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**Immediate effects of relaxation training in adolescent psychiatric patients**

**Platania-Solazzo, Adele, Ph.D.**

**University of Miami, 1989**

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UNIVERSITY OF MIAMI

IMMEDIATE EFFECTS OF  
RELAXATION TRAINING IN  
ADOLESCENT PSYCHIATRIC PATIENTS

By

Adele Platania-Solazzo

A Dissertation

Submitted To The Faculty  
of The University of Miami  
in partial fulfillment of the requirements for  
the degree of Doctor of Philosophy

CORAL GABLES, FLORIDA  
MAY, 1989

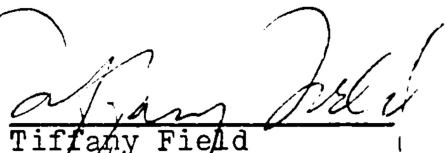
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Immediate Effects of Relaxation  
Training on Adolescent Psychiatric Patients

Adele Platania-Solazzo

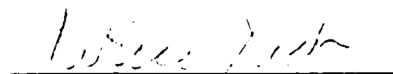
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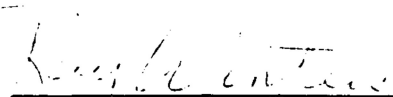
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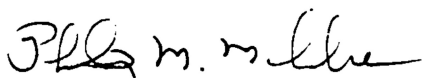
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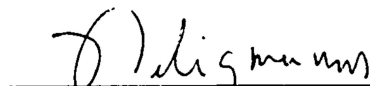
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IMMEDIATE EFFECTS OF RELAXATION THERAPY IN ADOLESCENT  
PSYCHIATRIC PATIENTS. May 1989

Abstract of a doctoral dissertation at the University of Miami. Dissertation supervised by Professor Tiffany Field.

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Relaxation training has widespread clinical use. Applications include treatment of insomnia, allergies, and anxiety. Few studies have examined the effects of relaxation training in adolescent psychiatric patients. In the present study, the immediate effects of relaxation training (Rt) were assessed on adjustment disorder and depressed children and adolescents. The Rt class consisted of 30-40 minutes of yoga exercises followed by 20 minutes of relaxation therapy, interspersed by a brief massage. All patients were given the state form of the STAI-C and the depression factor questions of the POMS. In addition, observers rated the subjects' behaviors according to a behavior observation scale. Heart rate, activity level, and cortisol levels were also measured. A subsample of patients were given the same set of measurements during a control condition (i.e. television viewing) in a counterbalanced fashion. All the subjects appeared to benefit from the Rt class. The patients showed a decrease in self-reported anxiety, in behaviorally observed fidgeting and anxiety and an increase in alertness, positive affect, and activity

following RT. Heart rate and activity levels increased during exercise and decreased during the relaxation portion of the class. Although depressed patients appeared to have higher cortisol values than the adjustment disorder patients there were no significant effects. The lack of statistically significant cortisol reduction may be a result of the large amount of variance in cortisol values among depressed patients. Because 62% of depressed patients showed increased cortisol values and 38% showed decreased cortisol values following relaxation training, two subtypes of depressed patients may be present. All adjustment disorder patients showed decreases in cortisol. The subsample of patients participating in the treatment and control condition showed greater reduction in anxiety (measured by the STAI-C and behavior rating), in heart rate, and in cortisol values during the treatment condition than in the control condition. Thus, relaxation training had immediate positive effects as seen by the changes in the entire sample of patients and in the subsample of patients participating in both conditions.

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## Introduction

Progressive muscle relaxation training refers to procedures that are employed to reduce tension and anxiety by training individuals to voluntarily relax the muscles of the body. Although a variety of relaxation techniques have been developed, they are all directed at reducing general anxiety and tension by attacking the symptoms. Relaxation training (Rt) is oriented toward creating a more comfortable state, rather than resolving conflicts or problems that are presumably causing tension.

In recent years, Rt has become accepted in clinical practices as an intervention on its own or as an adjunct to other forms of behavioral treatment. Perhaps the most clear application is in situations where simple tension is producing the problem (e.g., work related stress). Another application is in the treatment of psychosomatic symptoms such as headaches, ulcers, hives, and rashes which may be a direct result of tension (Jacobsen, 1970). Reports have also indicated the efficacy of Rt in reducing insomnia (Weil & Godfried, 1973), hyperactivity in children (Lupin, Braud, & Duer, 1974), stuttering (Brady, 1972), and test anxiety (Little & Jackson, 1974), and in alleviating pressure in prison populations (Marquis & Gendreau, 1975), as well as treating neuroses and psychoses in children (Corder, Whiteside, & Haizlip, 1986; Graziano & Kean, 1968; Richter, 1984). Although these disorders have different

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origins, relaxation training can be applied to any of them because it focuses on a common symptom: reduction of tension. By reducing anxiety levels, the disorder may be cured or alleviated to the point where other treatment approaches may be more effective. The variety of situations in which Rt is used indicates its flexibility as an intervention.

### Relaxation Training Procedures

Tension can be concretely defined as tight muscles, high blood pressure, and/or the chronic oversecretion of hormones. These tension responses can be effectively controlled through several different relaxation procedures. Some common techniques include forms of meditation originating in the Far East, Transcendental Meditation, hypnosis, and biofeedback. The present study focused on progressive muscle relaxation and yoga exercises.

### Progressive muscle relaxation

Essentially, progressive muscle relaxation training involves teaching techniques of muscle relaxation to the patient. The "father" of relaxation training, Edmund Jacobsen (1938), developed the basic techniques that are used today. His technique is primarily known as progressive muscle relaxation (pmr). Jacobsen used relaxation as a treatment for a wide variety of anxiety related problems. Progressive muscle relaxation can produce a relaxation response in participants whereby muscle tension, cortical activity, heart rate, and blood pressure all decrease as

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breathing slows. In this state of low arousal, recuperation from stress can take place (Zimbardo, 1985). Relaxation training is more effective if it is presented to the patient as an active self-control technique rather than as a passive technique that will automatically prevent tension. To begin Rt, the patient is asked to recline on a comfortable chair or mat in a quiet room without any direct light. The patient, who should not feel embarrassed or awkward, is then instructed to relax each of the body's muscle groups in succession until complete relaxation is achieved. The therapist uses a calm, soothing voice during the session. After relaxation of the muscle groups is achieved, guided imagery can be offered. Here the patient is asked to imagine a pleasant place or an experience that has been a source of enjoyment. Imagery can increase the relaxation response as is shown by a greater decrease in heart rate when it is used in conjunction with relaxation training (Jasnoski & Kugler, 1987).

#### Yoga exercises

Relaxation techniques can be enhanced by the use of exercises. Hatha yoga involves exercises that apparently affect the circulatory system. Increases in heart rate during Hatha yoga are the same for trained and untrained individuals (Funderburk, 1977). Studies have shown an average heart rate increase ranging from 2 to 12 beats per minute, depending on the exercise (Dhanaraj, 1974). In addition to affecting heart rate, yoga exercises have

also been shown to affect the endocrine system. Udupa et al (Udupa, Singh, & Settina, 1971) found that a group of 12 subjects showed an increase in cortisol levels after three months of regular Hatha yoga. Udupa & Singh (1975) also noted that 3 of 4 subjects showed an immediate increase in plasma cortisol after engaging in Hatha exercises. These studies indicate that Hatha yoga exercises have an immediate and long term effect on the endocrine system. Hatha yoga also includes stretching and breathing exercises which do not raise heart rate or have significant endocrine effects.

Stress and emotional disturbance are commonly thought to be accompanied by muscular tension. Hatha yoga exercises have been shown to reduce muscle tension. Although heart rate and cortisol levels may increase during some of the exercises as a result of the physical activity involved, the reduction of muscular tension following a yoga session elicits a relaxation response (Funderburk, 1977). Along these lines Boruchov et al (Boruchov, Harris, Starer, et al., 1978), proposed that emotional disturbance could be ameliorated by reducing muscular tension via yoga exercises. They employed yoga exercises with severely disturbed psychiatric patients in a Veterans Hospital. Prior to the exercise program the subjects were administered psychological tests (WAIS-R, TAT, and Bender -Gestalt) and aptitude tests to determine manual dexterity and attention. After a three month period, the authors noted improvement in one or more of the test areas. There was also a significant

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decrease in disruptive behavior on the ward. Unfortunately, the authors did not assess any concurrent physiological changes (i.e., heart rate or cortisol) which may have taken place. Engaging in exercises, such as yoga stretching, prior to the Rt procedures described above, may produce a more significant reduction in tension. Given that the effects of exercise followed by relaxation training have not been documented, research is needed in this area.

### Effects of Rt on Different Diagnostic Groups

#### Depression

Affective disorders, such as depression, are characterized by disturbances of mood in which the person may be either excessively elated, excessively depressed, or both. Depressed mood, low self-esteem, diminished pleasure in activities, and continual loss of energy are features of depression. Anxiety is another common component of depression (Beck & Emery, 1985). Although a depressed individual's behavior may be exaggerated and self-defeating, it is generally not considered severe enough to be labeled psychotic. Depression has been referred to as the "common cold of psychology" since most people have experienced depression at one point in their life. However, in a depressive disorder the symptoms are more intense, prolonged, and recurrent. Approximately 5% of adults between 18- 25, have serious depressive symptoms. Depression accounts for the majority of all mental hospital

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admissions (Bielski & Friedel, 1977). Depression in children, at one point thought to be rare, is now considered to be a common event. The DSM III-R describes depressive symptoms as essentially the same for children and adolescents as it is for adults. Kashani et al. (Kashani, Husain, Shokim et al., 1981) suggest that the prevalence of depression in children depends on the population surveyed (e.g., normal, psychiatric, delinquent, etc.) as well as the criterion employed. Although there are few epidemiological studies on childhood depression, a well regarded study by Kashani & Simonds (1979) proposed that 1.9% of all children under 18 meet the DSM-III criteria for depression.

Some interesting neurochemical correlates of depression have been found in profoundly depressed people. For example, an increase or hypersecretion of cortisol in the afternoon and evening hours has been noted (Sacher, Anis, Nathan, Halbreich, & Halpern, 1980). In contrast, nondepressed individuals experience relatively low levels of cortisol secretion at these times (Sacher, 1981). These neurochemical changes may be linked to stress. Puig-Antich et al. (Puig-Antich, Chambers, Halpern, et al., 1979) noticed that hypersecretion of cortisol occurred during the acute stage of depression and normalized upon recovery in prepubescent children. These findings suggest that cortisol secretion fluctuates with the severity of depression, and thus, with the level of anxiety in depressed patients. Further support for increased cortisol levels in depressed

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patients is a study by Ktiovetc (1984) who observed decreases in corticosteriod binding globulin which is associated with increases in total and free plasma cortisol.

Recent evidence suggests that Rt is an effective technique for symptom reduction in depression (Angras, 1983; Biglan & Dow, 1981). One study utilized Rt as an attention control group, yet found it to be as effective as psychotherapy and pharmacotherapy in reducing depression related anxiety (McLean & Hakstian, 1979). Others have reported that Rt is an effective component of treatment protocols for depression (Blaney, 1981; Zeiss, Lewinsonn, & Munoz, 1979). More recently, Reynolds and Coats (1986) compared the efficacy of cognitive behavioral therapy, relaxation therapy, and a wait list control for the treatment of moderately depressed adolescents. Relaxation training consisted of ten 50 minute sessions over a period of five weeks. Both active treatment groups showed a significantly greater reduction in depressive symptoms than the waiting list control. There was no significant difference in symptoms of depression between the two treatment groups. Furthermore, post test findings indicated that the relaxation group continued to show reduced anxiety levels more successfully than the other two groups. Since anxiety has been identified as part of depressive symptomology, relaxation training is a viable treatment approach. Relaxation training can also provide a way to cope with future stress. For example, when faced with a



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stressful situation, an individual trained in relaxation is equipped to reduce anxiety levels and, thereby, respond more effectively. In addition, relaxation training may counteract the neurochemical changes (i.e., increase in cortisol levels) which have been linked to depression.

#### Adjustment Disorders.

Adjustment disorders involve a maladaptive reaction to a recent stressor (DSM III-R). Common symptoms include impairment in school, in interpersonal relationships, and in everyday activities. Patients with adjustment disorder generally display a reaction that is a combination of a stress response and a compensatory adaptation mechanism (Chess & Hassibi, 1978). The impact of stress generally decreases over time. However, the manner in which they cope or adapt to the disruptive life event may have more lasting effects. A compensatory adaptation mechanism involves an individual's effort to reestablish previous internal and external equilibria. These changes may become incorporated into the structure of the personality and be resistant to further change (Chess & Thomas, 1984). The manner in which these individuals cope has given rise to several categories of Adjustment Disorder, each presenting with a slightly different clinical picture. For example, Adjustment Disorder with depressed mood presents with an incomplete depression. Other features include conduct and emotional disorders. The use of relaxation techniques with adjustment disorder was not found in any of the articles reviewed.

However, given the description of this disorder, Rt may be a viable part of the treatment protocol. Anxiety is likely to be present in patients with adjustment disorder as a byproduct of the underlying stressor present in adjustment disorder and in response to some of the symptoms of this disorder such as failing school or family conflict. In these patients, the reduction of anxiety through relaxation training may lead to improved behavioral functioning.

### Physiological Responses to Relaxation Training

#### Heart Rate

There appears to be a common physiological response to relaxation training and related techniques such as transcendental meditation and biofeedback. In various populations, Rt seems to affect heart rate, blood pressure, and oxygen consumption as well as electroencephalographic changes (Davidson, Winchester, Taylor, Alderman & Ingels, 1979). Relaxation training induces a "wakeful hypometabolic state" where the patient is awake, but has a slowing down of physiological systems (i.e., slower heart rate) (Benson, Kotch, Crossweller, & Greenwood, 1974). Although the physiological mechanisms of these effects remain unknown, central nervous system activity has been postulated (Davidson et al., 1979). Early studies of progressive muscle relaxation with adults have generally shown a reduction in heart rate during relaxation. A study by Wallace, Benson, and Wilson (1974), for example, showed a

mean drop in heart rate of 3 beats per minute in 13 normal subjects during relaxation. Another study noted a 1.5 beat per minute decrease in heart rate in 6 normal subjects (Gash & Karliner, 1978). Other studies have also noted a decrease in heart rate following relaxation training (DeGood & Redgate, 1982; Hosmand, Helmes, Kazarian, & Tekatch, 1985; Jacobson, 1938; Paul & Trimble, 1970; Throll, 1982).

### Cortisol Levels

In addition to affecting the cardiovascular system, relaxation training affects plasma cortisol. As increases in cortisol levels are considered a classical response to stress (Selye, 1974), a decrease in cortisol levels should be seen following Rt (Bujatti & Riederer, 1976; Brevon, et al., 1977). A decline in cortisol during relaxation may be a result of lessened pituitary-adrenal activity (Jevening et al., 1977). It appears that relaxation training has a "quieting" effect on the body as assessed by decreases in heart rate and motoric activity as well as cortisol decreases. In contrast, cortisol is produced by the hypothalamico-pituitary -adrenocortical (HPAC) system when activated by stressors such as infection, physical restraint, or emotional distress (Schneiderman & McCabe, 1985). Cortisol is released according to a diurnal rhythm, with high levels noted in the morning hours and relatively low levels in the late afternoon and early evening hours (Sacher, 1981). The fluctuation in values appears to be at

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least partially under the control of the suprachiasmatic nucleus of the hypothalamus. Lesions in this area have abolished the circadian rhythm in rats (Moore & Eichler, 1972). Cortisol has a multitude of functions including metabolic effects, vascular reactivity, and immune system consequences with glucocorticoid receptors found in almost every nucleated cell in the body (McGrady, Woerner, Bernal, and Higgins, 1987).

In order to identify the effect of relaxation on cortisol, sampling should be done before and after the relaxation intervention. Several studies have examined cortisol levels during transcendental meditation and biofeedback training. Jevning et al. (1977) found significant decreases in plasma cortisol after meditation in 30 individuals who had meditated regularly over a 3 to 5 year period. Part of the successful results of the Jevning et al. study may be a result of the large sample size and the controls for the circadian effects of cortisol; all cortisol samples were taken between 12 and 4 p.m. Cooper et al (Cooper, Joffe, Lamprey, Botha, Shives, Baker, & Seftel, 1985) examined the effect of transcendental meditation (TM) on various endocrine responses, including cortisol levels. Ten experienced adult meditators employed TM for 40 minutes, while 10 matched controls relaxed for the same amount of time. The subjects remained seated quietly for a minimum of 50 minutes prior to the relaxation period. No significant differences in endocrine responses emerged between the

groups, although differences were noted in heart rate and<sup>12</sup> electroencephalogram patterns. A possible explanation of these negative results may be that both groups were relaxed prior to meditation, thus attenuating the expected difference in cortisol levels. In contrast, a study by DeGood and Redgate(1982) showed significant decreases in plasma cortisol and heart rate, as well as changes in electromyography in 12 participants who had 9 biofeedback training sessions. The discrepant findings of these studies indicate the need for more research in the area. In general, the literature suggests that cortisol decreases during relaxation training. The observed changes in cortisol may be part of a hypometabolic condition (under the influence of the parasympathetic nervous system) elicited by the relaxation response.

#### Effects of Relaxation Training on Clinical Measures of Anxiety

Although Rt has gained increasing popularity in clinical practice, critical evaluations are rare. Luiselli et al. (Luiselli, Marholin, Steinman, & Steinman; 1979) reviewed the Rt literature over a three year period and found that 70% of studies offered no mention of how the effects of relaxation were assessed. This was particularly true when Rt was used with clinical populations. Only a small percentage of published relaxation studies employed clinical subjects. Borkovec and Sides (1979) reviewed 25 studies on Rt in which

physiological measures were used; they found that only 20% included clinical subjects. More recent reviews suggest similar percentages (Lichstein, Sallis, Hill & Young, 1981; Marquis, Ferguson, & Taylor, 1980; Norton & Johnson, 1983; Schilling & Poppen, 1983). However, the differences noted in anxiety response patterns between clinical and nonclinical samples warrant attention. Particularly lacking are clinical studies of Rt in psychiatric inpatient settings. Despite the casual acceptance of Rt, more research needs to be done, especially in psychiatric settings.

Anxiety reduction has been assessed by a number of clinical measures. Assessment strategies range from clinical interviews to self-report questionnaires. One method is the State-Trait Anxiety Inventory (STAI) which was developed as a research tool to measure anxiety or anxiety change (Spielberger, Gorsuch, & Lushene, 1970). The STAI has been used to evaluate the effects of relaxation training in several studies (DeGood & Redgate, 1982; Hoshmand et al., 1985; Wright, 1978). The studies reviewed clearly indicate that anxiety is reduced following relaxation training. Hoshmand et al (1985), for example, found a significant reduction in state anxiety after 9 sessions of relaxation training in psychiatric inpatients. Similarly, DeGood et al (1982) found reduced state anxiety following 9 biofeedback training sessions.

Another measure of anxiety is the Profile of Mood

Scales (POMS) developed by McNair and Lorr(1971). The POMS yields subjective data regarding feelings, affect, and mood. It has been used in a variety of research situations ranging from the assessment of depression (Raskin & Crook, 1976) to the effects of sleep deprivation (Lubin, Moses, Johnson, & Naitoh, 1974). Although well suited to measure mood state following Rt, it has not been utilized in this area very often. An exception is a study by Matthews and Gelder(1969) who reported significant changes in mood as rated on the POMS following brief relaxation training. The frequent use of relaxation training today demands standardized dependent measures like the STAI or the POMS to enable comparisons across studies.

None of the relaxation studies reviewed utilized behavior observations or behavior observation scales. Comparing the observable behavior of each participant prior to, during, and after Rt therapy is another potentially effective measure of the effects of relaxation on anxiety. An inherent problem with this method is observer bias. However, if inter-observer reliability assessments are made and if the observers are similarly trained, bias can be reduced to acceptable levels.

#### Rationale For This Study

Relaxation training can help people learn to consciously relax their muscles (Jacobsen, 1970). This procedure generally results in a comfortable and more

relaxed state and can be enhanced by guided imagery and exercise. Guided imagery is noted to reduce anxiety by having patients visualize themselves as becoming stronger and healthier, and coping with their problems. Beck and Emery (1985) have reported the use of guided imagery in reducing anxiety. In general, Rt is an effective technique for any situation or condition in which anxiety is present (Bernstein & Borkevoc, 1980). Anxiety is an all pervasive phenomenon that is difficult to define. It affects almost every system in the body: physiology, cognition, motivation, affect, and behavior. This study attempted to measure the effects of relaxation training on several of these systems.

Individuals experiencing anxiety may react with negative appraisals of their performance, affecting their cognitive system (i.e., I'm not worth anything). Common affective or emotional reactions may include feeling edgy, jittery, scared, or nervous. The STAI and the POMS are two well known inventories that tap cognitive and emotional responses to anxiety. These inventories may reflect the level of anxiety change following an intervention. The POMS, which appears to tap mood level for a period of weeks, is a less transient measure of anxiety than the state section of the STAI, which measures the immediate level of anxiety. Nonetheless, Matthews and Gelder (1969) have shown a positive mood change on the Poms after subjects had



engaged in brief relaxation training. Since this study will examine the immediate effects of relaxation training, the greatest impact of relaxation would be expected on a transient measure of anxiety (STAI). The immediate effects of Rt on anxiety levels have not been assessed.

In contrast to the STAI and POMS measuring self-reported changes in anxiety levels, a behavior rating scale was used to tap changes in behavioral manifestations of anxiety. Behavioral symptoms of anxiety typically include restlessness, fidgety and nervous behavior, and hyperactivity or hypoactivity. Relaxation, which is presumably incompatible with these symptoms, was expected to reduce these symptoms.

The most widely documented effects of anxiety are the physiological effects such as increased sympathetic activity (e.g., increased heart rate). Although research generally indicates that Rt results in decreased heart rate, the evidence for cortisol changes is controversial. An increase in cortisol is typically associated with a stress response (Selye, 1967). Many researchers also propose that a decrease in cortisol levels is associated with a relaxation response (Brevan, et al 1977; Jevning et al 1977). This study attempted to measure the immediate effects of relaxation on these physiological measures. Relaxation studies have traditionally focused on nonclinical samples. Only 16% of published relaxation training studies employed clinical populations. And even

fewer studies examined the effects of relaxation training on hospitalized psychiatric patients, particularly adolescents. An exception was a study by Corder et al (1986) who found that adolescent inpatient psychiatric patients showed less acting out behavior following the use of relaxation techniques. However, because they used non-standardized self-report measures and inadequate behavioral observations, their results are difficult to evaluate.

Relaxation training may be particularly helpful as an adjunct treatment for specific pathologies such as adjustment disorder and depression. Although Rt is not considered the major treatment for either of these disorders, it may be an effective adjunct treatment. Relaxation can reduce anxiety which may be present in adjustment disorder as part of the underlying stressor or response to the symptoms of the disorder ( e.g., family conflicts). However, anxiety is not necessarily included in the definition of this disorder. There is strong evidence for the use of relaxation as a treatment component for depressed patients (Reynolds & Coats, 1987). As anxiety is a central feature of depression, relaxation training may have powerful results. Therefore, depressed patients may respond more strongly to relaxation training than adjustment disorder patients. To address some of the issues described above the present study examined the immediate effects of relaxation therapy on physiological, behavioral, and self-report measures of anxiety in adolescents who were

hospitalized for depression or adjustment disorder.

This study examined the following hypotheses:

1. That self-reported anxiety (on the STAI-C and the POMS) would diminish following the relaxation class;
2. That motor activity, anxiety, and fidgety behavior would decrease and alertness, positive affect, and cooperation would increase following relaxation therapy class as measured by behavior observation ratings;
3. That saliva cortisol and heart rate levels taken after relaxation therapy class would be lower than baseline levels.

## Methods

### Subjects

Forty children and adolescents who were hospitalized on the Adolescent Unit at Jackson Memorial Hospital comprised the sample. The subjects ranged in age from 8 to 18 years (mean = 13.9). Twenty of the patients were diagnosed as depressed and the other twenty with adjustment disorder. Diagnoses were made following a one hour intake interview with a staff psychiatrist, who employed DSM III-R criteria. See Table 1 for a breakdown of subjects by medication, sex, and diagnosis. Approximately one quarter of the patients had previous admissions to a psychiatric facility. The average hospital stay at the time of testing was 7 days. Patients were recruited upon admission to the unit prior to the relaxation therapy classes. There was no significant difference between adjustment disorder patients and depressed patients on factors of age, previous admissions, and hospital stay ( $p > .05$ ). A subsample of 10 patients who participated in the relaxation therapy classes were also seen on other days for the collection of within subjects' control data.

### Procedures

Relaxation Therapy. The subjects engaged in a 60 minute Relaxation Training Class which is routinely offered (2 times a week) in the unit by a relaxation therapist. The same therapist was used for every class. The relaxation

Table 1

Characteristics of Study Subjects

|                |        | Groups     |                     |
|----------------|--------|------------|---------------------|
|                |        | Depression | Adjustment Disorder |
| <hr/>          |        |            |                     |
| Medications    |        |            |                     |
|                | Female | 2          | 1                   |
|                | Male   | 2          | 3                   |
|                |        | <hr/> 4    | <hr/> 4             |
| No Medications |        |            |                     |
|                | Female | 12         | 9                   |
|                | Male   | 4          | 7                   |
|                |        | <hr/> 16   | <hr/> 16            |
| <hr/>          |        |            |                     |

therapist has a Master's Degree in psychology and is also a Registered Nurse. She has worked in the Psychiatry Department for several years and teaches yoga classes in the community. The Relaxation Training Class consisted of 30 - 40 minutes of yoga exercises and 20 minutes of progressive muscle relaxation and guided imagery, interspersed by a brief massage. Eight to ten children/adolescents participated in each class. One to three of these individuals were employed as study subjects. The patients initially layed in a supine position on exercise mats. The yoga period began with stretching exercises that gradually became more aerobic toward the end of the 30 -40 minute session. The basic exercises were as follows:

(1) Leg Stretch: This is a warm-up exercise that is done while lying in a supine position, legs flat on the floor. One leg is repeatedly flexed and extended followed by the other leg. This is repeated several times.

(2) Rocking: The patient sits up and holds the knees with both hands, rocking backward and forward, repeatedly. It is repeated ten times.

(3) Cobra: This is so named because it simulates the rearing-up of a serpent. It begins by lying on a mat with the chin on the floor, hands along side of the chest, palms down, elbows in and feet parallel ("push-up" position). Next, the back is arched by extending the elbows. The head is brought back for the maximum stretch from chin to navel, the latter remaining on the mat. The posture is held

briefly.

(4) Swan: This begins as in the Cobra, in the "push-up" position. One slowly rears up until the elbows are straightened, the head is brought back, the back is arched. Then, with the hands always in the same place and the feet together, the trunk and thighs move backwards, until one is seated on the heels. Then the head is lowered until it touches the mat. Next, one raises the head, returning to the raised position, then back on the heels again, drawing the hands as one sits up.

(5) Spinal Stretch: This is done from a standing position. One stands on the left foot and bends the right leg back so that the heel touches the right buttock. The right foot is held with the right hand. The left hand reaches upward for the maximum reach. Then it is reversed and repeated on the right foot.

(6) Shoulder Stand: For this exercise, one again lies down on the mat, flat on the back, hands along side of body. One raises the legs, keeping the knees still, the legs straight and together. As the legs are raised above the head, the hands are pressed against the small of the back, raising the back above the mat so that the weight is supported on the shoulders. The torso is kept straight, the chin locked up against the chest. This position is held for 30 seconds to one minute. Then the hands are placed down flat on the mat and the legs are lowered slowly.

(7) The Plow: This exercise begins as in the shoulder

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stand, lying on the back, hands alongside the body. One raises the legs, with knees and legs straight, until they touch the floor at the back of the head.

(8) The Woodchucker: One starts in an upright position with legs hip distance apart. The arms are clasped overhead and brought in rapid succession through the leg five times.

The brief massage, following the yoga exercises, was approximately 2-3 minutes long and consisted of the instructor using a rolling pin on the subject's back and massaging their shoulders with her hands. For the remainder of the class time (approximately 20 minutes) a modified version of progressive muscle relaxation was administered by the relaxation therapist. The participants were instructed to breathe deeply for several minutes. Then, the therapist asked the subjects to alternately relax and tense their muscles. Eight basic muscle groups were the focus of relaxation. After relaxing the different muscle groups, the instructor used imagery to enhance the feelings of relaxation while the subjects continued to breathe deeply.

The control condition featured a similar time frame of television viewing in a communal meeting room. The same measurements used in the experimental condition were employed in the control condition for a subsample of the subjects using the same time frame.

Assessments. The following assessments were made by three research assistants who were participant observers in the RT class:



1. Thirty minutes prior to the class the following baseline measures were taken: heart rate (pulse), saliva cortisol, the state portion of the State-Trait Anxiety Inventory for Children (STAIC), and depression factor of the POMS. Actometer and behavior observation ratings were also made based on that 30 minute period; 2. At the end of the exercise portion of the class the following measures were taken: heart rate, saliva cortisol, and actometer readings; 3. At the end of class, heart rate was measured, actometer reading was taken, and behaviors observed during the class were rated; and 4. Thirty minutes following termination of the class the following assessments were made: heart rate, saliva cortisol, actometer reading, STAIC, POMS, and behavior observation ratings based on the 30 minute period following the class.

A summary of the assessments can be seen in Table 2.

### Measures.

#### 1. The STAIC

The STAIC is an adaptation of the STAI for children specifically designed for the study of anxiety in school age children and adolescents who are below average in reading level. The inventory is composed of two parts with similar formats; one asking how the subject feels right now (state) and the other asking how the child feels in general (trait). The present investigation used only the state form of the STAIC. The state form consists of 20 items. The subject

Table 2

Summary of Assessment Measures

- A. Baseline - 30 minutes prior to class
  - Heart rate
  - Saliva cortisol
  - STAI-C
  - POMS
  - Behavior Observation Scale
  - Actometer - (Activity Watch)
- B. Post exercise - 30 minutes after class has begun
  - Heart rate
  - Saliva cortisol
  - Actometer - (Activity Watch)
- C. Post Relaxation Training - end of class
  - Heart rate
  - Behavior Observation Scale
  - Actometer - (Activity Watch)
- D. Follow-up - 30 minutes after class ended
  - Heart rate
  - Saliva cortisol
  - STAI-C
  - POMS
  - Behavior Observation Scale
  - Actometer - (Activity Watch)

completes statements such as, " I feel.....very calm, calm, or not calm". The STAI-C appears in Appendix A. As expected, test-retest reliability for the State form is low, ranging from .31 to .47 regardless of elapsed time intervals (Spielberger, et al. 1970). The test was individually administered prior to the class and took between 5 -10 minutes to complete. The STAIC was also administered 30 minutes after the RT class was finished.

## 2. The POMS

The POMS is a 5 point adjective rating scale asking the subject to describe how well an adjective describes his/her feelings for the past two weeks, including today. The questionnaire, which includes adjectives such as happy or gloomy, consists of 65 items. This study utilized those 14 items that comprised the Depression factor of the POMS (McNair & Lorr, 1964). The POMS appears in Appendix B. The experimenters had a standard list of definitions for the adjectives to be used whenever the subjects were unsure of a descriptor. These definitions can also be seen in Appendix B. The answer choices are 0= not at all, 1=a little, 2=moderately, 3=quite a bit, and 4=extremely. The test-retest reliability ranges from .43 to .64 in a time period ranging from 4 to 12 weeks (McNair & Lorr, 1964). The authors propose that the POMS is a sensitive measure for assessing mood changes of psychiatric patients to various therapeutic approaches (McNair, Lorr, & Droppleman, 1971).

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This questionnaire was individually administered prior to the Rt class and required approximately 5 minutes to complete. The scale was given again 30 minutes after the Rt class was finished.

### 3. Behavior Observation Ratings

The observers rated the behavior of each subject on a 3-point continuum on seven scales : state, affect, activity, vocalization, anxiety, cooperation, and fidgety/nervous behavior. The observation scale was completed 3 times based on behavior observed a) during the 30 minutes prior to the Rt class, b) during the class itself, and c) during the 30 minute period after the class was finished. For each of these periods, the seven scales were summed to yield a summary score. The summary score ranged from a low score of seven to a high score of 21. Observers were given descriptors and examples of each level of the seven scales. These descriptions can be seen in Appendix C. Interobserver agreement was assessed by two independent observers recording simultaneously across the observation period for one-third of the subjects. Reliability was calculated using Cohen's Kappa, a chance-corrected statistic (mean  $K = .86$ , range = .72 to .96)( Cohen, 1968).

An actometer was used to measure the subjects' activity. The actometer is a watch that cumulatively records movements in the horizontal and vertical plane. It was worn on the subjects' wrist, similar to a normal watch. Activity level was calculated by subtracting readings taken

at the beginning from the reading taken at the end of each section of the relaxation training class (i.e., baseline, exercise, relaxation training, and recovery) . The difference was then divided by the number of actual seconds that elapsed. As a result of minimal movement during certain periods of relaxation therapy (i.e., progressive muscle relaxation), the quotient was often a number less than one-tenth. Therefore, the quotient was multiplied by 100 to yield a larger number.

#### 4. Physiological Measures

Heart rate was measured by taking the subject's radial pulse for 30 seconds a half hour prior to the class, during the class (following the exercises), after the class, and at the end of the thirty minute period following the termination of the class. Control subjects' heart rate was measured in the same manner and in a similar time frame during the television viewing condition.

Saliva cortisol samples were collected one half hour prior to class, following the exercise portion of the class, and one half hour after the class was finished. Due to the 20 minute lag in cortisol change, saliva samples reflected cortisol levels 50 minutes prior to class, at the middle of the yoga exercise portion of the class, and at the end of the relaxation portion of the class. Changes in saliva cortisol mirror changes in plasma levels of cortisol (Bustamante, 1984). To assess the possibility of a circadian change in cortisol, cortisol was also sampled (n = 10) at

the same time intervals as the Rt class, but while watching television instead of participating in the Rt class. Samples were obtained at three assessment times: baseline, 50-60 minutes after baseline, and 120 minutes after baseline. These intervals matched the time frame of the experimental group.

Saliva cortisol samples were obtained by having subjects place a cotton dental swab dipped in sugar-free lemonade crystals along their gumline for 30 seconds. The swab was then placed in a syringe and the saliva was removed and inserted in a 1.5 micro centrifuge tube, labeled with subject's name and time the saliva was taken. The saliva samples were frozen and subsequently assayed for cortisol levels at the Clinical Pharmacology Lab at Duke University (supervised by Dr. S. Schanberg). Upon arrival at the lab, the samples were thawed. Saliva cortisol was measured by high-pressure liquid chromatography (HPLC)-purified tritiated tracer, 3H cortisol, antiserum, and standards purchased from Radioassay System Laboratories (Carson City, Ca.). Antibody bound and free hormone were separated by the dextran-coded charcoal technique. Samples were counted by liquid scintillation spectrometry using toluene-based scintillation fluid. Performance of the assay sensitivity is .0005ng/tube. The range of the standard curve is .0005 to 2.0 ng (S. Schanberg, personal communication).

#### Data Analysis

All statistical calculations were analyzed by the BMDP

computer program. A correlation analysis was initially performed to determine whether any of the possible confounding variables (i.e., age, sex, medication, previous admissions, and length of hospital stay) were correlated with diagnosis. Any variable which was significantly correlated was entered into the analyses as a covariate. Two series of repeated measures analyses of variance were then conducted. In the first series, diagnostic group was the between subjects variable and assessment period was the repeated subjects variable. In the second series of repeated measures analysis of variance, two within factors were employed on a subsample of patients ( $n = 10$ ) with condition (treatment and control) as one factor and assessment periods as the other factor. All significant repeated measures effects were examined by the Tukey test. All significant interactions were examined by the Bonferroni pooled t-test. The dependent measures for the analyses included the state portion of the STAI-C, the depression factor of the POMS, behavior observation ratings, activity level actometer recording, heart rate, and saliva cortisol levels. The Geiser-Greenhouse test was used to minimize the chance of Type 1 error as a result of multiple F tests (Kepel, 1982).

## RESULTS

### Correlation Analysis

A correlation analysis was performed to determine whether age, sex of subject, number of previous admissions, number of previous Rt classes, medication, and length of hospital stay were correlated with diagnosis. Sex was significantly correlated with diagnosis ( $r = .38$ ,  $p < .05$ ); there was more depressed female patients than depressed male patients (see Table 1). This factor was then entered into the repeated measures analysis of variance as a covariate. No significant effects were noted for sex as a covariate on any of the dependent measures ( $p > .05$ ).

### Self-Report Anxiety Measures

Group (depressed/adjustment disorder) by assessment period (pre/post RT session) repeated measures analyses of variance were conducted on the self-report anxiety measures with assessment period as the repeated measure. As can be seen in Table 3, significant repeated measures effects were noted for the STAI-C ( $F(1,32)=13.17$ ,  $p = .01$ ) and for the POMS ( $F(1,32) = 6.87$ ,  $p = .02$ ) with scores on both measures decreasing following the Rt class. No group or interaction effects were noted.

A repeated measures analysis of variance for the self-report measures for the subsample of subjects ( $n = 10$ ) who participated in both relaxation training and television viewing control conditions suggested a condition by



Table 3

Means for the self-report measures pre and post Rt (S.D.'s are in parentheses)

|         | <u>Assessment Periods</u> |         |        |
|---------|---------------------------|---------|--------|
|         | Pre                       | Post    | Effect |
| measure |                           |         |        |
| STAI-C  | 32.7(8)                   | 29.1(7) | R      |
| POMS    | 14.0(10)                  | 9.6(9)  | R      |

R = repeated measures effect

p = .02

p = .01

assessment period interaction effect  $F(1,9) = 5.31, p > .05$ . The Bonferroni pooled t-test revealed the following: a) no significant difference was noted at baseline between the two conditions ( $p < .05$ ); b) subjects showed a significantly lower anxiety score after relaxation training in the treatment condition than in the control condition. ( $p > .05$ ). See Table 4 for STAI-C means by condition. No significant interaction, group, or repeated measures effects were noted for the POMS.

#### Behavior Observation Scale Ratings

Repeated measures analyses of variance were then conducted on the Behavior Observation Scale (BOS) ratings with group as the between subjects measure and assessment period (A = baseline, B = post class, and C = follow up) as the repeated measure. As can be seen in Table 5, the following results emerged: a) for the state rating a significant main effect for group ( $F(1,37) = 9.33, p = .004$ ). A Bonferroni pooled t-test suggested that depressed subjects were more alert than adjustment disorder subjects during the exercise portion of the class; b) for the affect rating, a significant repeated measures effect suggested that affect ratings changed across the three assessment periods ( $F(2,76) = 4.48, p < .01$ ). Tukey post-hoc tests suggested that the subjects showed a more positive affect during the Rt class and 30 minutes after the class than at baseline; c) for the activity rating, a significant repeated measures effect was

Table 4.

Means for the STAI-C pre and post RT by condition(S.D.'s are in parenthe

| Condition    |                      |                   |
|--------------|----------------------|-------------------|
|              | Treatment<br>(n =10) | Control<br>(n=10) |
| Pre          | 31.0(6)a             | 31.8(6)a          |
| Post         | 27.2(4)a             | 31.6(9)b          |
| Effect C X A |                      |                   |

C X A condition by assessment period interaction effect,  $p = .02$ .

\* different letter subscripts across columns indicate significant Bonferroni pooled t-tests comparisons.

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Table 5

Mean behavior observation scale ratings for baseline (A), immediately postclass (B), and 30 minutes post class (C) ( S.D.'s are in parentheses).

| A.                       | Groups    |                         |                         |                         |                |                                    | Effect |
|--------------------------|-----------|-------------------------|-------------------------|-------------------------|----------------|------------------------------------|--------|
|                          | Depressed |                         | Adjustment Disorder     |                         | C              |                                    |        |
|                          | A         | B                       | A                       | B                       |                |                                    |        |
| <u>Behavior Ratings*</u> |           |                         |                         |                         |                |                                    |        |
| State                    | (.87)**   | 2.76(.43)               | 2.88(.48)               | 2.66(.65)               | 2.36(.65)      | 2.27(.63) 2.50(.59) g <sup>3</sup> |        |
| B.                       |           |                         |                         |                         |                |                                    |        |
| Assessment Periods       |           |                         |                         |                         |                |                                    |        |
|                          | A         |                         | B                       |                         | C              |                                    |        |
| Affect                   | (.88)     | 1.95(.6) <sup>a</sup>   | 2.30(.6) <sup>b</sup>   | 2.25(.7) <sup>b</sup>   | R <sup>2</sup> |                                    |        |
| Activity                 | (.80)     | 1.86(.4) <sup>a</sup>   | 2.12(.5) <sup>b</sup>   | 1.95(.5) <sup>ab</sup>  | R <sup>1</sup> |                                    |        |
| Anxiety                  | (.93)     | 1.87(.6) <sup>a</sup>   | 1.47(.6) <sup>b</sup>   | 1.46(.5) <sup>b</sup>   | R <sup>4</sup> |                                    |        |
| Fidgeting                | (.86)     | 1.67(.7) <sup>a</sup>   | 1.35(.4) <sup>b</sup>   | 1.32(.4) <sup>b</sup>   | R <sup>3</sup> |                                    |        |
| Vocalization             | (.72)     | 1.75(.5) <sup>a</sup>   | 1.85(.5) <sup>a</sup>   | 1.92(.5) <sup>a</sup>   | NS             |                                    |        |
| Cooperation              | (.96)     | 2.33(.6) <sup>a</sup>   | 2.52(.6) <sup>a</sup>   | 2.70(.5) <sup>a</sup>   | NS             |                                    |        |
| Summary                  |           | 14.82(2.0) <sup>a</sup> | 16.85(2.2) <sup>b</sup> | 17.22(2.1) <sup>b</sup> | R <sup>4</sup> |                                    |        |

\*different letter subscripts indicate significant Tukey post-hoc comparison effects ( $p < .05$ )  
 \*\*Inter-observer reliability coefficients are in parentheses.

1 = p < .05  
 2 = p < .01  
 3 = p < .005  
 4 = p < .001

R = Repeated Measures Effect  
 G = Group Effect  
 NS = Not Significant

revealed  $F(2,76)=3.49$ ,  $p=.03$ ). Tukey post-hoc tests suggested that the subjects showed an increase in activity level from baseline to class time. ( $p<.05$ ); d) for the anxiety rating, results revealed a repeated measures effect for assessment period ( $F(2,76)=10.73$ ,  $p<.001$ ). Tukey post-hoc comparisons revealed significant decreases in anxiety ratings between the first and second and between the first and third assessment periods (baseline and follow-up). e) for the fidgeting/nervousness behavior rating a repeated measures effect for assessment period emerged ( $F(2,76)=14.45$ ,  $p<.005$ ). Tukey post-hoc analyses revealed a significant decrease in fidgeting /nervousness between the first and second assessment periods and the first and third assessment periods for all subjects; f) no effects were revealed for the vocalization and cooperation ratings ( $p\geq.05$ ); and g) a significant repeated measures effect was revealed for the summary score suggesting an overall improvement in behavior ( $F(2,76) = 26.40$ ,  $p<.001$ ). Tukey post-hoc analyses suggested that subjects showed improved behavior from the first to the second and the first to the third assessment periods.

Condition (treatment/control) and assessment periods repeated measures analysis of variance for the Behavior Observation Scales were also conducted for the subsample of patients ( $n = 10$ ) who participated in both the relaxation and television conditions. As seen in Table 6 the following results emerged: 1) a significant interaction effect was

Table 6

Mean behavior observation scale ratings for baseline (A), immediately post class (B), and 30 minutes post class (C) RT sessions by conditions. (S.D.'s are in parentheses).

|                           | <u>CONDITIONS</u> |                           |            |            |                         | <u>Effect</u>    |
|---------------------------|-------------------|---------------------------|------------|------------|-------------------------|------------------|
|                           | <u>A</u>          | <u>Treatment</u><br>(n=0) | <u>C</u>   | <u>A</u>   | <u>Control</u><br>(n=0) |                  |
| <u>Behavior Ratings</u>   |                   |                           |            |            |                         |                  |
| State                     | 2.4 (.5)          | 2.4 (.5)                  | 3.1 (.6)   | 2.5 (.5)   | 2.4 (.5)                | 2.6 (.5) NS      |
| Affect                    | 1.8 (.6)          | 2.1 (.6)                  | 2.1 (.3)   | 2.4 (.5)   | 2.2 (.4)                | 2.1 (.3) NS      |
| Activity                  | 1.66(.5)          | 2.00(.5)                  | 2.00(.5)   | 1.88(.3)   | 2.22(.6)                | 2.11(.6) NS      |
| Anxiety                   | 2.11(.6)          | 1.55(.7)                  | 1.33(.3)   | 1.66(.5)   | 1.88(.6)                | 2.0 (.5) C x A   |
| Fidgeting/<br>Nervousness | 1.55(.72)         | 1.22(.4)                  | 1.22(.4)   | 1.66(.86)  | 1.66(.7)                | 1.77(.83) NS     |
| Vocalization              | 1.6 (.5)          | 1.8 (.3)                  | 2.1 (.1)   | 2.22(.6)   | 2.1 (.78)               | 2.1 (.78) NS     |
| Cooperation               | 2.33(.8)          | 2.55(.7)                  | 2.88(.3)   | 2.77(.4)   | 2.66(.5)                | 2.77(.4) NS      |
| Summary                   | 14.33(.32)        | 16.66(2.1)                | 17.00(.16) | 16.11(2.0) | 16.33(1.7)              | 14.77(1.3) C x A |

EFFECTS

C x A = condition by assessment period

NS = not significant

seen for the anxiety behavior rating ( $F(2,18) = 5.75, p = .02$ ). A Bonferroni pooled t-test suggested that subjects had a significantly lower anxiety rating in the treatment condition than the control condition during the third assessment period (immediately following relaxation training,  $p < .05$ ). However, there were no significant differences in anxiety ratings during the first and second assessment periods; and 2) for the summary score, a significant condition by assessment period interaction also emerged. The Bonferroni pooled t-test indicated that subjects showed more overall improvement in behavior during the third assessment period (following relaxation training) in the treatment condition than in the control condition ( $p < .05$ ).

#### Actometer Readings

Due to mechanical difficulty only a subsample of subjects were able to wear the actometer ( $n = 13$ ). Thus, the subjects were not analyzed by diagnostic group nor by condition. Repeated measures analysis of variance on the actometer readings (activity level) revealed higher activity level following the exercise portion of the Rt class as compared to the baseline, immediately post class (following the relaxation component) or 30 minutes post the termination of class ( $F(3,32) = 6.45, p = .001$ ; see Table 7).

#### Heart rate

Repeated measures by group analysis of variance on heart

Table 7

Means for Activity Level (as measured by the actometer).

| Assessment Periods |          |         |         | Effect |
|--------------------|----------|---------|---------|--------|
| A                  | B        | C       | D       |        |
| 57(59)a            | 116(72)b | 53(59)a | 57(43)a | R      |

A = baseline, B= post exercise, C= post relaxation(end of class),  
D = 30 minutes post end of class

R = Repeated measures effect  
p<.001

\*Different letter subscripts indicate significant Tukey post-hoc  
comparison effects (p<.05).



rate yielded a significant repeated measures effect ( $F(3,111)=9.44, p < .001$ ). Tukey post-hoc analysis suggested that heart rate was significantly lower following the relaxation component of the class than following the exercise component for both groups. Table 8 presents means for heart rate.

Repeated measures analysis of variance on heart rate for the subsample of patients participating in both treatment and control conditions yielded a significant interaction effect ( $F(3,27) = 5.27, p = .01$ ). A Bonferroni pooled t-test suggested the following: 1) heart rate was significantly lower for subjects in the treatment condition than in the control condition during the third assessment period (immediately following relaxation training) and during the fourth assessment period ( 30 minutes post relaxation training); 2) No significant differences were noted between the groups at baseline or during the second assessment period. See Table 9 for heart rate means by condition.

#### Cortisol Levels

Ten subjects were excluded from the cortisol analysis because of overly diluted cortisol samples. A group by repeated measures analysis of variance for the cortisol data yielded a group by assessment period interaction effect that approached significance ( $F(2,52)=2.57, p=.08$ ) (See Table 10). The results indicated that adjustment disorder patients

Table 8

Means for heart rate (S.D.'s are in parentheses).

| <u>Assessment Periods</u> |          |          |          | <u>Effect</u> |
|---------------------------|----------|----------|----------|---------------|
| <u>A</u>                  | <u>B</u> | <u>C</u> | <u>D</u> |               |
| 77(10)ab                  | 84(10)a  | 73(14)b  | 76(11)b  | R             |

A = baseline

B = post-exercise

C = post relaxation

D = follow-up

R = repeated measure effect,  $p = .01$ .

Table 9

Means for heart rate by condition (S.D.'s are in parentheses).

| <u>Groups</u>    |                             |                          |
|------------------|-----------------------------|--------------------------|
|                  | <u>Treatment</u><br>(n =10) | <u>Control</u><br>(n=10) |
| <hr/>            |                             |                          |
| Heart rate (bpm) |                             |                          |
| A.               | 76(11)a                     | 76(10)a                  |
| B.               | 88(11)a                     | 81(9)a                   |
| C.               | 71(13)a                     | 86(12)b                  |
| D.               | 74(14)a                     | 85(8)a                   |
| Effect C X A     |                             |                          |

A = Baseline

B = Post-exercise

C = Post relaxation (end of class)

D = Follow-up (30 minutes after end of class)

C X A = condition by assessment period interaction

\*differences in subscripts across columns indicate significant Bonferroni post-hoc comparisons.

Table 10

Means for cortisol measures by diagnostic group (S.D.'s are in parentheses).

|                     | <u>GROUPS</u>           |          |           |                                   |          |          |
|---------------------|-------------------------|----------|-----------|-----------------------------------|----------|----------|
|                     | <u>Depressed (N=14)</u> |          |           | <u>Adjustment Disorder (N=16)</u> |          |          |
|                     | <u>A</u>                | <u>B</u> | <u>C</u>  | <u>A</u>                          | <u>B</u> | <u>C</u> |
| Cortisol<br>(ng/ml) | 1.07(1.5)               | .90(1.0) | 1.24(2.5) | .91(.5)                           | .52(.3)  | .37(.2)  |

---

A = Baseline, B = Post exercise, C = Follow-up (30 minutes after class).

showed a tendency for lower salivary cortisol levels following relaxation class whereas the depressed subjects showed a slight increase in cortisol levels following Rt. A closer examination revealed that 62% of the depressed subjects had higher cortisol levels and 38% had lower cortisol levels following relaxation training, contributing to the large amount of variance in cortisol values among depressed patients. The results suggested two types of depressed patients. Further analyses were then conducted to examine the question that differences in cortisol levels among depressed patients may be associated with differences in anxiety reduction. First, a series of t-tests were performed at the pre- and post- measurement levels of the STAI-C, the POMS, and the behavioral rating of anxiety for depressed subjects who showed decreasing cortisol and for those who showed no change/increased cortisol. A significant baseline difference was noted between the group for the STAI-C ( $t(13) = 2.74, p = .01$ ), but not a significant post-difference ( $p > .05$ ). There were no pre- or post- differences between depressed subgroups for the POMS or behavioral observation rating of anxiety scale ( $p > .05$ ). An analysis of covariance, with STAI-C baseline as the covariate, was then performed to measure differences in anxiety reduction on the STAI-C between the decreased cortisol and no change/increased cortisol depressed subjects. The repeated measures effect was significant ( $F(1,11) = 6.71, p = .02$ ). However, despite a larger decrease in the anxiety

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scores of the decreasing cortisol group (9 versus 2 points), the interaction effect was not significant. See Table 11 for STAI-C means by depressed subgroup.

A repeated measures analysis of variance for cortisol for the subsample of subjects ( $n = 10$ ) who participated in both relaxation training and the television viewing control condition suggested that cortisol levels were lower following the relaxation class than following the control condition ( $F(1,7) = 5.24, p < .05$ ). The Bonferroni pooled  $t$ -tests revealed the following: a) as was expected, no significant differences were noted between the treatment and control group at baseline and at the second assessment period; and b) a significantly lower cortisol level for the treatment group in the last assessment period (30 minutes post relaxation training). These results suggest that subjects' cortisol levels decreased during relaxation class but not during the control condition. See Table 12 for cortisol means by condition (relaxation/television viewing).

Adjusted cell means for STAI-C (S.D.'s are in parentheses)

|          | Depressed Groups               |                                             |
|----------|--------------------------------|---------------------------------------------|
|          | Decreasing Cortisol<br>(n = 5) | No Change/Increasing<br>Cortisol<br>(n = 8) |
| Pre      | 34.9(5.2)                      | 31.2(3.9)                                   |
| Post     | 26.1(5.6)                      | 29.2(2.5)                                   |
| Effect R |                                |                                             |

R = repeated measures effect,  $p = .02$ .

Table 12

Means for cortisol levels (ng/ml) during relaxation therapy and control (television viewing) conditions. (S.D.'s are in parentheses).

| Condition           |                       |                   |
|---------------------|-----------------------|-------------------|
|                     | A Treatment<br>(n=10) | Control<br>(n=10) |
| assessment periods* |                       |                   |
| A.                  | .81(.37)a             | 1.00(.50)a        |
| B.                  | .55(.27)a             | .71(.23)a         |
| C.                  | .56(.28)a             | .90(.26)b         |
| Effect              | G                     |                   |

A=Baseline, B = Post Exercise, C = 30 minutes post end of class.

G = group effect  $1 = p < .05$ .

\*different letter subscripts indicate significant Bonferroni, post-hoc effects



## Discussion

These results are consistent with the literature showing a decrease in depressed patients' anxiety following relaxation training (McGrady et al 1981; Reynolds and Coats, 1986; Richter, 1984). STAI-C scores in the depressed adolescents decreased from the 72nd percentile to the 35th percentile. According to the norms presented in the STAI-C manual, these depressed subjects scored slightly above the mean prior to the relaxation class and below the mean after the class. These results provide support for the use of relaxation training as part of a treatment protocol for hospitalized psychiatric adolescents (Blaney, 1985). Although the anxiety reduction is statistically significant, a more clinically profound difference was expected. Perhaps, a greater difference in the STAI-C scores was not found because of the heterogeneous population (mixed depressed and adjustment disorder patients) and because of a tendency for the patients to underreport negative descriptors.

The small subsample of patients who participated in both the treatment and control (television) conditions showed significantly greater anxiety reduction during the relaxation condition than the control condition. During the treatment condition, patients' state anxiety scores dropped from the 62nd percentile to the 24th percentile, while the scores remained at the 68th percentile during the control situation. Despite the small sample of subjects, these results support the hypothesis that relaxation training leads to reduction in anxiety.

Although the subjects showed a decrease in their scores on the depression factor of the POMS, the baseline POMS score for all subjects were much lower than the mean score reported for neurotics (14 compared to 23). The lower scores of these adolescents may have resulted from underreporting. Some of the descriptors in the POMS are not socially desirable (i.e. desperate, worthless) and the adolescents may have been reluctant to acknowledge these feelings, even if they were experiencing them. The patients also had a difficult time understanding the descriptors necessitating the provision of alternate items which resulted in a list of definitions for the POMS, see Appendix B. In addition, the normative sample used in standardizing the POMS did not include psychiatric children and adolescents. Although the patients did show a small increase in positive mood following relaxation training the lack of significant clinical difference may be partially explained by the reasons mentioned above. Furthermore, relaxation training is targeted at reduction in anxiety, not necessarily depressed mood (Bernstein & Borkevoc, 1973). Therefore, it is reasonable to expect a less significant reduction in depressed mood than in anxiety following an exercise/relaxation intervention.

The subsample of patients who participated in both the treatment and the control situation did not yield any significant effects for the POMS. The small number of patients combined with the social bias of the descriptors,

the lack of appropriate norms, and the poor comprehension of the descriptors by the subjects most likely clouded any meaningful evaluation of the data on the POMS depression factor.

Ratings on the Behavior Observation Scale showed significant changes following relaxation therapy treatment. In general, the patients showed increased physical activity and increased positive affect following relaxation therapy. They also showed less fidgeting/ nervousness and anxiety behavior during and after the intervention. The responsivity of the patients has important clinical implications. As suggested by previous researchers (Blaney, 1985; Reynolds & Coats, 1986), relaxation training can be a viable component of a treatment program for psychiatric patients. This study further supports the use of this treatment approach in general, and for children and adolescents in particular.

The subsample of patients who participated in both conditions showed a significantly greater decrease in anxiety ratings and a significantly greater improvement in overall behavior in the treatment condition than in the control condition. The combination of a decrease in anxiety as measured by the STAI-C and the anxiety behavior rating further supports the usefulness of relaxation training in

As might be expected, the activity level of the subjects was higher following the exercise portion of the class than at other assessment periods. Lesser activity during baseline and post-relaxation periods were probably

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related to subjects completing questionnaires at these times. These questionnaires required more time than anticipated and thus constrained the natural activity we had hoped to tap during these periods. In a future study, baseline and follow-up periods should be as naturalistic as possible with questionnaire sessions being limited to the end points of these periods.

Similarly, heart rate was lower following the relaxation than after the exercise portion of the class for both diagnostic groups. Inasmuch as decreases were also noted in physical movement during this period (as measured by the actometer) the decreases in heart rate were undoubtedly a cardiac-somatic coupling effect. However, activity level and heart rate during relaxation and follow-up were not significantly different from baseline. This unexpected similarity between baseline and follow-up heart rate (and activity level) may relate to the situational constraints of the unit. During piloting, the children/adolescents were scheduled for free play during baseline and post relaxation periods (i.e. engaging in normal psychiatric ward activity). At that time, activity level / heart rate decreases noted following relaxation therapy as compared to baseline were dramatic. However, during the time course of this study, the relaxation therapy sessions were held to occur immediately following school sessions so the children/adolescents were in extremely passive/sedentary situations prior to the relaxation therapy contributing to

low baseline levels.

The subsample of patients participating in both conditions showed a significantly lower mean heart rate immediately following relaxation training and thirty minutes post class than they did at comparable times in the television condition. As noted in other studies, lowered heart rate after relaxation training is a component of the relaxation response (Benson et al, 1974).

The cortisol data provided puzzling information on the effects of relaxation training. First, the significantly lower values during the relaxation versus the television sessions, indicate that the reductions in cortisol may have resulted from the intervention and not diurnal changes in cortisol. Furthermore, the samples taken during the relaxation session remained at decreased levels, while the samples during the television viewing session showed a tendency to increase during the follow-up period.

Secondly, the repeated measures analysis suggested a trend for a group by assessment period interaction effect for cortisol values. While the cortisol levels increased in the depressed patients, they decreased in the adjustment disorder patients. These values are consistent with others reported in the literature. Namely, depressed subjects had higher cortisol values (Ktioviet, 1984) which tended to increase in the afternoon (Sacher, 1981). The interaction did not reach significance possibly because of the large amount of variance present in the group of depressed subjects. The

variance in cortisol values in the depressed subjects supports findings that there is variable cortisol secretion among depressed subtypes. Van Zersen, Berger, & Doerr (1984) found that neuroendocrine dysfunction in depressed patients (e.g., hypersecretion of cortisol) is seen primarily in endogenous depression as opposed to psychogenic depression. Therefore, the depressed group in this study may represent a mixture of depressed patients producing widely varying amounts of cortisol. Closer examination of the depressed subjects revealed that 62% showed no change or increases in cortisol secretion following relaxation training while 38% showed decreases in cortisol values similar to the adjustment disorder group. It is possible that those patients who showed "no change/increase" in cortisol values may have endogenous depression while those that showed an appropriate decrease in cortisol following relaxation training may have psychogenic depression. Alternately, neuroendocrine dysfunction may also be associated with severity of dysfunction (Puig-Antich et. al., 1974). However, the two groups did not differ in terms of depression as measured by the POMS or in state anxiety as measured by the STAI-C. The lack of differences in depression and anxiety further support the hypothesis of diverse depressed subgroups, rather than difference in severity of functioning among depressed patients.

Another unexpected finding was a significant decrease

in cortisol measured after the exercise portion of the class in the adjustment disorder group. Cortisol levels were expected to increase following yoga exercises as a result of physical exertion (Funderbark,1976). The decrease in cortisol values may be partially explained by the time frame in which the samples were taken. That is cortisol was sampled after the 30 minute exercise portion of RT class; the cortisol values reflected levels during the first half of the exercise class. This decrease in cortisol values may be related to the relaxing effect of the breathing and stretching exercises used during the first portion of the exercise class. The exercises which would have led to increases in cortisol (i.e. more aerobic exercises) did not occur until the second half of the exercise period. Despite the careful timing of behavior and physiological measures as well as saliva sampling, no conclusions can be drawn regarding causality. It is not clear what the specific treatment effect was in this study, i.e. whether exercise (yoga or aerobic type), massage ( as brief as they were) or relaxation therapy effected changes in reported feelings, in behavior, and in cortisol levels. Although this study was intended to simply evaluate the effectiveness of a typical relaxation therapy session, it is clear that the individual components of those sessions and the contexts in which they are provided (e.g., variable baseline conditions) are worthy of further study.

In sum, this study suggests that relaxation training is

an effective form of therapy for adolescent psychiatric inpatients. Differences among a subsample of patients who participated in the treatment/control condition supported the hypothesis that relaxation training is associated with reduction in anxiety, decreased heart rate, and decreased cortisol levels. All of these factors are part of the relaxation response (Benson et al, 1974). However, the small number of subjects participating in the control condition, reduces the strength of the statistical analyses. The study subjects as a whole showed reduction in state anxiety, depression, and heart rate and an increase in positive behaviors. The lack of significant effects for cortisol may be a result of the large amount of variation present in depressed patients. Different subtypes of depressed patients may be partially responsible for differences in cortisol secretion. However, as with any biochemical parameter, cortisol is subject to many influences of the external and internal milieu (e.g., stress levels, circadian rhythm). The reliability of cortisol as a marker of stress reduction is dependent on controlling or accounting for these influences. This study demonstrated beneficial effects immediately following relaxation training. Future studies might examine the long-term effects of relaxation therapy on disruptive behavior in psychiatric patients. In the interim, relaxation training can be considered a noninvasive, effective form of therapy that can easily be incorporated into the treatment protocol



of child and adolescent psychiatric patients.

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## **APPENDICES**

**Appendix A STAI-C**

**Appendix B POMS**

**List of POMS Descriptors**

**Appendix C Operational Definitions for Behavior**

**HOW-I-FEEL QUESTIONNAIRE**

Developed by C. D. Spielberger, C. D. Edwards, J. Montuori and R. Lushene  
STAIC FORM C-1

NAME \_\_\_\_\_ AGE \_\_\_\_\_ DATE \_\_\_\_\_

**DIRECTIONS:** A number of statements which boys and girls use to describe themselves are given below. Read each statement carefully and decide how you feel *right now*. Then put an X in the box in front of the word or phrase which best describes how you feel. There are no right or wrong answers. Do not spend too much time on any one statement. Remember, find the word or phrase which best describes how you feel right now, *at this very moment*.

- |     |                  |                                          |                                     |                                         |
|-----|------------------|------------------------------------------|-------------------------------------|-----------------------------------------|
| 1.  | I feel . . . . . | <input type="checkbox"/> very calm       | <input type="checkbox"/> calm       | <input type="checkbox"/> not calm       |
| 2.  | I feel . . . . . | <input type="checkbox"/> very upset      | <input type="checkbox"/> upset      | <input type="checkbox"/> not upset      |
| 3.  | I feel . . . . . | <input type="checkbox"/> very pleasant   | <input type="checkbox"/> pleasant   | <input type="checkbox"/> not pleasant   |
| 4.  | I feel . . . . . | <input type="checkbox"/> very nervous    | <input type="checkbox"/> nervous    | <input type="checkbox"/> not nervous    |
| 5.  | I feel . . . . . | <input type="checkbox"/> very jittery    | <input type="checkbox"/> jittery    | <input type="checkbox"/> not jittery    |
| 6.  | I feel . . . . . | <input type="checkbox"/> very rested     | <input type="checkbox"/> rested     | <input type="checkbox"/> not rested     |
| 7.  | I feel . . . . . | <input type="checkbox"/> very scared     | <input type="checkbox"/> scared     | <input type="checkbox"/> not scared     |
| 8.  | I feel . . . . . | <input type="checkbox"/> very relaxed    | <input type="checkbox"/> relaxed    | <input type="checkbox"/> not relaxed    |
| 9.  | I feel . . . . . | <input type="checkbox"/> very worried    | <input type="checkbox"/> worried    | <input type="checkbox"/> not worried    |
| 10. | I feel . . . . . | <input type="checkbox"/> very satisfied  | <input type="checkbox"/> satisfied  | <input type="checkbox"/> not satisfied  |
| 11. | I feel . . . . . | <input type="checkbox"/> very frightened | <input type="checkbox"/> frightened | <input type="checkbox"/> not frightened |
| 12. | I feel . . . . . | <input type="checkbox"/> very happy      | <input type="checkbox"/> happy      | <input type="checkbox"/> not happy      |
| 13. | I feel . . . . . | <input type="checkbox"/> very sure       | <input type="checkbox"/> sure       | <input type="checkbox"/> not sure       |
| 14. | I feel . . . . . | <input type="checkbox"/> very good       | <input type="checkbox"/> good       | <input type="checkbox"/> not good       |
| 15. | I feel . . . . . | <input type="checkbox"/> very troubled   | <input type="checkbox"/> troubled   | <input type="checkbox"/> not troubled   |
| 16. | I feel . . . . . | <input type="checkbox"/> very bothered   | <input type="checkbox"/> bothered   | <input type="checkbox"/> not bothered   |
| 17. | I feel . . . . . | <input type="checkbox"/> very nice       | <input type="checkbox"/> nice       | <input type="checkbox"/> not nice       |
| 18. | I feel . . . . . | <input type="checkbox"/> very terrified  | <input type="checkbox"/> terrified  | <input type="checkbox"/> not terrified  |
| 19. | I feel . . . . . | <input type="checkbox"/> very mixed-up   | <input type="checkbox"/> mixed-up   | <input type="checkbox"/> not mixed-up   |
| 20. | I feel . . . . . | <input type="checkbox"/> very cheerful   | <input type="checkbox"/> cheerful   | <input type="checkbox"/> not cheerful   |



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These consist of pages:

59-61, Appendix B

62-63, Appendix C

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