0.40	7

1-2207), and the average duration of pain was 27 years (range = 2-62).

Thus it can be seen that these studies examined a sample that differed from those in the effect size sample. Patients were slightly older, had suffered pain longer and sample sizes were larger than in the previous group of studies.

## Results

### *Type of treatment*

As can be seen in Table V, the percentage of improvement for subjects in no-treatment conditions was striking. Further, the distribution of the percentages of improved patients in the various treatment categories differs from that seen in the effect size sample. The rough aggregation of categories in this sample is not particularly different from that done in the traditional narrative review. Yet the conclusions that can be offered differ from that obtained from the true effect sizes calculated in the previous sample. Based on the 'percentage improved' method one can conclude that only relaxation training is truly effective. Biofeedback training is minimally effective and the other treatments are actually less effective than no treatment at all.

### *Type of pain*

Table VI reveals that the tension and migraine headaches consistently responded well to treatment. Inspection of the type of treatment used for

TABLE VI

PERCENTAGES OF IMPROVED PATIENTS AS A FUNCTION OF TYPES OF PAIN

Pain	Mean percent	S.D.	No. of studies
Back or neck	79	15.83	4
Cancer	45	17.68	2
Dental	64	24.26	21
Iatrogenic	64	24.93	4
Joint	80	21.73	5
Migraine headache	82	34.12	7
Mixed group	78	29.26	11
Mixed headache	38	25.87	2
Tension headache	88	18.43	10

these categories indicates that a variety of treatments were employed. Package treatments were more likely to be used for tension headache, and hypnosis was used more often than other treatments in the studies reviewed here for migraine headache. This is not easily concluded from the data in Table V and emphasizes the difficulties inherent in this crude form of data aggregation.

### *Type of outcome measure*

Finally, the percentage of improved patients as reflected by the dependent measures was calculated. Inspection of Table VII reveals that unlike the effect size sample, pain intensity and duration of pain episodes consistently showed improvement in this group of studies. Although, the 100% improved figure for mood must be viewed with cau-

TABLE V

PERCENTAGE OF PATIENTS IMPROVED AS A FUNCTION OF TREATMENT TYPE

Treatment	Mean percentage	S.D.	n
Autogenic	68	12.02	4
Biofeedback	84	23.56	16
Hypnosis	13	—	1
No treatment	77	22.67	14
Other	60	9.65	6
Pill placebo	70	9.64	3
Package	72	32.85	15
Relaxation	95	12.08	4
TENS	74	17.56	4

TABLE VII

PERCENTAGE OF IMPROVED PATIENTS AS A FUNCTION OF TYPES OF OUTCOME MEASURE

Pain	Mean percent	S.D.	n
Activity level	74	37.48	2
Duration	85	32.65	5
Frequency	77	27.35	23
Improvement rating	63	15.50	12
Index score	61	20.32	5
Intensity	88	21.79	16
Medication intake	72	19.61	11
Mood	100	—	11
Other	51	38.08	3
Subjective symptoms	72	40.31	2

tion, this result is consistent with that of the effect size sample and underscores our previous conclusion regarding the active ingredients of psychological treatments for pain.

## Discussion

Previous reviews of non-medical interventions for chronic pain have relied on qualitative summaries. In contrast, this review has attempted to integrate the various study findings quantitatively to provide a systematic evaluation of the evidence. This review therefore permits an assessment of the outcome of various treatments, as well as the relative degree of efficacy of each.

In the 109 studies reviewed, treatments were on the average quite effective particularly when compared to the effect sizes obtained from other statistical reviews. For example, effect size estimates obtained by Miller and Berman [5] in their review of cognitive behavior therapies ranged from 0.21 to 0.83. Shapiro and Shapiro's [8] analysis of psychotherapy outcome studies yielded effect size estimates of  $-0.10$ – $2.94$ . The greater effect sizes in the present analysis may be a product of the higher degree of specificity of both complaint and dependent measures enjoyed in pain treatment. Regardless of the overall high effect sizes, meaningful differences did emerge.

The conclusions that can be drawn from our two samples, effect size and percentage improved, are quite different. This may be explained by the different procedures involved in aggregating the findings. The calculation of effect size is a more sensitive test than simple calculation of proportion of patients rated as improved and is thus more likely to reflect subtle differences. This is clearly reflected in our data.

It was our opinion, initially, that studies that were subjected to statistical analysis would probably be of higher quality than those not subjected to such rigorous inspection. Unfortunately, most of the studies committed similar errors, thus producing insufficient variance to use the quality ratings in the analysis.

Conspicuously lacking in the present review is

an analysis of the effectiveness of these treatments at follow-up. Due to the absence of follow-up data in the literature, the long-term effectiveness of psychological pain management techniques cannot be presently evaluated. Additionally, it could not be determined from the information reported whether the high improvement rate for the no-treatment conditions in the second sample was real or artifactual. For example, if the initial symptom ratings included a wide range of severity, and patients with the most severe symptoms dropped out of the no-treatment condition to seek active treatment elsewhere, then the symptoms recorded for this group at a later time might be artificially reduced. Unless data are provided on dropouts as compared to patients who completed treatment, this issue will remain unclarified.

We found a large effect for pill placebo conditions. This effect is likely due, in our opinion, to a combination of factors. First, pill placebo conditions in the medical literature have traditionally had strong effects in the short run. These effects tend to disappear over time. These short-term effects are commonly attributed to the beliefs and expectations of the subject combined with the effect of contact with a 'helping' professional. The studies we reviewed that used a pill placebo condition only measured short-term effects. In addition, those studies did not measure what portion of the effect could be attributed to beliefs and expectations and what portion to contact with a professional who was likely seen as caring and empathic. Finally, one must be cautious in interpreting the large effect size due to the small number of studies in the sample.

The overall pattern which emerges from this analysis suggests a uniform efficacy of treatments despite differences in types of pain treated, dependent measures used, inpatient or outpatient status or patient characteristics. This evidence suggests that the effectiveness of these treatments may be attributable not to the differences between treatments, but to the features they share in common, for example, the identification of psychological factors which exacerbate pain, contact with an empathic professional, and installation of hope for relief from symptoms.

Perhaps a more fruitful approach to developing

reliable, effective therapies is one that involves isolating shared components of effective treatments. For example, autogenic training, hypnosis, biofeedback and relaxation training all impart knowledge to the patient of the effects of the body's reaction to stress on pain. Further, they teach techniques of reducing physiological reactions to stress. The question of interest then becomes identifying which method of imparting that information is easiest for a particular patient to learn, and which method can be retained and used months after termination of treatment.

What is needed is not simply more research in this area, but more refined research. Studies investigating the match between type of pain and type of treatment and personality style of the patient, efficacy of treatment at 6 and 12 month follow-up, and reliability of various dependent measures would contribute substantially to the literature. The critical issue at this time is not demonstration of the superiority of one type of treatment over others, but instead the identification of the type of treatment most likely to provide long-term benefit from a specific type of pain for a specific type of pain patient.

This study also raises serious questions about the type of relief that can be expected. Our results indicate that psychological treatments reliably affect only mood and subjective symptom ratings. What we do not know is whether this makes a difference in the pain patient's quality of life. Perhaps reduction of the fear and depression associated with pain is a more realistic goal than the reduction of the pain itself. In order to assess this, however, researchers must begin to view pain as a multidimensional experience composed of intensity and emotion, rather than simply as a physical sensation.

As more patients become aware of non-medical options to treatment of chronic pain, practitioners will be required to support their claims of long-term efficacy. This can only be accomplished by obtaining long-term follow-up data. Further, as treatment costs rise and third-party reimbursements decrease, providers will be strongly encouraged to supply maximal benefits at minimal cost. It therefore becomes prudent to isolate shared components of effective therapies and determine

the best way to provide them for cost-effective results.

We would be remiss if we did not acknowledge that the results of this meta-analysis are only as good as the data on which it is based. Accordingly it is useful to consider some potential sources of error in the analysis. One potential source of error is in the use of estimated control data to calculate effect sizes in studies that lack control groups. This was a fairly common occurrence in our sample of studies. To the extent that the existent control groups provide a reasonable estimate of the missing control groups, the estimated effect sizes will be unbiased. However, if the existent control groups differ from the missing control groups, then the estimated effect sizes will be biased (either overestimates or underestimates). We have no way of knowing how well the existent control data approximate the missing control data. On the other hand, given that our interest is in the relative effectiveness of particular treatments (rather than their absolute effectiveness), the present data still provide important information. A second problem that could complicate inferences is the aggregation of studies of differing quality. This is unlikely to be a serious problem in our analysis in that an attempt was made to code study quality and little variability was found. On the other hand, the pool of studies as a whole was not especially exemplary from a design standpoint, suggesting the need for caution in drawing inferences from this research to future empirical efforts (that hopefully will overcome some of the problems identified here). Finally, because of sample size restrictions we were unable to examine effect size differences for combinations of study characteristics. That is, although we found biofeedback to be a relatively effective treatment overall, we were unable to examine whether it was more or less effective for particular types of pain. This type of analysis must await additional research. Additional limitations with the meta-analysis approach have been discussed in detail elsewhere [e.g., 7,10]. Provided some healthy respect for these limitations is kept firmly in mind, the present results provide information that may assist in the practical and theoretical application of past research on pain management.

## Appendix A

### BRIEF DESCRIPTION OF STUDIES INCLUDED IN THE ANALYSIS

Investigator	N	Age	Duration	Treatment	Variable	Type of pain
1. Achterberg et al. [14]	24			BFT	duration	joint
2. Adler and Adler [15]	68	37	18	package	frequency	mixed group
3. Anderson et al. [16]	34			operant	medication	mixed group
4. Anderson et al. [17]	14	20	5	package	frequency	tension h.a.
5. Anderson et al. [18]	47			hypnosis	frequency	migraine h.a.
6. Andreychuk and Skriver [19]	33			BFT hypnosis	index	migraine h.a.
7. Bennick et al. [20]	9			relaxation	intensity	mixed h.a.
8. Bild and Adams [21]	21			BFT	intensity	tension h.a.
9. Blanchard [22]	1			BFT	intensity	mixed h.a.
10. Blanchard et al. [23]	14			BFT	index	mixed h.a.
				relaxation		
11. Blanchard et al. [24]	11	44	13	package	duration frequency intensity	mixed h.a.
12. Blanchard et al. [25]	8			BFT	index relaxation	mixed h.a.
13. Budzynski et al. [26]	5	35	8	BFT	intensity	tension h.a.
14. Budzynski et al. [27]	18	36	8	BFT	index	tension h.a.
15. Butler [28]	12	51		hypnosis	frequency	cancer
16. Cangello [29]	22			hypnosis	medication	cancer
17. Cedercreutz et al. [30]	140			hypnosis	frequency	non-specific
18. Cheek [31]	1	27	5	hypnosis	frequency	back/neck
19. Chesney and Shelton [32]	24			operant	intensity	tension h.a.
				frequency		
				duration		
20. Cohen et al. [33]	25			operant	intensity	back/neck
				phys ther		
21. Cohen et al. [34]	52	42		BFT	frequency duration intensity EMG	migraine h.a.
22. Cox et al. [35]	27	39	11	BFT	index	tension h.a.
23. Crasilneck and Hall [36]	4			hypnosis	frequency	mixed group
24. Daly et al. [37]	56	35	16	BFT	intensity frequency index	mixed h.a.
25. Diamond and Montrose [38]	395			package	rating	non-specific
26. Dougherty [39]	1	54		BFT	intensity	phant. limb
27. Drury et al. [40]	4	45	33	autogenic	frequency	tension h.a.
28. Elmore and Tursky [41]	23			BFT	frequency duration intensity	migraine h.a.
29. Eriksson et al. [42]	44	62	7	TENS	rating	dent/facial
30. Feuerstein and Adams [43]	4	13	34	BFT	activity frequency duration	mixed h.a.
31. Feuerstein et al. [44]	1	67	62	BFT	other	unspecified h.a.
					EMG	
32. Fogel [45]	2	44	12	hypnosis	frequency	non-specific
33. Fordyce et al. [46]	29			operant	rating intensity activity other	mixed group



## Appendix A (continued)

Investigator	N	Age	Duration	Treatment	Variable	Type of pain
34. Friar and Beatty [47]	9	30		BFT	frequency	migraine h.a.
35. Fried et al. [48]	563			TENS	intensity medication activity other	mixed group
36. Friedman and Taub [49]	18	39	19	hypnosis	intensity	migraine h.a.
37. Graham [50]	2	47	13	hypnosis	frequency	migraine h.a.
38. Grzesiak [51]	4	26	2	relaxation	intensity	mixed group
39. Hart and Cichanski [52]	22	33	12	BFT	index	tension h.a.
40. Hay and Madders [53]	20			package	index	tension h.a.
41. Haynes et al. [54]	21	21	5	BFT	activity frequency medication	tension h.a.
42. Hilgard and Lebaron [55]	19			hypnosis	intensity	cancer
43. Hoelscher and Lichstein [56]	1	61	20	BFT	frequency medication	mixed h.a.
44. Holroyd et al. [57]	31	19		BFT	frequency	tension h.a.
45. Holroyd et al. [58]	31			cognitive	intensity symptoms EMG	tension h.a.
46. Howard et al. [59]	1	30	17	hypnosis	frequency	migraine h.a.
47. Hutchings and Reinking [60]	12	23		package	index	tension h.a.
48. Isele [61]	3	45		package	frequency	mixed group
49. Johnson and Turin [62]	1	27	2	BFT	duration	migraine h.a.
50. Kabat-Zinn [63]	51	45	5	autogenic	index other symptoms mood	mixed group
51. Keefe et al. [64]	111	39		package	EMG medication	back
52. Kewman and Roberts [65]	34	40		BFT	frequency duration symptoms rating medication	migraine h.a.
53. Khatami and Rush [66]	5	43	11	package	medication mood intensity	mixed group
54. Khatami and Rush [67]	14	43		package	intensity	mixed group
55. King et al. [68]				BFT	activity intensity	joint
56. King and Arena [69]	1	69	37	BFT	medication	mixed h.a.
57. Kondo and Canter [70]	20	26	2	BFT	frequency	tension h.a.
58. Kremsdorf et al. [71]	2	30	7	package	activity	tension h.a.
59. LaCroix et al. [72]	27	41	19	BFT	index	migraine h.a.
60. Lake et al. [73]	24	33	14	relaxation BFT package	index	migraine h.a.
61. Lankhorst et al. [74]	2207			package	rating	back
62. Large [75]	18	40	8	BFT	rating	mixed group
63. Large and Lamb [76]	18	40	8	BFT	intensity	mixed group
64. Lea et al. [77]	18	47		hypnosis	frequency	
65. Lehmann et al. [78]	54	39		TENS placebo	activity intensity	back/neck

## Appendix A (continued)

Investigator	N	Age	Duration	Treatment	Variable	Type of pain
66. Lewis et al. [79]	28			TENS	intensity symptoms	joint
67. Linton and Gotestam [80]	15	43		relaxation package	intensity activity medication mood	mixed group
68. Lundeberg [81]	731			TENS	intensity	mixed group
69. Lundeberg [82]	267	55		TENS	rating	other
70. Lundeberg et al. [83]	366	45		TENS	rating	other
71. Lutker [84]	1	22	8	relaxation	intensity	migraine h.a.
72. Matthew [85]	676			BFT drug package	index	mixed h.a.
73. Medina et al. [86]	27	35		BFT	medication	mixed group
74. Melzack and Perry [87]	24	48		BFT hypnosis package	index	mixed group
75. Melzack et al. [88]	41	46	1	TENS	intensity index activity	back/neck
76. Miller and LeLieuvre [89]	4	65	7	package	index	joint
77. Mitch et al. [90]	20			autogenic	frequency	tension h.a.
78. Mitchell and White [91]	12	28	7	package	frequency	migraine h.a.
79. Moore et al. [92]	51	47	4	package	intensity	mixed group
80. Montgomery and Ehrisman [93]	13			package	frequency intensity	mixed h.a.
81. Mullin et al. [94]	11			BFT	index	tension h.a.
82. Newman et al. [95]	36	45	6	operant	exercise ret to work medication	back/neck
83. Nouwen [96]	20	43	12	BFT	intensity EMG	back/neck
84. Olness and MacDonald [97]	3	11	3	package	frequency	mixed group
85. Peck and Kraft [98]	32			BFT	rating	mixed h.a. back/neck dent/facial
86. Reading and Mohr [99]	6	41	13	BFT	index	migraine h.a.
87. Reeves [100]	1	20	5	package	intensity	tension h.a.
88. Roberts and Reinhardt [101]	26	45	9	operant	frequency	mixed group
89. Rybstein-Blinchik [102]	11	54	5	cognitive	frequency	mixed group
90. Rybstein-Blinchik and Grzesiak [103]	5			cognitive	frequency	mixed group
91. Sacerdote [104]	8			hypnosis	medication	cancer
92. Sargent et al. [105]	15	19		autogenic	medication	mixed group
93. Sargent et al. [106]	19			autogenic	medication	mixed group
94. Schlutter et al. [107]	48			autogenic	intensity	tension h.a.
95. Smith and Balaban [108]	1	41	12	hypnosis	intensity	Lupus
96. Spence [109]	21	36	5	BFT	intensity medication EMG symptoms	mixed group
97. Steger and Harper [110]	20	34	4	BFT relaxation package	frequency EMG	tension h.a.
98. Stenn et al. [111]	11	23		package	intensity	dent/facial
99. Sturgis et al. [112]	22	44	35	BFT	duration	mixed group

## Appendix A (continued)

Investigator	N	Age	Duration	Treatment	Variable	Type of pain
100. Swanson et al. [113]	186	45	7	operant	medication	mixed group
101. Tasto and Hinkle [114]	6	20	2	relaxation	duration frequency	tension h.a.
102. Taylor et al. [115]	7	49	15	package	activity mood intensity	mixed group
103. Trent [116]	1	47	20	relaxation	activity intensity medication	back/neck
104. Turner [117]	36	42	9	relaxation	symptoms activity medication imp. rating	back/neck
105. Varni [118]	3	24		package	other	joint
106. Wagner [119]	1	20	14	EMG	frequency	migraine h.a.
107. Warner and Lance [120]	25			relaxation	frequency	mixed h.a.
108. Wickramasekera [121]	1	20	14	package	frequency	migraine h.a.
109. Wickramasekera [122]	5			package	intensity	tension h.a.

## References

- Blanchard, E.B., Andrasik, F., Ahles, T.A., Teders, S.J. and O'Keefe, D. (1980) Migraine and Tension Headache: a Meta-Analytic Review. *Behav. Ther.*, 11, 613-631.
- Glass, G.W., McGraw, B. and Smith, M.L. (1981) *Meta-Analysis in Social Research*. Sage, Beverly Hills, CA.
- Hedges, L.V. and Olkin, I. (1985) *Statistical Methods for Meta-Analysis*. Academic Press, New York.
- Jackson, G.G. (1980) Methods for integrative reviews. *Rev. Educ. Res.*, 50, 438-460.
- Miller, R.C. and Berman, J.S. (1983) The efficacy of cognitive behavior therapies: a quantitative review of the research evidence. *Psychol. Bull.*, 94, 39-53.
- Rosenthal, R. (1983) Assessing statistical and social importance of the effects of psychotherapy. *J. Consult. Clin. Psychol.*, 51, 4-13.
- Rosenthal, R. (1984) *Meta-Analytic Procedures for the Social Sciences*. Sage, Beverly Hills, CA.
- Shapiro, D.A. and Shapiro, D. (1982) Meta-analysis of comparative therapy outcome studies: a replication and refinement.
- Strube, M.J. (1985) Combining and comparing significance levels from nonindependent hypothesis tests. *Psychol. Bull.*, 97, 334-341.
- Strube, M.J. and Hartmann, D.P. (1983) Meta-analysis: techniques, applications and functions. *J. Consult. Clin. Psychol.*, 51, 14-27.
- Trifiletti, R.J. (1984) The psychological effectiveness of pain management procedures in the context of behavioral medicine and medical psychology. *Genet. Psychol. Monogr.*, 109, 251-178.
- Turner, J.A. and Chapman, C.R. (1982) Psychological interventions for chronic pain: a critical review. I. Relaxation training and biofeedback. *Pain*, 12, 1-21.
- Turner, J.A. and Chapman, C.R. (1982) Psychological interventions for chronic pain: a critical review. II. Operant conditioning, hypnosis, and cognitive behavioral therapy. *Pain*, 12, 23-46.
- Achterberg, J., McGaw, R. and Lawlis, G.F. (1981) Rheumatoid arthritis: a study of relaxation and temperature biofeedback training as an adjunctive therapy. *Biofeedback Self-Regul.*, 6, 207-223.
- Adler, C.S. and Adler, S.M. (1976) Biofeedback psychotherapy for the treatment of headaches: a five year follow-up. *Headache*, 16, 189-191.
- Anderson, T.P., Cole, T.M., Gullickson, G., Hudgins, A. and Roberts, A.H. (1978) Behavior modification of chronic pain: a treatment program by a multidisciplinary team. *Clin. Orthop. Rel. Res.*, 129, 96-100.
- Anderson, N.B., Lawrence, P.S. and Olson, T.W. (1981) Within subject analysis of autogenic training and cognitive coping training in the treatment of tension headache pain. *J. Behav. Ther. Exp. Psychiat.*, 12, 219-223.
- Anderson, J.A.D., Basker, M.A. and Dalton, R. (1975) Migraine and hypnotherapy. *Int. J. Clin. Exp. Hypnos.*, 23, 48-58.
- Andreychuk, T. and Skriver, C. (1975) Hypnosis and biofeedback in the treatment of migraine headache. *Int. J. Clin. Exp. Hypnos.*, 23, 172-183.
- Bennick, C.D., Hulst, L.L. and Bentham, J.A. (1982) The

## Studies used in the analysis

- effects of EMG biofeedback and relaxation training on primary dysmenorrhea. *J. Behav. Med.*, 5, 329–341.
- 21 Bild, R. and Adams, H.E. (1980) Modification of migraine headaches by cephalic blood volume pulse and EMG biofeedback. *J. Consult. Clin. Psychol.*, 45, 51–57.
  - 22 Blanchard, E.B. (1979) The use of temperature biofeedback in the treatment of chronic pain due to causalgia. *Biofeedback Self-Regul.*, 4, 183–188.
  - 23 Blanchard, E.B., Andrasik, F., Jurish, S.F. and Teders, S.J. (1982) The treatment of cluster headache with relaxation and thermal biofeedback. *Biofeedback Self-Regul.*, 7, 185–191.
  - 24 Blanchard, E.B., Andrasik, F., Neff, D.F., Arena, J.G., Ahles, T.A., Jurish, S.E., Pallmeyer, T.P., Saunders, N.L., Teders, S.J., Barron, K.D. and Rodichok, L.D. (1982) Biofeedback and relaxation training with three kinds of headache: treatment effects and their prediction. *J. Consult. Clin. Psychol.*, 50, 562–575.
  - 25 Blanchard, E.B., Andrasik, F., Neff, D.F., Teders, S.J., Pallmeyer, T.P., Arena, J.G., Jurish, S.E., Saunders, N.L., Ahles, T.A. and Rodichok, L.D. (1982) Sequential comparisons of relaxation training and biofeedback in the treatment of three kinds of chronic headache, or the machines may be necessary some of the time. *Behav. Res. Ther.*, 20, 469–481.
  - 26 Budzynski, T., Stoyva, J. and Adler, C. (1970) Feedback induced muscle relaxation: application to tension headache. *Behav. Ther. Exp. Psychiat.*, 1, 205–211.
  - 27 Budzynski, T.H., Stoyva, J.M., Adler, C.S. and Mullaney, D.J. (1973) EMG biofeedback and tension headache: a controlled outcome study. *Psychosom. Med.*, 35, 484–496.
  - 28 Butler, B. (1964) The use of hypnosis in the care of the cancer patient. *Cancer*, 7, 1–14.
  - 29 Cangello, V.W. (1964) The use of hypnotic suggestion for pain relief in malignant disease. *Int. J. Clin. Exp. Hypnos.*, 9, 17–22.
  - 30 Cedercreutz, C., Lahtenmaki, R. and Tulikoura, J. (1976) Hypnotic treatment of headache and vertigo in skull injured patients. *Int. J. Clin. Exp. Hypnos.*, 24, 195–210.
  - 31 Cheek, D.B. (1966) Therapy of persistent pain states. I. Neck and shoulder pain of five years duration. *Am. J. Clin. Hypnos.*, 8, 281–286.
  - 32 Chesney, M.A. and Shelton, J.L. (1976) A comparison of muscle relaxation and electromyogram biofeedback treatment for muscle contraction headache. *J. Behav. Ther. Exp. Psychiat.*, 7, 221–225.
  - 33 Cohen, M.J., Heinrich, R.L., Naliboff, B.D., Collins, G.A. and Bonebakker, A.D. (1983) Group outpatient physical and behavioral therapy for chronic low back pain. *J. Clin. Psychol.*, 39, 326–333.
  - 34 Cohen, M.J., McArthur, D.L. and Rickles, W.H. (1980) Comparison of four biofeedback treatments for migraine headache: physiological and headache variables. *Psychosom. Med.*, 42, 463–480.
  - 35 Cox, D.J., Freundlich, A. and Meyer, R.G. (1975) Differential effectiveness of electromyograph feedback, verbal relaxation instructions and medical placebo with tension headaches. *J. Consult. Clin. Psychol.*, 43, 892–898.
  - 36 Crasilneck, H.B. and Hall, J. (1973) Clinical hypnosis in problems of pain. *Am. J. Clin. Hypnos.*, 15, 153–160.
  - 37 Daly, E.J., Donn, P.A., Galliher, M.J. and Zimmerman, J.S. (1983) Biofeedback applications to migraine and tension headaches: a double blinded outcome study. *Biofeedback Self-Regul.*, 8, 135–152.
  - 38 Diamond, S. and Montrose, D. (1984) The value of biofeedback in the treatment of chronic headache: a four year retrospective study. *Headache*, 24, 5–18.
  - 39 Dougherty, J. (1980) Relief of phantom limb pain after EMG biofeedback assisted relaxation: a case report. *Behav. Res. Ther.*, 18, 355–357.
  - 40 Drury, R.L., DeRisi, W.J. and Liberman, R.P. (1979) Temperature biofeedback treatment for migraine headache: a controlled multiple baseline study. *Headache*, 19, 278–284.
  - 41 Elmore, A.M. and Tursky, B. (1981) A comparison of two psychophysiological approaches to the treatment of migraine. *Headache*, 21, 93–101.
  - 42 Eriksson, M.B., Sjölund, B.H. and Sundbarg, G. (1984) Pain relief from peripheral conditioning stimulation in patients with chronic facial pain. *J. Neurosurg.*, 61, 149–155.
  - 43 Feuerstein, M. and Adams, H.E. (1977) Cephalic vasomotor feedback in the modification of migraine headache. *Biofeedback Self-Regul.*, 2, 241–254.
  - 44 Feuerstein, M., Adams, H.E. and Beiman, I. (1976) Cephalic vasomotor and electromyographic feedback in the treatment of combined muscle contraction headaches in a geriatric case. *Headache*, 16, 232–237.
  - 45 Fogel, B.S. (1984) The 'sympathetic ear': case reports of a self hypnotic approach to chronic pain. *Am. J. Clin. Hypnos.*, 27, 103–106.
  - 46 Fordyce, W.E., Fowler, R.S., Lehmann, J.F., DeLateur, B.J., Sand, P.L. and Trieschmann, R.B. (1973) Operant conditioning in the treatment of chronic pain. *Arch. Phys. Med. Rehab.*, 54, 399–408.
  - 47 Friar, L.R. and Beatty, J. (1976) Migraine: management by trained control of vasoconstriction. *J. Consult. Clin. Psychol.*, 44, 46–53.
  - 48 Fried, T., Johnson, R. and McCracken, W. (1984) Transcutaneous electrical nerve stimulation: its role in the control of chronic pain. *Arch. Phys. Med. Rehab.*, 65, 228–231.
  - 49 Friedman, H. and Taub, H.A. (1982) An evaluation of hypnotic susceptibility and peripheral temperature elevation in the treatment of migraine. *Am. J. Clin. Hypnos.*, 24, 172–182.
  - 50 Graham, G.W. (1975) Hypnotic treatment for migraine headaches. *Int. J. Clin. Exp. Hypnos.*, 23, 165–171.
  - 51 Grzesiak, R. (1977) Relaxation techniques in treatment of chronic pain. *Arch. Phys. Med. Rehab.*, 58, 270–272.
  - 52 Hart, J.D. and Cichanski, K.A. (1981) A comparison of frontal EMG biofeedback and neck EMG biofeedback in the treatment of muscle contraction headache. *Biofeedback Self-Regul.*, 6, 63–74.
  - 53 Hay, K.M. and Madders, J. (1971) Migraine treated by relaxation therapy. *J. Roy. Coll. Gen. Practit.*, 21, 664–669.
  - 54 Haynes, S.N., Griffin, P., Mooney, E. and Parise, M.

- (1975) Electromyographic biofeedback and relaxation instructions in the treatment of muscle contraction headaches. *Behav. Ther.*, 6, 672-678.
- 55 Hilgard, J.R. and Lebaron, S. (1982) Relief of anxiety and pain in children and adolescents with cancer: quantitative measures and clinical observations. *Int. J. Clin. Exp. Hypnos.*, 30, 417-442.
  - 56 Hoelscher, T.J. and Lichstein, K.L. (1983) Blood volume pulse biofeedback treatment of chronic cluster headache. *Biofeedback Self-Regul.*, 8, 553-541.
  - 57 Holroyd, H.A., Andrasik, F. and Noble, J. (1980) A comparison of EMG biofeedback and a credible pseudo-therapy in treating tension headache. *J. Behav. Med.*, 3, 29-39.
  - 58 Holroyd, K.A., Andrasik, F. and Westbrook, T. (1977) Cognitive control of tension headache. *Cogn. Ther. Res.*, 1, 121-133.
  - 59 Howard, L., Reardon, J.P. and Tosi, D. (1982) Modifying migraine headache through rational stage directed hypnotherapy: a cognitive experimental perspective. *Int. J. Clin. Exp. Hypnos.*, 30, 257-269.
  - 60 Hutchings, D.F. and Reinking, R.H. (1976) Tension headaches: what form of therapy is most effective? *Biofeedback Self-Regul.*, 1, 183-190.
  - 61 Isele, F.W. (1982) Biofeedback and hypnosis in the treatment of pain. *NY St. J. Med.*, 1, 38-44.
  - 62 Johnson, W.G. and Turin, A. (1975) Biofeedback treatment of migraine headache: a systematic case study. *Behav. Ther.*, 6, 394-397.
  - 63 Kabat-Zinn, J. (1982) An outpatient program in behavioral medicine for chronic pain patients based on the practice of mindfulness meditation: theoretical considerations and preliminary results. *Gen. Hosp. Psychiat.*, 4, 33-47.
  - 64 Keefe, F.J., Block, A.R., Williams, R.B. and Surwit, R.S. (1981) Behavioral treatment of chronic low back pain: Clinical outcome and individual differences in pain relief. *Pain*, 11, 221-231.
  - 65 Kewman, D. and Roberts, A.H. (1980) Skin temperature biofeedback and migraine headaches: a double blind study. *Biofeedback Self-Regul.*, 5, 327-345.
  - 66 Khatami, M. and Rush, A.J. (1978) A pilot study of the treatment of outpatients with chronic pain: symptom control, stimulus control, and social system intervention. *Pain*, 5, 163-172.
  - 67 Khatami, M. and Rush, A.J. (1982) A one year follow-up of the multimodal treatment for chronic pain. *Pain*, 14, 45-52.
  - 68 King, A.C., Ahles, T.A., Martin, J.E. and White, R. (1984) EMG biofeedback controlled exercise in chronic arthritic knee pain. *Arch. Phys. Med. Rehab.*, 65, 341-343.
  - 69 King, A.C. and Arena, J.G. (1984) Behavioral treatment of chronic cluster headache in a geriatric patient. *Biofeedback Self-Regul.*, 9, 201-208.
  - 70 Kondo, C. and Canter, A. (1977) True and false electromyographic feedback: effect on tension headache. *J. Abnorm. Psychol.*, 4, 93-95.
  - 71 Kremsdorf, R.B., Kochanowicz, N.A. and Costell, S. (1981) Cognitive skills training versus EMG biofeedback in the treatment of tension headaches. *Biofeedback Self-Regul.*, 6, 93-101.
  - 72 LaCroix, M., Clarke, M.A., Bock, J.C., Doxey, N., Wood, A. and Lavis, S. (1983) Biofeedback and relaxation in the treatment of migraine headaches: comparative effectiveness and physiological correlates. *J. Neurol. Neurosurg. Psychiat.*, 46, 525-532.
  - 73 Lake, A., Rainey, J. and Papsdorf, J.D. (1979) Biofeedback and rational emotive therapy in the management of migraine headache. *J. Appl. Behav. Anal.*, 12, 127-140.
  - 74 Lankhorst, G.J., VandeStadt, R.J., Vogelaar, T.W., VanderKorst, J.K. and Prevo, A.J. (1983) The effect of the Swedish Back School in chronic idiopathic low back pain: a prospective controlled study. *Scand. J. Rehab. Med.*, 15, 141-145.
  - 75 Large, R.G. (1985) Prediction of treatment response in pain patients: the illness self-concept repertory grid and EMG feedback. *Pain*, 21, 279-281.
  - 76 Large, R.G. and Lamb, A.M. (1983) Electromyographic (EMG) feedback in chronic musculoskeletal pain: a controlled trial. *Pain*, 17, 167-177.
  - 77 Lea, P.A., Ware, P.D. and Monroe, R.R. (1960) The hypnotic control of intractable pain. *Am. J. Clin. Hypnos.*, 3, 3-8.
  - 78 Lehmann, R.T., Russell, D.W. and Spratt, K.F. (1983) The impact of patients with nonorganic physical findings on a controlled trial of transcutaneous electrical nerve stimulation and electroacupuncture. *Spine*, 8, 625-634.
  - 79 Lewis, D., Lewis, B. and Sturrock, R.D. (1984) Transcutaneous electrical nerve stimulation in osteoarthritis: a therapeutic alternative? *Ann. Rheum. Dis.*, 43, 47-49.
  - 80 Linton, S.J. and Gøtestam, K.G. (1984) A controlled study of the effects of applied relaxation and applied relaxation plus operant procedures in the regulation of chronic pain. *Br. J. Clin. Psychol.*, 23, 291-299.
  - 81 Lundeberg, T.C. (1983) Vibratory stimulation for the alleviation of chronic pain. *Acta Physiol. Scand.*, 523, 1-51.
  - 82 Lundeberg, T. (1984) Long term results of vibratory stimulation as a pain relieving measure for chronic pain. *Pain*, 20, 13-23.
  - 83 Lundeberg, T., Nordemar, R. and Ottoson, D. (1984) Pain alleviation by vibratory stimulation. *Pain*, 20, 25-44.
  - 84 Lutker, E.R. (1971) Treatment of migraine headache by conditioned relaxation: a case study. *Behav. Ther.*, 2, 592-593.
  - 85 Mathew, N.T. (1981) Prophylaxis of migraine and mixed headache: a randomized controlled study. *Headache*, 21, 105-109.
  - 86 Medina, J.L., Diamond, S. and Franklin, M.A. (1976) Biofeedback therapy for migraine. *Headache*, 16, 115-118.
  - 87 Melzack, R. and Perry, C. (1975) Self regulation of pain: the use of alpha feedback and hypnotic training for the control of pain. *Exp. Neurol.*, 46, 4522-4569.
  - 88 Melzack, R., Vetare, P. and Finch, L. (1983) Transcutaneous electrical nerve stimulation for low back pain: a

- comparison of TENS and massage for pain and range of motion. *Phys. Ther.*, 63, 489-493.
- 89 Miller, C. and LeLievre, R.B. (1982) A method to reduce chronic pain in elderly nursing home residents. *Gerontologist*, 22, 314-317.
  - 90 Mitch, P.S., Grady, A. and Iannone, A. (1976) Autogenic feedback training in migraine: a treatment report. *Headache*, 15, 267-270.
  - 91 Mitchell, K.R. and White, R.G. (1977) Behavioral self-management: an application to the problem of migraine headaches. *Behav. Ther.*, 8, 213-221.
  - 92 Moore, M.E., Berk, S.N. and Nypaver, A. (1984) Chronic pain: inpatient treatment with small group effects. *Arch. Phys. Med. Rehab.*, 65, 356-361.
  - 93 Montgomery, P.S. and Ehrisman, W.J. (1976) Biofeedback alleviated headaches: a follow up. *Headache*, 15, 64-65.
  - 94 Mullinex, J.M., Norton, B.J., Hack, S. and Fishman, M.A. (1978) Skin temperature biofeedback and migraine. *Headache*, 17, 242-244.
  - 95 Newman, R.I., Seres, J.L., Yospe, L.P. and Garlington, B. (1978) Multidisciplinary treatment of chronic pain: long term follow up of low back pain patients. *Pain*, 4, 283-292.
  - 96 Nouwen, A. (1983) EMG biofeedback used to reduce standing levels of paraspinal muscle tension in chronic low back pain. *Pain*, 17, 353-360.
  - 97 Olness, K. and MacDonald, J. (1981) Self hypnosis and biofeedback in the management of juvenile migraine. *Dev. Behav. Pediatr.*, 2, 168-170.
  - 98 Peck, C.L. and Kraft, G.H. (1977) Electromyographic biofeedback for pain related to muscle tension. *Arch. Surg.*, 112, 889-895.
  - 99 Reading, C. and Mohr, P.D. (1976) Biofeedback control of migraine: a pilot study. *Br. J. Soc. Clin. Psychol.*, 15, 429-433.
  - 100 Reeves, J.L. (1976) EMG biofeedback reduction of tension headache: a cognitive skills training approach. *Biofeedback Self-Regul.*, 1, 217-225.
  - 101 Roberts, A.H. and Reinhardt, L. (1980) The behavioral management of chronic pain: long term follow-up with comparison groups. *Pain*, 8, 151-162.
  - 102 Rybstein-Blinchik, E. (1978) Effects of different cognitive strategies on chronic pain experience. *J. Behav. Med.*, 2, 93-101.
  - 103 Rybstein-Blinchik, E. and Grzesiak, R.C. (1979) Reinterpretative cognitive strategies in cognitive pain management. *Arch. Phys. Med. Rehab.*, 60, 609-612.
  - 104 Sacerdote, P. (1961) The place of hypnosis in the relief of severe protracted pain. *Am. J. Clin. Hypnos.*, 4, 150-157.
  - 105 Sargent, J.D., Green, E.E. and Walters, E.D. (1972) The use of autogenic feedback training in a pilot study of migraine and tension headaches. *Headache*, 12, 120-124.
  - 106 Sargent, J.D., Green, E.E. and Walters, E.D. (1973) Preliminary report on the use of autogenic feedback training in the treatment of migraine and tension headache. *Psychosom. Med.*, 35, 129-135.
  - 107 Schlutter, L.C., Golden, C.J. and Blume, H.G. (1980) A comparison of treatments of prefrontal muscle contraction headache. *Br. J. Med. Psychol.*, 53, 47-52.
  - 108 Smith, S.J. and Balaban, A.B. (1983) A multidimensional approach to pain relief: case report of a patient with systemic lupus erythematosus. *Int. J. Clin. Exp. Hypnos.*, 31, 72-81.
  - 109 Spence, N.D. (1984) Relaxation training for chronic pain patients. *Aust. NZ J. Psychiat.*, 18, 263-272.
  - 110 Steger, J.C. and Harper, R.G. (1980) Comprehensive biofeedback vs. self-monitored relaxation in the treatment of tension headache. *Headache*, 20, 137-142.
  - 111 Stenn, P.G., Mothersill, K.J. and Brooke, R.I. (1979) Biofeedback and a cognitive behavioral approach to treatment of myofascial pain dysfunction syndrome. *Behav. Ther.*, 10, 29-36.
  - 112 Sturgis, E.T., Tollison, C.D. and Adams, H.E. (1978) Modification of combined migraine muscle contraction headaches using BVP and EMG biofeedback. *J. Appl. Behav. Anal.*, 11, 215-223.
  - 113 Swanson, D.W., Maruta, T. and Swenson, W.M. (1979) Results of behavior modification in the treatment of chronic pain. *Psychosom. Med.*, 41, 55-61.
  - 114 Tasto, D.L. and Hinkle, J.E. (1973) Muscle relaxation treatment for tension headache. *Behav. Res. Ther.*, 11, 347-349.
  - 115 Taylor, C.B., Zlutnick, S.I., Corley, M.J. and Flora, J. (1980) The effects of detoxification, relaxation and brief supportive therapy on chronic pain. *Pain*, 8, 319-329.
  - 116 Trent, J.T. (1982) Cognitive relaxation as a treatment of chronic pain: a single case experiment. *Am. J. Clin. Biofeedback*, 5, 59-63.
  - 117 Turner, J.A. (1982) Comparison of group progressive relaxation training and cognitive behavioral group therapy for chronic low back pain. *J. Consult. Clin. Psychol.*, 50, 757-765.
  - 118 Varni, J.W. (1981) Self regulation techniques in the management of chronic arthritic pain in hemophilia. *Behav. Ther.*, 12, 185-194.
  - 119 Wagner, M. (1980) A combined behavioral approach with long term follow-up for the treatment of migraine. *J. Am. Soc. Psychosom. Dent. Med.*, 27, 24-28.
  - 120 Warner, G. and Lance, J.W. (1975) Relaxation therapy in migraine and chronic tension headache. *Med. J. Aust.*, 1, 298-301.
  - 121 Wickramasekera, I. (1972) Electromyographic feedback training and tension headache: preliminary observations. *Am. J. Clin. Hypnos.*, 15, 83-85.
  - 122 Wickramasekera, I. (1973) The application of verbal instructions and EMG feedback training to the management of tension headaches: preliminary observations. *Headache*, 13, 74-75.