EFFECTS OF RELAXATION AND BIOFEEDBACK UPON PERSONALITY CHANGE AND BLOODFLOW OF RHEUMATOID ARTHRITICS

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The antiquity of arthritis is evident from skeletal remains of neolithic man and Egyptian mummies. Such bone diseases have long been suspected of containing a psychosomatic element. For example, 1000 years ago Razi the great Persian physician and poet cured a king of arthritis by tricking him into expressing his anger. Was the cure a function of the mind or some physical change? Can or does the mind control the body? This raises the age old question by investigating the effects of systematic relaxation upon blood flow.

Rheumatic symptoms appear to be at least in part a common expression of neurotic conversion mechanisms. Family worries, interpersonal conflicts and in particular, anxiety reactions may all express themselves as "fibrosities", "muscular rheumatism", etc. Depressive illness may also result in muscle tension, thereby producing rheumatic symptoms (Powe, 1972). Halliday (1942) found in his study of 20 rheumatoid arthritic (RA) subjects that they were inhibited in expressing their feelings and were unusually conscientious, clean and punctual. Alexander, French and Pollock (1968) found that their subjects displayed overt calmness, lacked freedom to express anger, and all had participated in vigorous athletics. Meyerowitz, Jacox and Hess (1968) found in their monozygotic twin discordant RA study that a preference for activity was present in both members of twins but with the afflicted member there was psychological stress. From this twin study Meyerowitz et al. further concluded that hereditary factors are not relevant. O'Brien, Bennett, Burch, and Bunim's (1967) genetic study supports the conclusion that genetic mechanisms do not play a part in the etiology of RA.

Rhematoid arthritics describe their reactions to stress in terms of physical and personality changes rather than in terms of ideational and/or visual and auditory changes in perception (Ahstrom, Barrington, Gordon, 1967). The areas of stress most frequently reported by RA patients were deprivation in early life, with an emphasis on the loss of one or both parents and adult situations resulting in stress such as that commonly found in a marriage (Meyerowitz, Jacox and Hess, 1968).

Meyerowitz (1970) found that RA patients demonstrated common personality characteristics such as neurotic response patterns, especially depression, over-concern with bodily function, rigidity, dependency, emotional, instability, low ego-strength and feelings of guilt. After reviewing 80 studies on emotional factors in RA, Moos (1964) concluded that emotional factors were one of the major variables in the onset and for the course of the disease. His conclusion was supported by the fact that he found very few exceptions to this premise. Moos (1964) further demonstrated, comparing 16 RA patients to their same sexed healthy siblings, significant differences on the MMPI scales reflecting 1. physical symptoms, 2. depression, apathy and lack of motivation, 3. general "neurotic" symptoms, 4. psychological rigidity, and 5. similartiy of psychosomatic conditions. The arthritics in Moos's study appeared to be more neurotic, depressed, anxious, masochistic and over-controlled than their healthy family members. His study is given further support by Cohen (1949) and Wiener (1952). Cobb, Miller and Weiland (1959) found that when comparing RA subjects to non-RA subjects that the RA's showed greater sex role distrubances and higher schizophrenic (SC) elevations. Rimon (1969) who studied 37 female RA subjects prior to the onset of the disease found that a depressive mood, associated with a pessimistic

thought content seemed to play a role in the clinical course of RA. Additional support to Rimon's conclusions was found in a study conducted by Glyn (1971).

The onset of RA is not only precipitated by emotional factors but also by vasculitis. Vasculitis seems to be a phenomenon of the rheumatoid process. Vascular lesions have often been found in the muscles of patients. An intense inflammatory process in capillaries or venules have been described in the early rheumatoid subcutaneous nodule and synovial reaction. The observations of inflammatory processes have led to a theory that RA is a form of vasculitis. Congestion, edema and cellular infiltration are characteristic in the early stages with lymphocytes and plasma cells prevalent. The infected tissue grows inward from the synovium along the surface of the articular cartilage to which it is tightly connected so that it interferes with nutrition of the cartilage (Sodeman, 1961, p. 1050).

Blood flow to the skin serves two main functions: regulation of body temperature; and nourishment to the skin (Best, 1971, p. 852). Since vasoconstricter tone develops earlier and is more stable and less readily reversed by body warming in the feet than in the hands, it has been suggested that the lower extremities are concerned with gross adjustments while the upper extremities provide the fine regulation of body temperature (Best, p. 842). These adjustments in the hand varies about 1° C. (Allen, Barker, Heins, 1971, p. 3). Numerous studies have shown a greater increase in blood flow to the hand can be obtained through relaxation (Schwartz, 1973; Blanchard and Young, 1974). Taub and Emurin (cited in Shapiro, Barber, Dicara, Ramiya, Miller, Stoyva, 1972) found that Ss could bring about a 6°5 F temperature increase to the hand within four 15 minute sessions through meditation procedures.

Emotional factors affect neural control of blood vessels through the sympathetic vasoconstrictor fibers and sympathetic vasodilator fibers. About 10% of the blood volume can be channeled into the internal vessels (Guyton, 1971, p. 376). Walter Cannon called this reflex "fight or flight" or "defense alarm" reaction. This reaction was necessary for survival during man's early history whereas in today's modern society it is no longer appropriate. Due to the rapid and unsettling changes of modern society, the visceral response is being constantly evoked and is probably responsible for many of today's serious diseases (Shapiro, Barber, Dicara, Kamiya, Miller, Stoyva, 1972, p. 364).

Although biofeedback is still in its infancy numerous studies have shown it to be effective in bringing about control of the autonomic nervous system (Jacobson, 1972; Blanchard and Young, 1974; Birk, 1973; Schwartz, 1973). By blending the behaviorist principle of immediate reinforcement and the introspectionists' concept of subjective awareness, it is possible to bring under conscious self-control involuntary bodily functions through biofeedback (Birk, 1973). The immediate reinforcement of biofeedback with Jacobson's (1939) modified progressive relaxation techniques bring about a state of heightened awareness and makes it possible to voluntarily bring about visceral changes (Brown, 1974, p. 301).

Progressive relaxation is a fundamental keystone in the field of psychosomatic disease. Jacobson's techniques teach muscle tension and relaxation awareness (Brown, p. 337) Jacobson (1939) contends that many illnesses are social diseases of tension and that release from muscle tension will decrease anxiety. Biomedical devices i.e. EEG and EMG when combined with feedback aid in producing deeper states of relaxation (Shapiro et. al., 1972).

Numerous studies have shown that muscle relaxation will decrease anxiety, but it remains to be determined whether these techniques are of real therapeutic value in alleviating psychosomatic diseases.

Due to the emotional factors associated with RA and the effect emotional factors have upon the neural control of blood vessels, the intent of this study was to test the hypothesis that relaxed muscles would bring about an increased supply of blood to the afflicted joints and bring about positive changes in the personality ($p<.01$) as measured by the MMPI.

The MMPI was chosen to appraise the RA's personality change because of its sensitivity to mood changes at the time of its administration. It is a valid and reliable paper and pencil questionnaire for personality appraisal. The 550 true/false questions solicit information about complaints, feelings and behavior relevant to psychiatric diagnosis and treatment (Freedman, Kaplam and Saddock, 1972, p. 174).

The items of the MMPI are combined to form several scales. Each scale was validated by studing various psychiatric diagnostic groups. There are nine psychopathological MMPI scales: hypochondriasis, depression, hysteria, psychopathic deviation, masculinity/feminity, paranoia, psychasthenia, schizophrenia and mania.

On test-retest studies the MMPI scales fell within ± 5 T score points of the original scores for all the scales except depression and anxiety which were greater than ± 5 T scores.

Method

Subjects

Subjects (Ss) who participated in this experiment were 20 volunteer RA patients diagnosed by a physician in accordance with the American Rhematoid

Arthritic criteria (see Appendix A). Local physicians were asked to recommend RA patients. No restrictions to the severity or acuteness of the disease were imposed. Ss were contacted by phone and given a brief explanation of the purpose of this study. Twenty of the 22 patients agreed to participate. Transportation was provided for 2 patients by the experimenter. All Ss were experiencing some degree of joint pain, aching and/or stiffness at the onset of the treatment plan. Three Ss were experiencing an acute phase of the disease, one S was confined to a wheelchair and 2 Ss had joint prosthesis replacement. Fourteen Ss were currently receiving gold therapy, 3 Ss cortizone therapy and 3 Ss other anti-inflammatory arthritic drugs. Ss range of RA diagnosis was from 2 months to 34 years with a mean of 8 years. Two control Ss and 2 experimental Ss had above high school education. Seventy five per cent are currently employed and 15 per cent of these Ss have been asked to retire by their doctors. The Ss ranged in ages from 38 years to 66 years with a mean of 48 years. They were matched as closely as possible for age and sex.

Apparatus and Materials

A two channel electromyrograph (EMG) Teca model TE4 apparatus with a 7 inch cathode ray oscilloscope and also equipped with sound was utilized as the biofeedback apparatus. Two pairs of 10 mm surface EMG electrodes were utilized to sample the selected muscles. A Rauh surface pyrometer was utilized for skin temperature determinations. A MMPI (book form) was administered as a measure of personality change.

Experimental Design

Groups	MMPI Pretest	Pyrometer Repeated Measure	EMG	Relaxation	Pyrometer Repeated Measure	MMPI Posttest
I (N=10)	X	X	X		X	X
II (N=10)	X	X	X	X	X	X

This study incorporated a groups design with Ss being matched on age and sex and then randomly assigned to one of two groups, the control or experimental group. All Ss received the MMPI before and after the experimental treatment; the pyrometer on a repeated measure design, before and after each session; and the EMG on a continuous basis throughout each session. Only the experimental group received the relaxation training.

Procedure

There were 10 control Ss and 10 experimental Ss. Ss were matched for age and sex as closely as possible. There were 6 males and 14 females. All Ss were matched within a 5 year or less age difference. They were randomly placed in each group. Both groups were administered individual MMPI's during the first and last experimental sessions. Most Ss required approximately 1½ hours for each MMPI administration. Skin temperature readings were taken from the web space of the left thumb adjacent to the hyperthena eminence ulitizing the Rauh surface pyrometer's thermacouple. These readings were taken at the beginning and end of each of the 4 treatment sessions. The duration of each of these sessions was 30 to 45 minutes. Two 10 mm EMG surface electrodes from the EMG apparatus were placed and secured on the skin located over the left hyperthena musculature. An additional pair of electrodes were applied over the muscle belly

of the vastus medialis component of the left quadricep muscle group. In a shielded, dimly lighted room Ss were supplied supportive padding to help facilitate relaxation. Visual feedback was provided from the cathode ray oscilloscope. The filters of the amlifiers were set at 16 HZ low frequency and 8 KHZ high frequency to provide Ss with auditory feedback. Ss were oriented with EMG's display of spike like activity on the oscilloscope and static like noise which occurs during muscle contracture.

Control Ss were requested to keep the machine as quiet as possible while maintaining a straight line on the oscilloscope during a 20 minute relaxation period. The same procedure was given the experimental group but with additional instructions in progressive relaxation. (See Appendix B).

Results

A pre/post blood flow reading was taken at each treatment session for each subject. (See Appendix E). Pre/post blood flow differences were found for each subject and analyzed by a two way analysis of variance for a repeated measure designed with one between and one within factor. (See Appendix C).

Differences scores were collapsed across sessions to compare the experimental group who received biofeedback and relaxation instructions with the control group who received biofeedback alone. This comparison revealed a significant difference between the two groups with the experimental group generally having a greater blood flow increases ($F(1, 18)=68.07$, $p<.001$).

Experimental and control groups data were combined to test for a trial effect. There was no significant difference found between trials ($F(1, 3)=.782$, NS).

Analysis of variance revealed a significant group by trial interaction ($F(1, 3)=3.75$, $p<.05$). Specific comparisons were made with the Newman Keul a posteriori test ($p<.05$). Results of this analysis showed that the experimental

group difference scores were significantly higher than the control group scores at each session. Within each group there was only one significant difference found between sessions. The difference score for session 2 was significantly higher than the score for session 1 in the experimental group. There were no significant effects across sessions in the control group.

One way analysis of variance failed to reveal a significant difference in personality change. (See Appendix C).

Discussion

RA's, using progressive relaxation, demonstrated a significant increase in blood flow through the hand as compared to a control group of RA's who received all but the relaxation exercises. When comparing personality characteristics as a function of relaxation, as measured by the MMPI, no significant differences were found.

Three experimental Ss experienced blood flow measure increase during the first treatment session but all experimental Ss demonstrated blood flow change by the second session. From the second session of relaxation training through the remainder of this study, all Ss in the experimental group showed a consistently higher significant increase in blood flow through the hand than during the first session. This was not observed for any of the control Ss. This change appears to have occurred as a function of extended training in relaxation. The blood flow change ranged from 0°to 4°F in pre/post measures. The control Ss ranged from -1° to 2°F, with only one S achieving a blood flow increase during all four treatment sessions. This indicates that biofeedback when paired with progressive relaxation is more effective than biofeedback alone in the reduction of

anxiety as measured by increase in blood flow.

Visual biofeedback seemed to be the mode that most Ss preferred. During treatment, Ss were less attentive to the EMG auditory stimuli but they were provided verbal reinforcement. On several occasions Ss fell asleep.

Several factors may have contributed to the lack of personality change. The MMPI was probably not sensitive enough to detect subtle personality changes within the brief training period. Studies also indicate that RA's are subject to chronic depression which does not readily respond to external manipulation (Rimon, 1974; Moos, 1964).

This study indicates that depression and the need for religiousity appears to be a stable factor in the lives of the people who participated in this study. Seventy five per cent mentioned religion as being very important in their lives. One S was a ministerial student who felt that RA was a result of disobeying God's call. Another S stated that through the power of prayer he is able to walk again. One S stated that she is waiting for God to cure her. These people believe in a vengeful God. It is with a sense of God purifying one's character that they accept their illness with passive acceptance. This lends support to other studies describing RA's as being highly moralistic, psychologically rigid and masochistic (Meyerowitz, 1970; and Moos, 1964).

Due to the nature of the disease and the unknown effects of gold therapy it was impossible to ascertain the effects of relaxation on RA in the two week treatment plan. There was only one S who was experienceing acute pain and edema during the time of the study. He was requested to concentrate on relaxing the inflammed wrist until the next treatment session. The following day edema was visibly reduced and S reported a reduction in pain after having followed instructions.

From this study it appears that progressive relaxation when compared to biofeedback was more effective in bringing about a more consistent state of deep relaxation. Seventy per cent of the experimental group reported a heightened sense of well being. Apparently these differences were too subtle to be measured by the MMPI.

It seems that future research should include supportive therapy in addition to progressive relaxation to assist with the many daily living problems that RA's must face due to the debilitating effects of the disease. Since it is felt that depression and anxiety are stable traits of the RA's personality this research should be conducted over a longer period of time before a tentative hypothesis can be made on the mind-body dichotomy.

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Appendix A

Table 1. Functional Classes in Rheumatoid Arthritis

Class I - Complete
Ability to carry on all usual duties without handicaps
Class II - Adequate for normal activities
Despite handicap of discomfort or limited motion at one or more joints
Class III - Limited
To little or none of duties of usual occupation or self-care
Class IV - Incapacitated, largely or wholly
Bedridden or confined to wheelchair; little or no self-care

Table 2. Anatomical Stages of Rheumatoid Arthritis

Stage I - Early
*1. No destructive changes roentgenologically
2. Roentgenologic evidence of osteoporosis may be present
Stage II - Moderate
*1. Roentgenologic evidence of osteoporosis, with or without slight bone destruction; slight cartilage destruction may be present
*2. No joint deformities, although limitation of joint mobility may be present
3. Adjacent muscle atrophy
4. Extra-articular soft tissue lesions, such as nodules and tenosynovitis, present
Stage III - Severe

*1. Roentgenologic evidence of cartilage and bone destruction, in addition to osteoporosis

*2. Joint deformity, such as subluxation, ulnar deviation or hypertension, without fibrous or bony ankylosis

3. Extensive muscle atrophy

4. Extra-articular soft tissue lesions, such as nodules and tenosynovitis, may be present

Stage IV - Terminal

*1. Fibrous or bony ankylosis

2. Criteria of stage III.

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* The criteria prefaced by an asterisk are those which must be present to permit classification of a patient in any particular stage or grade.

Appendix B

Progressive Relaxation Instructions

Take a deep breath and exhale slowly. Inhale, exhale and concentrate on relaxing. Tighten your right arm and hold-hole-hold. Now relax. Completely relax. Feel the difference between tension and relaxation. Now tighten your right arm again and as you tighten notice how your shoulder, neck and back tighten. Relax, completly relax. Make the machine silent. (Repeat instructions for left arm). Now tighten your stomach muscles-tighten-tighten-tighten. Now relax. Tighten your stomach again. Feel how the buttocks, thighs, and back also tighten. Relax, completely relax. Lift your left leg and tighten-tighten-tighten. Relax. Lift your left leg again; feel how your buttocks, back, shoulders and arms tighten. Feel the tension, isolate the tension. Now relax. Completely let go and relax. (Repeat instructions for right leg). Now close your eyes and completely relax. Concentrate on relaxing your toes, now your ankles, the calves of your legs. Everything below your knees is completely relaxed. Relax your thighs, stomach, and now your buttocks. Everything below your waist is completely relaxed. Concentrate on your chest, back, shoulders. Now the upper parts of your arms, elbows, lower part of your arms. Let the tension flow out of your finger tips. Breathe deeply and slowly. Inhale, exhale. (Repeat 3 times). Relax the muscles around your mouth, up around your nose, muscles between the eyebrows. Concentrate on your forehead and around your ears. You're completely relaxed. Concentrate on the difference between the way you're feeling now and the way you came in. Lay there for a few minutes and enjoy the the relaxed feeling that you are now experiencing. Please practice twice a day until our next session.

Appendix C

Analysis of Variance

Blood Flow via Blood Temperature Measure

Source	df	ms	f
Total	79		
Between Groups	1	55.28	68.07***
Within Groups	18	.812	
Within Trials	3	1.87	.782
Groups X Trials	3	2.39	3.75*
Trials X Subjects Within Groups	54	.637	

*** p<.001
* p<.05

MMPI Clinical Scales

Scale 1

Source	df	ms	f
Total	19		
Between Groups	1	5	.02
Within Groups	18	200.83	

* p>.01

Scale 2

Source	df	ms	f
Total	19		
Between Groups	1	20	.1
Within Groups	18	196.98	

*p>.01

Scale 3

Source	df	ms	f
Total	19		
Between Groups	1	4.05	.02
Within Groups	18	147.09	

*p>.01

Scale 7

Source	df	ms.	f
Total	19		
Between Groups	1	3.2	.03
Within Groups	18	96.58	

*p>.01

Scale 8

Source	df	ms	f
Total	19		
Between Groups	1	36.45	.43
Within Groups	18	83.11	

*p>.01

Scale 9

Source	df	ms	f
Total	19		
Between Groups	1	7.2	.05
Within Groups	18	135.83	

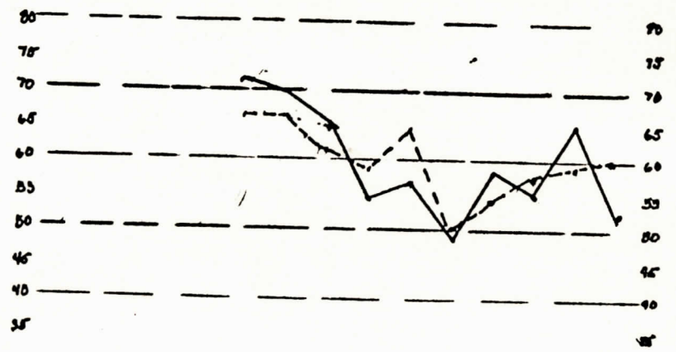
*p>.01

Scale 0

Source	df	ms	f
Total	19		
Between Groups	1	238.05	2.33
Within Groups	18	102.13	

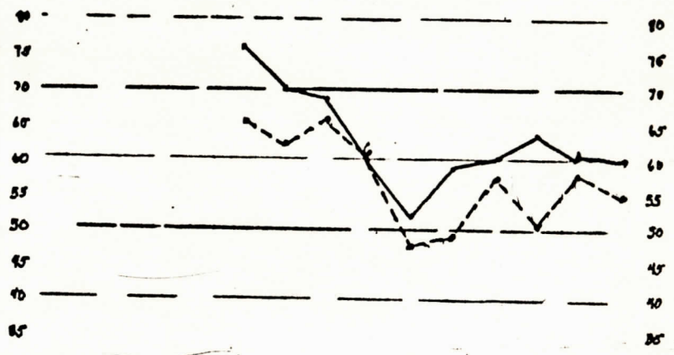
*p>.01

MMPI



Control Pretest---
Posttest---

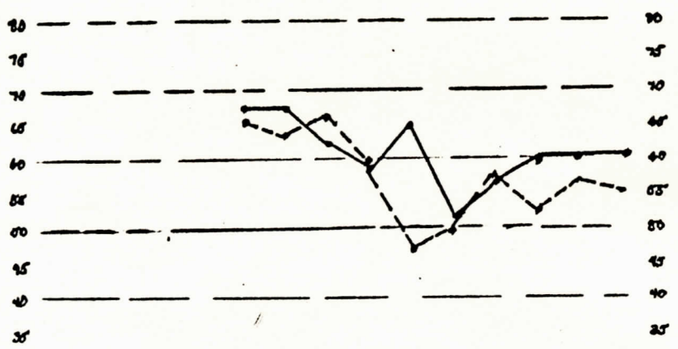
MMPI



Treatment Pretest---
Posttest---

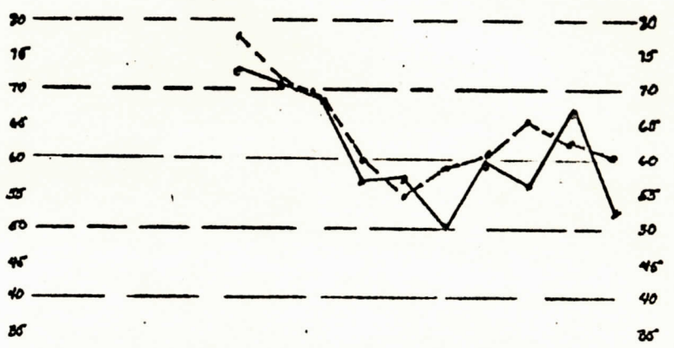
Appendix D

MMPI



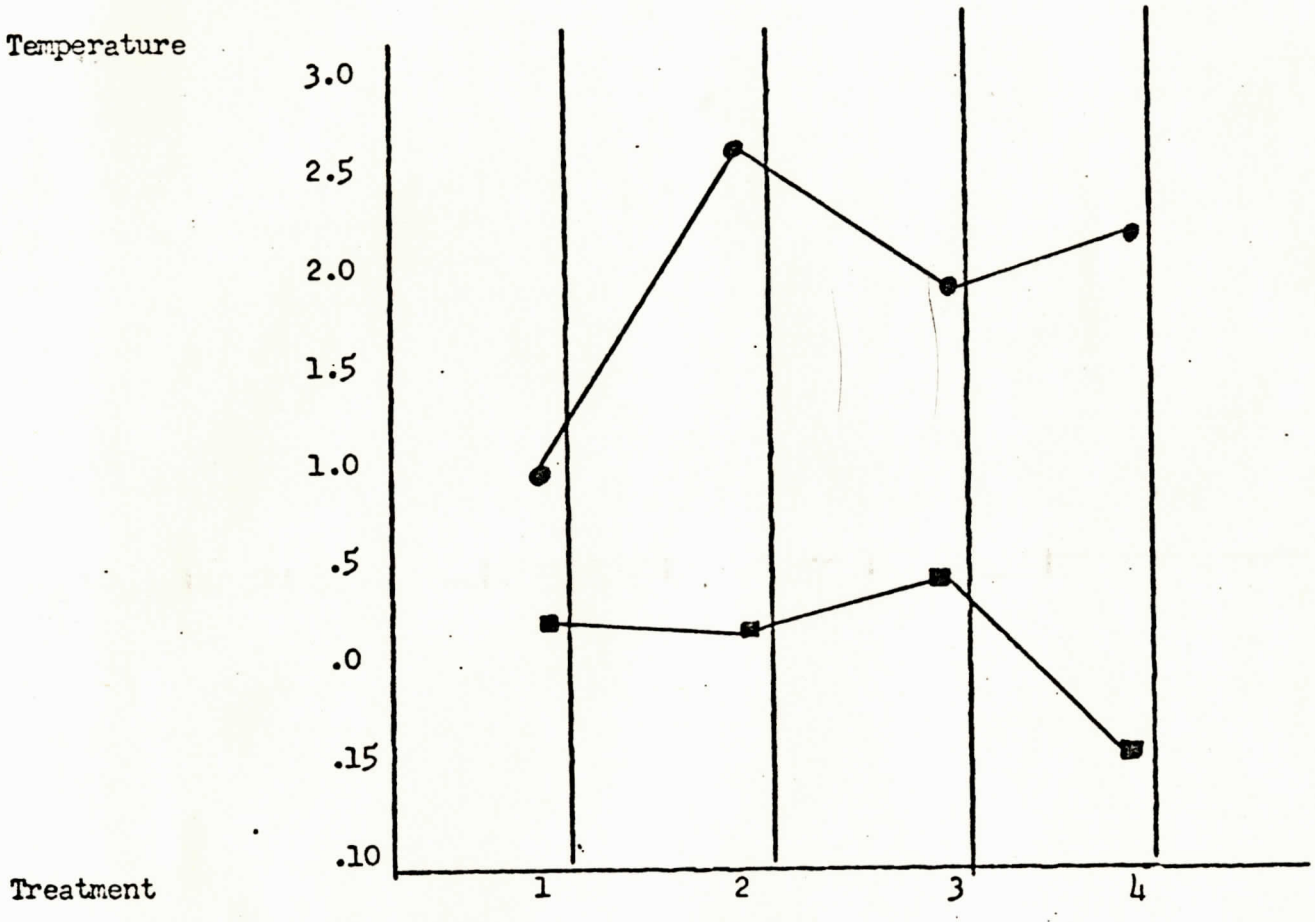
Posttest Treatment——
Control ---

MMPI



Pretest Treatment——
Control ---

Appendix E



Mean Temperatures of Subjects

Experimental Ss --- ●
Control Ss --- ■