RESEARCH REPORT

# Progressive Muscle Relaxation and Restricted Environmental Stimulation Therapy for Chronic Tension Headache: A Pilot Study

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*Thirty-one patients suffering from chronic tension headache participated in one of four procedures, each of which comprised two one-and-one-half hour sessions per week for 4 weeks. The conditions were: Chamber/Control (both weekly sessions lying on a bed in a dimly-lit room), and three active treatment procedures: Chamber/Tank, one session as above, the other floating in a dark, silent REST tank; Chamber/Relaxation, one as above, one doing progressive muscle relaxation exercises; and Tank/Relaxation, one session floating and one doing progressive muscle relaxation. By 6 months after the end of treatment, complete data had been obtained from 20 subjects. There was a significant overall decrease in headache reports; the active treatment groups collapsed improved significantly more than the control group. At the 6-month followup, the treatment groups showed continuing improvement (57% over end of treatment for the Tank-Relaxation group and a mean of 25% for the other two), whereas the control group had deteriorated by 34% since end of treatment. Clinical improvements were comparable to those of more time- and effort-consuming relaxation therapies, and confirm the usefulness of REST as a long-lasting and versatile treatment in behavioral health.*

## INTRODUCTION

Chronic headache is salient among the syndromes that persistently detract from the quality of life for many generally healthy people. Chronic headaches reportedly afflict 40-50 million Americans (almost 15% of men and over 25% of women in the general population of the U.S.);[1] 48% of men and 65% of women report having one or more headaches a month;[2] and an estimated 157 million work days per year are lost because of headaches.[3] Muscle contraction ("tension") headaches account for over 80% of headaches,[4] and are thus by far the most common type.

Tension headaches have been posited to result from the sustained contraction of the muscles in the region of the head. This, in turn, has been interpreted as a physiological response to stress,[5] although not all specialists in the field would agree with that explanation. The data are mixed. For example, some researchers have found heightened frontalis or neck EMG during tension headache episodes;[6] but the findings are not consistent[7] and the causal sequence is unclear. Reductions in the frequency and/or intensity of headache episodes may be associated with general reductions of head-region EMG[8-13] — or they may not.[14-19] Recent theoretical approaches have emphasized the interaction among genetic, constitutional, cognitive, emotional and environmental factors.[20]

Regardless of etiology, routine medical treatment for tension headache involves medication with muscle relaxants, analgesics, and anti-depressants. In addition, some $400 million per year is spent on nonprescription painkillers to alleviate headaches.[3] However, pharmacological approaches entail such problems as increasing tolerance, potential abuse, addiction, and undesirable side-effects. For these reasons, behavioral treatments have frequently been

*Manuscript submitted April 26, 1990 ; and accepted August 15, 1991.*

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used, the most common ones being biofeedback and some sort of relaxation training (often used in conjunction).

The results have been encouraging. Both behavioral techniques have been shown to be better than placebo medication,[9] and pre- to post-treatment comparisons within patients have found significant improvements with either relaxation or biofeedback, with an estimated headache reduction rate of 60% at end of treatment and 39% one year later.[21,22] Relaxation may in fact be a component of biofeedback treatments[23] which would explain why there seem to be no reliable differences in the effects of the two techniques.[6,7] In view of these data, relaxation training — which requires much less time and no electronic equipment — seems to be the behavioral treatment of choice.[23]

The current study was designed as a first step in exploring the utility of a technique that is known to facilitate relaxation: REST (Restricted Environmental Stimulation Therapy), and specifically the flotation REST procedure.[25] Flotation leads to the rapid achievement of deep states of relaxation as measured by self-reports,[26,27] bloodpressure,[28,29] EMG[30] and pituitary-adrenal axis activity (plasma cortisol and ACTH[31]). Other studies have used REST, sometimes in combination with systematic relaxation training and/or biofeedback, in successfully treating a variety of stress-related dysfunctions.[32-34] Chamber REST, the other major form, has been less useful with psychophysiological problems,[25] but was included in this study to test its effectiveness.

We have already discussed some of the drawbacks of pharmacological treatments of tension headache. Both systematic relaxation training and biofeedback training are just that: training. For maximal effectiveness, they require that the patient continue to practice the methods and skills learned, a requirement that — given our knowledge about noncompliance — can be unrealistic. Biofeedback training, in addition, requires elaborate apparatus. Previous REST research has shown that the technique is not only useful by itself but can potentiate other methods;[35,36] and while it certainly involves elaborate apparatus of its own, it does not depend upon continued "practice" or continuing participation for its effectiveness. Thus, it is potentially a useful substitute for, or addition to, more demanding methods.

## MATERIALS AND METHODS

### Subjects

Subjects for this study were recruited through press releases or referred by physicians who had received information packages concerning the research. Volunteers had to meet the following criteria:

1. Medical diagnosis of tension headache.
2. Occurring at least three times per week on average.
3. Age between 18 and 65.

Of over 200 respondents, the first 40 who met these requirements (age range, 22-65; headache chronicity, 2-17 years) were selected for participation. Of these, 9 withdrew before completing the 4-week treatment program (see below); the sample completing treatment was composed of 6 male and 25 female subjects, who were randomly assigned to treatment conditions.

Because of an early attempt to replace dropouts, which had to be abandoned because of the scarcity of qualified volunteers, the number of subjects beginning each treatment varied widely (see Table 1). Table 1 also shows the sex and age distribution within each group. Because of further attrition during followup, complete 6-month data were obtained from only 20 subjects.

### Treatment Conditions

The treatment consisted of two sessions, each lasting 1½ hrs. per week for four weeks for a total of eight sessions. Every session included one hour spent in the particular

**Table 1** Participation and Demographic Characteristics.

| | Participation* | | | | Sex | | Age | |
|---|---|---|---|---|---|---|---|---|
| Trtmt. Gp. | 1 | 2 | 3 | 4 | M | F | M | Range |
| Chber/Relax | 6 | 0 | 4 | 5 | 2 | 13 | 33.7 | 24-57 |
| Tank/Relax | 5 | 3 | 2 | 0 | 4 | 6 | 38.1 | 24-60 |
| Chber/Tank | 4 | 1 | 1 | 1 | 2 | 5 | 35.7 | 25-54 |
| Chber/Ctrl | 5 | 0 | 0 | 3 | 2 | 6 | 34.4 | 25-65 |

* 1 = Completed 6-mo. followup
2 = Incomplete followup
3 = End of treatment only
4 = Dropout during treatment

treatment condition plus a pre- and a post-treatment interview. The conditions were:

### Control:

Chamber/Control: All sessions conducted in a small, dimly lit, sound-reducing room, with the subject lying on a bed. This was a minimal-REST condition, included essentially for control purposes and to establish a lower limit for REST impact.

### Active treatment groups:

Chamber/Tank: Of the two weekly sessions, one each spent in the room (as above) and one in the flotation tank. The tank is a large (2.4m x 1.2m x 1.2m), covered bathtub. The participant floats in a supine position, with the face and ventral surface of the body out of the water, in 25-30 cm of a liquid solution consisting of water and Epsom salts (MgSO4). The solution is maintained at a specific gravity of about 1.26 and temperature of 32° C. The tank is located in a darkened, quiet room. The subject showers before and after each float. In all Room and Tank conditions, a monitor listens throughout the session over an intercom to answer questions and to ensure that the subject is not experiencing any problems. Subjects may terminate the session at will either by informing the monitor or by simply arising and walking out, but such termination is an extremely rare occurrence (less than 5%).

Chamber/Relaxation: Each week, one session in the chamber and one of progressive muscle relaxation exercises. The latter were administered in groups in a dimly lit room, based on the procedures of Bernstein and Borkovec.[37]

Tank/Relaxation: Each week, one session in the flotation tank and one of progressive muscle relaxation exercises.

### Dependent Measure

Prior to beginning treatment, each subject completed a number of paper and pencil measures. The major index was a Headache Diary (adapted from Blanchard & Andrasik[38]), in which the participant rated the frequency, duration and intensity of headache pain. After careful training in the use of the format during three interview sessions, subjects kept such diaries from at least two weeks before the first treatment session throughout the treatment period, and for one week each 2, 4 and 6 months after completion of treatment.

As is standard in the use of Headache Diaries, the entries were combined to calculate a Headache Index for each client at each time period. A rough index of self-reported medication use (number of headache pills per day) was also reported for baseline and during treatment. There were no significant differences in medication usage among the groups.

Because of the complexity of scheduling treatments and data collection, in a few cases one or another component of the timetables described in the previous sections was extended or altered to accommodate subjects.

## RESULTS

Random assignment and differential dropout rates left different Ns in the various conditions. Five subjects in the Chamber/Relaxation, three in the Chamber/Control, and one in the Chamber/Tank condition dropped out during treatment, leaving 31 who completed the program. At baseline, there were no significant differences among the groups on the Headache Index, $F < 1$. Table 2 presents mean percentage reductions from baseline on the Headache Index for all subjects who completed treatment.

Repeated measures ANOVA for the 20 subjects who completed all measures at all five measurement periods showed a significant headache decrease over time. Table 3

**Table 2. Mean (%) Reductions on Headache Index, All Subjects Responding at Each Point.**

| Group[a] | BL[b] | LWT[c] | 2 Mo. | 4 Mo. | 6 Mo. |
|---|---|---|---|---|---|
| Tank/Relax | 0.61 | 0.33 (47) | 0.48 (22) | 0.54 (12) | 0.13 (80) |
| Chamb/Relax | 0.84 | 0.67 (20) | 0.91 (-8) | 0.50 (41) | 0.44 (48) |
| Chamb/Tank | 1.17 | 0.99 (15) | 0.87 (26) | 0.94 (20) | 0.71 (39) |
| Chamb/Contr | 0.93 | 0.59 (37) | 1.01 (-9) | 0.75 (19) | |

a Cell n's vary from 4-10
b Baseline
c Last week of treatment

**Table 3. Mean (%) Reductions on Headache Index: Subjects Completing All Measures Through Six-Month Followup.**

| Group, n | BL[a] | LWT[b] | 2 Mo | 4 Mo | 6 Mo |
|---|---|---|---|---|---|
| Tank/Relax, 5 | 0.69 | 0.28 (59) | 0.52 (25) | 0.71 (-3) | 0.13 (81) |
| Chamb/Relax, 6 | 1.02 | 0.62 (39) | 0.91 (11) | 0.50 (51) | 0.44 (57) |
| Chamb/Tank, 4 | 1.15 | 0.89 (23) | 0.80 (30) | 0.94 (18) | 0.70 (39) |
| Chamb/Contr. 5 | 0.92 | 0.56 (39) | 1.01 (-10) | 0.74 (20) | 0.75 (18) |

a Baseline
b Last week of treatment

shows the mean Headache Index scores and percentage reductions for these subjects. Mean total Headache Index scores were: baseline, 0.94; last week of treatment, 0.58; 6-month followup, 0.49; $F(2,32) = 9.86$, $p = .001$. The major effect was on headache frequency, Ms = 0.87, 0.68, and 0.44 at the three salient data collection points, $F(2,32) = 9.86$, $p = .001$. Headache duration had decreased significantly from baseline to last week of treatment, M = 0.41 vs. 0.27, $F(1,16) = 14.95$, $p < .001$, but the change was no longer significant at 6-month followup. Intensity was not significantly affected at any point.

To analyze the clinical significance of the results in a way that has become common in this field, we then categorized the subjects in three outcome groups[21]:

"Improved" — Headache Index reduction of 50% or more

"Slightly improved" — Reduction of 25%-49%

"Unimproved" — Reduction of less than 25%

The results were then compared with the outcomes of one of the most rigorous studies in the literature on relaxation training as a treatment for tension headache.[21] Table 4 shows this comparison, with last week of treatment results outside and 6-month followup data inside the parentheses (Blanchard et al. reported end of treatment data only).

Collapsing the three active treatment groups (Chamber/Relax, Chamber/Tank and Tank/Relax), and comparing their outcomes with the minimal intervention group (Chamber/Control), we find significantly better reductions in headache reports after active treatment, $F(1,18) = 4.74$, $p<.05$.

In view of suggestions that one major strength of REST as a procedure in health psychology is the high maintenance rate of its effects,[36] we looked at this factor in the current group of subjects. The mean difference between last week of treatment and 6-month followup showed not only maintained improvement, but actually further gains, for the three treatment groups: 54% for Tank/Relax subjects completing all followups, 29% for Chamber/Relax, and 21% for Chamber/Tank. In contrast, the last week of treatment to six-month followup data of the Chamber/Control group showed a deterioration (i.e., increased headaches) of 34%.

Between two and three years after the end of treatment,

**Table 4. Clinical Outcomes**

| | | % of Ss reporting reductions | | |
|---|---|---|---|---|
| Group | N | Improved | Slightly impr. | Unimpr. |
| Blanchard et al. (1985): End of Treatment | | | | |
| | 94 | 42 | 16 | 43 |
| Current Study: Last Week of Treatment/6-Mo. Followup | | | | |
| Tank/Relax | 5 | 60/80 | 40/20 | 0/0 |
| Chamb/Relax | 6 | 50/67 | 17/0 | 33/33 |
| Chamb/Tank | 4 | 25/75 | 50/0 | 25/25 |
| Chamb/Contr. | 5 | 40/40 | 40/20 | 20/40 |

we attempted to re-establish contact with the clients. Of the 31 who had completed the procedure, nine were reached successfully and agreed to keep a 1-week headache diary. All four groups were represented, with a mean elapsed time between last week of treatment and long-term followup of 29.4 months (range, 21 to 38 months). Because of the small N, the results were not analyzed by condition. Of the six subjects who had been classified as "Improved" on the six-month followup, four were still in that category; the mean reduction from baseline was 33% (compared to 52% at six months).

## DISCUSSION

Our results indicate that flotation REST may serve as an effective treatment, and as a valuable component in multi-method treatment, of chronic tension headache. The combination of flotation and progressive muscle relaxation may increase the duration of treatment effects, perhaps by altering the psychobiological predisposition to headache.[39]

Results during the last week of treatment for the REST only condition (Chamber/Tank) were comparable to those found in successful and rigorous tests of the effects of relaxation training.[21] Given the economy in time and effort, and the fact that continued practice is not required, REST can be an easy alternative to systematic relaxation.

As in previous research, the effects of REST were long-lasting. The active treatments did not differ strikingly from the control condition at the last week of treatment. By the six-month followup, however, the active treatment groups showed significantly more improvement, with the flotation plus relaxation group being the most improved. Of these subjects, 80% were rated as "Improved" six months after treatment. Blanchard[40] has reported continued improvement after the completion of other behavioral treatments, so that REST effects are compatible with other members of the class.

These findings are indicative, but not definitive. The design of the study, which was intended as a first step to test whether REST had any efficacy in this area, should be expanded in future research to:

1. Include other commonly used behavioral interventions (e.g. biofeedback), with and without REST.

2. The effects of flotation REST could be compared with those of both relaxation training and chamber REST at the usual therapeutic dosage levels of these techniques (respectively, 10 or more relaxation training sessions, and 24 hrs. in the chamber).

3. Medication usage should be carefully monitored and, if possible, controlled.

4. A major problem in this study was the small and uneven initial N (ranging from 7 to 15 across groups), coupled with a very high dropout rate through the followup period. The resulting small number of subjects providing complete data in each group makes the reliability of the findings moot. Further studies should include at least 15 subjects per group, perhaps recruited through a headache clinic or physician referrals, which might enhance the stability of participation. Another strategy might be to require a non-trivial financial deposit, which would be returned when the client has completed all followups.

Within the shortcomings noted above, the apparent power of the tank plus relaxation combination confirms previous reports describing the synergistic effect of combining an appropriate REST procedure and a more established, standard treatment.[35,36] Such combinations may represent the optimal use of REST in the fields of behavioral medicine and health psychology.

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## Acknowledgements

We gratefully acknowledge the advice and assistance of Elizabeth J. Ballard, Susan Bluck, Linda Cousins, Donald G. Forgays, James Frankish, Leslie Leader, Luzbea Pizano, Steven Sian, Jeffrey Soo, and Mark Stephens.

## INDEX TERMS

**Headache, tension, treatment, progresive relaxation, restricted environmental stimulation therapy**

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