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AUTHOR Jessup, B.; And Others
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ABSTRACT

The possibility of alleviating migraine headaches by autogenic relaxation training, with or without hand temperature biofeedback, was assessed. The study examined five independent groups in a bi-directional control group design. Volunteer migraine sufferers served as subjects, each participating for 12 weeks. The first four weeks of the study were used to collect physiological baselines and headache symptom and personality data. During the remaining eight weeks two groups attempted to learn hand warming at home by listening daily to an autogenic cassette. Similarly, two groups attempted to learn hand cooling, while the fifth group continued only to keep the headache diary and visit the laboratory. Migraine frequency, intensity and duration all decreased significantly over the course of the study, but these decreases were not related to physiological control, which the subjects did not exhibit. The amount of headache reduction (1/3) was equal to the characteristic benefits of placebo drug treatment. Relaxation training and biofeedback are probably more effective placebos for the treatment of migraine than experimenter attention and headache record keeping. (Author)

AUTOGENIC TRAINING AND HAND TEMPERATURE BIOFEEDBACK IN THE TREATMENT OF MIGRAINE: A PRELIMINARY ANALYSIS

Jessup, B., Neufeld, R.W.J. and Stenn, P.G.
University of Western Ontario
and
University Hospital
London, Ontario

ABSTRACT

The possibility of alleviating migraine headaches by autogenic relaxation training, with or without hand temperature biofeedback, was assessed. The study examined five independent groups in a bi-directional control group design. Volunteer migraine sufferers served as subjects, each participating for 12 weeks. Throughout the study all subjects kept a detailed headache diary, and visited the University Hospital, London psychophysiology laboratory weekly. Forehead and hand temperatures and frontalis muscle tension were monitored. The first 4 weeks of the study were used to collect physiological baselines and headache symptom and personality data. During the remaining 8 weeks two groups attempted to learn hand warming at home by listening daily to an autogenic cassette. The tape was augmented by a biofeedback meter for 4 of the 8 weeks. Similarly, two groups attempted to learn hand cooling, while the fifth group only continued to keep the headache diary and visit the laboratory.

Migraine frequency ($p<.001$), intensity ($p<.05$) and duration ($p<.002$) all decreased significantly over the course of the study, but these decreases were not related to physiological control, which the subjects did not exhibit. The amount of headache reduction (1/3) was equal to the characteristic benefits of placebo drug treatment. Relaxation training and biofeedback are probably more effective placebos for the treatment of migraine than experimenter attention and headache record keeping.

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This paper was presented at the Annual Meeting of the Canadian Psychological Association, Toronto, Ontario, Canada, June 8-12, 1976.

Our talk today on the use of relaxation training and biofeedback to reduce migraine headaches has two main purposes. The first is to report data from 33 migraine sufferers who have completed our research program. The second purpose is to relate these preliminary findings to current issues in biofeedback, such as the role of placebo effects and the relationship, if any, between psychological and physiological variables.

Migraine is a complex syndrome diagnostically distinct from muscle contraction "tension" headaches and head pain due to organic pathology. Since a substantial component of migraine pain is due to dilated arteries at the head, vasoconstrictive agents such as ergotamine tartrate, as well as analgesics, are frequently prescribed treatments. Both carry serious risks of side effects: a drug-free migraine therapy would be highly desirable.

Autogenic training has been used by Schultz and Luthe (1969) as a treatment for migraine. Autogenic training is a relaxation procedure consisting of the mental repetition of six standard phrases that suggest physiological effects (e.g. "My right arm is warm", "My forehead is cool"). Schultz and Luthe reported clinically that the majority of their migraine patients suffered less frequent and less intense headaches after several months of practicing autogenic training.

The addition of hand warming biofeedback to autogenic training was developed at the Menninger Foundation by Sargent,

Walters and Green (1973). Although their initial observation was serendipitous, Sargent's group offered this three step rationale for using hand warming training to reduce migraine: (1) They postulated that migraine may be a type of stress response due to excessive sympathetic arousal. (2) Since the sympathetic nerves to the hand constrict blood flow, making the hand colder, hand temperature can be used as a one-variable index of sympathetic arousal. (3) Training migraine sufferers to warm their hands should therefore reduce sympathetic outflow, and thereby reduce their headaches. Daily, at home, patients tried to warm their hands by watching a temperature trainer, while practicing a form of autogenic training. The patients kept detailed headache records, including a one month pre-treatment baseline. On the basis of Dr. Sargent's "global clinical judgment", aided by the patients' records of headache intensity and analgesic use, 81% improved. The 81% showing improvement were roughly equally divided between "slight" or "moderate" and "good" or "very good" improvement.

Despite methodological and data reporting shortcomings of the Menninger Clinic study, it formed the basis for a great deal of similar work on the use of relaxation training and biofeedback for the treatment of migraine. These studies are detailed in Table 1 of the handout. They can be summarized in three main points: 1) Headache reduction in all studies was similar to Sargent's et al's data and similar to the effectiveness of migraine medication. 2) The 5 studies that monitored

analgesic consumption all reported decreased drug use. 3) All but a small pilot study totalling 7 subjects by Turin (1975) were methodologically unsound.

Careful research design is particularly important in work on migraine because it is demonstrably susceptible to placebo effects. For example, Waters (1970) compared the widely prescribed migraine medication ergotamine tartrate to placebo pills in a double-blind cross-over design study. He found that 51% of his subjects improved with erotamine, versus 58% with placebo. Significantly more subjects were made worse with ergotamine. At the end of the trial subjects were offered a small supply of their preferred medication. Of the 43 who accepted the offer, 21 chose ergotamine and 22 chose placebo.

Personality variables may also be relevant to migraine headaches, and the debate as to whether or not there is such a thing as a "migraine personality" has gone on for several decades.

Migraine sufferers have been described as tense, insecure, inflexible, meticulous, perfectionistic, and tending to repress resentment. Careful psychometric assessments of migraineurs are scarce. Personality measures may be of potential clinical utility in the treatment of migraine.

The three most important problems then, in the field of voluntary control of migraine, appear to be: (1) first and foremost, the need for a well controlled assessment of relaxation training and biofeedback procedures, compared to placebo effects.

(2) Secondly, the relationship of personality measures to headache and physiological variables needs to be examined. (3) Finally, the relationship of physiological variables to headache change also needs to be reported.

METHOD

Subjects for our project were solicited by local newspaper advertisements. To be included in the study, they had to have at least two migraines per month, and exhibit at least three migraine symptoms. All volunteers were screened medically by Dr. John Brown, a London Neurologist.

Of the 33 volunteers who have completed the study, 6 were males and 27 were females. As Slide 1 shows, all adult age groups were well represented. The next slide shows how long the subjects have been suffering from migraine. All but three had been suffering frequent headaches for longer than 9 years, and over half (17) had headache histories exceeding 16 years. The volunteers were thus a selected group of severe, chronic migraine sufferers who often had already run the gamut of unsuccessful or partially successful pharmaceutical treatments.

Apparatus for the experiment consisted of the facilities of the psychophysiology laboratory at University Hospital, London. Forehead muscle tension was measured using surface EMG procedures, while skin temperature was monitored at the forehead and left

index finger with thermisters. Subjects were loaned relaxation tape cassettes and hand temperature meters for the training parts of the study.

Procedure: Slide 3 shows the experimental design. Throughout the study the volunteers kept a detailed headache diary on a standard form, and visited the laboratory weekly for a 15 minute monitoring of their forehead EMG, and forehead and hand temperatures. All subjects began with a 4 week baseline period. During the baseline, volunteers were asked simply to "let yourself relax as deeply and completely as possible" when they were at the lab. Personality and headache symptom data was also collected during baseline. At the end of week 4 subjects were randomly assigned to treatment conditions. The "attention-placebo/self-monitoring" group 5 continued to follow the baseline procedures. Groups W1 and W2 were given 15 minute cassettes of autogenic instructions (I) that included suggestions of hand warming and forehead cooling. The tapes were augmented for 4 of the 8 treatment weeks with a hand temperature biofeedback meter (FB). Groups W1 and W2 differ only in the order in which they used the feedback meter. Groups C1 and C2 followed procedures identical to those of W1 and W2 except that their autogenic instructions included suggestions of hand cooling and forehead warming, i.e. directional instructions exactly opposite to those suggested by Sargent's (1973) rationale, and opposite to those used in all preceding studies. Subjects were asked to practice

their assigned procedures daily at home - listening to the taped instructions with or without attempting to control the hand temperature meter in the suggested direction. During the weekly laboratory visits, participants practiced in the laboratory whichever procedure they were using at home. At the end of Week 12, subjects were debriefed and offered the loan of any tapes or meters for their personal use.

Data Analysis: All data were analyzed in 5 X 3 independent groups by repeated measures analysis of variance. Within session change scores were calculated at each laboratory session by subtracting minute 1 values from minute 15 values for each of the three physiological variables. These change scores were averaged for each of the 3, 4 week blocks of the study. Weekly headache frequency, intensity, duration and density were tabulated from the volunteers' headache diaries. Density is the product of each headache's duration times its 1 to 3 intensity rating, calculated separately for each headache and then totalled for each week. For example, a participant suffering 2 migraines in one week, a mild 2 hour one with an intensity of 1, and a severe 10 hour one with an intensity of 3, would generate the following data for that week: 1) frequency, 2 headaches/week, 2) mean intensity, 2 (1 + 3 ÷ 2), 3) duration, 12 hours (2 + 10), 4) density = 32, (2 X 1 + 10 X 3). Note that the density can differ from the product of the total duration times the mean intensity (12 X 2 = 24 in the present example).

Number of prescription and non-prescription headache medications ingested each week was also tabulated. Finally, the intercorrelations between physiological change and headache activity during baseline with personality variables were calculated.

RESULTS

Overall, the headache variables decreased markedly during the course of the experiment, but physiological learning did not take place.

EMG: Forehead muscle tension did not change systematically in any way, with or without relaxation training. The average within session muscle tension change over all 396 sessions monitored (33 subjects X 12 sessions each) was -.58 microvolts. Forehead EMG decreased decreased in 63% of the sessions, rose in 33% and did not change in 4%.

Forehead Temperature showed no treatment-related changes. The average change over all monitoring sessions was $+.5^{0}C$. Forehead temperature rose in 70% of the sessions, decreased in 21% and did not change in 9%. Forehead and hand temperature changes tended to co-vary (Pearson's r = .46).

Hand Temperature change is summarized on Slide 4. The numbers given in the cells of the experimental design are the within session changes in hand temperature (minute 15 - minute 1) averaged over the 4 sessions in each treatment block. No statistically significant changes occurred in this data. Note,

however, that the hand cooling groups did not learn hand cooling, nor for that matter did the hand warming groups learn hand warming. The positive mean change values are not the result of a few extremely high temperature changes. Hand temperature increased in 65% of the sessions, decreased in 30% and did not change in 5%. These proportions of hand temperature increase and decrease were similar in the 5 treatment groups. Another interesting feature of this data (discussed below) is that, with one exception (C3, WK5-8), hand temperature increased less in all of the 8 treatment blocks than during baseline, while increasing more with the passage of time during no treatment (X 5).

Summary of Physiological Results: To summarize the physiological results then, the within session changes in forehead EMG and forehead and hand skin temperature did not differ significantly between treatment groups, with the passage of time, nor in any groups X time interaction. Range between groups baseline differences and large within groups variance may have contributed to these negative results.

Headache Frequency: (Slide 5) The average number of headaches per week is summarized on Slide 5. Headache frequency decreased significantly during the course of the experiment ($F = 9.98$, $df = 2, 56$, p .001). No significant differences between treatments, or the interaction of treatments with blocks of weeks occurred in the 5 X 3 ANOVA. Note, however,

that a fairly marked trend appeared in the results, with the reduction in headache frequency being largest in the hand warming groups, least in the hand cooling groups, and moderate in the self-monitoring and no-treatment groups.

Headache Intensity (Slide 6) decreased significantly during the experiment ($F = 3.25$, $df = 2,56$, $p < .05$), but treatments and the interaction of treatments with blocks of weeks did not significantly differ. The trend appears to favour the hand warming groups.

Headache Duration (Slide 7) in average hours of head pain per week also decreased significantly over the experiment ($F = 7.61$, $df = 2,56$, $p < .002$), but treatment groups and the interaction of groups X blocks of weeks did not differ significantly. The trend again appears to favour the hand warming groups. Notice too that the baseline results confirm the chronic pattern of the volunteers' migraines. During the baseline period subjects averaged 14 hours of head pain per week.

Headache Density (Slide 8) also decreased over the course of the study, but this decrease only approached statistical significance ($F = 2.4$, $df = 2,56$, $p < .1$). Once more the trend favoured the hand warming groups.

Medication Usage: No changes in the use of prescription or non-prescription medication were statistically significant. Nonetheless, average prescription medication use dropped from 2.7 tablets per week to 2 tablets per week, a decrease of 26%.

Average non-prescription medication use decreased 13% over the course of the study.

Summary of Headache Data: The number of headaches per week, their intensity and their duration all decreased significantly over the course of the study. There were no statistically significant differential effects for treatments, or for the interaction of treatments and time. Trends in the data suggested that the hand warming groups benefited more than the other groups in the study.

Personality Data: On the Jackson Differential Personality Inventory (DPI), subjects' mean profile was at the 99.99th percentile on the "headache proneness" scale, at the 96th percentile on "hypochondriasis" and at the 99th percentile on "panic reaction". Panic reaction on the DPI means simply that the person is easily scared, and readily becomes anxious over small matters. The Personality Research Form profiles were within the average range, with a moderate elevation on "harmavoidance", i.e. non-adventurousness, fearfulness of physical harm. Cattell's 16 Personality Factor Test (16PF) placed the mean subject's profile at the 85% percentile on factor Q4; tense, frustrated, driven, overwrought, and experiencing tension between conflicting needs. The volunteers also tended to be above average in intelligence, easily upset, readily affected by feelings, overly sensitive to threat, clinging, apprehensive and insecure. The mean personality profile was thus remarkably congruent with existing clinical

opinion, although, of course, there was substantial variance around each scale mean.

Relationship of Physiological Change to Headache Activity: The within session changes in the 3 physiological variables were not significantly correlated with concurrent headache activity. The only correlation of interest was between non-prescription drug use and within session forehead EMG change (Pearson's r = .44). People whose muscle tension goes up while sitting in the laboratory tend to use more aspirins.

Relationship of Physiological Change and Headache Variables to Personality: Four correlations larger than .5 occurred between personality scales and physiological and headache variables.

(1) Forehead temperature increase correlated with the DPI "perceptual distortion" scale (r = .52). The perceptual distortion scale includes the items "I see bright pictures and colours in my head even when I don't want to" and "Sometimes my brain is full of coloured lights". Most of the other items deal with auditory hallucinations, e.g. "A special voice follows me everywhere I go." Individuals with the classic variety of migraine, which is often accompanied by visual hallucinations, may exhibit a greater increase in blood flow to the head while simply sitting relaxing than sufferers with common migraine (which does not involve visual disturbances).

(2) Migraine density correlated .50 with DPI "hypochondriasis". People who get longer, more intense headaches tend (reasonably enough) to always feel they are sick, e.g. they would agree with

statements such as "I am almost always aware of pains in some part of my body."

(3) Migraine density correlated .52 with DPI "ideas of persecution", although the volunteers' mean scale score was in the normal range. High scorers on the "ideas of persecution" scale believe certain people are against them and are trying to make their lives difficult or unpleasant, e.g. "Every day someone makes me do something against my will." The correlation with migraine density suggests that volunteers who feel abused by others have longer, more severe headaches (also vice versa).

(4) Non-prescription drug use correlated .50 with DPI "disorganization of thinking". This scale indicates how easily the respondent is distracted and confused, e.g. "I cannot remember how to do things which used to be easy for me." Migraine sufferers who are easily confused tend to take more aspirins. (By comparison, the correlation of prescription drug use to "disorganization of thinking" was -.20. Forehead EMG change correlated .31 with this personality scale.)

DISCUSSION

What conclusions can be drawn from these results? First of all, the obvious caveat: these are only preliminary findings based on a total of 33 subjects. The number of subjects in each treatment group 1 to 5 was respectively, 8, 5, 7, 7, 6. Therefore, any conclusions should be considered as only tentative.

The most rigorous conclusion possible is that participation in a relaxation training and hand warming or cooling experiment significantly reduced the frequency, intensity and duration of migraines, even in chronic sufferers. This change was probably not due to the passage of time, since subjects had long headache histories. The reduction in migraines was both of statistical ($p < .001$, $p < .05$, $p < .002$) and clinical (overall mean decrease in migraine frequency = 1/3) significance.

The changes in headache frequency, intensity and duration were entirely unrelated to concurrent within session changes in forehead EMG and forehead or hand temperature.

Moderate but statistically non-significant trends in the data suggest that hand warming training, with or without biofeedback, may prove to be superior to hand cooling or no training in relieving migraine. If hand warming training proves to be a superior procedure for migraine reduction even though it has no differential effect on hand temperature, such a finding would hopefully not be due to experimenter demand characteristics, since they were guarded against as much as possible throughout the study, and the experimenter's own attitudes were somewhat skeptical.

If you recall the data on hand temperature change, which showed a smaller increase during treatments, and a larger increase during baseline and no treatment, one possible interpretation of the results is suggested. Various researchers have demonstrated that the orienting response, or attention, reduces hand blood

flow (e.g. Vinogradova and Sokolov, 1957; Royer, 1965). Conceivably, the trend toward more migraine reduction with hand warming involves some cognitive component since hand temperature increases, compared to baseline, were least for the hand warming group. Such a "cognitive effect" could legitimately be called a placebo effect; i.e. the reduction in headaches is unrelated to the actual contents of the treatment. The amount of headache reduction (roughly 1/3) was equal to the characteristic benefits of placebo drug treatment. Relaxation training and biofeedback particularly hand warming are probably more effective placebos for the treatment of migraine than experimenter attention and headache record keeping.

To sum up then, we have found substantial decreases in headache frequency, intensity and duration over the course of the study, with trends suggesting that possibly the hand warming training groups benefited most. The headache changes were unrelated to concurrent within session physiological changes. Our results, while admittedly preliminary, suggest that in all preceding studies on handwarming treatment for migraine, inadequate methodology and data reporting (see Table 1) have precluded identification of the relevant treatment variables, or even identification of the effectiveness, if any, of the treatment itself. Currently we are collecting more data and subjecting it to more refined statistical analyses (such as analysis of covariance, and cluster analysis of symptom and personality profiles) in an attempt to clarify these issues.

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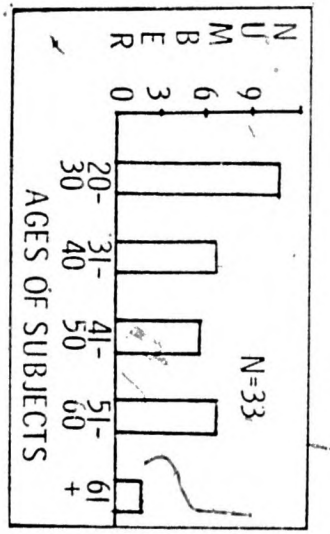

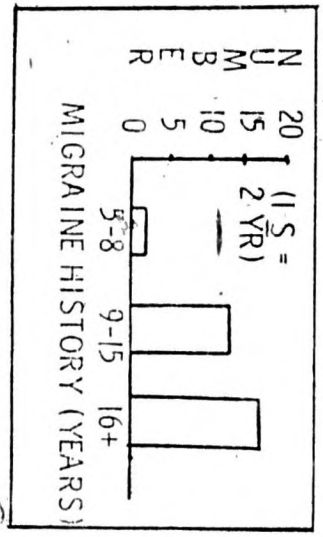

W1	X	1	1+FB
W2	X	1+FB	1
C3	X	1	1+FB
C4	X	1+FB	1
X5	X	X	X
WK	1-4	5-8	9-12

EXPERIMENTAL DESIGN

W1	2.0	.8	.7
W2	1.3	.7	.6
C3	1.5	1.7	1.2
C4	.8	.5	.7
X5	.8	.9	1.8
WK	1-4	5-8	9-12

HAND TEMP CHANGE ^{0}C

W1	1.2	.8	.6
W2	2.1	1.1	1.1
C3	2.9	2.4	2.3
C4	1.9	1.8	1.5
X5	2.3	1.7	1.7
WK	1-4	5-8	9-12

HEADACHES PER WEEK

W1	1.5	1.0	1.0
W2	1.5	1.2	1.0
C3	1.2	1.4	1.1
C4	1.4	1.3	1.0
X5	1.5	1.4	1.4
WK	1-4	5-8	9-12

INTENSITY 1=MILD 3=SEVERE

W1	11.5	10.8	7.3
W2	15.8	9.2	6.1
C3	16.3	12.7	12.4
C4	20.4	17.0	13.2
X5	21.1	16.3	19.0
WK	1-4	5-8	9-12

DURATION HRS/WEEK

W1	25.0	24.9	17.6
W2	35.7	20.4	12.6
C3	33.7	28.9	30.9
C4	37.1	29.1	25.8
X5	32.1	31.6	33.1
WK	1-4	5-8	9-12

DENSITY INT X DUR

HANDWARMING TREATMENT OF MIGRAINE

Authors	Dependent variables	Subjects #	Subjects type	Freq. & Duration of treatment	Procedure	Concurrent other treat.	Results	Research design	Adequate demonstration of handwarming effect	Comments
Andreychuk & Skriver 1974	-HA* rates -suggestability (Hypnotic induction profile) -MMPI	18	migraine	8 sessions in 2 weeks	-handwarming FB** -alpha enhancement FB -self hypnosis	-none independent groups	All groups reduced HA, no group diff's high suggestibility Sa showed signif. more HA reduction than low suggestibility	- 3 single group outcome studies	No	N.B. suggestibility
Diamond & Franklin 1974	- number & severity of HA	107	vascular psychogenic & mixed	4-6 weeks, 2 sessions/wk.	-handtemp. FB	-simultaneous frontalis EMG*** FB	successes: vascular 12/17 mixed 32/81 psychogenic 5/9	- 3 single group outcome studies 40% overall success	No	no improvement in patients with depression
Diamond & Franklin 1975	- number & severity of HA success = decrease in both measures	93	migraine & mixed	intensive = 12 days x 2 sessions/day routine = 4-6 wk, 2 sessions/wk.	-handtemp. FB	-simultaneous frontalis muscle tension FB	intense overall=50% vascular = 90% mixed = 40% routine overall=72% vascular = 76% mixed = 68%	2 single group outcome studies	No	emphasizes -the importance of careful diagnosis (vascular only Sa response best) - under 30 age -need for home practice - routine procedure best
Drury, DeRisi & Liberman 1975	-HA intensity, duration, freq. & medications	4	migraine carefully screened	daily monitoring, 5 months	-reading HA article -relaxation training -autogenic phrases -fingertip temp.FB -self charting	treatments introduced sequentially 4 month baseline for 1 S	treatment packages functionally related to HA intensity & meds idiosyncratic variations monitoring alone reduced HA for the S with long baseline	multiple baseline	No	problem of idiosyncratic responses of the 4 subjects
Mitch, McGrady & Iannone 1975	-HA duration freq., intensity medications, daily HA sheet	15	migraine but 1 sinous, & some mixed & tension	daily x 12 wks.	- handtemp FB month 1= daily increase temp, mo.2 = increase temp. at HA onset mo.3 = only at HA onset & reduce meds.	simultaneous autogenic phrases	4 poor 3 fair 8 good-excellent	single group outcome study	No	fair & poor responders also had daily tension HA
Pearce, Walters, Sargent & Keers 1975	-"control or management of HA"	21	"migraine and/or tension"	5 day intensive	hand blood flow FB	-autogenic phrases -relaxation -body stress scanning	19 (82.5%) "successful"	follow-up of single group outcome design	No	multiple treatments
Peper & Grossman 1974	-HA freq. & medication	2	childhood migraine 2 girls age 9 &13	3 weeks daily practice, 2 training sessions	-handwarming FB practice with & without machine home & school	- none	4 months symptom free no medication	2 unsystematic case studies	No	fast handwarming learning in 2 children.
Sargent, Walters & Green 1973	-HA intensity, total analgesics, analgesic potency	42	-no psych disorders - all migraine	150 days, daily home practice	-handwarming FB	- autogenic relaxation & handwarm training	81% made success 9/42 slight 25/42 moderate to very good	single group outcome study	No	selection of data reported.
Turin 1975	-"HA activity" How assessed?	7	- migraine	"short term"	-Finger temp. FB stage 1= 4 Ss warm, 3 Ss cool then 3 cool Ss warm	- none	HA activity same or worse during cooling; decreases only during warm	bidirectional controlled group design	Yes ?	- small N, - control for expectancy only if E gave equal cues.
Weinstock 1972	-HA frequency	7	- undifferentiated tension & migraine, 2-35 yrs. duration	4-5 months 2 taped relaxation -instruction/day	- psych. - history functional analysis of behavior -b mod, EMG FB, handwarming FB	-concurrent relaxation -handwarming FB follows EMG FB	[illegible] Ss HA free	single group outcome	No	emphasizes incorporation of HA into lifestyle of sufferers
Wickramasekera 1973	-HA frequency & intensity, analgesic use	2	-severe migraine 15 yrs duration	16 wks EMG 3 wks baseline 10 wks training	frontalis EMG FB 2-3 wks break, then 3 wks baseline, 10 wk. fingerwarm FB, 3 mo. followup	-temperature FB follows EMG FB	No effect of EMG FB reduction of HA & analgesics to virtually nil; still effective at 3 mo. follow-up	2 systematic case studies	Yes ?	-lack of effect during EMG FB supports temperature effect versus placebo -specific treatment for type of HA -no control for maturation

* HA = headache
** FB = feedback
*** EMG = electromyograph