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THE EFFECT OF ANXIETY MANAGEMENT TRAINING ON THE COURSE AND CONTROL OF JUVENILE DIABETES MELLITUS

by

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Thesis submitted to the School of Graduate Studies of the University of Ottawa as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

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DEDICATION

This thesis is dedicated to the memory of Dr. Roger Stretch whose untimely passing during the course of the study was a great personal loss.

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ABSTRACT

It has been well documented both clinically and experimentally that psychological factors affect carbohydrate metabolism and influence the daily regulation of glucose levels in diabetic patients. This is particularly true in juvenile diabetics who are insulin dependent and who suffer from the chronic stress and anxiety of having to live with the illness while attempting to project the image of themselves as not being different from their non diabetic peers.

In spite of the basic understanding of the interaction between the physical illness of diabetes and the psychosocial functioning of the child, few attempts have been made to improve the course and control of diabetes through psychological intervention procedures.

The present study was designed to determine whether diabetic control could be improved through the direct psychological management of stress and anxiety. The study consisted of two phases. In the first phase five poorly controlled female diabetics ranging in age from 15-18 years were used as subjects. All were seen on an outpatient basis over a six month period. A single subject format employing a multiple baseline design across subjects was used. The independent variable used in the phase was a

technique known as anxiety management training.

Baseline, attention-control, and treatment data were collected on a number of dependent measures. Subjective estimates of anxiety and tension by each subject were gathered on a bi-weekly basis using the Multifactorial Scale of Anxiety. Diabetic control was assessed daily using the Diastix method and weekly using the quantitative glucose method.

Data on the five subjects suggested that improved control of stress and anxiety had a positive effect on diabetic regulation. Decreases in urine glucose levels using both urine testing methods were found. However, no decreases in the subjects' personal assessment of tension and anxiety were evident.

The second phase of the study was designed to investigate whether the decreases in urine glucose levels were due to cognitive or physiological effects of improved anxiety management.

Three poorly controlled female diabetics between 13 and 17 years of age, were hospitalized for ten days each. A single subject format employing an alternating treatment design was used. The independent variable used was the abbreviated version of Jacobson's deep muscle relaxation technique.

Baseline, attention-control and treatment data were collected on blood glucose, urine glucose, EMG and subjectively experienced relaxation levels during the two hour test period each day. Results on the three subjects were inconclusive with regards to clarification of the mechanism(s) involved in reducing glucose levels.

It was posited that a combination of cognitive and physiological factors were responsible for the reduction in urine glucose levels found in the first phase of the study. An attempt was also made to explain why the subjects' cognitive assessment of their anxiety levels did not decline with physiological improvement in diabetic control.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION AND REVIEW OF THE LITERATURE

Since the earliest description of diabetes mellitus, there has been much speculation regarding the relationships between emotional factors and the disease. Over the years a number of investigators have attempted to shed additional light on this matter. The notion that emotional factors might be important to diabetic stability has led investigators to focus research on three areas: (1) the study of the psychological characteristics of children in good or poor control; (2) the study of these children's families; and (3) the study of the effects of stress on levels of glucose and free fatty acids (Johnson, 1980).

The issue of diabetic stability/instability is of particular concern since poor metabolic stability has been found to be associated with short and long term complications of both a physical and emotional nature. As such, a good deal of research has been oriented towards delineating those factors which might be associated with good vs poor control. Recent findings suggest that during adolescence the number of children in poor control rises and then declines (Fallstrom, 1974; Koski & Kumento, 1975; Lundvigssion, 1977). However, it is not entirely clear as to what role psychological factors play. Most studies concede the fact that poor social-emotional adjustment of the child and/or his family is

often associated with poor diabetic control. Whether or not psychological problems are the result of diabetic instability or its cause is not well understood so the causal mechanisms involved are still unclear. This differentiation must be elucidated if treatment strategies are to be designed in the hope of improving diabetic control.

Few studies have investigated psychological methods of improving diabetic control. Empirical investigations of psychological treatments for diabetic children are even rarer (Johnson, 1980). Since the relationship between psychological factors and diabetic control has been illustrated the question arises as to why further research has not been generated in this area. It may be that the numerous methodological problems inherent in research in this area has precluded empirical investigations from being carried out. In the past, research has been plagued by poorly validated and unreliable instruments (Koski, 1969). In addition, researchers are often aware of the child's degree of control leading to experimenter bias (Koski, 1969). Different definitions of control and subject selection procedures are frequently employed and rarely have the same measures been used by different investigators (Delbridge, 1975). A further complication is the relative importance of different factors in each patient. The effect of stress, caloric intake, exercise, etc. affects each individual rather uniquely and dramatically, thus complicating group research

designs.

These problems however need not prevent further research from being generated. Methodological improvements are required with greater reliance on repeated measures or single subject designs to take into account individual specificity (Johnson, 1980).

The present study is an attempt to deal with some of these methodological issues in the hope of answering certain questions regarding the psychological treatment of the poorly controlled diabetic child.

The Nature of Diabetes Mellitus

Diabetes mellitus is a common, chronic disease which is said to affect approximately twenty-six million people in the world today (Traisman, 1971). It is characterized by an excess of glucose in the blood (hyperglycemia), by sugar in the urine (glycosuria) and often by elevated blood cholesterol levels which reflect a generalized disorder of metabolism affecting the storage and utilization of carbohydrates, proteins and fat.

Essentially, diabetes mellitus may be of two types: hereditary (primary) or nonhereditary (secondary). Hereditary diabetes is thought to be the most common type (Cull & Hardy, 1974). Nonhereditary diabetes may be caused by the removal of the pancreas in cases of carcinoma, by

pancreatitis, by malignant diseases or by hyper-functioning of the adrenal cortex or adrenal medulla. With respect to the hereditary variety of diabetes, there is much speculation regarding the nature of the genetic defect and its mode of transmission. Current thinking seems to point to hereditary diabetes as being caused by an inherited defect within the beta cells of the pancreas (Cull & Hardy, 1974). The theory posited most often suggests that the mode of inheritance is of the autosomal recessive type with incomplete penetrance (Renold & Cahill, 1966). However, this concept has been challenged by contentions that the gene transmission is of the dominant type and that inheritance is multifactorial rather than related to a single gene (Cull & Hardy, 1974).

The first description of diabetic symptoms were chronicled before the time of Christ. In the first century A.D. a good clinical description of the disease was made by Celsus, a Roman physician. Aretaeus, another Roman physician introduced the term 'diabetes'. In spite of the awareness of diabetic symptoms however, knowledge regarding the nature and treatment of the disease remained scant until the seventeenth century when Sir Thomas Willis remarked upon the sweet taste of the urine of his patients. In the late eighteenth century, John Rollo outlined a plan for the dietary treatment of the diabetic. As a result of the efforts of a number of investigators in many countries, steady advances in the field of diabetes were made, beginning in the nineteenth century.

Landmark contributions made during the past century include the description of the pancreatic islets by Langerhans in 1869; the production of experimental diabetes by Von Mering and Minkowski in 1889 and the discovery of a method for extracting insulin from the pancreas by Banting and Best in 1921.

With the discovery of insulin came the hope that the problem of diabetes had been solved. However, in subsequent years it has become apparent that the increased lifespan of the diabetic individual has revealed the deleterious long term effect that diabetes has on the vascular, ocular, renal and nervous systems. Best (1945) sums up this fact well by stating that, "Many of the gains made in the field of insulin and diabetes are well consolidated, but a whole host of new problems on a much broader front have appeared" (p. 212). This is particularly true in the case of the juvenile onset type of genetic diabetes where the prolongation of life leads to a large number of physical as well as psychological complications.

Juvenile diabetes mellitus may be defined as the form of diabetes mellitus with an onset prior to the age of fifteen (White, 1960). The incidence of juvenile diabetes has been variously determined by a number of investigators with the concensus that of the total diabetic population, juvenile diabetes is found in approximately five percent. The sex incidence in juvenile diabetes tends to be equal although

slight differences are present. Below the age of ten years, boys appear to have a slightly higher incidence of diabetes while during puberty, girls have more of a tendency to develop diabetes. The average age of onset of juvenile diabetes is ten to eleven years (White, 1960), but it has been reported to occur as early as eleven days of age (Guest, 1949).

The classical signs and symptoms of juvenile diabetes mellitus include the secretion of large amounts of urine (polyuria), excessive thirst (polydipsea), excessive hunger (polyphagia) and weight loss. These symptoms occur in the majority of children who develop diabetes and over eighty percent of children two years of age and older exhibit polyuria and polydipsia as initial symptoms. Other symptoms include anorexia, lethargy, enuresis, irritability, vomitting, a desire for sweets, personality change, frequency of skin infections and abdominal pain (Traisman, 1971).

The interval that exists between the onset of symptoms and the diagnosis of juvenile diabetes mellitus seems to vary with the child's age. Traisman (1971) has noted that the younger the child, the shorter the duration of the symptoms prior to the development of diabetes. Generally speaking, it has been found that the overall duration of symptomatology in all juvenile age groups, excluding infants, is approximately one month (Knowles, Guest, Lampe, Kessler & Skillman, 1965; Traisman, 1971).

Seen in a broader scope, the onset of juvenile diabetes mellitus can be broken down into three distinct phases. As previously mentioned, the onset of diabetes occurs quickly with the rapid development of polyuria, polydipsea, polyphagia and weight loss. It has been clinically observed that relatively high numbers of children have been admitted to the hospital suffering from states of diabetic ketoacidosis and coma (Knowles, et al., 1965; White, 1965). While juvenile diabetics may show acute symptoms at this first phase, they have been found to be relatively easy to manage even though relatively high doses of insulin may be required (Sussman, 1971). Following this initial phase which may last from two weeks to three months, various researchers have found that approximately twenty percent of diabetic children enter a remission phase where little or no insulin is required for diabetic control (Baker, Kaye & Root, 1967; Carlstrom & Ingemenson, 1967; Harwood, 1957; Peck, Kirtley & Peck, 1958; White, 1965). In this stage, diabetes is readily managed. Unfortunately, the reasons as to why some children go through this remission stage while others progress from the initial stage to one of severe diabetes, are not well understood. Generally, the second phase lasts only two to six months, although longer remissions have been reported (Carlstrom & Ingemenson, 1967). Factors which are thought to contribute to the conclusion of the remission phase include the emergence of the adolescent growth spurt, hormonal

changes associated with puberty, and the possibility of intercurrent illness. The final phase of total diabetes is characterized by metabolic instability. Wide swings between hyperglycemia and hypoglycemia are commonly found and the juvenile diabetic is prone to develop profound hyperglycemia and mild ketosis following insulin induced hypoglycemia (Sussman, 1971).

It is this state of diabetic lability which presents the greatest problem for the attending physician as well as for the juvenile diabetic. At the present time, no precise explanation has been found as to why certain juvenile diabetics have poor control in spite of optimal medical interventions. Despite a lack of definitive evidence Sussman (1971) lists a number of tentative explanations which include an impaired or absent capacity to synthesize insulin, peripheral insulin binding and inactivation, interference of intermediary metabolites with glucose utilization, endocrine imbalance, malabsorption syndromes, renal glucosuria and latent or occult hypoglycemia. None of the explanations have gained overwhelming support. However, one explanation which most investigators strongly feel affects metabolic control is that of the emotional state of the individual.

Emotional Factors in Diabetes Mellitus

Since juvenile diabetes mellitus was first recognized as

a disease, there has been an awareness that emotional factors significantly affect the illness. However, the literature concerning the emotional aspects of juvenile diabetes is filled with confusion and paradoxical findings. This confusion and conflict reflect the efforts of various researchers to answer similar questions regarding the etiology, course and control of the disease. Some workers have found evidence that emotional factors play an important role in the etiology and precipitation of diabetes while other researchers have not. Some authors have noted that emotional stress raises blood sugar levels while others have found the opposite to be true. Some investigators have found no difference between the personalities and emotional adjustment of diabetic children while others have reported important differences. In addition, there have been varying approaches to the treatment of emotional aspects of juvenile diabetes.

In order to examine the relationship between emotional factors and diabetes, it is necessary to group those studies which have investigated these relationships. Kubany, Danowski and Moses (1956) and Treuting (1962) favour the following groupings: 1) the role of emotional factors in the etiology of diabetes mellitus and 2) the role of emotional factors in the course and control of the disease. It is this latter category that is most central to this study and as such it will be dealt with in the greatest depth. However,

an overview of the literature pertinent to the first category will be examined first.

The Role of Emotional Factors in the Etiology of Juvenile Diabetes Mellitus

When considering the emotional etiology of juvenile diabetes mellitus, it is necessary to distinguish between those cases caused primarily by chronic emotional conflict and those caused by some sudden, acute traumatic experience. While some individual case reports occasionally appear with respect to the latter, the majority of investigators have focused their interest on the effects of acute trauma on the course of diabetes rather than on its etiology per se. Conversely, theories of etiology have arisen from cases of chronic sustained emotional conflict (Vandenbergh, 1971).

In order to appreciate the current etiological theories one must first be aware of the various stages of development that psychosomatic medicine has undergone over the past few decades.

The first significant stage was that of the General Specificity Theories. These theories indicated that certain diseases such as asthma, ulcerative colitis, peptic ulcer and diabetes mellitus had specific emotional etiologies. Dunbar, Wolfe and Rioch (1936) posited that people with specific personalities developed certain diseases. They went on to

further propose specific personality profiles for each disease. They developed what was considered to be the personality profile of persons particularly susceptible to the development of diabetes. Diabetics were found to be more passive than active, to have an oral preoccupation and a tendency toward masochism, to have conflicts of sexual identification, to be indecisive and to have such weak ego function that they suffered from intense anxiety until the disease appeared.

General Specificity Theory was carried a step further by Alexander and his associates (Alexander & French, 1948). It was suggested that specific unconscious dynamic conflicts were responsible for diabetic etiology. It was felt that the patient, when faced with emotional stress, regressed to the developmental stage where the conflict originated. The psychic conflict then expressed itself somatically as a specific disease through a paralleling physiological regression. With diabetes, Alexander felt that Dunbar's profiles primarily revealed the patient's defenses rather than the conflicts which could be specifically related to the development of the disease. Alexander suggested that many patients developed diabetes under the strain of the conflict between their infantile wishes to receive and to be taken care of and the demands placed upon them to take care of others (Alexander & French, 1948). As a consequence, specific unconscious conflicts were thought to produce an increase in

glycosuria, while a reduction in the tension of this conflict or the resolution of it might improve the metabolic derangement (Meyer, Bollmeyer & Alexander, 1945).

However, subsequent investigations found little evidence to support Alexander's theory. In fact, later researchers found a wide range of personalities in their diabetic patients (Bruch, 1949) as well as finding no significant differences in the personality traits of diabetics and those with other diseases. Major criticisms of Dunbar's work stemmed from the fact that no control groups were utilized and that the profiles used were evolved from patients who had already developed diabetes. Alexander's work has been criticized because, while valid psychoanalytical interpretations were made, difficulty in replicating the work precluded his theory from being validated.

Today, General Specificity Theory has been abandoned. Recent clinical and experimental findings have demonstrated that patients who exhibit various psychosomatic disorders generally present a variety of psychodynamic problems and psychiatric diagnoses. In addition, psychological problems cannot be reliably predicted from the nature of psychomatic symptoms and vice versa or by post hoc research designs (Freedman, Kaplan & Sadock, 1972). Experimental studies using animals have shown that certain psychophysiological reactions which are central to specificity theory can be evolved in response to nonspecific stress (Selye, 1946).

Advocates of the nonspecificity hypothesis, such as Mirsky (1948) and Hinkle and Wolf (1952a), have suggested an emotional etiology for diabetes mellitus. They suggest that any nonspecific emotional stress produces chronic anxiety which produces psychosomatic symptoms. Physiological manifestation of these symptoms are thought to be determined by hereditarily determined organ susceptibility rather than by a specific dynamic conflict or personality. Mirsky (1948) has pointed to Selye's observations that practically any nonspecific noxious stimulus will induce profound morphologic and metabolic disturbances due to excessive stimulation of the adrenal cortex. He stated:

> "Diabetes mellitus in man may result from a relative failure in an individual's atttempt to adapt physiologically and psychologically to the stresses of his environment. The physiologic integrative mechanisms are of variable capacity and are predetermined chiefly by genetic endowment. The physiologic integrations are likewise of variable capacity, but are predetermined chiefly by environmental influences. The response of the total organism thus becomes dependent upon genetic and environmental factors" (p. 194).

Hinkle and Wolf (1952a) also felt that anxiety developed as the result of a malfunctioning adaptive response to a chronically sustained state of anxiety. They stated that,

> "some persons because of constitutional predisposition or strong conditioning or both, in later life respond to cumulative psychological, situational, and physical stresses which involve the loss of affection and security, as if they represented threats of starvation. In this situation they utilize a metabolic adaptation

> to starvation which is inappropriate, and they continue to do so even when food is supplied to them in large amounts. The long continued use of this mechanism is associated with the irreversible changes in structure and function which are associated with diabetes" (Hinkle & Wolf, 1952(a), p. 567).

Since the early attempts at specifying an emotional etiology of diabetes, little evidence has been gathered which strengthens the contention that emotional factors play a significnt role in the etiology of diabetes mellitus. This is not to say however, that in certain individual cases the onset of diabetes is not caused by an acute traumatic emotional state. Rather, these findings fit with the currently accepted approach in psychosomatic medicine -- that of individual response specificity theory.

In contrast to the nonspecificity model, the individual response model maintains that there is no generalized affective state such as chronic anxiety which is similar to all individuals. A correlation between specific patterns of affective arousal and particular psychodynamic factors or personality profiles is denied. Instead the characteristic arousal pattern of the individual is thought to determine the development of a specific psychophysiological symptom. The individual response specificity model states that a wide variety of stimuli consciously or unconsciously experienced as stress, will lead to an affective arousal pattern which is specific, highly characteristic and consistent to the individual and the arousal pattern will produce a specific

psychophysiological symptom or disease.

Overall however, the current concensus among investigators appears to be best summed up by Danowski's (1963) comments:

> "It still appears therefore at present the contention that emotional stress can by itself produce permanent diabetes mellitus in a totally non-diabetic individual cannot be confirmed by clinical data, whereas considerable indirect and direct evidence can be assembled in support of the view that stress intensifies known pre-existent diabetes mellitus, brings to clinical recognition previously unrecognized actual diabetes, and may convert pre-diabetes to actual diabetes" (p. 184).

The Role of Emotional Factors in the Course and Control of Juvenile Diabetes Mellitus

While the literature pertaining to the role emotional factors play in influencing the course and control of diabetes has been plagued by a lack of precision due to poor experimental designs, this aspect of the relationship is somewhat less controversial and more readily observed than the previously discussed etiological topic.

Two major theories have been posited which attempt to explain the mechanism by which emotional factors affect the course and control of diabetes mellitus. The first of these theories deals with the possible contribution of the neuroendocrine system. The central question which has been asked concerns the role stress and hormonal changes play in the daily control of blood glucose and other metabolic levels

in the clinically diagnosed diabetic. The second theory revolves around the behavioural and cognitive aspects of the management of diabetes mellitus such as self care and compliance with treatment programs.

From the metabolic perspective the reaction to psychological stress operates primarily through two basic endocrine mechanisms, one relating to the adrenal medulla and the other to the adrenal cortex. General activities of the adrenal medulla combined with other components of the sympathetic nervous system serves as an "alarm" mechanism which stimulates the release of glucose, fatty acids and lactic acid. The rise in glucose occurs by increased glycogenolysis in the liver, direct inhibition of glucose uptake by muscles and an inhibitory effect of epinephrine upon insulin levels. Stimulation of the pituitary-adrenocortical axis causes growth hormone, and ACTH to be released both of which mobilize free fatty acids and inhibit glucose uptake.

Ketoacidosis has been shown to be directly dependent on the mobilization of free fatty acids and can be reversed by inhibition of fatty acid mobilization. Indeed, instances of ketoacidosis in juvenile diabetics have been reduced by the administration of adrenergic blocking agents (Baker, Barcai, Kaye & Haque, 1969). This suggests that the insulin deficient diabetic cannot compensate for counterinsulin hormonal states and therefore is more susceptible to the effects of stress on

blood glucose levels.

The propensity of physiological studies carried out by Hinkle and his colleagues (Hinkle & Wolf 1952(a), (b); Hinkle, Conger & Wolf, 1950; Hinkle, Evans & Wolf 1951 (a), (b); Hinkle, Fischer, Knowles & Stunkard, 1959) as well as other investigators (Vandenbergh, Sussman & Titus, 1966; Vandenbergh, Sussman & Vaughn, 1967) demonstrated that changes in blood glucose levels were the result of emotional life stresses. The nature of the stressors used in the Hinkle studies were episodes of life stress brought about through interviews while the Vandenburgh studies used hypnotically induced emotional states. Both sets of studies found that blood glucose levels could either be increased or decreased by stress although in the Hinkle studies it was found that in younger insulin dependent diabetics stress created a rise in blood glucose values. This finding closely parallels the clinical observation that juvenile diabetics are more likely to be in poor control when under stress. Bradley (1979) found that under conditions of noise stress, low blood sugar diabetics tended to show decreases in blood glucose levels whereas high blood sugar diabetics tended to show increases. However, a number of methodological problems exist which make conclusions difficult to draw. First, the studies by Hinkle and his associates were never able to establish whether a particular stress would cause the blood glucose levels of most of their subjects to increase or

decrease. In addition, there have been problems in accurately measuring and regulating amounts of stress experienced by individuals as well as the difficulties inherent in grouping juvenile and adult onset diabetics together.

One thing which has become apparent though, is that the stress of everyday living does contribute to unstable blood glucose levels. Recent developments in the measurement of life events has indicated that this form of stress affects metabolic control (Bradley, 1979; Grant, Kyle, Teichman & Mendels, 1974). Thus, it appears that if good control is to be achieved, it would be beneficial to reduce the destabilizing effects of stress.

As far as the behavioural and cognitive aspects of self care and compliance are concerned, a number of investigators have found that the daily stress involved in being diabetic is associated with particularly poor treatment adherence (Haynes & Sackett, 1976; Watkins, Williams, Martin, Hogan & Anderson, 1967; Williams, Martin, Hogan, Watkins & Ellis, 1967). In addition, it has been found that complicated treatment regimens lasting over prolonged time periods and requiring substantial degrees of behavioural change are correlated with poor treatment adherence (Haynes & Sackett, 1976). With a chronic disease like diabetes, particular compliance problems exist. Dietary management is critical. Insulin injections must be given in the correct dosage and at

the proper time. Regular urine testing is mandatory. Not surprisingly, there have been a number of reports (e.g., Turnbridge, 1953; Stone, 1961) that diabetic patients' level of self care is not adequate.

In many cases it is the juvenile diabetic who shows the poorest adjustment to the disease and as a result the poorest compliance to the treatment regimen. Isenberg and Barnett (1965) have provided an excellent outline for consideration of psychological problems in the juvenile diabetic. They deal with psychological problems created by diabetes mellitus in the three phases of the disease: Phase I, the onset; Phase II, the daily care; and Phase III, the period of chronic complications.

The onset of juvenile diabetes may be considered an emotional crisis. Adjustment to the crisis of diabetes onset is a process which continues over the course of at least the first year. In part, the child's response is determined by the age at the time of onset. Vandenbergh (1971) feels that while there is some controversy regarding personality development in relation to age of onset, the child who develops diabetes before six years of age is apt to be moe dependent on parental attitudes than a school age child. The older school age child has a better developed sense of reality and is better able to independently cope with the illness.

With the arrival of puberty and adolescence, major emotional adjustments occur in all children. The adolescent

is caught between feelings of dependence and independence towards parents and their homes. In addition, adolescents are faced with concerns about their bodies, adequacy, sex, marriage and academic and vocational achievement. The onset of a demanding chronic illness such as diabetes adds to their emotional burden and consequently, some of them may deny, neglect or rebel against the disease and its demands despite good parental attitudes.

The response of the individual adolescent generally depends upon the degree of maturity and responsibility that has been developed. At one extreme is the adolescent who accepts the realities and responsibilities of the disease and who becomes independent, reliable and self-confident in managing the demands. At the other extreme is the adolescent who refuses to accept the problems inherent in the disease and who has a defeatest reaction characterized by feelings of discouragement, frustration and helplessness.

During the daily care of the disease, emotionally loaded problems of diet, insulin injection, insulin reaction, ketoacidosis, urine testing, limitations of activity, social stigma and decision regarding choice of career, marriage and pregnancy occur.

In children, dietary problems are paramount. Sweets are severely restricted and often children equate food with affection. Thus, food restriction and/or deprivation may be misinterpreted as affectual deprivation. Many parents, in

the fear of providing too many carbohydrates, tend to repeat the same food day after day which further increases the sense of deprivation and isolation particularly if nondiabetic siblings enjoy a regular diet.

The adolescent faces new problems as well. Because of the wide range of social activities which involve the consumption of food, the adolescent may find it difficult to accept the fact of a menu differing from his peers.

During periods of hypoglycemia, a variety of emotional and behavioural symptoms may cause distress in the adolescent. Irritability and acting out behaviour may occur when sugar is needed. Latent or supressed feelings may be expressed which can cause distress in the family and may embarrass the child. In adolescence, anxiety reactions can be confused with insulin reactions or may be purposely feigned so as to avoid facing or dealing with the anxiety producing situation. Adolescents using diabetes as a weapon can choose to forget to inject insulin provoking episodes of ketoacidosis.

Adolescents often resent urine testing because they feel that it is a nuisance and because it is a reminder that something is wrong with them. As a result, urine testing is often neglected or faked particularly when dietary adherence has been poor. Deception will also occur if the adolescent feels that negative urine tests will eliminate insulin injections. There may also be a wish to eliminate testing

because they may feel that it forces them to be different from their peers.

Often, strenuous exercise must be avoided because of the chance of provoking a hypoglycemic episode. Adolescents face problems if their diabetic control is sensitive to slight emotional changes such as those found in sexual stimulation or excitement during activities such as watching sports.

While certain limitations can be dealt with in acceptable ways, such limitations are liable to foster feelings of inadequacy, of being different and that the disease is a stigma. In adolescents, these feelings may lead to personality changes such as defensive reactions. In order to cope with a negative self image, the adolescent diabetic may overcompensate an activity or may take unnecessary chances to prove that the disease is of little concern.

While the major chronic complications of diabetes mellitus such as vascular, ocular, renal and neuropathological disease are not often encountered in the adolescent diabetic, emotional stress can occur because of the anxiety associated with the threat of these complications (Fallstrom, 1974; Galatzer, Frish & Laron, 1977).

Aside from the general sources of stress which may contribute to poor compliance there is also a minority of juvenile diabetics who deliberately interfere with proper diabetic management.

Stearns (1959) found that with regards to self

destructive behaviour in juvenile diabetics, "such behaviour includes the purposeful omission of food or overdosage of insulin to produce hypoglycemia" (p. 379). He feels that such behaviour is apt to occur when major life adjustments must be made and when the emotional and socioeconomic environments are suboptimal. Hinkle (1956) suggests that the behaviour exhibited by these juvenile diabetics is an alteration between dependent and overdemanding behaviour and rebellion. This behaviour pattern usually is centered around the parents or other care takers such as the physician. Eventually the parent or parent figure reacts with annoyance and the child reacts with hostility and rebellion which may involve a disregard for diet, failure to take insulin, disregard for aseptic precautions and deliberate attempts to precipitate diabetic acidosis. Because of individual variations, situations in which patients respond to with metabolic changes have high degrees of specificity. As a result, apparently major crises may be weathered rather well with respect to the course of diabetes, whereas responses to seemingly innocuous events may be met with major metabolic upheavals.

Clinical observations, by and large, suggest the life situations to which juvenile diabetics respond with major metabolic changes leading to ketosis, are acute conflicts with significant individuals (parents, peers, etc.), or the threatened loss of a significant individual. Situations

which tend to be chronic in nature such as feelings of loneliness, objection and resentment are often associated with metabolic changes requiring an adjustment of insulin intake. Conversely, life situations to which the juvenile diabetic responds with feelings of contentment, security and relative freedom from care may be associated with a diminution of insulin need (Treuting, 1962).

Various case reports strongly suggest that the root of many of the emotional and environmental problems of these individuals lies in their interpersonal relationships with their parents. Conscious or unconscious conflicts in preadolescent or adolescent patients often exist as a result of interpersonal parental relationships. While the cases presented by Rosen and Lidz (1949) dealt with juvenile diabetics who deliberately induced states of acidosis, unstable blood glucose levels have been observed in patients who unconsciously act out their emotional conflicts. Often these conflicts stem from psychological conflicts of the parents in response to the diabetic condition of the child.

Several investigators such as Benedek (1948), Hinkle (1956), Starr (1955), Bain and Chute (1965) and Schiff (1964) have noted the various types of parent-child relationships and the effect these relationships have on the child's behaviour. While these studies have suffered from a variety of methodological flaws they nevertheless have touched upon an important issue. Vandenbergh (1971) and Tomm, McArthur

Leahey (1977) feel that three major emotional reactions displayed by parents can often effect the course of juvenile diabetes. They feel that because of the inherited nature of diabetes, many parents of children suffering from diabetes mellitus often feel guilty of having given the child the disease. This guilt may then be manifested by an overly indulgent and permissive attitude on their part toward the child. Because of the pressures placed on the child by the disease, dietary and insulin discretions often occur which result in poor diabetic control.

Another reaction parents may exhibit is that of tremendous anxiety. Vandenbergh (1971) and Tomm et al. (1977) feel that this is most often seen in parents who become anxious in times of stress and/or in those parents who do not understand the nature of diabetes itself. They feel that this anxiety may be of two types: 1) the parental reaction of continually watching, warning and frightening the child with regards to the potential dangers which might occur if the child deviates from the proper diabetic regime, and 2) the parental reaction of acting in a perfectionistic, controlling and punitative manner toward the child. Perfect diabetic regulation may be required at all times and at all costs. The disease is regulated considerably beyond what is actually adequate for good control. If anxiety and anger are exhibited by such parents, the child is apt to become defiant and rebellious in order to escape such an environment or he

may rebel in order to emancipate himself from his parents. In doing so however, poor diabetic control is often the result as the child confuses emancipation from diabetes with emancipation from parents.

Thirdly, parental reaction may be one of anger and resentment stemming from the tremendous burden in terms of emotional energy, time, effort and financial expense. This anger may be expressed through denial of the problem which leads to neglect of the child's needs. If the child is desirous of denying the existence of the disease too, then poor diabetic control is likely to result. While these three patterns are not the only ones possible, Vandenbergh (1971) and Tomm et al. (1977) feel that they are the ones most commonly observed in clinical practice in varying degrees of severity. Parents who react in such ways may produce not only rebellious children, but dependent children whose individuality and independent spirit have been overwhelmed. Many investigators have stressed the importance of positive emotional reactions by parents towards their diabetic children (Benedek, 1948; Hinkle, 1956; Starr, 1955; Schiff, 1964, Stearns, 1959; Swift, Sidman & Stein, 1967; Tomm, McArthur & Leahey, 1977). A number of authors have reported that children who are in poor control have a higher incidence of family disturbance (Delbridge, 1975; Koski, 1969; Koski & Kumento, 1977). In addition, Stersky's (1963) well controlled study emphasized that those diabetic children who

exhibited emotional pathology had a significantly greater frequency of mentally disturbed mothers than those diabetic children without emotional pathology.

Thus, most studies suggest that poor social-emotional adjustment of the child and/or his family is more often associated with poor diabetic control. This does not however, specify causal mechanisms. Thus, it would appear that the best indicator of how well the individual will cope with the illness depends in part on his/her premorbid personality, the manner in which the disease was handled since its onset and the individuals ability to cope with daily life stresses (Isenberg & Barnett, 1965).

Treatment of Emotional Problems

As previously noted, it appears that the course and control of diabetes mellitus can be altered by emotional stress. While one of the most important factors in treating the emotional aspects of diabetes is the physician's responsibility for the routine care of the patient, the role of the parents in fostering a healthy emotional state in the juvenile diabetic should not be overlooked. However, while the emotional adjustment of the child can be facilitated by good parental and medical involvement, the child's routine of living with the illness and having to interact with others outside of the home can still cause emotional conflict.

Tomm, McArthur and Leahey (1977) feel that the physiological effects of poorly controlled diabetes result in the impairment of perceptual and cognitive functioning thus contributing to poor academic and social growth. Studies by Koski (1969) and Fallstrom (1974) found school problems and below average school performance in unstable diabetics. In addition, there is evidence which supports the contention that microvascular complications which inevitably develop, can be counteracted by keeping blood glucose levels as close as possible to that found in a nondiabetic state (Bloom, 1967). Biochemical studies have shown persistent hyperglycemia to be associated with an accumulation of sorbital in nerve, eye and vascular tissue and with alterations in the vascular basement membrane (Gabby, 1973; Spiro, 1973). Animal studies have shown that reduction of hyperglycemia by insulin therapy prevents or minimizes formation of diabetic-like lesions in the eye, kidney, and nerve (Bloodworth, 1973). Management should therefore focus on the attempted normalization of blood glucose levels.

It would seem then, that a basic understanding of the interaction between the physical illness of diabetes and the psychosocial functioning of the child would be useful in providing a rationale for the psychological management of the juvenile diabetic (Treuting, 1962). Recently, attempts have been made to improve the course and control of diabetes mellitus through psychological intervention procedures. A

study by Minuchin and Barcai (1969) found family psychotherapy to be effective in reducing the emotional lability of a diabetic child leading to better diabetic control. However, the lack of subsequent studies of this nature, the absence of scientific rigour and the lack of follow up data preclude inferences from being made regarding its usefulness. A more recent study by Fowler, Budzynski and Vandenbergh (1976) has shown that electromyograph biofeedback relaxation training resulted in a decreased level of insulin intake in a twenty year old diabetic woman. While the results of the study are encouraging, no subsequent studies utilizing relaxation training have been published. It would therefore seem worthwhile to further explore the usefulness of such a technique with respect to juvenile diabetes mellitus. Since the literature suggests that a strong association exists between emotional lability and inappropriate metabolic regulation in the juvenile diabetic, it would seem important to investigate whether diabetic control could be enhanced if patients were taught to reduce the effects of emotional factors on physiological functioning.

In the past few years, several relaxation training techniques have been employed in the treatment of stress related disorders where the reduction of specific and non-specific tension is desired (Edie, 1972; Shoemaker, 1976). The use of anxiety management training (AMT), (Suinn, 1975) has been shown to be of value to individuals who suffer from

general anxiety and stress, regardless of its source. A more detailed discussion of AMT will be presented in the next chapter. Briefly, it consists of a conditioning technique which involves the use of instructions and cues to arouse anxiety responses and training the patient to develop competing responses such as relaxation or competency through muscle relaxation and breathing procedures. Providing juvenile diabetics with tools to reduce the effects of emotional trauma or conflict may help to enhance diabetic control. With improved regulation of stress and anxiety the diabetic child might be better able to accept his or her predicament, avoid the psycho-social delays caused by frequent illnesses, perhaps delay the onset of long-term complications and grow in the sense of personal adequacy, self sufficiency and basic maturity.

Thus, the present study will attempt to determine if anxiety management training significantly effects the course and control of juvenile diabetes mellitus by improving metabolic regulation of the disease in five poorly controlled adolescent diabetics. Specifically, it is hypothesized that subjects who partake in anxiety management training will show decreases in their average urine glucose levels both on a daily and weekly basis using two different assessment methods. In addition, it is predicted that a decrease in subjectively reported tension and anxiety levels will occur.

The Concept of Anxiety

As a construct, anxiety has received a greal deal of interest with respect to psychological research and treatment. While all people experience anxiety at one time or another, as a natural response to stress, anxiety becomes a hindrance rather than a help when it is sustained at high levels over time even after a stressful event has passed. If the anxiety continues and becomes uncontrollable then it "... may produce a crippling state of helplessness and there is serious interference with the patient's daily life and medical help has frequently to be sought ..." (Roth, 1969, p. 489). Contemporary clinical interest in anxiety was first dealt with by Freud (1936) in terms of psychological theory. He posited three basic types of anxiety which were similar in that they all possessed the quality of being unpleasant affective states or conditions. However, they did differ with respect to their source. Freud's first type of anxiety was termed 'reality anxiety' which resulted from a perception

of danger in the real world. The second type, 'neurotic anxiety', was aroused by a perception of danger from self-instincts. The third type of anxiety, that of the 'moral type', centered around the fear of conscience.

Although Freud was the first person to define anxiety from a psychological standpoint, others in the fields of psychology and psychiatry attempted to deal with the concept without agreeing on a widely accepted general definition. Sullivan (1953) through his interpersonal theory of personality, considered anxiety an intensely unpleasant state of tension resulting from threats to the individual's security. Horney (1945) coined the term "basic anxiety" which she saw as stemming from children's perceptions that they may be isolated in a potentially hostile world as the result of parental loss. May (1950) conceptualized anxiety as more of an apprehension which was cued by a threat to some value which the individual holds in high esteem, while Mowrer (1950) posited a guilt theory of anxiety.

A more objective, but restricted definition of anxiety was presented by Wolpe (1958). He identified anxiety as an autonomic response pattern that was characteristically part of an organism's response to noxious stimuli. The response elements that typically constituted an anxiety response were basically those associated with sympathetic responding of the autonomic nervous system. Wolpe considered anxiety to be the antecedent to the learning of all neurotic behaviours and the

severity of the neurosis could be judged in terms of the amount of unadaptive anxiety.

In its broadest sense, anxiety has more recently been defined as "an emotion characterized by a vague fear or premonition that something bad is about to happen ..." (Kagan and Havermann, 1968, p. 618). Paul (1969) defined anxiety "... as a shorthand term for a complex pattern of responses characterized by subjective feelings of apprehension and tension accompanied by or associated with physiological activation or arousal" (p. 63).

Factor analytic studies have set forth a two factor theory of anxiety (Cattell & Schirer, 1961; Lazarus, 1966; Spielberger, 1966). The first factor refers to characteristic anxiety which Lazarus (1966) labels 'chronic anxiety' while Spielberger (1966) calls it 'trait anxiety'. Trait anxiety is an acquired behavioural disposition that predisposes an individual to perceive a wide range of objectively nondangerous circumstances as threatening, and to respond to these with vaarious autonomic reactions (Spielberger, 1966). These autonomic reactions then become autonomic stimuli for further anxiety reactions.

The second factor refers to acute anxiety (Lazarus, 1966) or 'state anxiety' (Spielberger, 1966). This factor is characterized by subjective consciously perceived feelings of apprehension and tension induced by specific stimuli or set of stimulus conditions either from the external environment

or from internal cues. This factor is more of a transitory response and can fluctuate from situation to situation.

In spite of the diversified views on the conceptualization of anxiety, the literature seems to hold a consistent view on what constitutes the more extreme manifestations of anxiety. Portnoy (1959) gives a fairly typical example as anxiety is defined as:

> "... subjectively experienced uneasiness, apprehension, anticipation of danger, doom, disintegration and going to pieces, the source of which is unknown by the individual and toward which he feels helpless, with a characteristic somatic pattern. This somatic pattern shows evidence of increased tension in the skeletal muscles (stiffness, tremors, weakness, unsteadiness of voice, etc.); the cardiovascular system (palpitation, blushing or pallor, faintness, rapid pulse, increased blood pressure, etc.); and the gastrointestinal system (nausea, vomiting, diarrhea, etc.). There may also be other manifestations such as cold, wet extremities, rapid or irregular breathing, frequency of urination, and sleep disturbances ..." (p. 308).

The importance of anxiety as an influencing factor in learning and behaviour is a well established fact. Early research by Yerkes and Dodson (1908) found a curvilinear relationship between anxiety and learning. High drive levels on simple tasks were found to facilitate performance but impede performance on more complex tasks. Later work by Yerkes found that high levels of anxiety do not affect well learned responses, but rather disrupt novel sets. Task complexity or difficulty however, is not a concrete concept and can either be operationally defined or determined by

knowledge of habit hierarchies. Nevertheless, this theory has gathered support by researchers such as Farber and Spence (1953) and Taylor (1951).

While considerable research has been performed in the area of causal and associative factors, few if any studies of a nonbehaviouristic psychotherapeutic orientation have been performed on the treatment of anxiety. Haugen, Dixon and Dickel (1958) reviewed those approaches which attempt to control anxiety and suggested three major divisions: 1) approaches which attempt to build up the patient's feeling of strength; 2) approaches which diminish the apparent magnitude of the threatening situation or circumstances; and 3) approaches which reduce the general reactivity of the patient so that he can think more clearly and objectively. These three approaches are felt to be most effective when used together. As such, the main tools used by therapists to control anxiety would appear to be diversion, suggestion, reassurance, education and sedation (Haugen et al., 1958).

Although there is a paucity of controlled studies regarding the treatment of anxiety, Luborsky, Chandler, Auerbach, Cohen and Bachrach (1971) reviewed studies which examined factors which influenced psychotherapeutic outcomes. They found that patients with initially high anxiety levels were most likely to benefit from therapy. Unfortunately, although these studies showed positive results between anxiety levels and treatment outcomes, they suffered from

methodological flaws which makes the conclusion that high initial anxiety is related to success in therapy somewhat questionable.

Although studies of psychological approaches to the treatment of anxiety are rare, pharmacological approaches have been extensively researched. Studies showing the effectiveness of psychopharmacological agents on treating anxiety have ranged from those using major tranquilizers such chlorpromazine (Mitchell & Zax, 1959) to those using minor tranquilizers such as the benzodiazipines like Librium and Valium (Randall & Schallek, 1968; Greenblatt & Shader, 1974).

Thus, while it appears that the concept of anxiety has been extensively discussed and researched, psychotherapeutic investigations on treatment outcomes are virtually non-existent and predictive studies relating anxiety levels to treatment outcomes have produced equivocal results. Pharmacological approaches have been more extensively reserched with favourable results, but this approach is not totally acceptable because the use of medication does not give the individual any overt control over the anxiety and if prematurely terminated, symptoms could return. In addition, the use of medication with children is questioned because of the possibility of impaired cognitive functioning, coordination ataxia and drowsiness as well as ethical reasons. Therefore, chemotherapy is at best only an alleviant for anxiety not a cure. As such, recent trends have leaned towards the development of new techniques for

dealing with anxiety which allow the individual optimal control.

Anxiety Management Training and Deep Muscle Relaxation

Over the past few years the field of behaviour therapy has seen the development of a conditioning technique called anxiety management training (AMT; Suinn & Richardson, 1971). This technique is used to reduce anxiety and stress and was developed as a non-specific behavioural approach to overcome several deficiencies inherent in traditional systematic desensitization procedures.

One of the drawbacks of systematic desensitization is the time factor necessary for hierarchy construction. The necessity of identifying anxiety stimuli for hierarchy building leads to a lengthier treatment time as the therapist and patient work to construct anxiety hierarchies or as treatment sessions are taken up with patient exposure to each hierarchy item. In addition, the need for anxiety hierarchies demands that the stimulus conditions for anxiety be specific and that they be organized into a hierarchy of scenes that one can visualize. Another drawback of traditional desensitization is that it tends to concentrate on current maladaptive behaviour rather than on preparing the patient to cope with future tensions. While recent efforts in clinical psychology have been aimed at training patients to influence their physiological, behavioural and cognitive

responses without the assistance of external controlling agents, traditional behavioural approaches generally still focus only on the elimination of the maladaptive behaviour. As Cautela (1969) states:

> "... the behaviour therapist has not, to any extent, attempted to make the individual less susceptible to the development of future maladaptive behaviours .... For the most part, the behaviour therapist has concentrated exclusively on removing the maladaptive behaviour present in the individual when he comes for treatment" (p. 323).

Given the necessity of eliminating these deficiencies, the AMT procedure meets these criteria inasmuch as it eliminates the need for anxiety hierarchies and directly addresses itself to the modification of anxiety responses regardless of etiology. By not having to rely upon specific stimulus conditions, AMT provides a unitary approach which provides a tool for the treatment of pervasive or generalized anxiety. This is important because the treatment of generalized anxiety or tension has been difficult for behaviour therapists and has generally been avoided.

Free floating anxiety or tension traditionally involves anxiety responses tht are cued by stimuli which the patient is unable to identify. These stimuli are not identifiable either because the conditioning occurs below the patient's awareness or because the stimulus patterns prompting the anxiety responses are too complex to be easily verbalized. AMT relies upon the anxiety response as a discriminative

stimulus rather than on the anxiety stimulus itself. This enables the patient to manage future anxiety and tension instead of eliminating previously developed anxiety responses.

Theoretically, AMT centers on the belief that anxiety responses themselves can be viewed as discriminative stimuli, and that patients can be conditioned to respond to these stimuli with responses which effectively remove the stimuli through reciprocal inhibition. Anxiety management training is specifically directed towards teaching patients to respond with relaxation or competency to the stimulus dimension of onset or increasing levels of anxiety or tension. The basis of AMT is rooted in earlier animal research which suggests that anxiety or fear responses themselves can become discriminative stimuli which can be used to eliminate anxiety through a counterconditioning process. This formulation is essentially identical to that of learning theorists such as Brown (1961), Dollard and Miller (1950), and Mowrer (1950) who conceptualized the anxiety response as an acquired drive state in which the drive stimulus takes on cue properties of its own. Experimental support has been gathered which has illustrated the stimulus properties of fear (Miller, 1951). Relevant studies by Wynne and Solomon (1955) and Razran (1961) have shown that autonomic responses can act in maintaining avoidance behaviour and that interoceptive conditioning can occur to produce conditioned responses to

visceromotor stimuli. It has also been shown that conditioned stimuli can produce emotional effects partly through intervening self arousal systems. Further support regarding the theoretical basis of AMT has been gained through the research of Miller (1969) and DiCara and Miller (1968) who demonstrated that animals can respond to deviations from homeostatic states.

Essentially the AMT process involves: 1) the use of instructions and physiological anxiety cues to arouse both autonomic and cognitive anxiety responses and 2) training the patient in strong competing responses to anxiety such as relaxation and feelings of success or competency. A three phase process is used to train patients in anxiety reduction. The first phase is comprised of abbreviated Jacobsonian deep muscle relaxation training (Jacobson, 1938), as well as familiarization with the principle involved in AMT conditioning and with the planned treatment schedule. In addition, the patient is acquainted with the objectives of anxiety control. During this phase the patient is told that AMT is a method which emphasizes training in identifying early signs of anxiety and in reducing or eliminating tension before it becomes problematic. It is explained that muscle relaxation exercises are used as the self control technique and that practice in muscle relaxation is therefore essential. The patient is also informed that training will involve visualizing scenes of situations which tend to

foster anxiety so that this anxiety can be eliminated through self controlled relaxation.

During the second phase, the patient is helped to identify those situations which arouse anxiety or tension, relaxation or competency. With the therapist's intervention, the patient is relaxed and then led through relaxation scenes, a beginning level of anxiety and competency feelings. During the anxiety arousing situation, the patient is taught to attend to the ways anxiety is psychologically expressed, be it through muscle tension or other physiological parameters such as increased heart rate, increased rate of perspiration or rapid breathing. Later in this phase the patient is trained in rapid anxiety scene initiation, quick termination and the rapid instigation of another relaxing scene. The pace of this phase is regulated so that the patient is able to appreciate the technique used for anxiety arousal while still self-controlling the level of anxiety. As well, deep breath control cues are instituted for the rapid re-establishment of relaxation and removal of anxiety. In order to determine how well the patient is able to switch scenes, develop imagery, and react to the anxiety responses as cues, interviews are held at the end of each session.

Generally, the AMT sessions in this phase begin with maximum therapist control. The patients are told when to start and stop a scene and are given instructions

continuously. This allows the patient's responses to follow the stimuli of the therapist's instructions and words. As the patient becomes better able to re-establish relaxation control, the therapist gradually withdraws his input thereby allowing the patient more personal responsibility for initiating arousal, deciding when to stop arousal and for re-developing self-control. AMT sessions thus shift towards training in self management behaviours so as to foster generalization.

The final phase involves the actual conditioning during which the patient is relaxed, anxiety is aroused and the anxiety is terminated through the deep breath control signal and shift to relaxation or competency responses. During anxiety arousal, the patient is encouraged to attend to the stimulus qualities of the anxiety as it is allowed to build. The patients are instructed to stay within the anxiety scene while initiating the return of relaxation as opposed to the previous method of terminating the anxiety before initiating relaxation. Further sessions in this phase may be used to determine level of transfer to in vivo events, to provide for overlearning or to assess the use of AMT as a preventative measure. Typically the three phases of AMT are completed in six to eight sessions.

One common issue regarding AMT is of a patient's inability to generate imagery. While imagery is an important component of the training procedure, clear visual imagery is

not essential if the patient is able to experience anxiety during training. As mentioned, AMT is based on the concept that the anxiety response is converted into a discriminative stimulus for relaxation behaviour. Visual imagery is simply a mechanism for inducing the anxiety response. AMT can proceed if the patient is able to become anxious or tense by simply thinking about a past anxiety provoking incident. Visualization of the experience in imagery is not necessary. In addition, other senses such as tactual, auditory, olfactory and proprioceptive may be used to develop scenes when visual imagery cannot be employed.

Scene development is fostered by interviews which are conducted early in the training procedure. Scenes are generally comprised of concrete replications of events provoking anxiety and relaxation. Generally, details are equivalent to those used in desensitization procedures. Patients are requested to identify scenes that occur reasonably often and arouse either high anxiety or relaxation. For those patients who are unable to identify such events, the therapist focuses the patient on the last anxiety or relaxing situation experienced. While the function of the anxiety scene is to create arousal, the relaxation scene's function is to quickly initiate the return of relaxation after anxiety arousal. Later in training, methods such as the use of the deep breath cue or refocusing attention on muscle groups may be useful. Basically the

relaxing scene acts as a stimulus to trigger the relaxation response.

Thus, AMT is useful in training patients self control skills for coping with anxiety arousal regardless of its source. By bringing the anxiety under control, it may be possible for the patient to learn other adaptive behaviours.

Deep muscle relaxation is a technique developed by Jacobson (1938) which holds that regulation of anxiety or tension can be mediated through the striated musculature. Reduction of muscle tension by progressively tightening and relaxing various muscle groups leads to a dimunition of electromyograph activity resulting in increased feelings of calmness and well being. The feature of an individual acquiring autogenous control of his own body was felt by Jacobson to be of great benefit.

Increased tonus of the central nervous system as illustrated in tenseness or excessive movement of striated muscles is subject to voluntary control. The aim of the Jacobson method is to emphasize voluntary control of reduction of contraction or tonus of muscle groups and of motor associated portions of the nervous system.

Signs of increased relaxation include a decreased rate of respiration, flaccid muscle tonus and a reflex start following any unexpected noise. In addition, EMG measurements show significant decreases compared to baseline measurements. Results of studies investigating deep muscle relaxation

effects have indicated that the knee-jerk and other reflexes dwindle or disappear. Jacobson (1955) has found that relaxation also had a generalized neurogenic deactivation effect on the vegetative nervous system, in which the cardiovascular and gastrointestinal systems are involved. Another study by Jacobson (1938) found that this technique alleviates fatigue allowing individuals to "operate in their real interest causing greater efficiency of their mind and body (Jacobson, 1955, p. 558). More recent investigations on the efficacy of deep muscle relaxation have shown that this technique is useful in reducing hypertension (Shoemaker & Tasto, 1975), insomnia (Nicassio & Bootzin, 1974), tension headaches (Cox, Freudlich & Meyer, 1975), childhood asthma (Alexander, 1972) and phobias (Matthews & Gelder, 1969). These studies represent problem behaviour hypothetically maintained by some form of physiological over activation. Thus, providing a response inhibitory to anxiety in the face of the anxiety provoking stimulus causes reciprocal inhibition which eventually reduces autonomic arousal.

Before learning to relax any muscle group, the subjects are first asked to contract the muscle group with eyes closed so as to note the sensation from the contraction. This accomplishes two things: 1) recognition of the location of tension and 2) awareness that tension is a voluntary act which may be controlled. Once a person has become aware of

the tension feelings then attention is directed to relax the part or parts further and further each minute using any method which the person finds useful, be it imagery or deep breathing.

While sitting, the major muscle groups of the body are contracted until the entire body has been covered. Generally, the contractions performed are very slight in order to cultivate the muscle sensations.

Clinical use of progressive relaxation generally occurs in two forms. One form involves Jacobson's complete procedure which takes over fifty sessions for full body relaxation to be achieved. A more common form involves approximately ten sessions of abbreviated Wolpean relaxation. Under either form of training, subject control over the progress made is essential. As well, the clinical use of relaxation is rarely used unless physiological over activation in some form provides a basis for its use.

Single Subject Research Designs

Throughout the history of the development of new therapeutic procedures in psychology and psychiatry, single subject research has been used to observe, speculate and evaluate the effectiveness of therapeutic outcomes. However, because of an emphasis on scientific rigor expressed by some researchers, experimental methods employing large scale group

designs, and in particular, the between groups comparison design, have been primarily used. Unfortunately, in the area of clinical psychology, a major problem has been the difficulty in accumulating a large enough number of homogeneous subjects from clinical populations so as to be able to develop and evaluate effective treatments (Bergin & Strupp, 1970; Hersen & Barlow, 1976). In addition, it has been argued that group designs are sometimes too inflexible and are poorly suited for specific questions of applied field investigation, where the specific interest is in knowing what procedure works with a particular individual over time.

An alternative approach, well grounded in the scientific method, is the use of single-case experimental designs (N=1; Barlow & Hersen, 1973; Leitenberg, 1973; Hersen & Barlow, 1976). These designs have provided the alternative to group designs and are well suited for the early stages in a research cycle where researchers or clinicians are searching for critical variables and are attempting to generate new hypotheses.

Single case designs have been used throughout the history of psychological, psychiatric and physiological research (Hersen & Barlow, 1976). Two of the earliest reported N=1 studies were performed by Ebbinghaus (1885) and Stratton (1887). Other single subject experiments were carried out by Bryan and Harter (1899), Cannon and Washburn (1912) and Watson and Rayner (1920). Psychiatric research

utilizing N=1 designs were exemplified in landmark studies by Breuer and Freud (1895) and Prince (1905). Skinner's Behaviour of Organisms, (1938) was perhaps the modern forerunner of subsequent studies not only being an example of N=1 research, but also providing the basis for operant psychology upon which many recent N=1 studies are based.

From 1939 to 1963 a total of 246 N=1 studies were reported in various psychological journals (Dukes, 1965). Since 1963, there has been a tremendous increase in these studies, so much so that entire journals have been devoted to N=1 designs (e.g., Journal of Applied Behaviour Analysis; Journal of Experimental Analysis of Behaviour). In addition, single case designs have begun to proliferate in the biofeedback literature and in other journals specializing in this area. Recently, the theoretical and logical aspects of this strategy have been discussed by Baer, Wolfe and Risely (1968), Barlow, Blanchard, Hayes and Epstein (1977), and Hersen and Barlow (1976).

Despite the use of single subject studies in psychological research, many investigators still distrust ideographic designs. Reasons for this distrust stem from a number of criticisms of the approach. Those most commonly posited include: 1) the lack of control for internal validity; 2) the inability to generalize findings from only one subject and 3) the inappropriateness of descriptive statistics. While these criticisms may be valid for poorly

designed ideographic studies, recent advances in single subject research designs offer ways of avoiding these criticisms. Numerous and specific replies to the concerns voiced against ideographic research have been made. An overview of the replies to these concerns follows.

The Lack of Control for Internal Validity

Perhaps the most serious criticism of ideographic research is the supposed lack of internal validity. Edgar & Billingsley (1974) define internal validity as, "the concept that the change in the dependent variable bears a direct functional relationship to the occurrence of the independent variable to the degree that, if repeated, the study would yield similar results" (p. 150).

Traditionally, equivalent groups have been used as basic controls for variables affecting internal validity (Campbell & Stanley, 1963). Since equivalent groups are not easily found, the use of 'nearly equivalent' groups may affect the results. To the applied researcher, the task of grappling with sources of inter-subject variability is arduous. Realistically, each individual must be observed in terms of treatment response in relation to environmental forces. Ideographic research does away with the problem of matching groups by demonstrating reliable control of the dependent varible by the independent variable in a single instance.

Reversal techniques or multiple baselines may be used to show this relationship. Internal validity may also be established by replication of the intervention strategy. Sidman (1960) has observed that each successful replication of a procedure decreases the probability that chance affected the change. Replication of studies is perhaps the only agreed upon method in which to generate validity and generalization and as Chassan (1961) states "all things being equal, many intensively studies cases are better than one and a great many intensively studies cases are better than just many" (p. 47). Reliability and validity can thus be demonstrated at less cost in terms of time and resource allocation by utilizing the same individuals than by using large group designs.

Inability to Generalize from One Subject

The second criticism levelled at ideographic researchers is that one cannot make generalizations to a population of individuals from only one subject. The limitations of single case designs have been highlighted by the critics of ideographic research particularly when issues have retarded the growth of ideographic research and have caused many research authorities to deny the usefulness of studying single cases for any other purpose than the generation of hypotheses (e.g., Kiesler, 1971). As a result, the group

comparison approach has been widely used.

However, when studying human behaviour change, the usefulness of group comparison approaches is limited. Randomization of samples is a critical factor in group designs so that results can be generalizable to a particular population. Edgington (1967) states that, "you cannot statistically generalize to a population from which you have not taken a random sample, and this fact rules out statistical generalization to a population for virtually all psychological experiments, those with large samples or small" (p. 195). He goes on to say that, "In the absence of random samples hypothesis testing is still possible, but the significant statements are restricted to the effect of the experimental treatments on the subjects actually used in the experiment, generalization to other individuals being based on logical, non-statistical considerations" (p. 195).

While initial research utilizing single-case designs have been primarily devoted to hypothesis testing, newly developed procedures of direct and systematic replication have enabled findings to be generalized to individuals (Hersen & Barlow, 1976).

Since treatments in clinical settings are constructed ultimately for individuals rather than for the 'average' person in a group, replication procedures take on added importance. For this reason, the replication of single case experiments is critical in establishing the reliability and

generalizability of findings. Chassan (1961) compares intensive (ideographic) and extensive (nomothetic) designs in order to support the contention that generalizations can be made:

> "Once a significant difference appears within the single case design, one can specify the particular patient background variables and other relevant characteristics in whose presence the significant result was actually obtained... This is in sharp contrast to the extensive model. Furthermore, in a design which is based upon a detailed analysis of each case, each patient serves as his own control, and a statistically significant result cannot be an artifact of a lack of homogeneity between patients or of poor pairing... The degree of control or anything near it is obviously impossible in the extensive model" (p. 46).

Thus, it appears that the generalization issue can be adequately dealt with for as McNemar (1940) states, "the statistician who fails to see that important generalizations from research on a single case can ever be acceptable is on a par with the experimentalist who fails to appreciate the fact that some problems can never be solved without resort to numbers" (p. 361).

The Inappropriateness of Descriptive Statistics

A third criticism which has been levelled at ideographic researchers is that descriptive statistics are inappropriate for good scientific data analysis. Traditionally, population statistics and graphs have been used to draw inferences about

characteristics of the population used and to simplify results for communication purposes (Edgar & Billingsley, 1974). However, there is no need for ideographic researchers to use population statistics since only one subject or a replication of the same treatment on one or more subjects is used. As such, a description of treatment effects utilizing graphs or means scores is sufficient.

Ideographic research has frequently employed the use of mean scores. Mean scores may be gathered by repeated measures on one subject or scores on a number of subjects. If this latter method is used individual scores must be compared to the group mean. However, whether these scores represent the overall picture must be determined by the degree to which group data represents the scores of the individuals within the group. Caution must be taken in collapsing individual scores into group scores lest the group scores be misleading for any individual (Allport, 1937). Both Chassan (1961) and Sidman (1960) have shown that individual variance can distort group mean results.

In spite of the possible drawbacks of group mean results, Estes (1956) argues that group data can be used to establish parameters against which individual performance can be measured. This enables the investigator to formulate hypotheses regarding differential response rates and emphasizes the empirical nature of ideographic research (Edgar & Billingsley, 1974). As well, group data can also

demonstrate the general form of the stated relationship making hypothesis formulation somewhat easier.

The development of applied behavioural methodology has produced experimental designs that allow for an analysis of the controlling effects of variables. This permits scientifically valid conclusions to be made regarding the efficacy of treatment strategies. Clinical researchers have developed a variety of simple and complex designs and in spite of their differences common features exist in each. As in group designs, target behaviours are specified and methods of measurement are precisely defined. Unlike group designs however, continuous measurements are taken throughout the various phases of the study. In most designs, a baseline phase is instituted in which the naturally occurring frequency of behaviour is obtained. Following stabilization of baseline behaviour, a therapeutic variable or treatment is introduced and a comparison is made with the baseline data in order to determine whether the treatment is beneficial or not. Because of the complexity of variables affecting human behaviour, the A-B design, the simplest of all designs is not always appropriate. For this reason more complex designs employing sequential withdrawal or reversal techniques are often used to tease out the controlling effects of variables. Examples of these designs would include the A-B-A design, the A-B-A-B design, the B-A-B design and the A-BC-B-BC design where A represents the baseline phase and B and C represent

intervention strategies. An in-depth examination of these strategies and extensions of the A-B-A design can be found in Hersen and Barlow (1976).

The use of sequential withdrawal or reversal designs is inappropriate when treatment variables cannot be withdrawn or reversed due to practical limitations or ethical considerations (Hersen & Barlow, 1976). When carryover effects appear across adjacent treatment phases as in the case of therapeutic instructions (e.g., relaxation training) practical limitation prohibit phase reversal. When the treatment strategy is effective in reducing destructive or aversive behaviour, the withdrawl of treatment is ethially unwarranted. Under each of these circumstances the use of experimental strategies which circumvent these factors must be employed.

One commonly used design employed to circumvent these problems and the one most central to this study is that of the multiple baseline design. This design was first fully described by Baer, Wolf & Risely (1968) and essentially consists of a series of A-B designs in which the length of the baseline period is varied in order to avoid the likelihood of a correlation between other events and the introduction of the independent variable (Barlow, Blanchard, Hayes & Epstein, 1977). Once baselines are established and stabilized, experimental variables are applied to one of the behaviours and the changes observed. Subsequently, the same

variable is applied to a second behaviour and changes are noted. This procedure continues until the experimental variable has been applied to all target behaviours. Treatment variables are deemed to be effective if a change in behaviour frequency appears after its introduction while the rate of untreated behaviour remains relatively unchanged. A basic assumption is that the targeted behaviours are independent from each other. If covariance exists, then application of a multiple baseline design across subjects might yield useful information as to the effectiveness of the intervention strategy (Hersen & Barlow, 1976).

One of the major issues in the use of multiple baseline designs is the number of baselines needed for scientifically valid data to be generated. Baer, Wolf and Risely (1968) felt this issue should be left to the individual researcher and therefore did not specify the number needed. Barlow and Hersen (1973) argued that at least three target behaviours would be needed and Wolf and Risely (1971) as well as Hersen and Barlow (1976) suggest that replications across three or four baselines should be considered a minimum.

While demonstration of the controlling effects of a treatment strategy is somewhat weaker in the multiple baseline design compared to reversal designs, a major advantage of this technique is that it fosters the simultaneous measurement of concurrent target behaviours, subjects or settings. This is important because the

monitoring of concurrent factors allows for a closer approximation of naturalistic conditions and it leads to an analysis of covariance among the target behaviour, an area which has recently become of interest to applied behavioural researchers (Kazdin, 1973, Sajwaj, Twardosz and Burke, 1972).

Multiple baseline designs may be classified into three basic types - across behaviours, across subjects and across settings. Since this study is primarily concerned with how a particular treatment affects specific physiological and psychological factors across subjects, the multiple baseline across subject design is most relevant. However, a brief overview of all three designs will be presented.

With respect to the multiple baseline across behaviours, the same treatment variable is applied sequentially to independent target behaviours in a single subject or over a number of subjects. Various investigators (Hall, Cristler, Cranston & Tucker, 1970; Liberman & Smith, 1972; Marks & Gelder, 1967) have shown that sequential applications of reinforcement contingencies to individual responses confirms the controlling effects of treatment variables.

Multiple baseline designs across settings illustrates the effect of a particular treatment applied sequentially to a single subject or group of subjects across independent situations. Researchers such as Allen (1973), Barrish, Saunders and Wolf (1969) and Hall, Cristler, Cranston and

Tucker (1970) have successfully employed such a design to illustrate how well treatment considerations can be used under in vivo conditions.

In the multiple baseline design across subjects, a particular treatment is applied sequentially across matched subjects under similar environmental conditions. As the same treatment variable is applied to succeeding subjects, the baseline for each subject increases in length and only a single behaviour is focused upon. A variation of this design involves the sequential application of the treatment variable across groups of subjects. Investigators such as Hall, Cristler, Cranston and Tucker (1970), Liberman, Teigen, Patterson and Baker (1973), Christopherson, Arnold, Hill, and Quilitch (1972) and Wilson and Hopkins (1973) have shown the effects of time lagged continencies where changes in rates of behaviour across subjects changed only when the feedback or contingency conditions in force were applied.

In addition to the graphical and descriptive analysis of data generated by single subject designs, recent arguments have been presented both for and against the use of statistical analyses. Whether or not statistical analyses should be used to evaluate change in single subject designs has been a major point of contention (cf. Michael, 1974). A particularly salient issue in this controversy pertains to the criteria for evaluating change including notions of clinical and statistical significance (Hersen & Barlow,

1976).

Clinical criteria for "significance" refer to comparisons between behaviour change which has been accomplished and level of change required for the individual's adequate functioning in society (Risely, 1970). Small changes are not usually considered clinically significant even if the behaviour change is reliable and related to the experimental intervention.

Statistical "significance" refers to differences in percentages of a particular occurrance which are too large to be attributed to chance alone (Chassan, 1979). Here, small changes are considered statistically significant and are thought to be due to a particular experimental intervention.

Most of the criticisms against the use of statistics in intra subject replication designs are based upon the logic underlying traditional statistical tests. As previously mentioned Sidman (1960) and Edgington (1967) criticized the circularity of statistics which makes assumptions about the population from which a sample of observations is drawn. As well, objections have been raised regarding the likelihood of significance occurring on the basis of chance alone on a certain number of occasions.

Despite these criticisms, many researchers now believe that there are times in intra subject replication research where specific statistical procedures can be useful. These individuals do not propose that marked behaviour change

should be subjected to statistical analyses (e.g., Jones, Vaught & Weinnott, 1977). Instead they feel that a variety of situations may make visual interpretation of results difficult.

Often, baseline rates of behaviour do not stabilize within a given time period. Trends during baseline may or may not be in the direction of therapeutic change. If a trend is in the direction of therapeutic change acceleration of that change may prove statistically significant. Statistical analyses enable researchers to scrutinize continuous shifts across phases where there is no change in trends, whereas visual inspection often entails distinct changes in trends across phases. Thus, evaluations of an intervention may be made statistically which otherwise could not be easily assessed visually (Hersen & Barlow, 1976).

In other cases, statistics may provide a screening tool to aid in deciding which variables produce reliable changes. Often nondramatic effects occur in the data particularly when attention is directed towards variables with relatively subtle effects. Again visual inspection may not be sufficient when therapeutic intervention are not rapid or when the results appear visually ambiguous. Statistical significance may aid the researcher in focussing on interventions which have reliable, although not obvious, effects even though clinical significance has not been attained (Hersen & Barlow, 1976).

Specific statistical procedures which may be safely used in single subject research are limited. The reason for this limitation revolves around the concept of serial dependency. In the case of continuous or repeated measures over time the assumption of independence of observation is usually not met. Successive observations in time series designs tend to be correlated leading to a dependence of error components. As a result, the use of traditional F or t tests are inappropriate for either the t or F values would likely be overestimated giving inaccurate results. A number of variations of t tests and ANOVA's have been posed to evaluate N=1 studies (Gentile, Roden & Klein, 1972; Shine & Bower, 1971), but methodological faults have precluded their use. Time series analyses have been introduced which control for serial dependency (Glass, Wilson & Gottman, 1974). This analysis determines the degree to which the data points are autocorrelated and then transforms the data to remove the serial dependency so the error terms are uncorrelated. Once the data are transformed t tests for changes in level and slope are performed in the time series analysis.

Potential limitations of this analysis include the dependence on relatively large numbers of observations in each phase and the availability and complexity of the computer programs necessary to analyze data.

Measurements of Diabetic Control

Although significant advances have been made over the years in understanding the pathogenesis and treatment of diabetes mellitus, major concerns surrounding the relationship between degrees of diabetic control and the occurrence of diabetic complications have gone largely unresolved. Generally speaking, the primary goal of diabetic control is to restore normal metabolic homeostasis in diabetic patients by using carbohydrate metabolism as the index (White, 1965). While some studies suggest that certain complications can be prevented or reduced in severity by improving diabetic control (Jackson, Hardin, Walker, Hendricks & Kelly, 1950; Hardin, Jackson, Johnston & Kelly, 1956; Marble, 1965; Kilo, Vogler & Williams, 1972), other studies report that better control makes no significant difference (Knowles, Guest, Lampe, Kessler & Stillman, 1965; Siperstein, Unger & Madison, 1968; Siperstein, 1970). This confusion has led investigators to question whether present methods for quantitatively assessing diabetic control are adequate particularly with respect to the juvenile diabetic.

Traditional determinants of diabetic control are those of blood glucose concentrations (fasting and postprandial) and the degree of glycosuria as recorded in the physician's office as well as that recorded in the patient's home. Generally, urine testing using the Clinitest, Acetest, and

Diastix methods have been most widely used. Recent studies have indicated that qualitative and semiquantitative urine tests are valid measures of control when the mean of urine test values over several days are analyzed (Harding and Higgs, 1975; Malone, Hellrung, Malphus, Rosenbloom, Grgic and Weber, 1976). Care must be taken however to avoid errors in estimation of control because of problems with time sampling of urine tests (Forman, Paul, Goldstein & Genel, 1974).

Another technique which has been found to accurately reflect glucose homeostasis is that of the 24-hour fractional quantitative urine glucose analysis (Forman et al., 1974; Weil & Kohrman, 1972). The use of fractionation with the determination of both volume and total glucose excreted per collection period during the full 24-hour period permits the physician to assess diabetic control. After the pattern of glucose secretion is determined, the volume of urine can be used for more meaningful management. The problem of children purposely altering test results is minimized because the child who attempts to deceive his urine testing is usually not sophisticated enough to alter the 24-hour urine. If this is suspected then urine creatine determination can confirm the physician's suspicions.

The use of this method assumes that the day of collection is fairly typical in terms of dietary intake, exercise and emotional stress. Urine should therefore be collected on a representative day so the pattern of glucose homeostasis can be used for adjustments in the diabetic

therapy. Thus, when performed on an ambulatory basis, this test reflects the actual condition the child faces each day and takes into account insulin intake, diet, activity and stress. Furthermore, it is easily performed and has been shown to be readily accepted by both parents and their children (Forman et al., 1974). This system then, when used in combination with qualitative daily testing by the patients, provides a good estimation of diabetic control.

Another traditionally used method for assessing diabetic control is that of blood glucose analysis. The most commonly used methods are the Folin - Wu and Destrostix tests and more recently various home monitoring instruments. While blood glucose levels may give a rough indication of diabetic control in more stable adult diabetes, intermittent blood glucose determination in juvenile diabetics do not relate sufficiently to overall glucose homeostasis to be used as an accurate indicator of diabetic control alone. In children, random blood glucose levels are known to show wide variations which are characteristic of insulin deficient diabetes (Service, Molnar & Taylor, 1972; Molnar, Taylor & Ho, 1972). As such, authors such as Malone et al., (1976) do not recommend routine determination of blood glucose as the sole basis on which to assess diabetic control. Continuous 24-hour blood glucose monitoring is more accurate but is much too impractical for use with outpatients.

Recently, investigators have shown interest in a new

test, hemoglobin A_{1c}, as an indicator of integrated plasma glucose levels over prolonged periods of time (Gabbay, 1976; Gonen & Rubenstein, 1978; Lanoe, Thibult, Eschwege, Soria, Soria & Tchobroutsky, 1977). Extensive research has shown that levels of hemoglobin A_{1c} are increased in diabetic patients and reflect their degree of diabetic control. As well, it has been shown to be useful in the follow-up and treatment of diabetic patients.

The potential use of hemoglobin A_{1c} measurements in studies designed to investigate the relationship between diabetic control and diabetic complications is of great importance. However, there have been no published results of reports which have addressed this area. However, in terms of an analysis of short-term control, hemoglobin A_{1c} appears to have distinct advantages over urine glucose testing and blood glucose testing. The measurement of hemoglobin A_{1c} in percentages can be used as a standardized method for describing diabetic control in contrast to the often confused criterion for assessing diabetic control through urine or glucose tests.

Gonen and Rubenstein (1978) list six advantages of hemoglobin A_{1c} quantitation as a means of assessment of metabolic control in diabetic patients: 1) It is an objective test and is not dependent on the patient's cooperation or accuracy as is the case with spot checking of urine fractional collections; 2) it is independent of time of day,

meals and exercise; 3) it can describe metabolic control in patients with a single value; 4) it can aid in determining the necessity to change treat modes or to alter existing ones; 5) It can provide the physician with a goal towards which therapy can be directed and; 6) it may serve as a screening test for patients who appear to be in good control but who may not be.

Certain disadvantages are inherent with this technique in that it is not helpful in deciding upon acute manipulation in insulin therapy or diet. The physician may be alerted as to the need for better control, but the hemoglobin level would not indicate the time at which changes were required. In addition it cannot reflect the occurrence of hypoglycemic episodes. In certain hematologic disorders with abnormal red blood cell life span, hemoglobin A_{1c} levels are significantly altered, therefore precluding the usefulness of the test. As well, because of the ninety day life span of the red blood cell, measurements can be taken only every three months. This precludes its usage in short term periods. Overall however, hemoglobin A_{1c} determination appears to be a far better method of measuring diabetic control than the usual criteria of fasting and postprandial blood sugards and 24-hour urine glucose analysis. Daily urine analyses and occasional blood glucose analyses still remain the best way to estimate diabetic control, but with the addition of the hemoglobin A_{1c} method more accurate determination may be gained.

CHAPTER II

METHODOLOGY

Study I

Purpose of the Study

This study was designed to investigate the effectiveness of anxiety management training in improving the course and control of juvenile diabetes mellitus by improving metabolic regulation of the disease through a reduction of urine glucose levels.

Method

Subjects

Thirty-six poorly controlled adolescent diabetics from the Diabetic Clinic of the Children's Hospital of Eastern Ontario between thirteen and eighteen years of age were contacted by telephone regarding possible participation in the study. Of these, twenty-six declined to participate because of the time factor involved and/or disinterest in the study. Of the ten remaining subjects, two were found to be unsuitable for the study because they were in fact in reasonably good control. Two other subjects were unable to

participate because of severe family difficulties which made adherence to their experimental regimes impossible. As a result, six female subjects between the ages of fifteen and eighteen years were included in the study. Data on only five of these six subjects could be subjected to analysis however, as one of the subjects became so labile in her control during the study that frequent hospitalization and insulin adjustments made her test results uninterpretable.

All subjects who agreed to participate in the study were interviewed in person in a 20-30 minute clinical interview. The interview followed the general guidelines set forth in the intake form (See Appendix A). The main purpose of the interview was to describe the study in detail and to establish whether the subject had an anxiety or tension problem that possibly interferred with good diabetic control. Other information gathered centered around the chronicity of the problem and the physical symptoms associated with anxiety and tension. Also, it was determined to what extent, if any, the individual attempted to rectify the problem either through psychotherapy, medication other than insulin or through other means. A copy of a brief treatment outline was then given to all subjects (See Appendix B).

No subjects exhibited evidence of serious medical disorders which would interfere with their participation in the study. All subjects had been diabetic for at least three years with the mean age of onset being nine years. All

children lived at home with at least one parent. Both the children and their parents were informed as to the exact nature of the study and the techniques to be employed befroe consent forms were signed (See Appendix C).

Therapists

The therapist was an advanced doctoral candidate in child clinical psychology who had four years of extensive therapy experience in the field of applied behaviour analysis. The therapist was under the supervision of a registered Ontario psychologist. Medical supervision was provided by two physicians specializing in juvenile diabetes.

Setting

The study was conducted through the Psychology Department of the Children's Hospital of Eastern Ontario (CHEO). All children involved in the study were seen on an outpatient basis. The study was conducted over a 150 day period beginning in January 1980. Therapy took place in offices of the Diabetic Clinic, CHEO. Urine samples of the subjects were analyzed in laboratories at the Children's Hospital. Analyses were done without the technician knowing the treatment stage of the child.

Experimental Design

A single subject format employing a multiple baseline across subjects was used in the study. Baseline (B) conditions were of different lengths across subjects ranging from twenty-one days for subject A to fifty-four days for subject E.

Following the baseline phase for each subject, an attention-control (A-C) condition ranging from fourteen days to twenty-nine days was instituted. The use of the attention-control condition strengthened the design by allowing the effects of the independent variable to be compared to both baseline and attention-control phases. In this study the attention-control condition consisted of simple psychological testing utilizing the Minnesota Multiphasic Personality Inventory (Hathaway & McKinley, 1967) and the Weschler Intelligence Scale for Children - Revised (Weschler, 1974) or the Weschler Adult Intelligence Scale (Weschler, 1955) where age appropriate. All testing and feedback was performed within a seven hour period over two weeks so as to be as equivalent as possible to the actual treatment time. The context of the feedback sessions was kept as neutral as possible for each subject so that as little biasing as possible would be introduced. Each subject was given a treatment rationale which explained that often a knowledge of one's dynamic makeup is of benefit in coping

with daily life experiences and may serve to bring about better diabetic control (see Appendix D). A five item ten-point credibility/expectancy for improvement scale similar to that used by Borkovec and Nau (1972) was administered to each subject before and after the A-C phase to measure non-specific treatment factors such as patient expectancy for therapeutic gain and perceived treatment efficacy (See Appendix E). In addition, control of experimenter-subject contact was gained.

Following the attention-control phase for each subject the actual treatment phase was implemented. This consisted of seven hours of anxiety management training taught over a two week period. Before training began, each subject was given a treatment rationale (See Appendix F) which explained that relaxation may bring about a reduction in urine glucose levels leading to improved diabetic control. As in the A-C condition, the five item ten-point credibitility/expectancy for improvement scale was administered to each subject before and after training. After the seven hours of anxiety management training, each subject was given a cassette tape with muscle relaxation instructions recorded on it. Subjects were requested to practice relaxation with the tapes at least three times per week and were also requested to use the relaxation skill whenever they faced stressful situations. The length of this phase ranged from 115 days for subject A to 71 days for subject E. Table 1 indicates the exact number

of days the subjects spent in each phase.

Table 1

NUMBER OF DAYS SPENT IN EACH PHASE

	Phase		
Subject	Baseline	A-C	AMT
A	21	14	115
B	32	29	89
C	39	22	89
D	47	14	89
E	54	25	71

Testing Procedure and Instruments

Data collection was completed within a 150 day period for all subjects. Subjective estimates of anxiety and tension were gained through the use of the Multifactorial Scale of Anxiety (Fenz & Epstein, 1965) where each subject was asked to respond to each item according to recent subjective feelings. This scale was administered on a bi-weekly basis.

The Multifactorial Scale of Anxiety (See Appendix G) consists of a total of fifty-three items, comprising three subscales measuring state anxiety: Muscle Tension (MT) (eighteen items), Autonomic Arousal (AA) (sixteen items) and Feelings of Insecurity (FI) (nineteen items). The Muscle

Tension subscale contains items describing the effects of sustained contraction of striated muscles such as tremor, motor incoordination, backache, neckache, rapid breathing, tension headaches and skin sensitivity. The Autonomic Arousal subscale contains items referring to visceral symptoms relative to activation of the autonomic nervous system such as tachycardia, vasomotor reactions, emotionally induced sweating, failure of body temperature control and digestive disorders. The Feelings of Insecurity subscale contains items referring to subjective states of fear and insecurity and concomitant behaviour and attitudes such as the inability to relax and concentrate, the tendency to worry over small matters, unexplained feelings of fear and panic, fitful sleep and compulsive mannerisms. Reliability coefficients obtained from a sample of male and female university students (Fenz & Epstein, 1965), corrected for attenuation, for the scales MT, AA and FI are respectively .84, .83 and .85.

Degrees of diabetic control were assessed through the use of physiological tests. Urine testing performed at home on a thrice daily basis served as the cornerstone of diabetic assessment using the Diastix method (Ames Co. Ltd., Elkhart, Ind.). Urine tests were performed in the morning, late afternoon and at bedtime and an average reading was then calculated for the day. The children entered their test results as well as their insulin intake in a diabetic diary

(See Appendix H). Test results read negative, trace, ¼%, ½%, 1% and 2% which refered to the quantity of glucose in the urine. Information relating to caloric intake, exercise, medication, infection, accidents and emotional conflicts were also entered in the diary. Insulin intake was kept constant throughout the study for each subject. Each subject's height and weight were measured both before and after the study in an attempt to ascertain dietary compliance.

In addition, assessement of urine glucose homeostasis was also determined on a weekly baasis using the 24-hour fractional quantitative glucose method (Forman et al., 1974). Urine voided during the day and night was collected and was kept refrigerated or frozen until the specimens could be taken by the children's parents to the hospital laboratory and analyzed. Volumes were collected at home, aliquoted into four separate containers and labelled with time of collection and total volume: (1) 8AM-noon (first voided overnight urine was discarded); (2) noon-4PM; (3) 4PM-8PM; and (4) 8PM-8AM (first voided overnight morning urine was collected). Routine urine testing for glucose, three specimens a day, continued during this time. All the urine voided, but the few drops necessary for performing the tests, was added to the collection bottle. Children were considered in good control if only 20-60 gm. of glucose was spilled per day in the urine.

In order to assess the children's compliance with the

experimental regimen, all parents were asked to keep a dairy similar to the child's. Parents were requested to check the accuracy of their child's urine test on a specified number of occasions as indicated by the primary investigator. Reliability checks were then calculated.

Treatment Procedures

The independent variable in this portion of the study was that of anxiety management training. The first session was devoted to training in deep muscle relaxation (Jacobson, 1938) and lasted two hours. The relaxation instructions were those presented by Wolpe and Lazarus (1966). A copy of the relaxation instructions are presented in Appendix I.

Prior to training in deep muscle relaxation, a verbal description of the AMT treatment program was given to the subjects. The description informed the subjects that anxiety or tension is a learned response which could be modified or unlearned by following known learning principles. The overview went on to say that the purpose of AMT was to provide a new response, relaxation, which is a more adequate alternative than the subject's typical anxiety response which can interfere with good diabetic control. Further information on the effects of anxiety on diabetes was disseminated. Following training in deep muscle relaxation, the subjects received an orientation to the treatment

procedure. It was as follows:

> "The remaining sessions will continue to make use of deep muscle relaxation. It is important for you to find time to practice the relaxation between sessions as like many activities, the more that you can practice it, the easier it is to become more and more relaxed and to become relaxed more quickly. That is, with continuing practice deeper and deeper levels of relaxation can be achieved. The ideal situation would be to find a quiet place where you live - a place where you will not be bothered by anyone - to practice. Sometimes the only quiet time will be just before going to sleep at night. Anytime that is suitable to your schedule is fine; but what is important is that you can find some time each day to practice the relaxation."

In addition to the above introduction, further orientation remarks were as follows:

> "The remaining sessions will consist of two basic parts. First we will be focussing on developing three types of scenes clearly. That is, a pleasant relaxed scene, an anxiety scene and a success scene. Secondly, we will be focusing on the ways in which you express anxiety physically. We will look at and experience the differences between the opposite responses of relaxation and anxiety. They are opposite responses - that is, you cannot be relaxed and anxious or tense at the same time. We will also learn a way in which you can achieve control over feelings of anxiety and tension. Anxiety is a learned response and can be unlearned and calm relaxed feelings can be learned to take the place of the feelings of anxiety. That is, the feelings of anxiety can be stopped and replaced with feelings of calmness and relaxation through a learning process. As you become more and more aware of the physical signs of anxiety that you have, and more and more aware of the pleasant calm feelings of relaxation, you can learn to achieve the feelings of calmness more often and use them to your benefit. You can learn that it is you who have control over these feelings and that the relaxed calm feelings can be used by you in many situations in which you have felt anxious in the past."

The second session began with an orientation to the AMT

procedure:

> During this session you will be using the deep muscle relaxation technique that you have learned to look at the difference between feelings of anxiety and feelings of relaxation. You will also be developing a pleasant scene, an anxiety scene, and a success scene of your own choosing to help you become more aware of the great differences between those opposite feelings. I will also be stopping from time to time to talk about how it is going for you. Also during this session you will begin to learn how to achieve control over anxiety by switching from feelings of tension and the anxious scene to relaxed feelings and the pleasant scene. At first I will be helping you control the anxiety so do not be afraid to allow yourself to experience the anxiety associated with that scene fully and appreciate the differences between anxiety and the feelings of calmness and relaxation that come with the pleasant scene. I will be here to help you control the anxiety at first, but as you learn that anxiety can be controlled, you will be more and more in control of the situation and eventually will no longer need help from me in controlling the anxiety. You will notice that as you become more and more in control of your own feelings and more able to feel relaxed and calm a new set of feelings will begin to develop. You will begin to have some real positive feelings of competence and mastery over the anxiety as well as the pleasant, relaxed state that replaced the feelings of anxiety.

Following the above rationale of treatment the Ss were relaxed using the muscle tension exercises. Subjects were then interviewed briefly for 10 to 15 minutes to determine that each subject could become quite relaxed. Deep muscle relaxation was then induced again using interim directions (See Appendix J). The following directions were then presented:

> Now focus, without doing anything, on the feeling of bodily and mental relaxation you have achieved ... Notice exactly how it feels to be so relaxed and

calm ... you can achieve this relaxed state more often than you think, and it can be very useful to you ... You will be able to recapture part or all of this relaxed state when you get anxious or afraid ... this may help you to feel better and function better or more comfortably in a variety of situations ... just notice what it feels like for a moment ... focus on the feeling, the state, and enjoy it ...

Let yourself relax all over and let all distractions fade away ... let your mind become a blank screen, relaxed and calm ... let your awareness of anything outside yourself fade away ... now I want you to visualize yourself in a relaxed, pleasant scene ... it can be any scene, indoors or out, with or without people ... just let a pleasant, comfortable, relaxed, happy scene appear ... visualize many of the details of the scene as clearly as you can ... try to see yourself in the scene, be in it, put yourself in the relaxing, pleasant scene and as the scene becomes more and more clear actually experience the calmness, harmony, the relaxation ... if it helps you get into the scene, pay attention to any sounds, smells, tastes, or bodily sensations associated with this scene and the relaxation ... use any senses if they help you get into the scene and experience the pleasurable relaxation. Focus on the feelings ... the state of relaxation you are experiencing right now ... study the way it feels, physically and mentally relaxed and calm. This is the feeling of calmness that you can learn to achieve more often and use to your benefit ... just enjoy the feeling for a moment more ... now let the pleasant scene dissolve away ... let your mind go blank and continue relaxing for a moment.

Subjects were then aroused and interviewed briefly to ascertain that a pleasant, relaxed image could be produced by each subject. Subjects were then relaxed again using interim directions without muscle tension. While in a relaxed state subjects were asked to begin to visualize an anxiety provoking scene and to focus on the various bodily sensations which each subject associated with anxiety. This is the first time in the treatment procedure that subjects were

asked to visualize the anxiety scene. The anxiety induction procedure presented followed the following set of instructions:

> Alright, let the relaxation go now and pick out a real life situation from your past that involves a great deal of anxiety, fear, uncertainty, dread or awfulness. The scene must be useful to you in calling up and reliving feelings of anxiety and fearfulness ... just decide on any scene that helps you create a very anxious state. Begin to visualize the anxiety scene now. Use any image, sound or bodily sensation that helps you recreate the anxious or fearful feelings. Try to visualize it clearly ... be in it and let the sensations become more intense ... feel your heart starting to pound and your breathing becoming very shallow and irregular ... palms beginning to sweat and your stomach becoming jittery ... As the scene becomes clearer and clearer notice the various bodily sensations you use to express your anxiety ... the muscles becoming tight and tense ... your stomach feels like it has a knot in it ... your mouth feels dry ... just notice all the bodily changes that occur as the anxiety increases and spreads throughout your entire body. Don't stop yourself from feeling more and more fear and anxiety ... just let yourself experience the feelings that are associated with the anxiety scene. Experience the scene vividly and be n it ... Feel the discomfort of your body ... how rapidly you are breathing and how hard your heart is pounding ... the tight muscles ... the panicky helpless feelings ... let the feelings of anxiety reach a high peak as you visualize the scene ... let the anxiety reach such an intense point that you feel you have no control over it ...

The anxiety induction was terminated by asking each subject to let the anxiety scene fade away and by using the anxiety control cue and relaxation. The anxiety cotrol procedure presented was as follows:

> Now take in a deep breath, hold it for a moment ... slowly exhale ... and relax ... good. Switch back to relaxing now ... first let the anxiety scene fade away

> ... just sweep the scene away and focus only on reachieving the comfortable feelings of relaxation ... focus on the refreshing feelings of relaxation that spread throughout your entire body ... the forehead and scalp, smooth out ... the arms, comfortably heavy ... spread the relaxation to all the facial muscles, muscles of the back ... and allow the relaxation to flow into the muscles of the stomach, waist ... trunk, legs, thighs, and right down to your feet. Attend to your own breathing now ... notice how the rhythmic patterns of your own breathing serves to increase the feelings of tranquility and well being ... as you attend to your own breathing notice how comfortable the chest area becomes as feelings of relaxation spread across the chest and down into the stomach area ... the upper portion of your body becomes comfortably heavy and very relaxed ... Just let the same good feelings spread down into the legs ... the thighs, calves, ankles, and feet, so that the entire body is bathed in feelings of relaxation and inner tranquility ...
>
> As you enjoy this state of inner calm note that you achieved this yourself ... with comfort and relaxation ... enjoy these feelings for a few moments ... You can become twice as relaxed as you are by merely taking in a deep breath and slowly exhaling.

After returning the subjects to a relaxed state they were aroused and interviewed for 10 to 15 minutes to ascertain that an anxious scene was, in fact, visualized and that all subjects were able to return to a state of relaxation with the use of the anxiety control cue. Following the brief interview period the subjects were given the following set of instructions:

> Notice how the relaxation can be achieved again after you have become anxious ... and think about how enjoyable and pleasant those feelings of relaxation are ... Now we will be relaxing again and visualizing a scene we'll call the 'success scene' ... a situation in which you felt anxiety but were not overwhelmed and were able to go on and succeed at what you were trying to accomplish ...

Once again the subjects were relaxed using interim directions and were asked to visualize a success scene. The directions presented were as follows:

> Now recall a scene or situation from your past life in which you experienced real feelings of success ... it should involve such things as facing a difficult challenge and meeting it successfully ... it might be small to someone else, but it was important to you ... it may involve some feelings of anxiety or apprehension but they didn't overwhelm you ... rather you mastered them ... you should pick one situation that will help you develop and maintain certain feelings of success ... of mastery of the situation ... self-confidence ... competence ... the ability to face a difficult situation and handle it very well. Let the scene develop ... begin to put yourself into the scene ... really live it ... and focus in on the feelings of success, satisfaction, competence ... just experience these feelings for a moment and enjoy them ... now let the scene fade away ... your mind becomes blank ...

Subjects were then interviewed to ascertain that a success scene was visualized. The remainder of session two was made up of additional visualization training and practice at switching fromone type of scene to another. The order of the scene switching practice was as follows: 1) anxiety scene; 2) anxiety control and pleasant scene; 3) success scene; 4) anxiety scene; 5) anxiety control and pleasant scene; and 6) success scene. The switching practice sequence was repeated two more times. Following the last success scene subjects were given the following set of instructions:

> As you attend to these feelings, focus on the ease with which you have been able to achieve relaxation and

> calmness within yourself ... you have been able to dispel all feelings of tension in your body ... and replace them with feelings of inner calm and relaxation with the pleasant scene and the success scene ... you have mastered your own inner tension ... enjoy the feelings of accomplishment ... let these feelings develop fully ... a sense of mastery over your own personal feelings ... focus on these feelings and enjoy them for a moment longer.

All subjects were encouraged to practice the deep muscle relaxation at home at least three times per week. A cassette tape with recorded relaxation instructions was given to each subject. Session two was then terminated.

Sessions three and four of AMT Treatment were the same. The subjects were relaxed by the interim directions and, while in a relaxed state they were presented the following sequence of visualization with physiological cues: 1) anxiety scene; 2) anxiety control and pleasant scene; and 3) success scene. The sequence of scenes was repeated three times with the session ending after the third presentation of the success scene. Emphasis was placed on physiological cues for both anxiety and relaxation as well as for clarity of imagery. Also during sessions three and four more emphasis was placed on the subjects increasing ability to use the anxiety control cue to reduce feelings of anxiety. At the end of session three, subjects were asked to begin making use of the control cue in their daily lives by attempting to identify their anxiety at lower levels and using the AMT technique to control it.

A copy of the complete script can be found in Appendix K.

CHAPTER III

RESULTS

Study I

Scores on the major dependent measures can be found in Tables 2, 3 and 4 respectively. Mean values of the measures as well as their standard deviations (in brackets) are presented.

Urine Glucose (Diastix)

As can be seen from Table 2, all subjects showed mean urine glucose values of ½ percent or higher during the baseline phase. By the end of the A-C phase the mean urine glucose values had declined slightly except for one subject (E) whose mean urine glucose value rose somewhat. By the end of the AMT phase all subjects exhibited considerable decreases in their mean urine glucose values.

The results of each subjects' daily urine test results were subjected to statistical analysis through the use of the TMS (Time Series Experiments) computer program (Bower, Padia & Glass, 1974). TMS provides an inferential statistical analysis of intervention effects by means of a two-stage application of the program modules CORREL and TSX. From the output of CORREL, an identification of a stochastic model

Table 2

MEAN URINE GLUCOSE (DIASTIX) VALUES (%)

Subject	Phase		
	Baseline	A-C	AMT
A	.56 (.20)	.44 (.14)	.26 (.10)
B	1.20 (.41)	.98 (.30)	.61 (.33)
C	1.10 (.33)	.91 (.14)	.72 (.20)
D	1.24 (.41)	.92 (.38)	.48 (.26)
E	.80 (.24)	.88 (.20)	.59 (.26)

Bracketed values indicate standard deviation

appropriate for the time series is made. The time-series data is subjected to a correlogram and partial autocorrelation analysis. Once the model has been identified its indices are entered with the original data into the TSX module. The data are then transformed to eliminate the effect of all previous error terms and observations, thus changing each data point into the form of the general linear model. Output consists of values of theta ranging from +1 to -1, a residual error variance for each value of theta, an estimate of the true level of the series at time 0 (zero) and an accompanying t-statistic and an estimate of the change in level due to intervention in the series and a t-statistic for testing the significance of the difference of the estimate from 0 (zero).

Because of the single subject multiple baseline design, each subject's scores were unable to be collapsed to arrive at a group score. Therefore, t-tests on each subject's daily urine test results were performed. The test results revealed statistically non-significant differences between the baseline and A-C phases for all five subjects, but statistially significant differences between baseline and AMT phases and A-C and AMT phases for all subjects.

From Table 2 it can be seen that during the baseline phase, subject A's mean urine glucose test value stood at .56%, falling to .44% during the A-C phase and to .26% during the AMT phase. Differences between the baseline and A-C

phases were not statistically significant. Differences between the baseline and AMT phases were found to be statistically significant (t=-3.36, df=134, $p < 0.01$). Significant differences were also found between the A-C and AMT phases (t=-3.90, df=127, $p < 0.01$). Inspection of Figure 1 depicts these differences graphically. It also appears that during the baseline and A-C phases there is more variance compared to that exhibited in the AMT phase. Inspection of the standard deviations found in Table 2, seem to bear out this observation.

Figure 2 illustrates subject B's test results. Her mean urine glucose levels were 1.20% during baseline, .98% during the A-C phase and .61% during the AMT phase. Differences between the baseline and A-C phases were not statistically significant. Significant differences were found however between he baseline and AMT phases (t=-4.56, df=119, $p < 0.01$). As can be seen from Table 2 variance in the A-C phase was slightly reduced from the baseline phase but was elevated in the AMT phase.

Subject C's mean urine glucose level during baseline was 1.10%, falling to .91% during the A-C phase and to .72% during the AMT phase. This can be seen in Figure 3. The difference between baseline and A-C phases was not found statistically significant. Differences between the baseline and AMT phases were reliably different (t=-6.46, df=96, $p < 0.01$). Significant differences were also found between

Figure 1

SUBJECT A. - DAILY MEAN URINE GLUCOSE LEVELS
(DIASTIX METHOD)

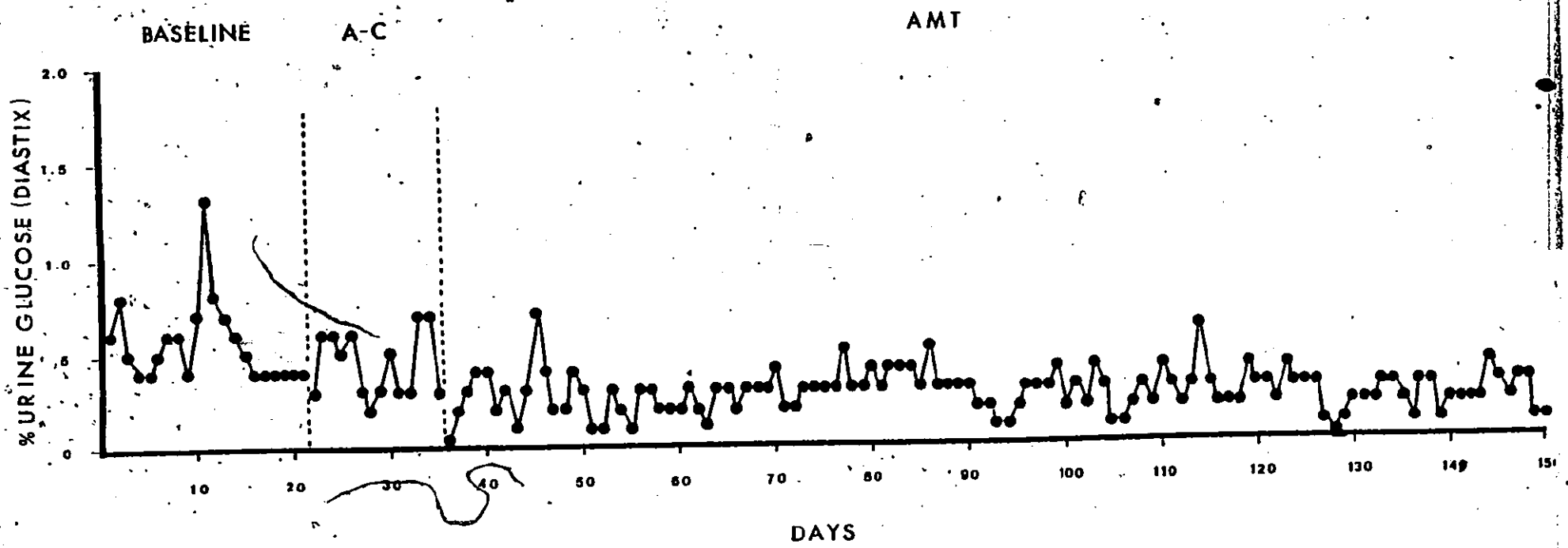

BASELINE
A-C
AMT
% URINE GLUCOSE (DIASTIX)
2.0
1.5
1.0
0
10
20
30
40
50
60
70
80
90
100
110
120
130
DAYS

Figure 2

SUBJECT B. DAILY MEAN URINE GLUCOSE LEVELS
(DIASTIX METHOD)

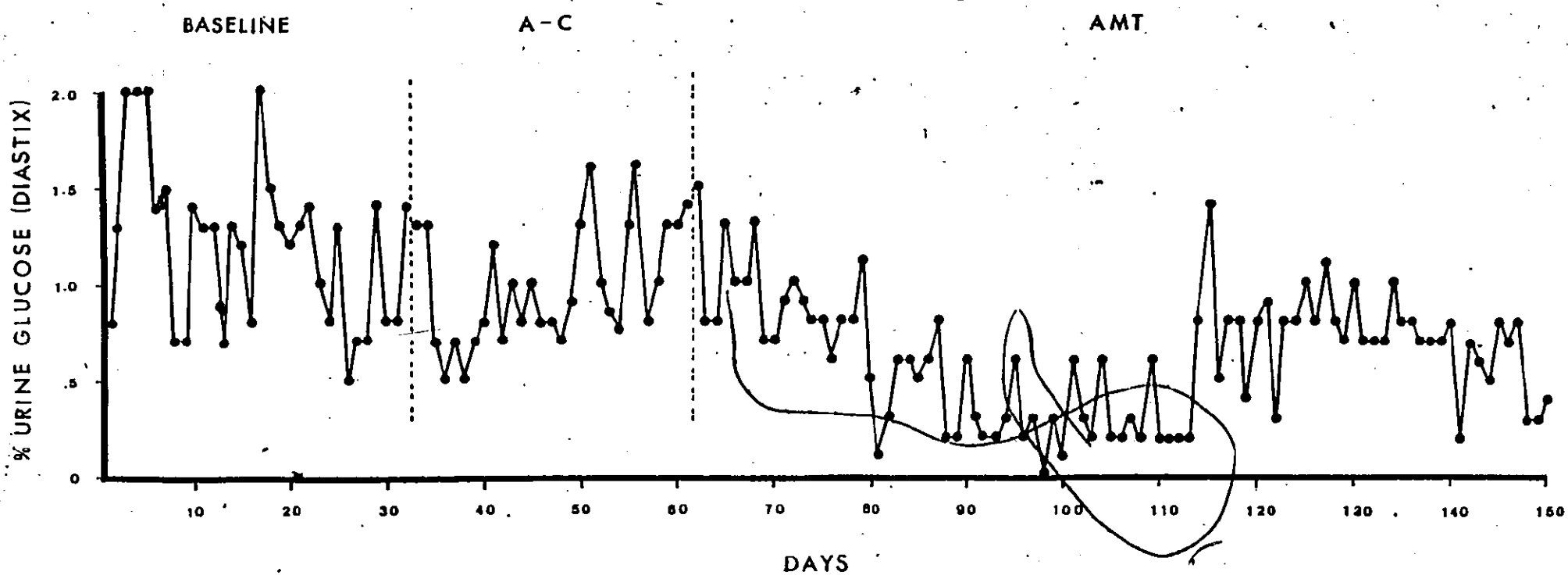
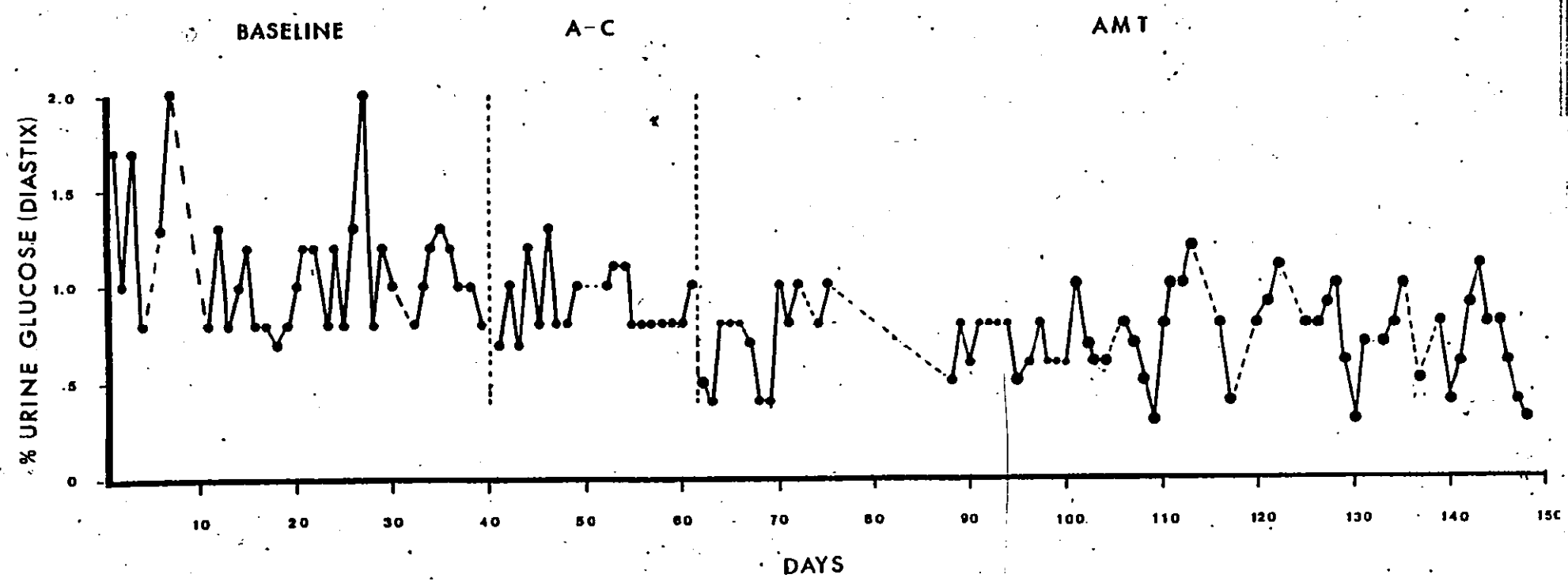

BASELINE
A-C
AMT
% URINE GLUCOSE (DIASTIX)
2.0
1.5
1.0
.5
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
DAYS

Figure 3

SUBJECT C. DAILY MEAN URINE GLUCOSE LEVELS
(DIASTIX METHOD)
DOTTED LINES INDICATE PROJECTIONS DUE TO MISSING DATA


BASELINE
A-C
AMT
% URINE GLUCOSE (DIASTIX)
2.0
1.5
1.0
.5
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
DAYS

the A-C and AMT phases (t=3.08, df=81, $p < 0.01$). Variances were reduced from the baseline phase in both the A-C and AMT phases (see Table 2).

Graphical illustration of subject D's urine test results can be seen in Figure 4. Subject D's mean urine glucose level during baseline was 1.24%. This decreased to .92% during the A-C phase and to .48% during the AMT phase. Non-significant differences were found between the baseline and A-C phases. However, the difference between the baseline and AMT phases was statistically significant (t=-9.04, df=125, $p < 0.01$) as was the difference betweenthe A-C and AMT phases (t=-4.43, df=95, $p < 0.01$). As in the previous subjects, variances in both the A-C and AMT phases were reduced from the baseline phase with the AMT phases sharing the largest reduction in variance (see Table 2).

Figure 5 illustrates subject E's urine test results. Subject E's mean urine glucose value during baseline stood at .80%. During the A-C phase this increased to .88% but during the AMT phase it dropped to .59%. Differences between the baseline and A-C phases were not found to be statistically significant. Differences between the baseline and AMT phases were found to be statistically significant (t=4.02, df=117, $p < 0.01$). Significant differences were also found between the A-C and AMT phases (t=4.27, df=86, $p < 0.01$). From Table 2 it can be seen that the variances were not appreciably reduced across phases. In fact, there was a slight increase

Figure 4

SUBJECT D. DAILY MEAN URINE GLUCOSE LEVELS
(DIASTIX METHOD)
DOTTED LINES INDICATE PROJECTIONS DUE TO MISSING DATA

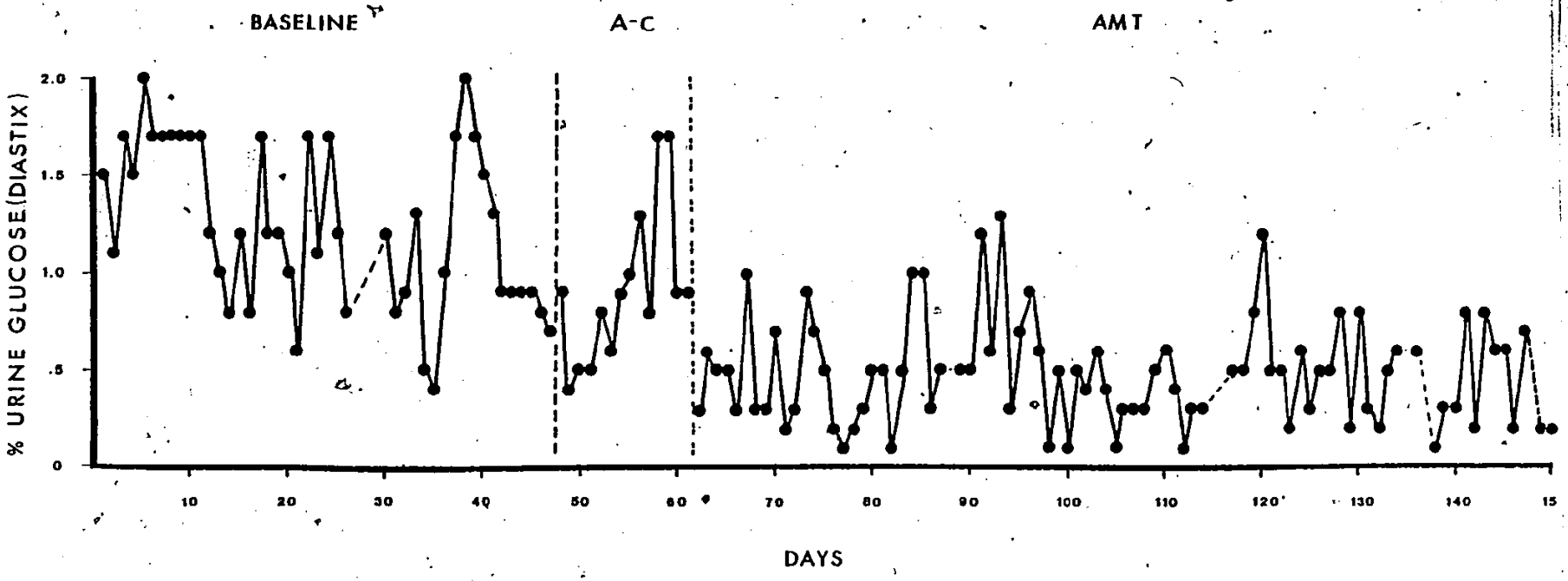
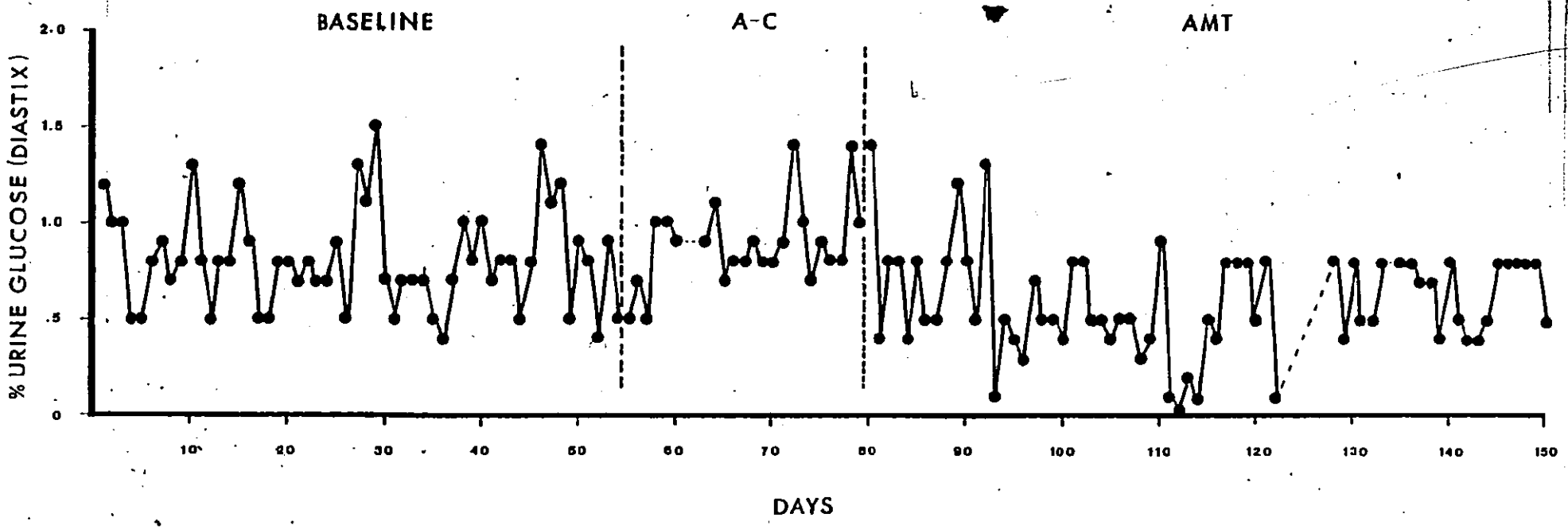

BASELINE
A-C
AMT
% URINE GLUCOSE(DIASTIX)
2.0
1.5
1.0
.5
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
15
DAYS

Figure 5

SUBJECT E. DAILY MEAN URINE GLUCOSE LEVELS
(DIASTIX METHOD)
DOTTED LINES INDICATE PROJECTIONS DUE TO MISSING DATA


BASELINE
A-C
AMT
% URINE GLUCOSE (DIASTIX)
2.0
1.5
1.0
.5
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
DAYS

in variance in the AMT phase in relation to that in the baseline phase.

24 Hour Fractionated Urine Glucose

As can be seen from Table 3, the results of the 24 hour urine glucose collection are not as consistent across subjects as the daily urine test results. This may be due in part to the frequency of missing data or the random application of the tests themselves, even though done on a weekly basis for twenty-one weeks. In addition, the variances across phases for each subject appear to vary in magnitude partially due to the small number of observations across phases and partially due to the lability of the degree of diabetic control each subject exhibited. Because of the small number of observations within each phase for each subject, statistical analyses using the TMS program were not able to be performed. In addition, due to the time series nature of the design, no other inferential statistical model could be used. Therefore only means and standard deviations as well as graphical analyses will be presented.

Table 3 and Figure 6 illustrate subject A's results. During the baseline phase her urine test results showed her to be excreting a mean of 117.2 g of glucose/24 hrs. This rose by 31.3% to 154 g during the A-C phase but dropped by 52.7% from the A-C phase to 72.8 g during the AMT phase.

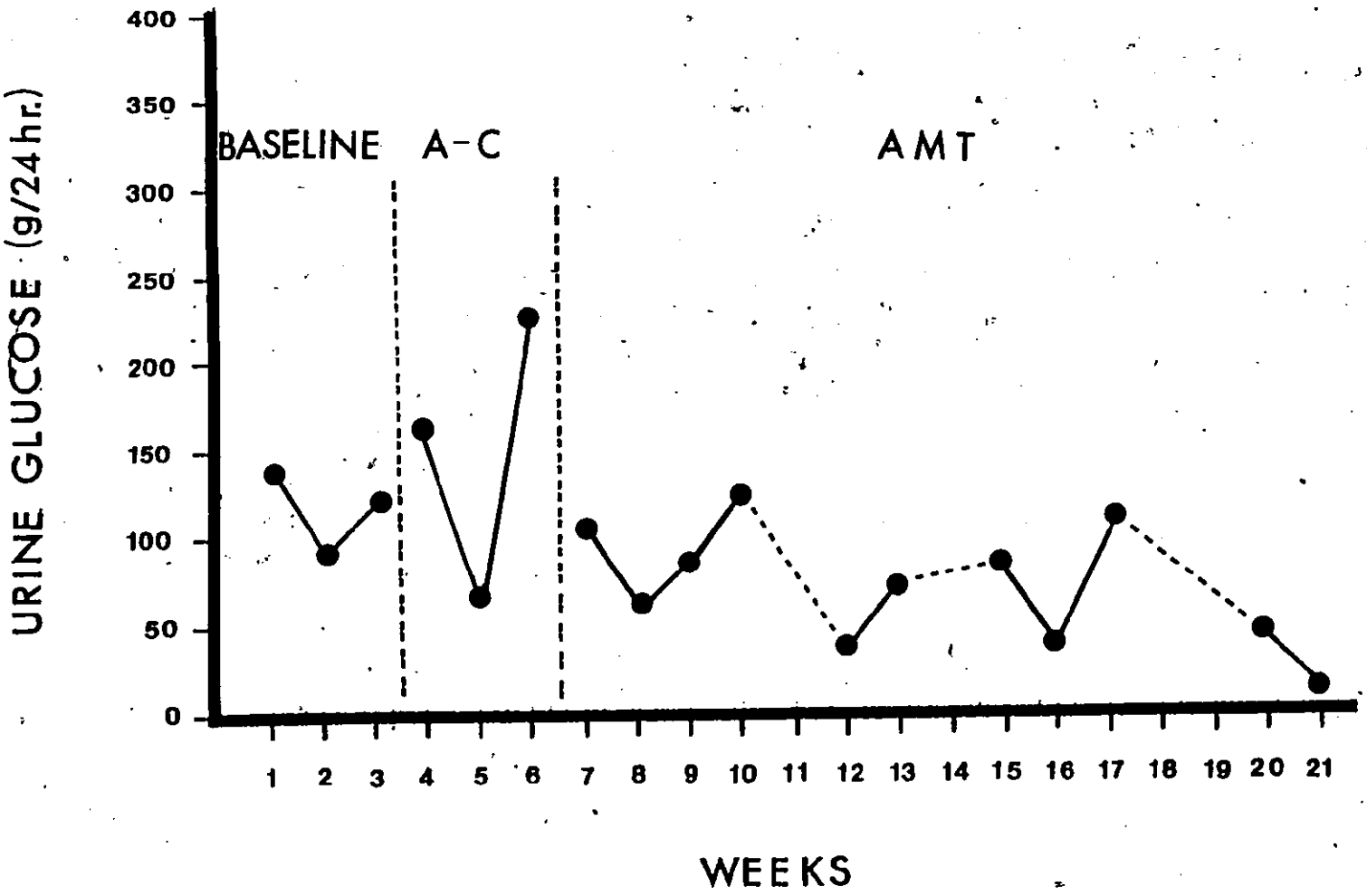
Table 3

MEAN FRACTIONATED URINE GLUCOSE VALUES (g./24 hrs.)

Subject	Phase		
	Baseline	A-C	AMT
A	117.2 (23.4)	154.0 (81.0)	72.8 (34.1)
B	128.5 (10.6)	55.3 (15.6)	70.0 (36.1)
C	104.9 (37.9)	151.2 (24.0)	125.3 (47.0)
D	158.0 (82.7)	104.0 (96.1)	61.0 (35.3)
E	79.7 (27.0)	123.2 (17.5)	38.2 (26.1)

Figure 6

SUBJECT A. WEEKLY FRACTIONATED URINE GLUCOSE VALUES
DOTTED LINES INDICATE PROJECTIONS DUE TO MISSING DATA


URINE GLUCOSE (g/24 hr.)
400
350
300
250
200
150
100
50
0
BASELINE
A-C
AMT
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21
WEEKS

Her variance was highest during the A-C condition and lowest during the baseline phase.

Table 3 and Figure 7 illustrate subject B's results. Unfortunately, only two observations were gained in the baseline condition for a mean value of 128.5 g glucose/24 hr. period. However, the variance was quite low lending somewhat more credibility to the scores. During the A-C condition only three observations were gained for a mean value of 55.3 g. Again the variance was low. In the AMT phase subject B's score rose by 26.5% to a mean value of 70.0 g averaged over nine observations. The variance was somewhat higher however than the other two conditions.

Table 3 and Figure 8 illustrate subject C's results. She was found to be excreting 109.9 g of glucose/24 hrs. during the baseline phase. This increased to 151.2 g during the A-C phase, an increase of 49.1%, but decreased to 125.3 g during the AMT phase although this was still higher than the baseline level. The variances across all three phases were moderately high suggesting little influence of the AMT on the dependent measure.

Subject D's test results are seen in Table 3 and Figure 9 show a consistent decrease in the amount of glucose excreted across phases. During the baseline phase she excreted a mean of 158 g over six observations with high variability. Within the A-C phase her mean glucose output dropped to 104 g, a decrease of 34.1%. However, high

Figure 7

SUBJECT B. WEEKLY FRACTIONATED URINE GLUCOSE LEVELS
DOTTED LINES INDICATE PROJECTIONS DUE TO MISSING DATA

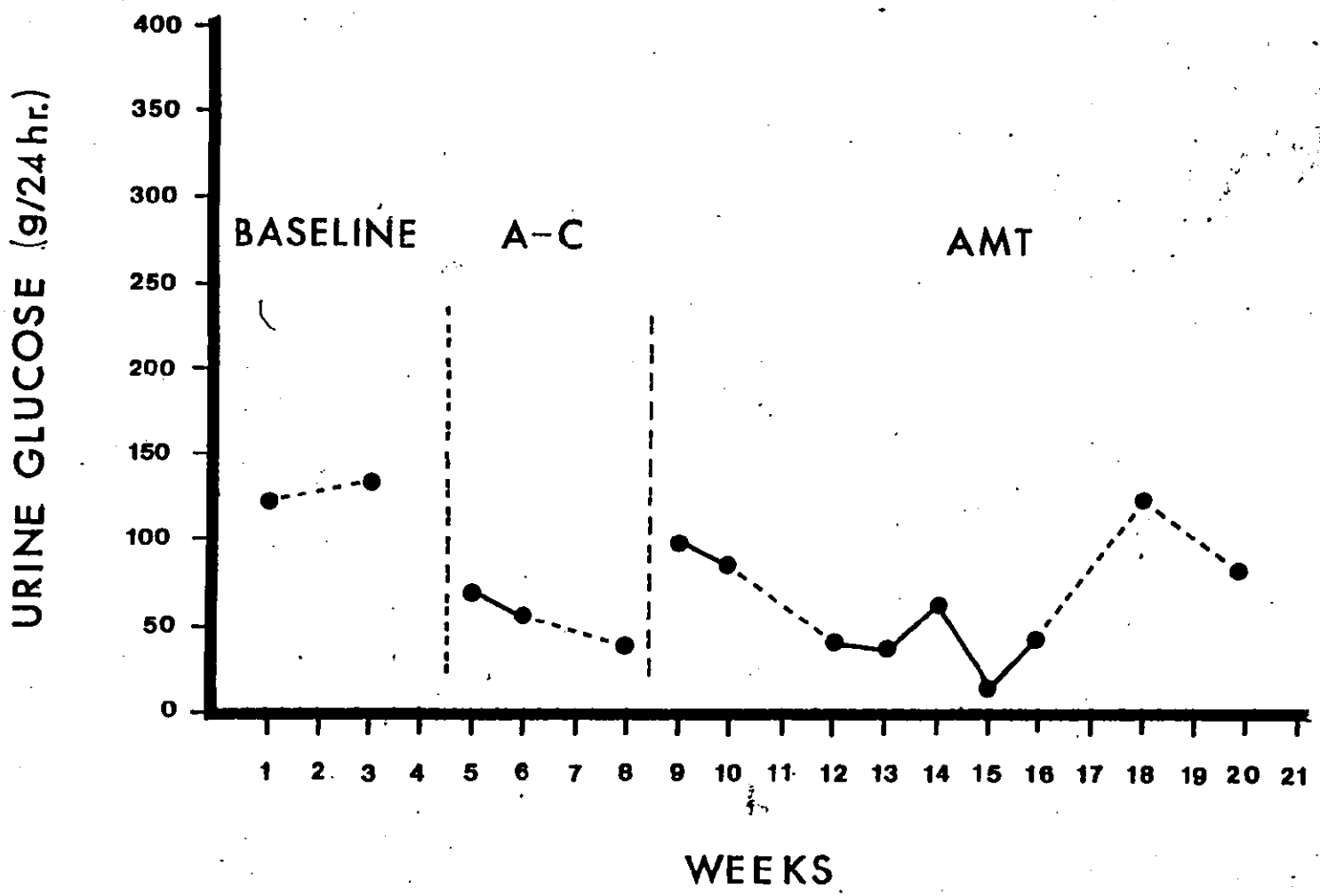

URINE GLUCOSE (g/24 hr.)
400
350
300
250
200
150
100
50
0
BASELINE
A-C
AMT
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21
WEEKS

Figure 8

SUBJECT C. WEEKLY FRACTIONATED URINE GLUCOSE LEVELS
DOTTED LINES INDICATE PROJECTIONS DUE TO MISSING DATA

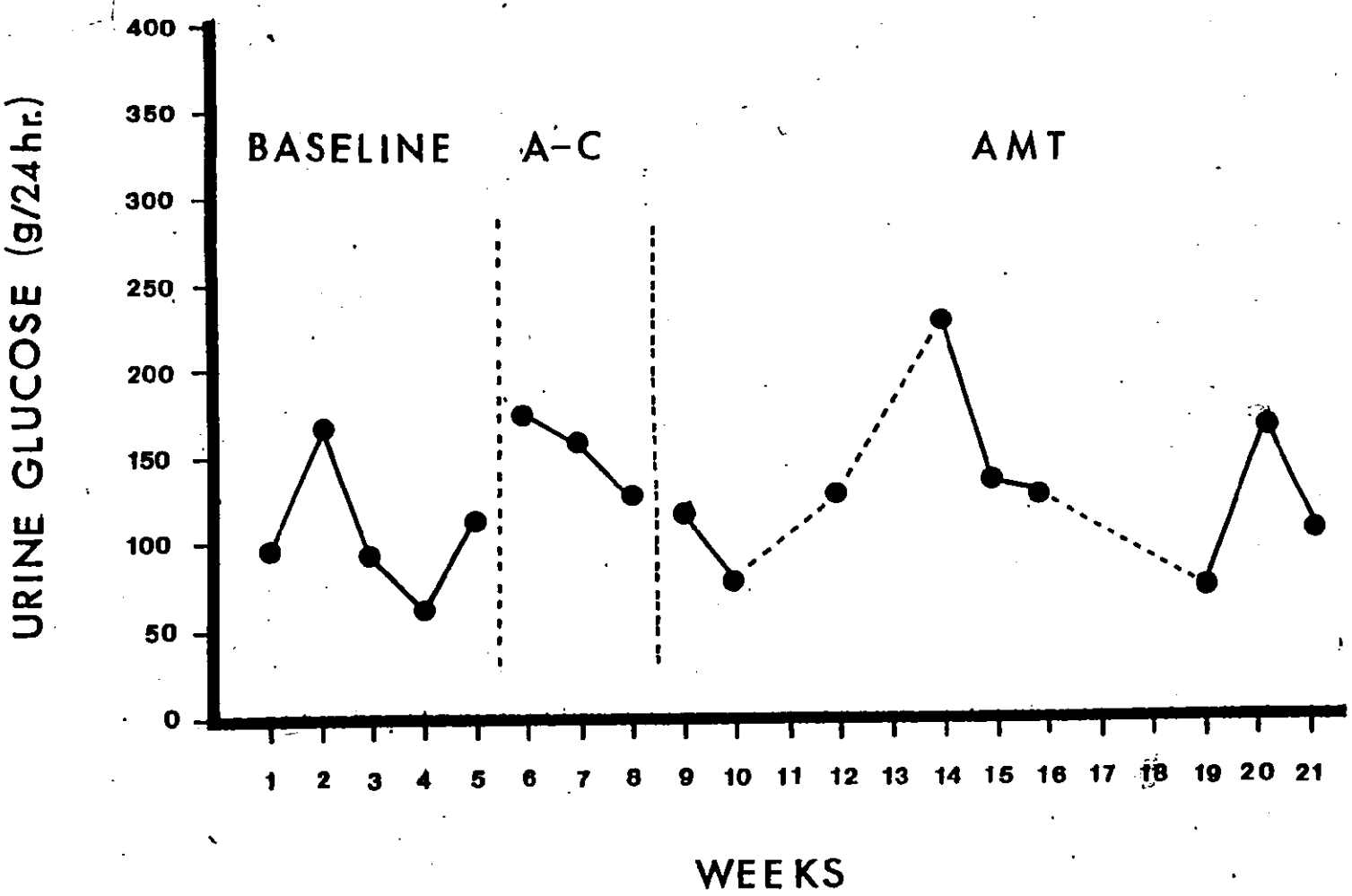
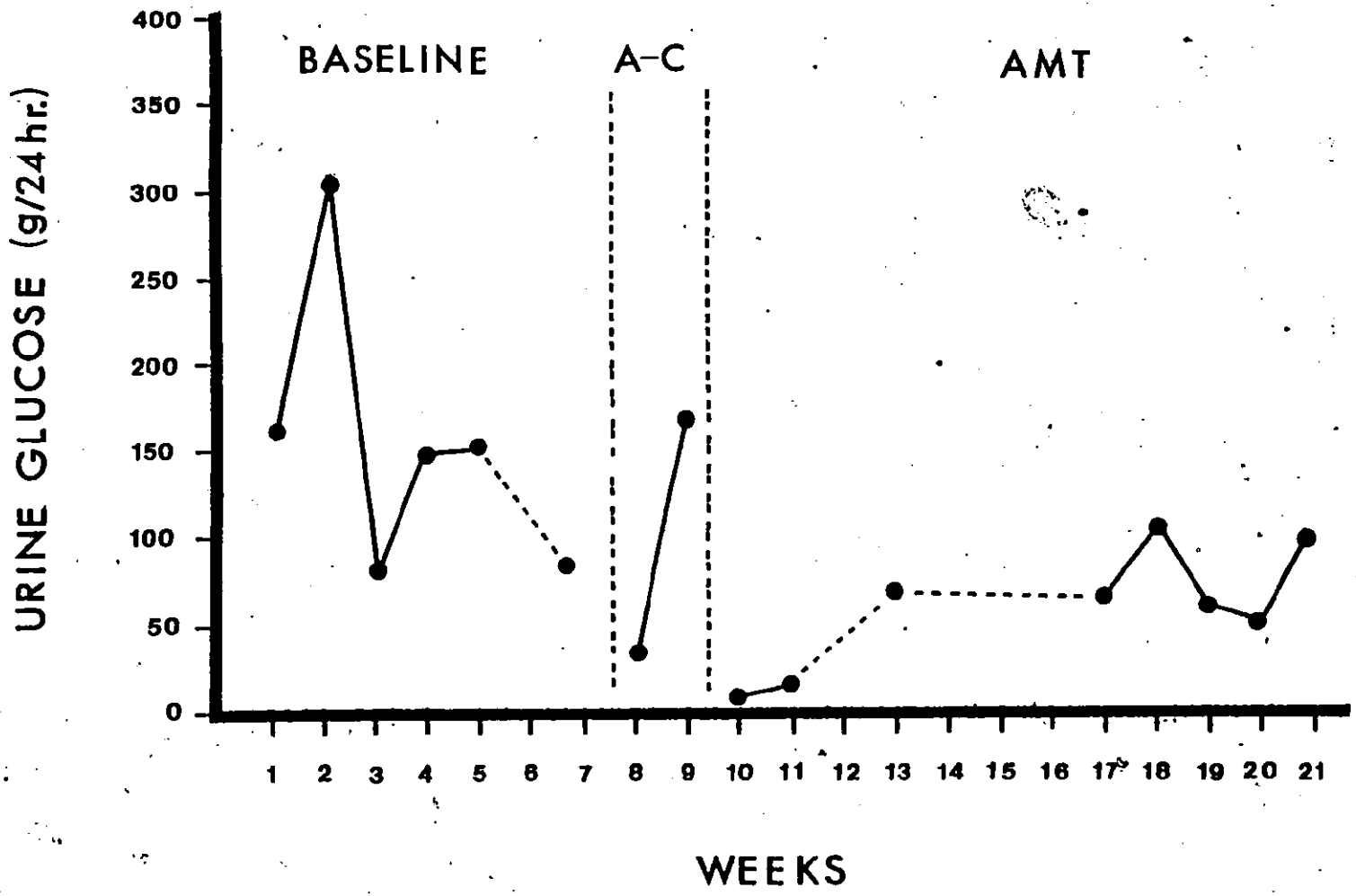

URINE GLUCOSE (g/24 hr.)
400
350
300
250
200
150
100
50
0
BASELINE
A-C
AMT
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21
WEEKS

Figure 9

SUBJECT D. WEEKLY FRACTIONATED URINE GLUCOSE LEVELS
DOTTED LINES INDICATE PROJECTIONS DUE TO MISSING DATA


BASELINE
A–C
AMT
URINE GLUCOSE (g/24 hr.)
400
350
300
250
200
150
100
50
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21
WEEKS

variability over only two observations tend to obscure the results. A mean glucose level of 61 g or a decrease of 41.3% during the AMT phase with moderate variability tends to suggest a more consistent decreased level of glucose output. While it appears that the AMT exerted substantial influence on both the variation and magnitude of glucose levels compared to the A-C phase the results must be cautiously interpreted for as mentioned there were only two observations with high variability in this phase.

Subject E's results can be seen in Table 3 and Figure 10. During the baseline phase she produced a mean of 79.7% g of glucose/24 hrs. This rose by 54.5% to a mean of 123.2 g during the A-C condition and dropped by 68.9% to a mean of 38.2 g during the AMT phase. In addition to this decrease, variability across all phases was consistent suggesting tht the treatment may have had a substantial influence on the dependent measure.

Multifactorial Scale of Anxiety

Because of the small number of observations within each phase for each subject and the time series nature of the design, inferential statistical procedures could not be used to analyze the results. Insted, graphical inspection of the data as well as mean scores and their standard deviations will be presented.

Figure 10

SUBJECT E. WEEKLY FRACTIONATED URINE GLUCOSE LEVELS
DOTTED LINES INDICATE PROJECTIONS DUE TO MISSING DATA

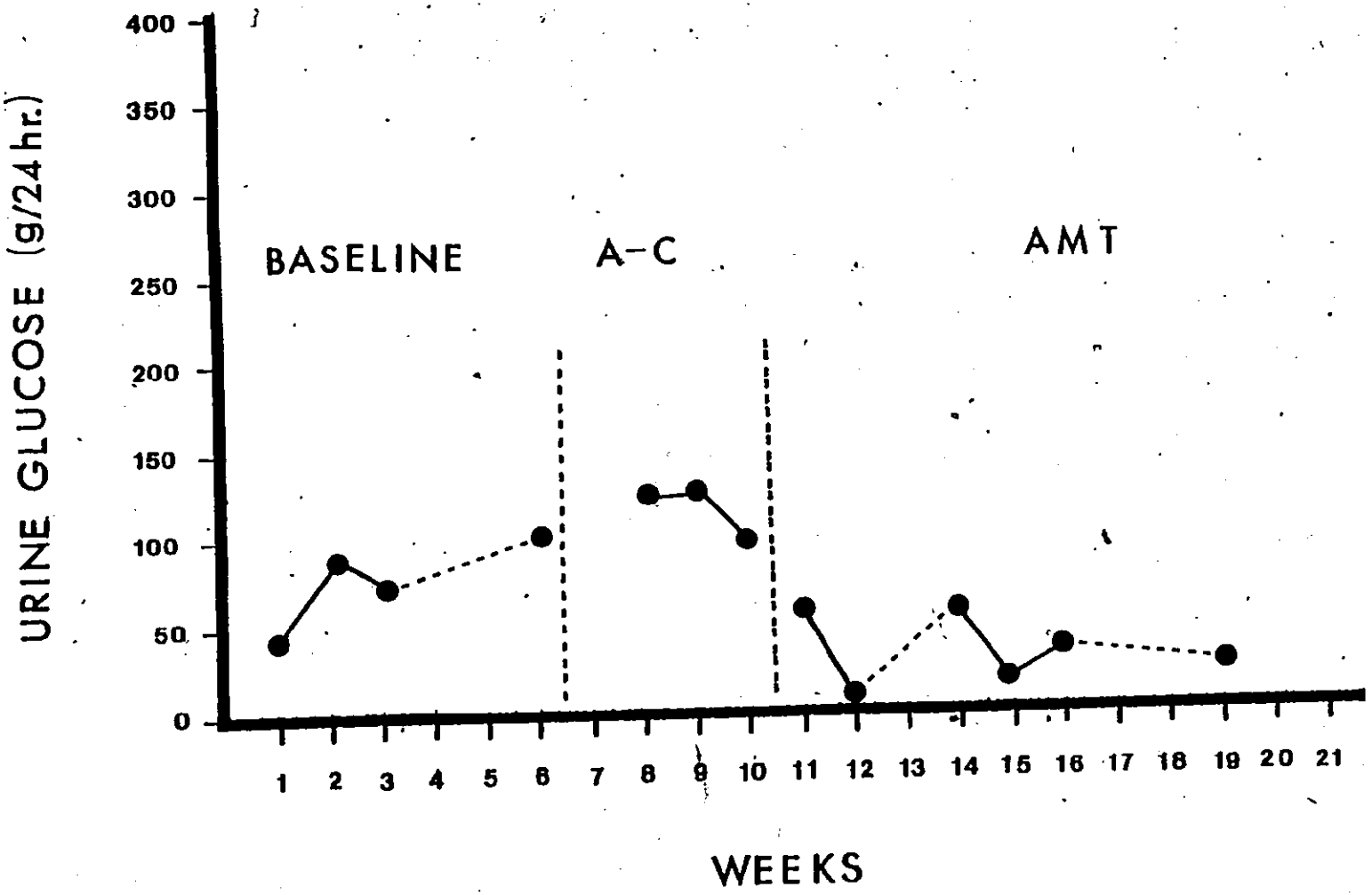

URINE GLUCOSE (g/24 hr.)
400
350
300
250
200
150
100
50
0
BASELINE
A-C
AMT
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21
WEEKS

Figure 11 and Table 4 illustrate subject A's results. As can be seen during the baseline phase her mean AA score stood at 2.30, rose to 2.40 during the A-C phase and further rose to 2.45 during the AMT phase. The mean MT score stood at 2.15 during the baseline phase, decreased to 1.80 during the A-C phase, but rose to 2.27 during the AMT condition. The same pattern occurred in the mean FI score as the baseline score stood at 3.45, decreased to 3.10 during the A-C phase, but rose to 3.40 during the AMT phase. Low or nonexistant variances were found across phases except for a moderate variance of the FI score in the AMT phase. These results suggest that the AMT procedure did not have any appreciable effect on reducing subjective feelings of anxiety.

Figure 12 and Table 4 depict subject B's scores. No major differences were found across the baseline (1.75) or A-C (1.65) phases mean scores on the AA scale. A somewhat lower mean score (1.25) was seen however in the AMT phase. Unfortunately only four observations were gained in this phase as the results of the remaining six weeks were accidently misplaced by the subject and could not be found. Again, variance was low on these scores. On the MT scale subject B's mean baseline score (1.50) was slightly higher than her mean scores in either the A-C (1.25) or AMT (1.25) phases. On the FI scale, an increase in both the A-C and AMT phase scores was found compared to baseline. Subject B's

Table 4

MULTIFACTORIAL SCALE OF ANXIETY (MEAN SCORES)

SUBJECT	Phase								
	Baseline			A-C			AMT		
	Autonomic Arousal	Muscle Tension	Feelings of Insecurity	Autonomic Arousal	Muscle Tension	Feelings of Insecurity	Autonomic Arousal	Muscle Tension	Feelings of Insecurity
A	2.30 (0.0)	2.15 (0.0)	3.45 (0.0)	2.40 (0.0)	1.80 (0.0)	3.10 (0.0)	2.45 (.17)	2.27 (.27)	3.40 (.41)
B	1.75 (0.0)	1.50 (.14)	2.40 (.28)	1.65 (.21)	1.25 (.21)	2.50 (0.0)	1.25 (.19)	1.25 (.10)	1.55 (.10)
C	3.06 (0.0)	2.20 (.17)	3.06 (.23)	3.30 (.28)	2.65 (.35)	3.45 (.21)	3.31 (.24)	2.65 (.34)	3.75 (.27)
D	1.57 (.25)	1.17 (0.0)	1.70 (.16)	1.30 (0.0)	1.10 (0.0)	1.70 (0.0)	1.26 (.13)	1.02 (0.0)	1.56 (.13)
E	2.48 (.35)	2.08 (.45)	2.94 (.16)	1.90 (.14)	1.35 (.21)	2.80 (0.0)	1.95 (0.0)	1.70 (0.0)	2.72 (0.0)

Figure 11

SUBJECT A. BIWEEKLY MULTIFACTORIAL SCALE OF ANXIETY SCORES

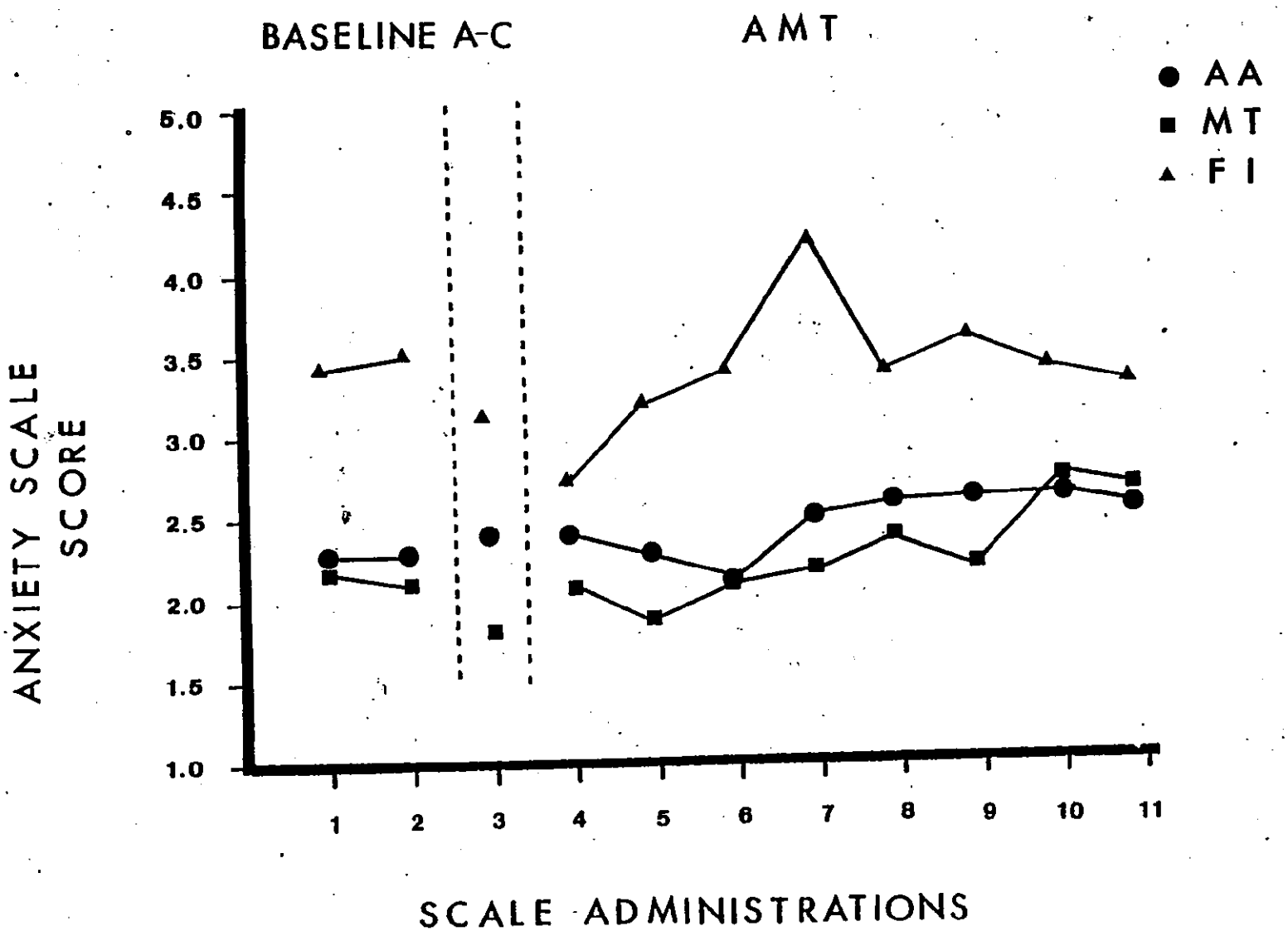
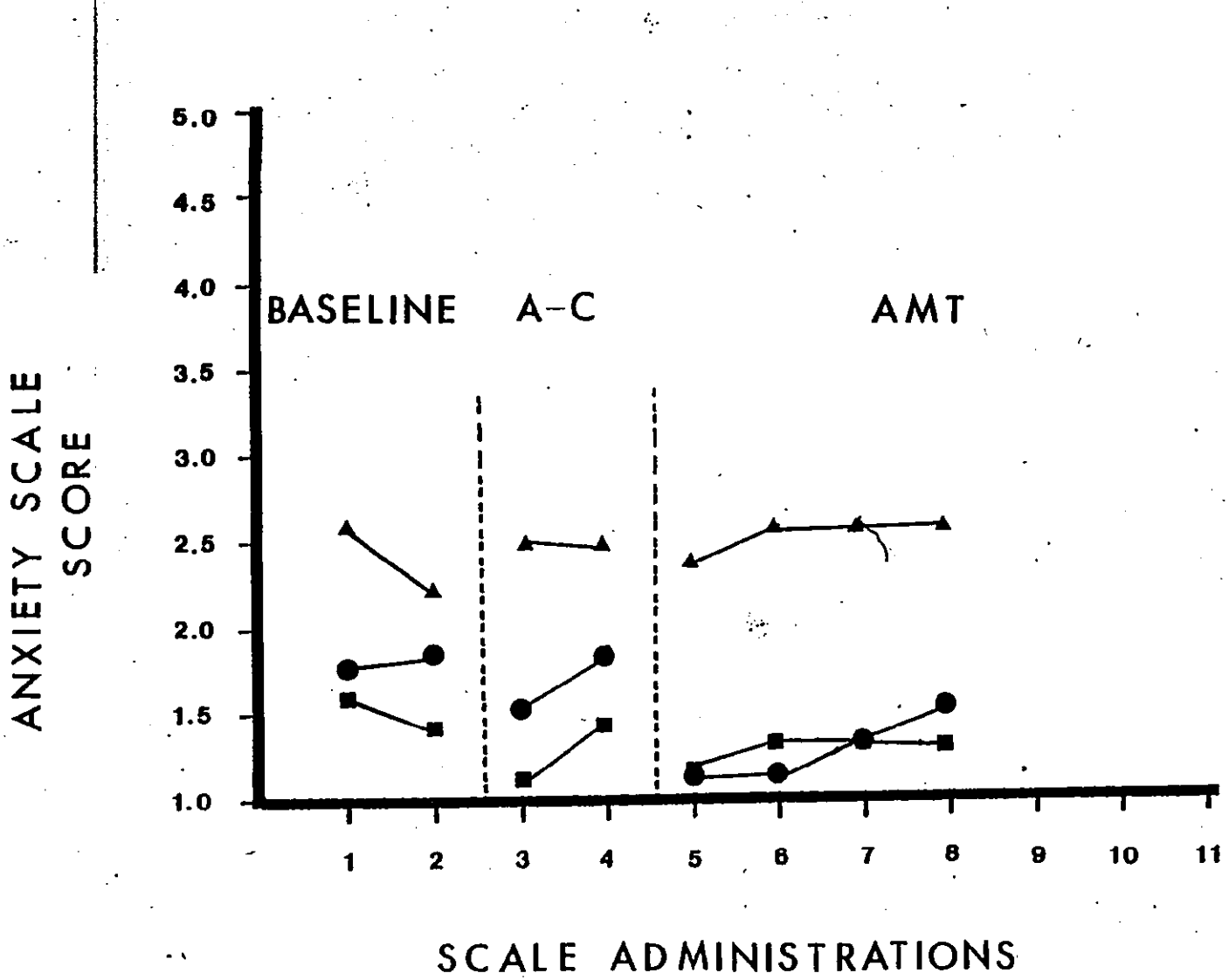

BASELINE A-C
AMT
AA
MT
FI
ANXIETY SCALE SCORE
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
1
2
3
4
5
6
7
8
9
10
11
SCALE ADMINISTRATIONS

Figure 12

SUBJECT B. BIWEEKLY MULTIFACTORIAL SCALE OF ANXIETY SCORES


AA
MT
FI
BASELINE
A-C
AMT
ANXIETY SCALE SCORE
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
1
2
3
4
5
6
7
8
9
10
11
SCALE ADMINISTRATIONS

mean baseline score stood at 2.40 while her mean A-C score increased to 2.50 and her mean FI score increased to 2.55. The score variance was again found to be low across phases. These results tend to suggest only minimal, if any, effects of the AMT procedure on subjectively experienced anxiety levels.

Figure 13 and Table 4 illustrate subject C's scores. On the AA scale, her mean score stood at 3.06 during the baseline phase, 3.30 during the A-C phase and 3.31 during the AMT phase. A similar pattern was found on both the MT and FI scale scores. Her mean baseline phase score on the MT scale stood at 2.20, increasing to 2.65 in the A-C phase and AMT phases. The mean baseline score on the FI scale stood at 3.06, increased to 3.45 during the A-C phase and rose to a high of 3.75 during the AMT phase. Variability was low to moderate. Overall, her test results suggest that the AMT procedure did not exert enough of an effect to override the anxiety she appeared to be experiencing towards the end of the study.

Subject D's test results can be seen in Figure 14 and Table 4. As can be seen, all three scale scores remained low across phases. The mean score for the AA scale during the baseline phase stood at 1.57 decreasing to 1.30 during the A-C phase and further decreasing to 1.26 during the AMT phase. The same pattern existed for the MT scale as her mean score during the baseline phase stood at 1.17, falling to 1.10 during the A-C phase and to 1.02 during the AMT phase.

Figure 13

SUBJECT C. BIWEEKLY MULTIFACTORIAL SCALE OF ANXIETY SCORES

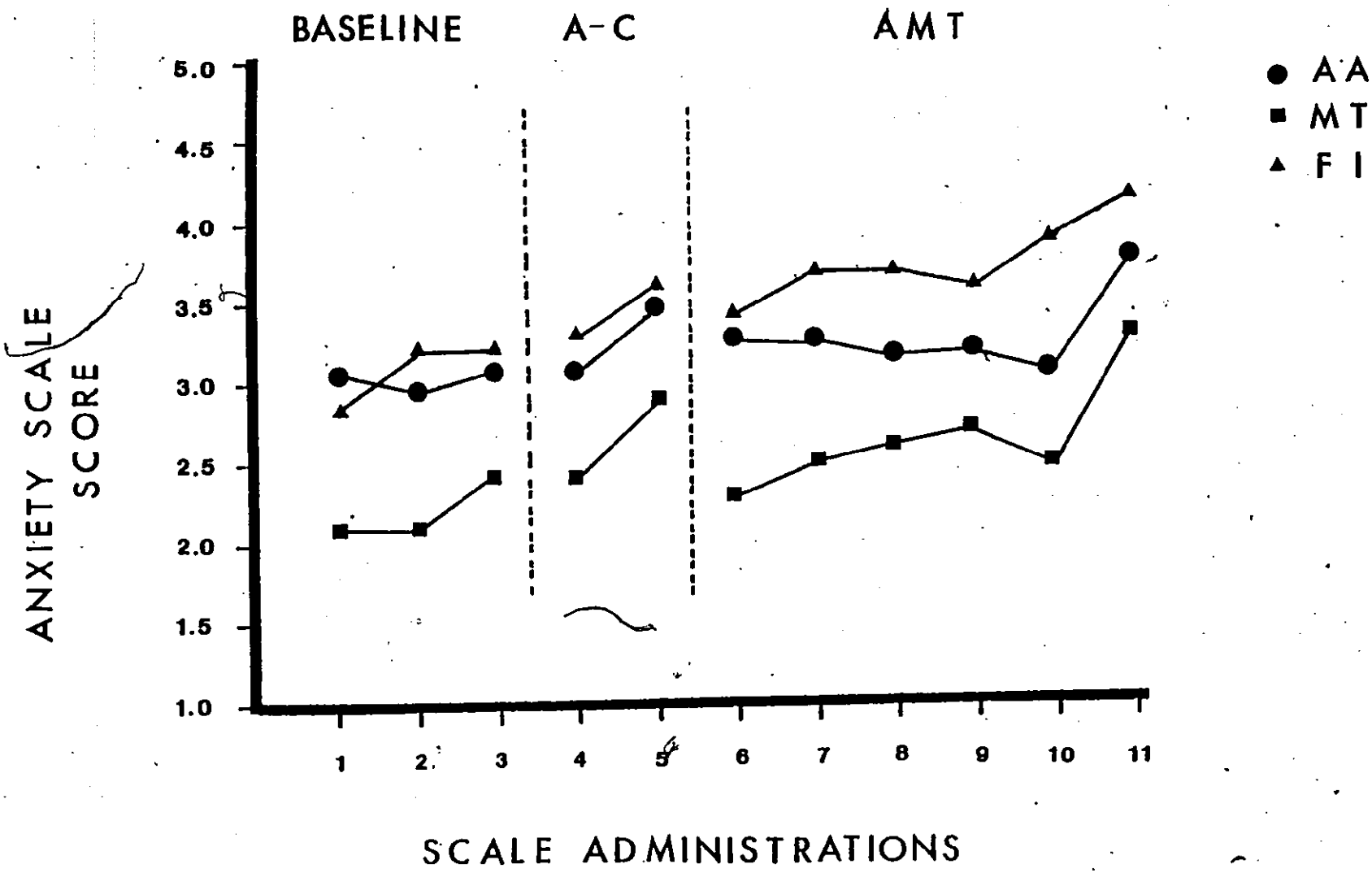
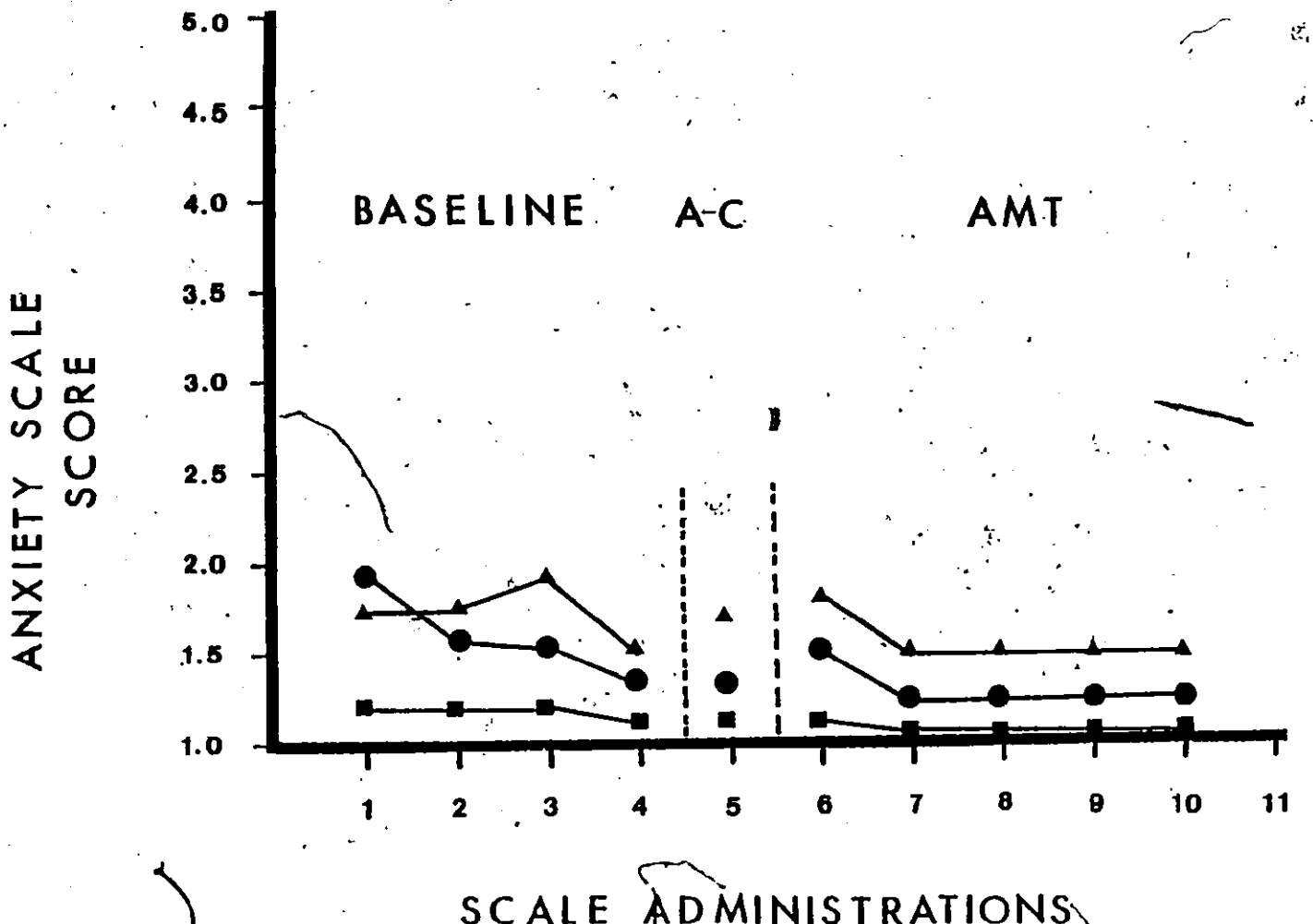

BASELINE
A-C
AMT
AA
MT
FI
ANXIETY SCALE SCORE
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
1
2
3
4
5
6
7
8
9
10
11
SCALE ADMINISTRATIONS

Figure 14

SUBJECT D. BIWEEKLY MULTIFACTORIAL SCALE OF ANXIETY SCORES


ANXIETY SCALE SCORE
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
BASELINE
A-C
AMT
AA
MT
FI
1
2
3
4
5
6
7
8
9
10
11
SCALE ADMINISTRATIONS

During the baseline and A-C phases, her mean FI score stood at 1.70 but fell to 1.56 during the AMT phase. Score variance remained low across phases. The small decreases found here do not appear to suggest that the treatment had any significant effect on the reduction of subjective feelings of anxiety.

Figure 15 and Table 4 depict subject E's scores. During the baseline phase, her mean AA score stood at 2.48, falling to 1.90 during the A-C phase and rising slightly to 1.95 during the AMT phase. Her mean MT score was 2.08 during the baseline phase, falling to 1.35 during the A-C phase and rising again to 1.70 during the AMT phase. The pattern was not repeated for the FI score as her baseline score averaged 2.94, falling to 2.80 during the A-C phase and falling further to 2.72 during the AMT phase. Score variances remained low over the A-C and AMT phases, but were moderately high within the baseline phase. Visual inspection of Figure 15 does not give the impression that the treatment exerted much influence in decreasing the subject's subjective reports of anxiety from either the baseline or A-C phase.

Treatment Credibility

Both the A-C and AMT treatments were rated as moderately to highly credible both at the beginning and completion of their respective treatments (see Table 5). T-tests for

Figure 15

SUBJECT E. BIWEEKLY MULTIFACTORIAL SCALE OF ANXIETY SCORES

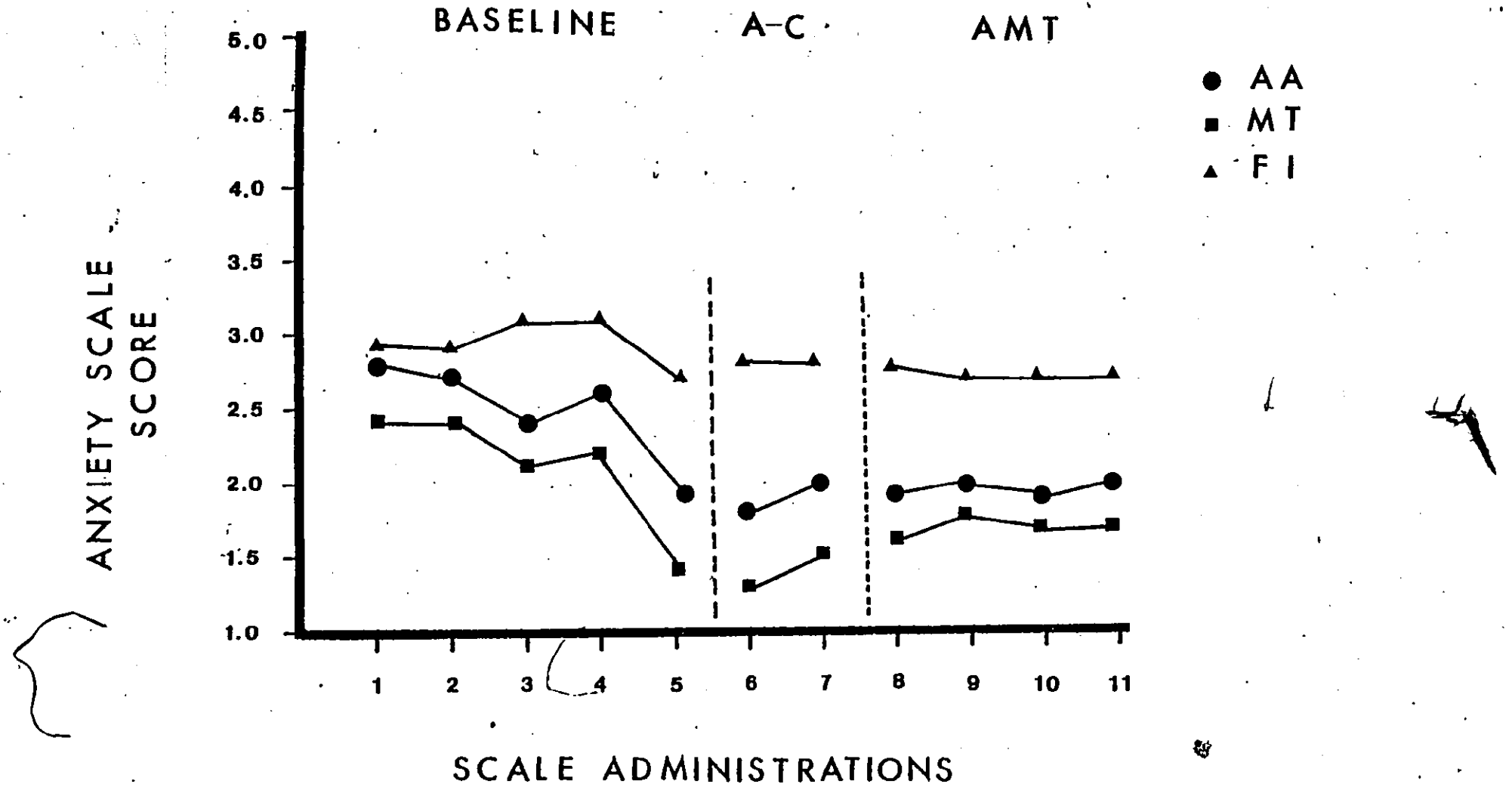

BASELINE
A-C
AMT
AA
MT
FI
ANXIETY SCALE SCORE
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
1
2
3
4
5
6
7
8
9
10
11
SCALE ADMINISTRATIONS

Table 5

TREATMENT CREDIBILITY

Subject	$A\text{-}C_1$	$A\text{-}C_2$	AMT_1	AMT_2	t
A	8.6	8.4	8.8	9.6	-1.66 N.S.
B	8.4	8.4	8.8	8.8	-1.81 N.S.
C	6.4	6.4	5.8	6.4	0.51 N.S.
D	6.8	7.0	7.6	7.8	-2.22*
E	7.0	7.0	7.0	7.6	-1.40 N.S.

* $p < .05$ (two-tailed test)

correlated samples between phases based on the five item ten-point credibility/expectancy for change scales revealed no significant differences for four of the five subjects. Only one subject's differences reached significance (t=-2.22, df=9, $p < 0.05$). Observed differences in treatment outcome cannot be attributed to differences in treatment credibility for the subjects whose credibility scores were not significantly different. For the subject whose credibility scores were significantly different, the possibility exists that this could account for treatment outcome, but in light of the other subject's outcomes, it is likely that this was not a factor.

Reliability

On selected days chosen at random by the experimenter, reliability data for the daily urine glucose tests was obtained by either of the child's parents. The parents were instructed to record on a diary similar to the child's, their child's test results by comparing the color of the reagent strip after being dipped in the child's urine to the color chart on the Diastix package. Reliability checks were to be performed three times per day for seventy-five of the total one hundred and fifty days that the children were in the study. The parents' cooperation in carrying out the reliability checks ranged from a high of 75.3% to a low of

34.3%. As far as the accuracy of urine test results was concerned the results ranged from 100% accuracy to 86.9% accuracy. The accuracy rates were determined by dividing the parents' observation by the child's and then multiplying this by 100. Complete data on both the parents cooperativeness and the reliability of the test results can be found in Table 6.

Compliance With Therapeutic Regimen

Insulin

Insulin levels were set at the beginning of the study and were not changed during the course of the experimental program. The type and dosage of insulin used as well as the time of injection for each subject during the study is shown in Table 7. No formal reliability measures were taken other than the subjects noting the type, dosage and time of injection in the daily diary. In addition, contact with the physician responsible for the care of each child indicated that no changes in insulin intake were ordered during the time the children were in the study.

Diet

Each child who participated in the study met with the

Table 6

COMPLIANCE AND RELIABILITY

Subject	Parents Compliance (%)	Test Reliability (%)
A	75.3	100.0
B	42.8	96.6
C	73.9	100.0
D	34.3	86.9
E	52.1	93.9
GROUP	55.6	95.4

Table 7

INSULIN REQUIREMENTS

Subject	Type	Dosage (units)	Injection Time
A	Lente/Lente Toronto/Toronto	44/20	A.M./P.M.
B	N.P.H. Toronto	54	A.M.
C	Lente Toronto	44	A.M.
D	N.P.H. Toronto	36	A.M.
E	Lente Toronto	45	A.M.

hospital dietician who specified the daily caloric intake tailored to that child's needs. Generally, caloric intake was set so that the children would maintain their present weight or lose a few kilograms. Table 8 depicts the number of calories each child was supposed to take in per day. However, as can be seen in Table 9 dietary compliance was poor in three of the five subjects. Subject C actually gained 3.2 kg. suggesting that she did not follow her diet closely at all. It is interesting to note that she seems to have shown one of the poorest responses insofar as her 24 hr. urine glucose output was concerned as her mean output during the AMT phase was even higher than her mean output during the baseline phase. None of the other subjects showed as poor a response. At the other extreme, subject D, who lost 1.3 kg. showed the greatest decreases from the baseline phase to the AMT phase on both measures of urine glucose excretion decreasing an average of 97 g on the 24 hr. output and .76% on the daily output. Table 10 shows the rank order of weight gain in comparison with mean decreases of urine glucose output for all subjects. Spearmans coefficient of rank correlation found weight gain to be only minimally correlated with daily urine glucose decreases (ρ=.30) but somewhat more highly correlated with 24 hr. urine glucose decreases (ρ=.70). Both values are non-significant. A .70 correlation was found between daily urine glucose decreases and 24 hr. urine glucose decreases. This was not found to be

Table 8

CALORIC INTAKE

Subject	Calories/Day
A	2000
B	2600
C	2000
D	1800
E	1600

Table 9

WEIGHT GAIN/LOSS

Subject	Pre-Study		Post-Study		Net Gain/Loss	
	wt(kg)	ht(cm)	wt(kg)	ht(cm)	wt(kg)	ht(cm)
A	59.8	160.0	61.5	160.0	+1.7	+0.0
B	55.8	162.0	56.8	162.5	+1.0	+0.5
C	70.0	162.5	73.2	162.5	+3.2	+0.0
D	62.2	162.5	60.9	162.5	-1.3	+0.0
E	61.3	160.0	61.5	160.0	+0.2	+0.0

Table 10

RANK ORDER OF WEIGHT GAIN
In Relation to Urine Excretion*

Subject	Weight Gain	Urine Glucose (daily)	Urine Glucose (24 hrs.)
A	4	4	3
B	3	2	2
C	5	3	5
D	1	1	1
E	2	5	4

* Lower numbers indicate lowest weight gain and largest urine glucose output decrease.

significant primarily due to the small sample size which demands very high correlations for significance.

CHAPTER IV

METHODOLOGY

Study II

Purpose of the Study

In study number one it was ascertained that AMT led to improved diabetic control as determined by decreases in urine glucose levels. However, it was not clear which aspect of AMT resulted in these decreases. It may have been that the relaxation alone had the greatest impact on urine glucose or that improved compliance to the treatment program led to these decreases. Thus a more rigorous experimental design was implemented in order to control for those factors which are difficult to control on an outpatient basis.

Specifically this portion of the study was designed to investigate the effects of deep muscle relaxation on carbohydrate metabolism in juvenile diabetics. In order to control for compliance factors the investigation was conducted on an inpatient basis. Because this was essentially an exploratory study investigating the mechanism responsible for change, no hypotheses were generated regarding possible treatment outcomes.

Method

Subjects

Fifteen poorly controlled adolescent diabetic selected from the Diabetic Clinic of the Children's Hospital between the ages of thirteen and seventeen years of age were

contacted by telephone regarding possible participation in this portion of the study. Of these, thirteen declined to participate because they did not want to spend time in the hospital over their summer holidays. As a result, the children who participated in the first portion of the study were contacted and two of the six agreed to participate. Of the four female subjects who did participate however, data on only three were able to be analyzed as one child developed an ear infection during hospitalization which resulted in insulin adjustments having to be made thus rendering her test results uninterpretable.

As in the previous study all subjects were selected by the primary researcher with the assistance of the pediatrician in charge of the clinic. The subjects had been diabetic for at least three years with the mean age of onset being 8½ years. All displayed no other serious medical disorder which would interfere with their participation in the study. All children lived at home with at least one parent. Both the children and their parents were informed as to the extent and nature of the study and the techniques to be employed before consent forms were signed (see Appendix L).

Therapists

As in the previous phase of the study, the therapist was

an advanced doctoral candidate in child clinical psychology who had four years of extensive therapy experience in the field of applied behaviour analysis. The therapist was under the supervision of a registered Ontario psychologist. Medical supervision was provided by two physicians specializing in juvenile diabetes.

Setting

The study was conducted in the Clinical Investigation Unit of the Children's Hospital of Eastern Ontario. All children involved in the study were seen on an in-patient basis. The children were admitted sequentially to the unit every 10 days. Blood and urine samples of the subjects were analyzed in the laboratories of the Children's Hospital. Analyses were done without the technicians knowledge of the treatment phase of the child.

Experimental Design

All subjects spent ten days in the hospital. The first three days were utilized as a period of adaptation of the patient to the hospital environment. At the same time, dietary requirements and insulin dosages were established and were kept constant throughout the study.

A single subject format employing an alternating

treatment design (A B C B C) was used for the remaining seven days (see Table 11). This particular design was chosen to control for the possibility of improvement being a function of time spent in hospital. For example, if blood and urine glucose levels declined slightly in baseline, a little more in the A-C condition and then even more in the active treatment condition (relaxation), it would be very difficult to ascribe changes to the active treatment itself. Thus, a reversal design would clearly aid in interpreting change.

All testing, regardless of phase, was performed over the same two hour period each day. As can be seen in Table 11 the first three test days consisted of the baseline period where the subjects were asked to simply sit quietly for the two hour test period while the various measures were taken. For subjects one and three, the next days consisted of the relaxation phase followed by the attention-control phase, a reversal to the relaxation phase and finally a return to the attention control phase. For subject two this order was reversed to control for ordering effects.

The attention-control condition consisted of simple psychological testing using the Edwards Personal Preference Schedule (Edwards, 1959) and the School Motivation Analysis Test (Sweney, Cattell & Krug, 1970). The content of the feedback sessions was kept as neutral as possible for each subject so as to avoid biasing. Each subject was given a treatment rationale which explained that often a knowledge of one's interests is of benefit in reducing anxiety associated

Table 11

EXPERIMENTAL DESIGN

Subject		Test Days				
A	Adaptation Period 3 days	Baseline 3	R 1	A-C 1	R 1	A-C 1
B	Adaptation Period 3 days	Baseline 3	A-C 1	R 1	A-C 1	R 1
C	Adaptation Period 3 days	Baseline 3	R 1	A-C 1	R 1	A-C 1

R = Deep Muscle Relaxation
A-C = Attention-control

with decision making insofar as future employment is concerned. Therefore this reduction in anxiety could lead to better diabetic control (see Appendix M).

A five item ten-point credibility/expectancy for improvement scale was administered to each subject before their first A-C phase to measure nonspecific treatment factors such as patient expectancy for therapeutic gain and perceived treatment efficacy (see Appendix E). The use of the A-C phase served to further strengthen the design by allowing the effects of the independent variable to be compared to the baseline and A-C condition and to control for experimenter-subject contact.

Following each A-C phase, the relaxation phase was implemented. Each subject underwent training in deep muscle relaxation (Jacobson, 1938).

A central assumption is that progressive deep muscle relaxation would directly result in the diminution of muscle tension and/or indirectly in the reduction of autonomic activity. Wolpe (1958) has clearly emphasized the autonomic nature of the anxiety response as well as the autonomic inhibitory effects of relaxation. As such, the specific role of relaxation was to provide a response inhibitory to anxiety thereby reducing physiological over-activation.

The relaxation instructions were those presented by Wolpe and Lazarus (1966) (see Appendix G). Each subject underwent training in progressive deep muscle relaxation for

the first 20-30 minutes of each two hour relaxation test phase. For the remaining 1½ hours subjects were asked to remain quietly seated with their eyes closed while physiological measurements were taken. Before the training took place, each subject was given a treatment rationale (see Appendix N) which explained that muscle relaxation may bring about a reduction in urine glucose and blood glucose measurements by reducing autonomic activity. As in the A-C condition, a five-ten-point credibility/expectancy for improvement scale was administered to each subject.

Testing Procedure and Instruments

Data collection took place during the same two hour period on each of the seven test days. Because no consistent measures have been used in the past to assess subjective reports of degrees of relaxation (Luiselle, Maholin, Steinman & Steinman, 1979) a simple rating scale, similar to that used by Lehrer (1978) was administered. Subjects were asked to rate their degrees of felt relaxation on a one hundred-point scale ranging from 0 (as relaxed as ever felt) to 100 (very anxious) (see Appendix O). Measurements were taken every fifteen minutes during the test period across all phases.

Objective measurements of muscle tension and relaxation were obtained through the use of the Autogen 1700 Electromyograph (EMG) unit coupled with the Autogen 5600 Data Acquisition Center and P-5000 Alphanumeric Printer

(Autogenics Inc.). Visual feedback and quantification of the subjects' time averaged EMG activity (15 second average time base) was provided to the therapist by the alphanumeric printer. Frontalis muscle tension levels were evaluated as a function of microvolt readings when the EMG unit was set for the 100-200 Hz bandpass. This bandpass was used because of its ability to pick up EMG signals over a broad radius and its superior artifact rejection capacity. Readings above 2 microvolts denoted a relatively tense frontalis muscle whereas readings below 1 microvolt indicated a relaxed muscle. Readings between 1 and 2 microvolts indicated average muscle tension (Autogenics Inc., 1976).

Blood glucose and urine glucose levels were monitored throughout each test period across all phases. Blood glucose levels were obtained through a Heparin lock venipuncture. During the test periods blood samples were drawn every 15 minutes by the nursing staff. Results were analyzed through the use of the glucose oxidase enzyme method. Urine glucose levels were assessed immediately before and after each test period using the clinitest method (Ames Co. Ltd., Elkhart, Ind.). In addition, daily assessments of urine glucose homeostasis were also determined on a twenty-four hour basis using the 24 hour fractional quantitative glucose method (Forman et al., 1974). Urine voided during the day and night was collected, aliquoted into four separate containers and labelled with time of collection and total volume: (1) 8 a.m.

- noon (first voided overnight urine was discarded); (2) noon - 4 p.m.; (3) 4 p.m. - 8 p.m.; (4) 8 p.m. - 8 a.m. (first voided overnight morning urine was collected).

CHAPTER V

RESULTS

Study II

Scores on the major dependent variables can be found in Tables 12, 13, 14 and 15. Mean values as well as their standard deviations are presented where appropriate. All variables except for blood glucose have scores for three subjects. Blood glucose values are not presented for subject C because of errors made regarding her caloric intake during the testing procedure. Parametric statistics were not used to analyze the data due to the time series nature of the design. As a result, only graphical and tabular analyses will be presented.

Blood Glucose Results

As can be seen from Table 12 and Figure 16, subject A's mean blood glucose values decreased across all phases except for a slight increase from phase B_3 to phase $A\text{-}C_1$. Subject A showed a mean blood glucose decrease of 4.7% from phase B_1 to B_2 and another decreaseof 4.9% from phase B_2 to B_3. There was a 3.1% increase in her glucose values from phase B_3 to $A\text{-}C_1$, but a subsequent decrease of 7.4% from phase $A\text{-}C_1$, to R_1. A further drop of 18.4% was found

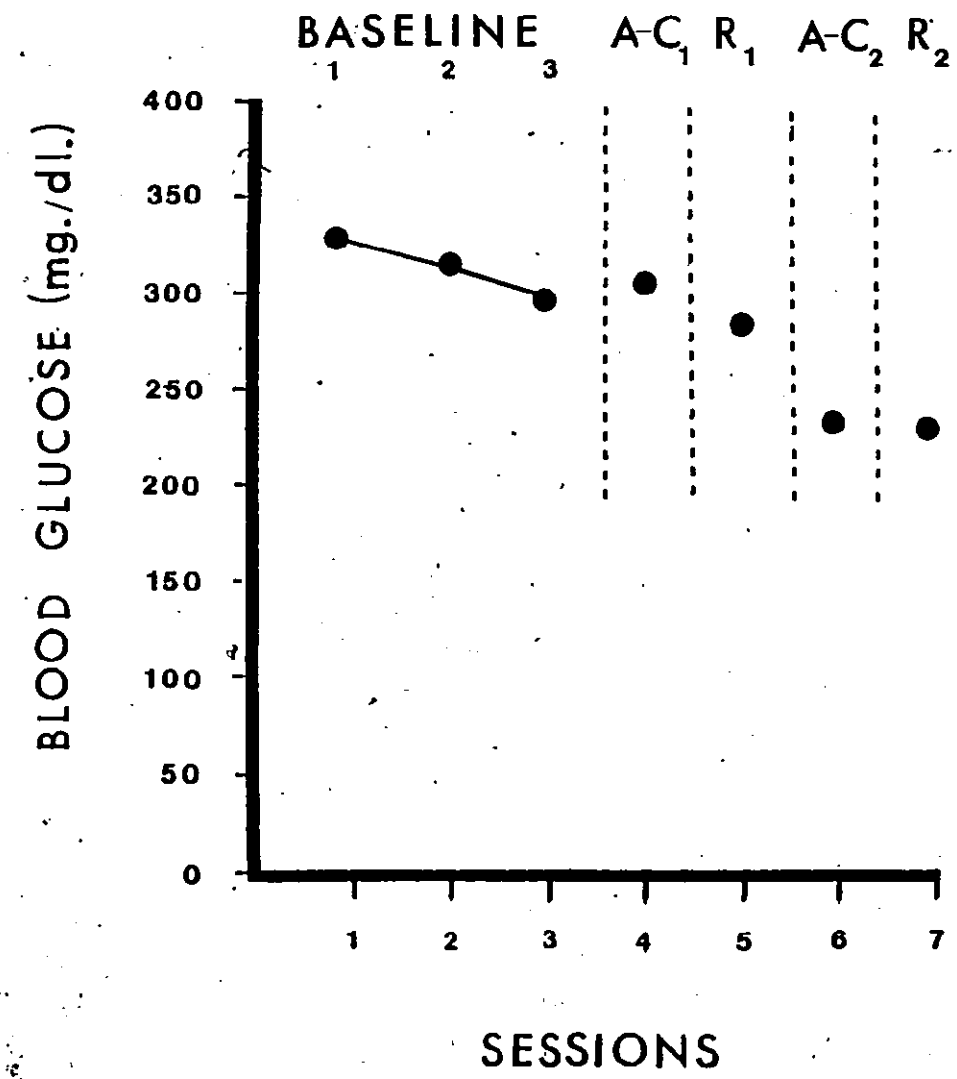
Table 12

BLOOD GLUCOSE (mg/dl)

Subject	Phase						
	B_1	B_2	B_3	$A\text{-}C_1$	R_1	$A\text{-}C_2$	R_2
A	329.7 (44.5)	314.2 (43.8)	298.5 (29.7)	307.8 (41.8)	285.0 (34.4)	232.4 (25.8)	230.1 (19.4)
	B_1	B_2	B_3	R_1	$A\text{-}C_1$	R_2	$A\text{-}C_2$
B	297.7 (42.2)	314.4 (22.2)	306.8 (33.4)	208.6 (11.5)	273.4 (21.1)	139.6 (15.9)	254.1 (12.0

Figure 16

SUBJECT A. MEAN BLOOD GLUCOSE LEVELS PER SESSION

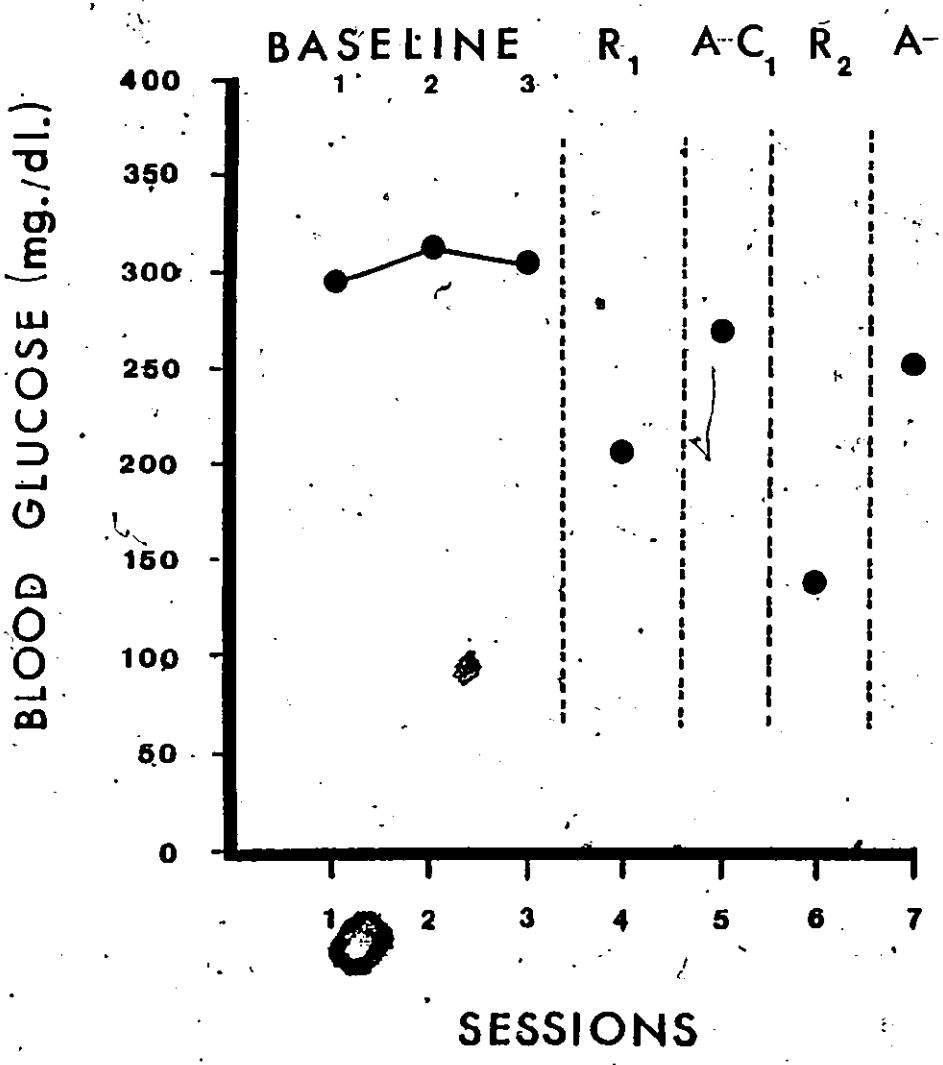

BASELINE
A-C1
R1
A-C2
R2
1
2
3
400
350
300
250
200
150
100
50
0
BLOOD GLUCOSE (mg./dl.)
1
2
3
4
5
6
7
SESSIONS

between phases R_1 and A-C_2. A slight decrease of 0.9% occurred between phases A-C_2 and R_2. The variances of her blood glucose values remained moderately high until the last two phases where a lessening of variance occurred. The consistent decreases across phases is thought to reflect improved control due to the time spent in the hospital under optimal management conditions rather than due to the relaxation itself. In fact, a consistent intake of 1700 calories per day caused subject A to lose 3.1 Kg. of weight in only ten days.

Table 12 and Figure 17 show subject B's blood glucose results over the seven test days. Subject B showed a 5.6% increase in her mean blood glucose values between phases B_1 and B_2 and a 2.4% decrease between phases B_2 and B_3. However, a large decrease of 32% occurred between phases B_3 and R_1. In turn, an increase of 31% was found between phases R_1 and A-C_1. A 48.9% decrease in mean blood glucose values was found between phases A-C_1 and R_2 with a subsequent rise of 82% in mean blood glucose levels between phases R_2 and A-C_2. These results strongly suggest that the decreased levels of blood glucose found in phases R_1 and R_2 may be directly attributed to the effect of relaxation on physiological mechanisms. The variance of blood glucose levels remained relatively low across the latter phases.

Figure 17

SUBJECT B. MEAN BLOOD GLUCOSE LEVELS PER SESSION


BASELINE
R1
A-C1
R2
A-C2
1
2
3
400
350
300
250
200
150
100
50
0
BLOOD GLUCOSE (mg./dl.)
1
2
3
4
5
6
7
SESSIONS

Fractionated Urine Glucose

Table 13 and Figure 18 show subject A's fractionated urine glucose results. No value exists for phase R_2 as her urine sample was accidently contaminated and therefore could not be used. Between phases B_1 and B_2 a 64.2% decrease in urine glucose levels occurred. This was followed by a 29.9% increase between phases B_2 and B_3. A 39.5% decrease occurred between phases B_3 and A-C_1 while a 9.5% increase was observed between phases A-C_1 and R_1. This was followed by a 22.8% decrease between phases R_1 and A-C_2. Again we see a trend of decreased urine glucose values over time which may be indicative of improved control. This might be a function of improved therapeutic management rather than due to the effect of relaxation on physiological mechanisms however.

As can be seen from Table 13 and Figure 19, subject B showed the opposite results. There is no urine glucose values for the third baseline day as a portion of her urine sample was accidently misplaced rendering the remaining sample inaccurate. A decrease of 41.8% was found between phases B_1 and B_2 with a further decrease of 85.9% occurring between phases B_2 and R_1. An increase of 823% was found between phases R_1 and A-C_1, but a decrease of 78.3% occurred between phases A-C_1 and R_2. A 123% increase in urine glucose levels was found between phases

Table 13

FRACTIONATED URINE GLUCOSE (g/24 hrs.)

Subject	Phase						
	B_1	B_2	B_3	$A\text{-}C_1$	R_1	$A\text{-}C_2$	R_2
A	59.9	21.4	27.8	16.8	18.4	14.2	-
	B_1	B_2	B_3	R_1	$A\text{-}C_1$	R_2	$A\text{-}C_2$
B	31.8	18.5	-	2.6	24.0	5.2	11.6
	B_1	B_2	B_3	$A\text{-}C_1$	R_1	$A\text{-}C_2$	R_2
C	56.1	47.5	65.0	-	35.9	32.7	31.7

Figure 18

SUBJECT A. DAILY MEAN FRACTIONATED URINE GLUCOSE LEVELS

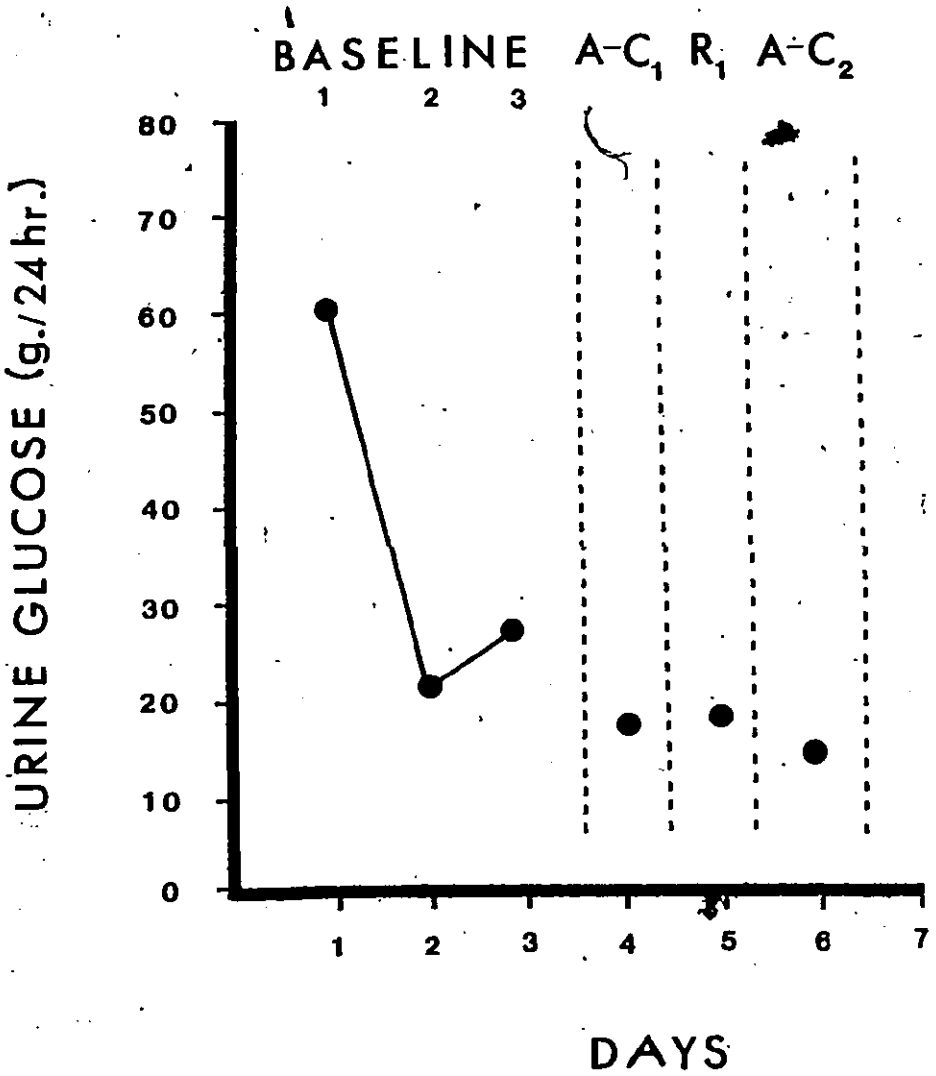
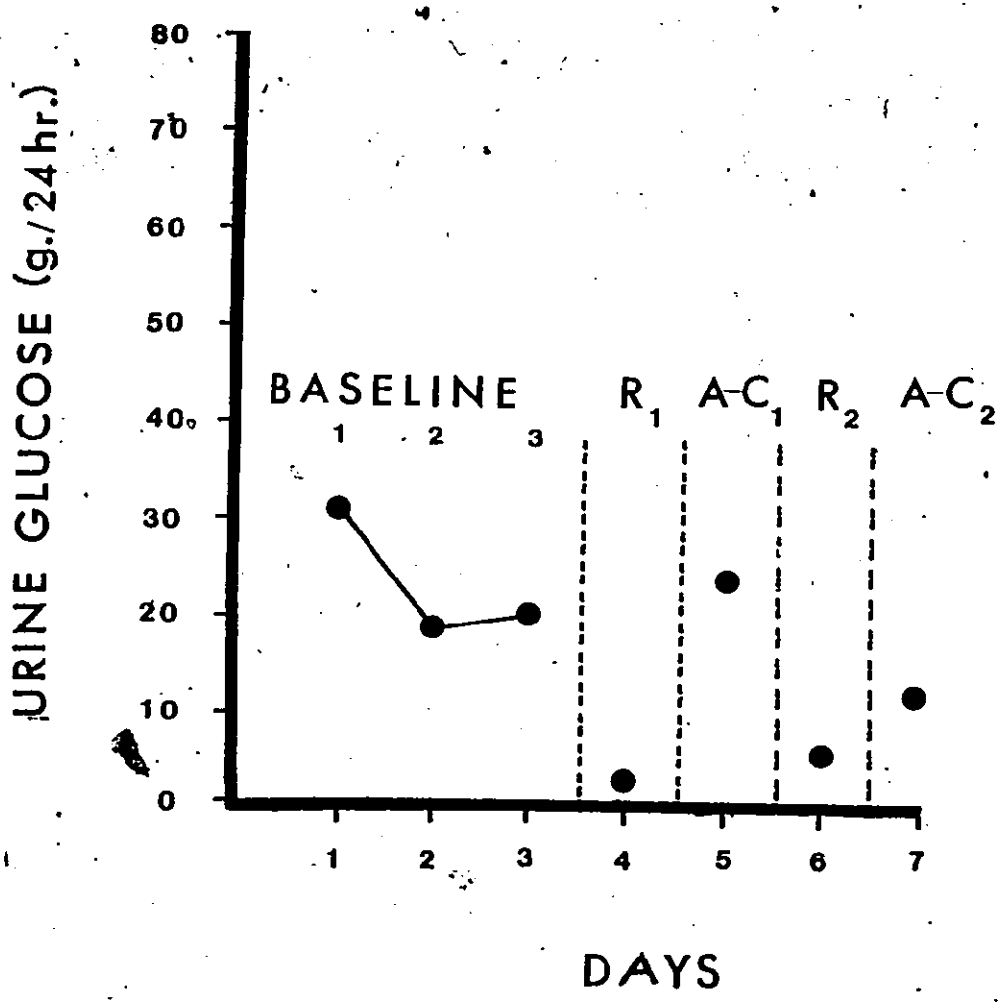

BASELINE
A-C1
R1
A-C2
1
2
3
URINE GLUCOSE (g./24 hr.)
80
70
60
50
40
30
20
10
0
1
2
3
4
5
6
7
DAYS

Figure 19

SUBJECT B. DAILY MEAN FRACTIONATED URINE GLUCOSE LEVELS


URINE GLUCOSE (g./24 hr.)
80
70
60
50
40
30
20
10
0
BASELINE
1
2
3
R1
A-C1
R2
A-C2
1
2
3
4
5
6
7
DAYS

R_2 and A-C_2. These results seem to parallel subject B's blood glucose results as a strong reversal effect was evident between the R and A-C phases. It is therefore unlikely that her improved control was due to improved therapeutic management of the illness, but rather due to the relaxation effect itself.

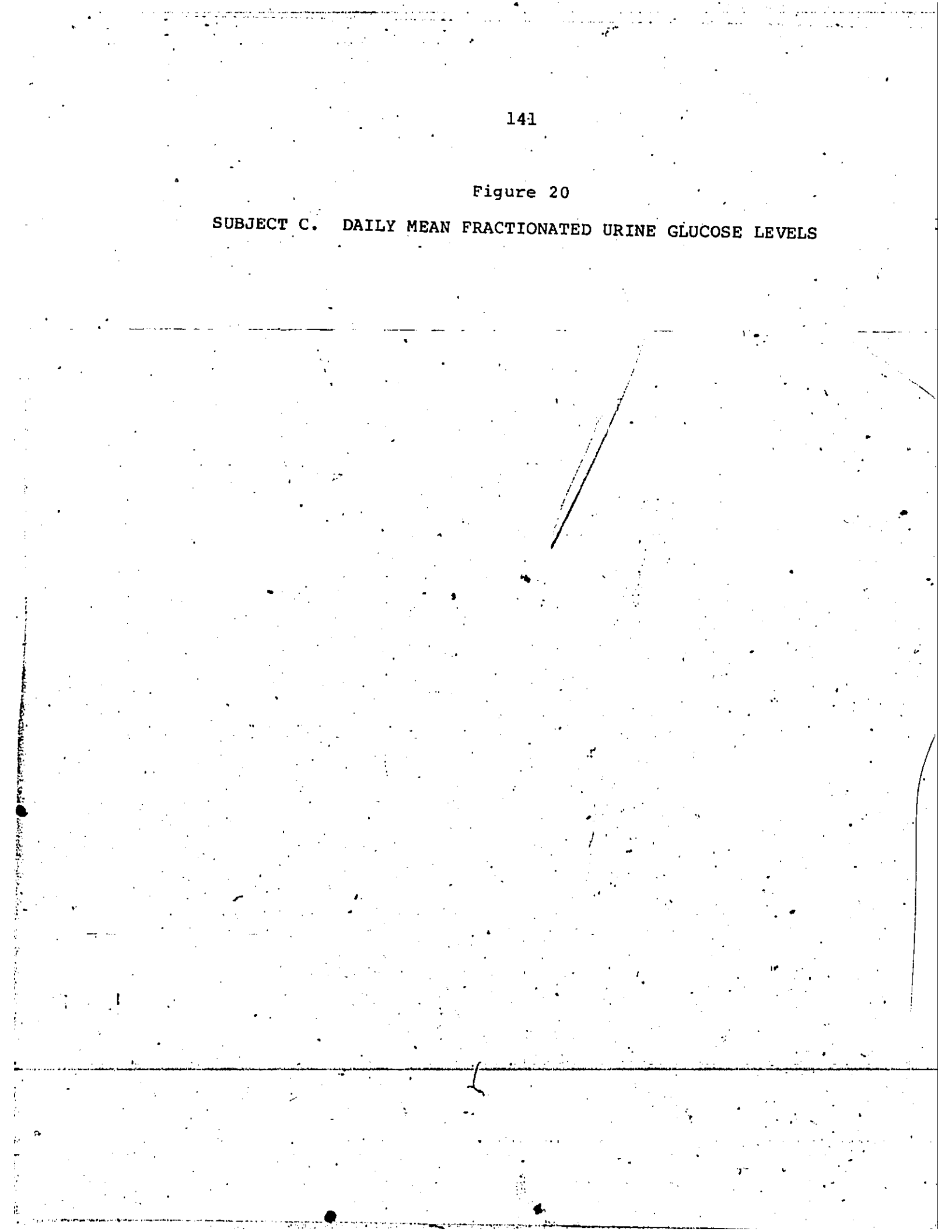
Subject C's test results can be found in Table 13 and Figure 20. Her results closely approximate subject A's as no reversal effect was found. No value for phase A-C_1 exists because of an error made with subject C's diet on that particular day. A 15.3% decrease in urine glucose levels occurred between phases B_1 and B_2 while a 36.8% increase occurred between phases B_2 and B_3. Between phases B_3 and R_1 a 44.7% decrease in urine glucose levels was found compared to a 8.9% decrease between phases R_1 and A-C_2. A further 3% decrease occurred between phases A-C_2 and R_2. These findings tend to suggest that the control gained is a function of improved therapeutic management rather than a function of the relaxation itself.

Self Rated Relaxation Scale

Table 14 illustrates the mean values and standard deviations of each subject's subjective estimates of relaxation as measured every fifteen minutes during the test procedure.

Figure 20

SUBJECT C. DAILY MEAN FRACTIONATED URINE GLUCOSE LEVELS



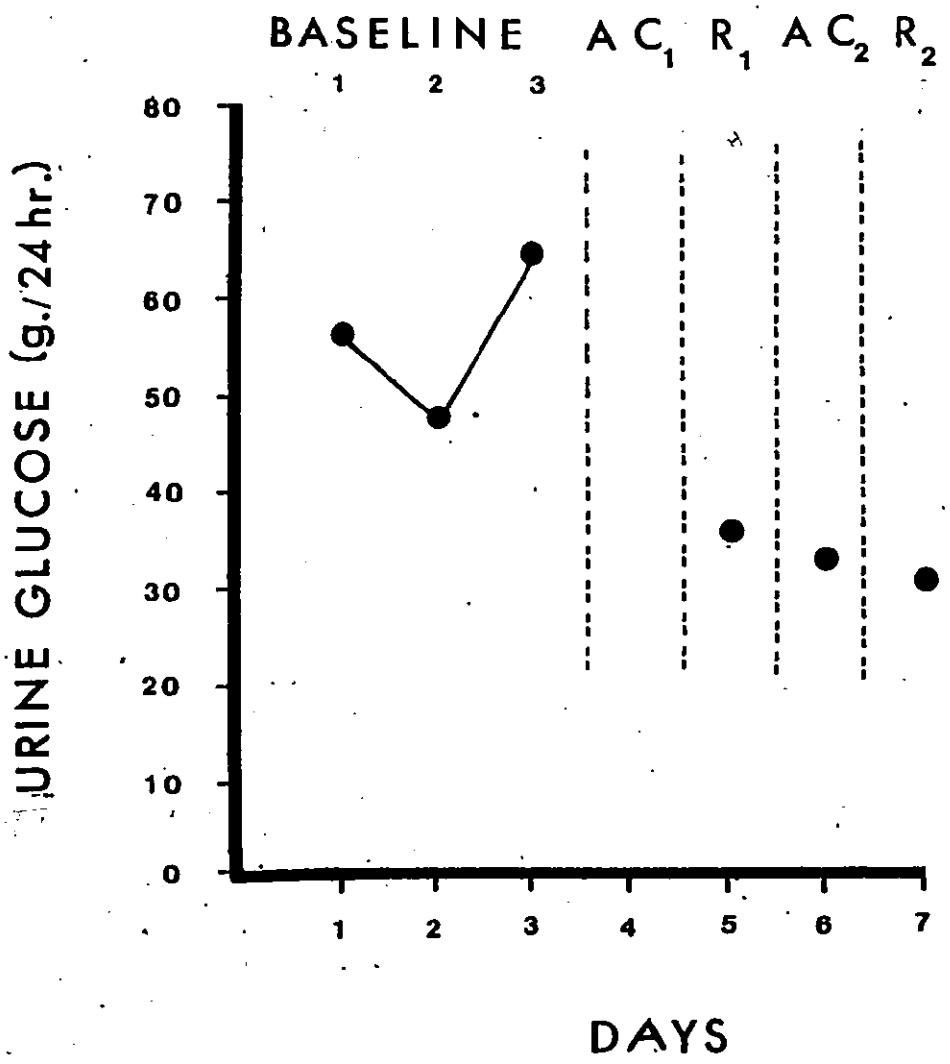

BASELINE
AC1
R1
AC2
R2
1
2
3
URINE GLUCOSE (g./24 hr.)
80
70
60
50
40
30
20
10
0
1
2
3
4
5
6
7
DAYS

Table 14

SELF RATED RELAXATION SCALE

Subject	Phase						
	B_1	B_2	B_3	$A\text{-}C_1$	R_1	$A\text{-}C_2$	R_2
A	52.7 (11.4)	46.1 (6.9)	49.4 (8.8)	54.4 (8.8)	55.6 (9.8)	50.0 (0.0)	58.1 (7.5)
	B_1	B_2	B_3	R_1	$A\text{-}C_1$	R_2	$A\text{-}C_2$
B	34.4 (13.0)	43.3 (16.2)	28.8 (4.1)	12.5 (12.5)	31.1 (10.8)	11.8 (8.4)	30.0 (12.5)
	B_1	B_2	B_3	$A\text{-}C_1$	R_1	$A\text{-}C_2$	R_2
C	53.2 (8.7)	51.3 (11.3)	42.7 (11.5)	-	23.7 (4.2)	31.7 (3.3)	16.1 (5.2)

Table 14 and Figure 21 illustrate subject A's results. As can be seen, subject A did not subjectively experience any significant decrease in felt relaxation in spite of undergoing deep muscle relaxation. There was a 12.5% decrease from phase B_1 and B_2 and a 7.1% increase in tension feelings from phase B_2 to B_3. A further 10.1% increase in tension feelings occurred between phases B_3 and A-C_1 and another 2.2% increase occurred between phases A-C_1 and R_1. A 10% decrease in felt tension occurred between phases R_1 and A-C_2 but this trend was reversed between phases A-C_2 and R_2 as subject A experienced a 16.2% increase in tension. Variances remained low across all phases.

Subject B, in keeping with her previous results, showed the opposite pattern. As can be seen in Table 14 and Figure 22 sound differences are evident between the baseline, R and A-C phases. She showed a 25.8% increase in tension feeling between phases B_1 and B_2 and a 33.4% decrease between phases B_2 and B_3. During the R_1 phase her tension level decreased 56.5% as compared to the B_3 phase. There was a subsequent 148% increase in tension feelings beweeen phase R_1 and A-C_1 and a 62% decrease between phases A-C_1 and R_2. A 154% increase in felt tension characterized the difference between phases R_2 and A-C_2. Variance remained low across all phases. These results suggest that deep muscle relaxation did have a noticeable effect on

Figure 21

SUBJECT A. SUBJECTIVELY EXPERIENCED LEVELS OF RELAXATION ACROSS SESSIONS. A SCORE OF 0 INDICATES COMPLETE RELAXATION WHILE A SCORE OF 100 INDICATES HIGH TENSION

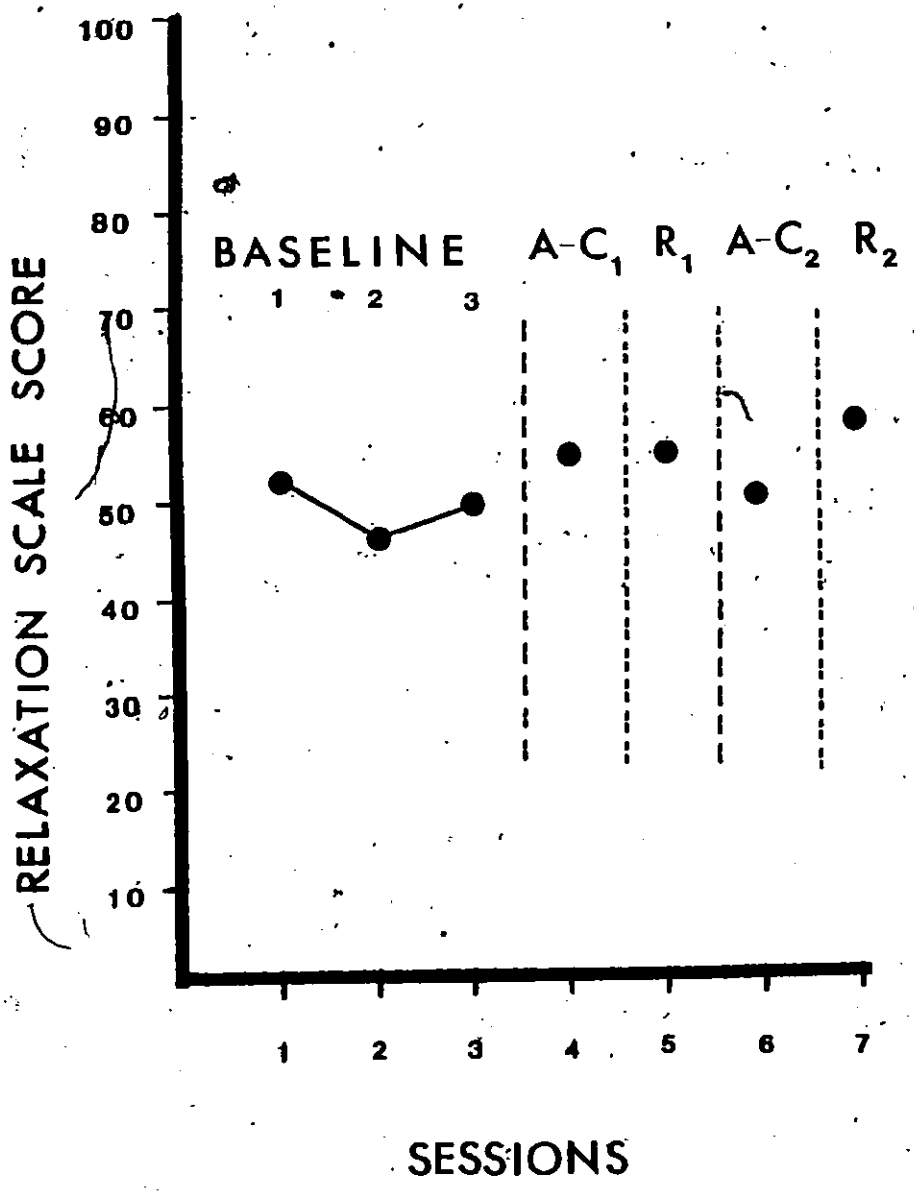
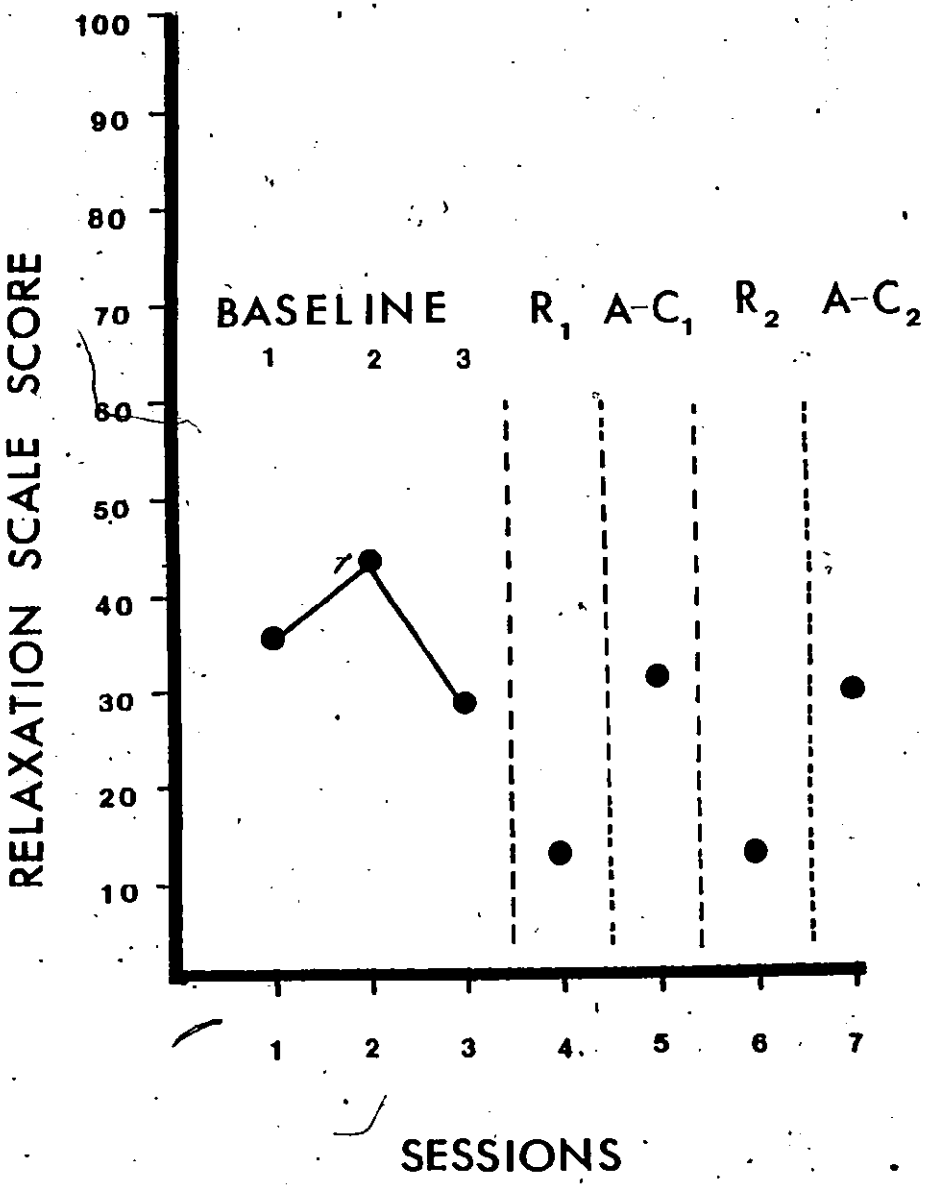

RELAXATION SCALE SCORE
100
90
80
70
60
50
40
30
20
10
BASELINE
A-C1
R1
A-C2
R2
1
2
3
1
2
3
4
5
6
7
SESSIONS

Figure 22

SUBJECT B. SUBJECTIVELY EXPERIENCED LEVELS OF RELAXATION ACROSS SESSIONS. A SCORE OF 0 INDICATES COMPLETE RELAXATION WHILE A SCORE OF 100 INDICATES HIGH TENSION


RELAXATION SCALE SCORE
100
90
80
70
60
50
40
30
20
10
BASELINE
1
2
3
R1
A-C1
R2
A-C2
1
2
3
4
5
6
7
SESSIONS

subject B's perception of bodily states.

Table 14 and Figure 23 illustrate subject C's results. No data is available for phase A-C_1 as errors were made during the test protocol on that day. Subject C experienced a 3.5% decrease in tension feelings between phases B_1 and B_2 and a further decrease of 16.7% between phases B_2 and B_3. A 44.4% decrease in felt tension occurred between phases B_3 and R_1 with a 33.7% increase occurring between phases R_1 and A-C_2. This trend reversed itself with the administration of the second A-C phase as a 49.2% decrease in tension levels occurred between phases R_2 and A-C_2. Variances remained low across all phases. These results strongly suggest again that deep muscle relaxation may be perceived by individuals as decreasing subjectively experienced tension levels.

EMG

Table 15 illustrates the EMG results for all three subjects. Mean scores and standard deviations are presented.

Subject A's results are presented in Table 15 and Figure 24. As can be seen, there was a 27.5% increase in muscle tension levels between phases B_1 and B_2 and a 4.4% decrease between phases B_2 and B_3. A 9.7% increase occurred between phases B_3 and A-C_1 while a 61.6%

Figure 23

. SUBJECT C. SUBJECTIVELY EXPERIENCED LEVELS OF RELAXATION ACROSS SESSIONS. A SCORE OF 0 INDICATES COMPLETE RELAXATION WHILE A SCORE OF 100 INDICATES HIGH TENSION.

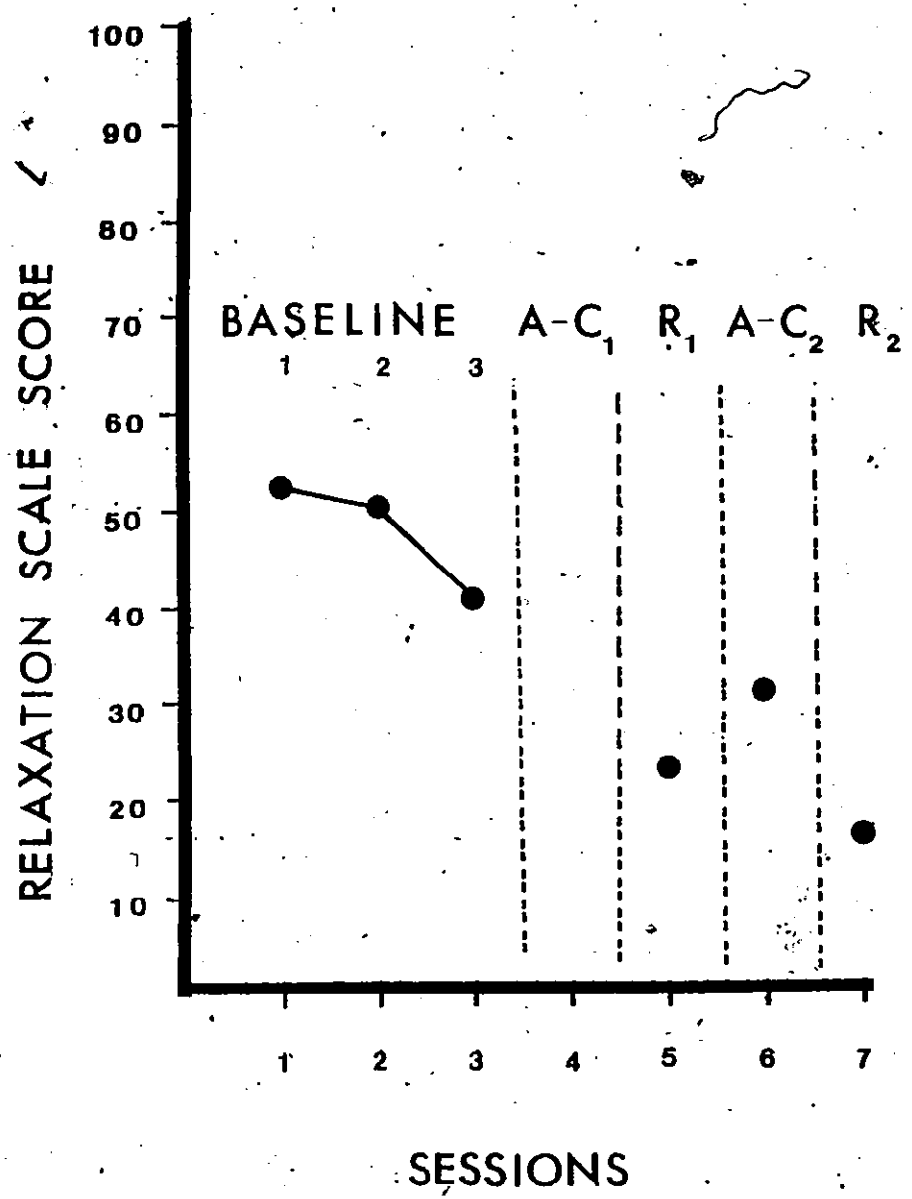

RELAXATION SCALE SCORE
100
90
80
70
60
50
40
30
20
10
BASELINE
A-C1
R1
A-C2
R2
1
2
3
1
2
3
4
5
6
7
SESSIONS

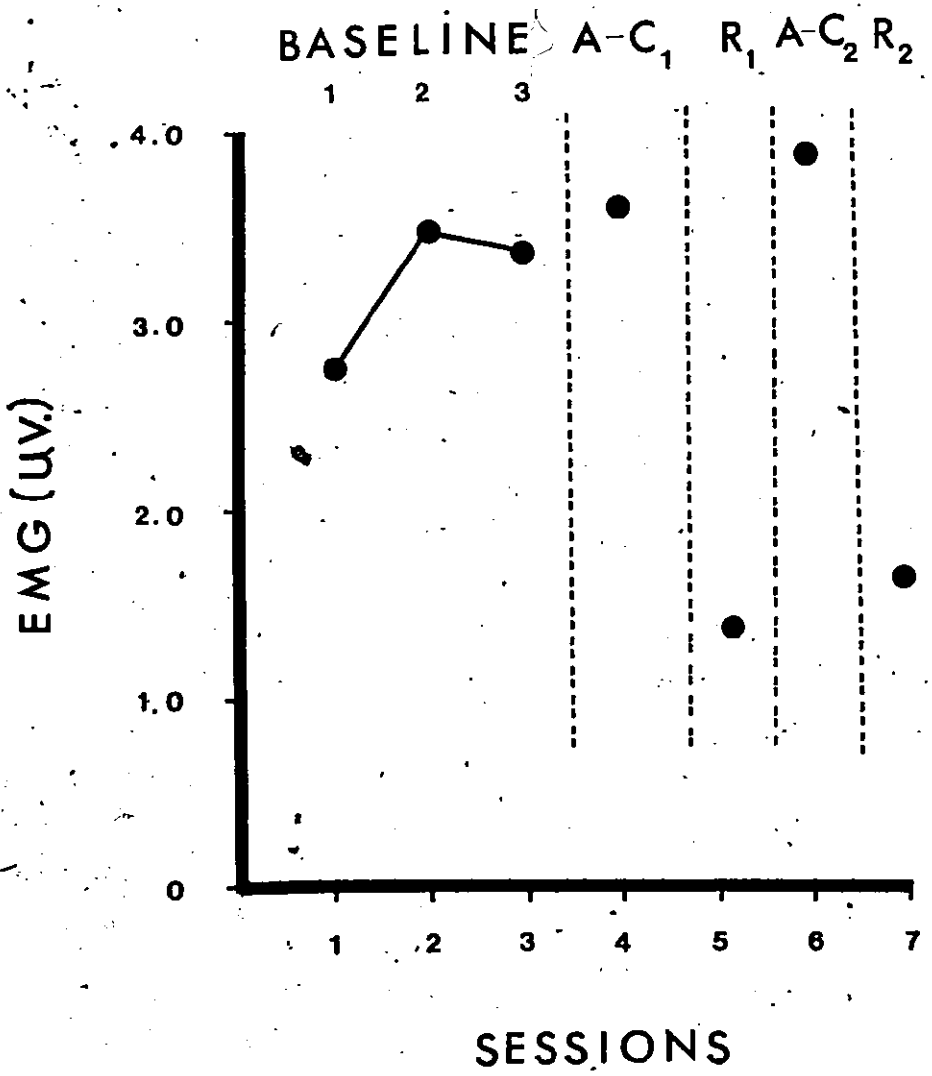
Table 15

EMG (uV)

	Phase						
Subject	B_1	B_2	B_3	$A\text{-}C_1$	R_1	$A\text{-}C_2$	R_2
A	2.79 (.56)	3.56 (.51)	3.40 (.68)	3.73 (1.06)	1.43 (.58)	3.96 (.96)	1.68 (.41)
	B_1	B_2	B_3	R_1	$A\text{-}C_1$	R_2	$A\text{-}C_2$
B	2.62 (.24)	3.21 (.63)	3.70 (.52)	1.66 (.45)	2.74 (.47)	2.01 (.46)	3.67 (.52)
	B_1	B_2	B_3	$A\text{-}C_1$	R_1	$A\text{-}C_2$	R_2
C	1.32 (.23)	1.59 (.20)	1.58 (.20)	-	.89 (.21)	2.08 (.23)	1.16 (.17)

Figure 24

SUBJECT A. EMG TENSION LEVELS ACROSS SESSIONS


BASELINE
A-C1
R1
A-C2
R2
1
2
3
4.0
3.0
2.0
1.0
0
EMG (U.V.)
1
2
3
4
5
6
7
SESSIONS

decrease was found between phasea A-C_1 and R_1. With a return to the A-C_2 phase, subject A's muscle tension levels increased 176.9% but decreased 57.5% when phase R_2 was instituted. Variances remained moderate within each phase. These results tend to verify the physiological effects of deep muscle relaxation.

Subject B's results can be seen in Table 15 and Figure 25. There was a 22.5% increase in tension levels between phases B_1 and B_2 and a further 15.2% increase between phases B_2 and B_3. With the introductionof phase R_1, subject B's tension levels dropped 55.1%. An increase of 65% occurred between phases R_1 and A-C_1 but this trend was reversed as phase R_2 was instituted resulting in a 26.6% decrease between phases A-C_1 and R_2. A 82.5% increase in tension levels occurred between phase R_2 and A-C_2. Again variances remained moderate within each phase. These results tend to again suggest that there is indeed a measurable difference between relaxation and non-relaxation levels as reflected in muscle tension.

Subject C's results can be found in Table 15 and Figure 26. Again no results are available for phase A-C_1. A 20.4% increase in muscle tension levels between phases B_1 and B_2 was found with a 0.6% decrease between phases B2 and B_3. This was followed by a 43.6% decrease in tension levels between phases B_3 and R_1. A 133% increase in tension levels occurred with the introduction of phase A-C_2

Figure 25

SUBJECT B. EMG TENSION LEVELS ACROSS SESSIONS

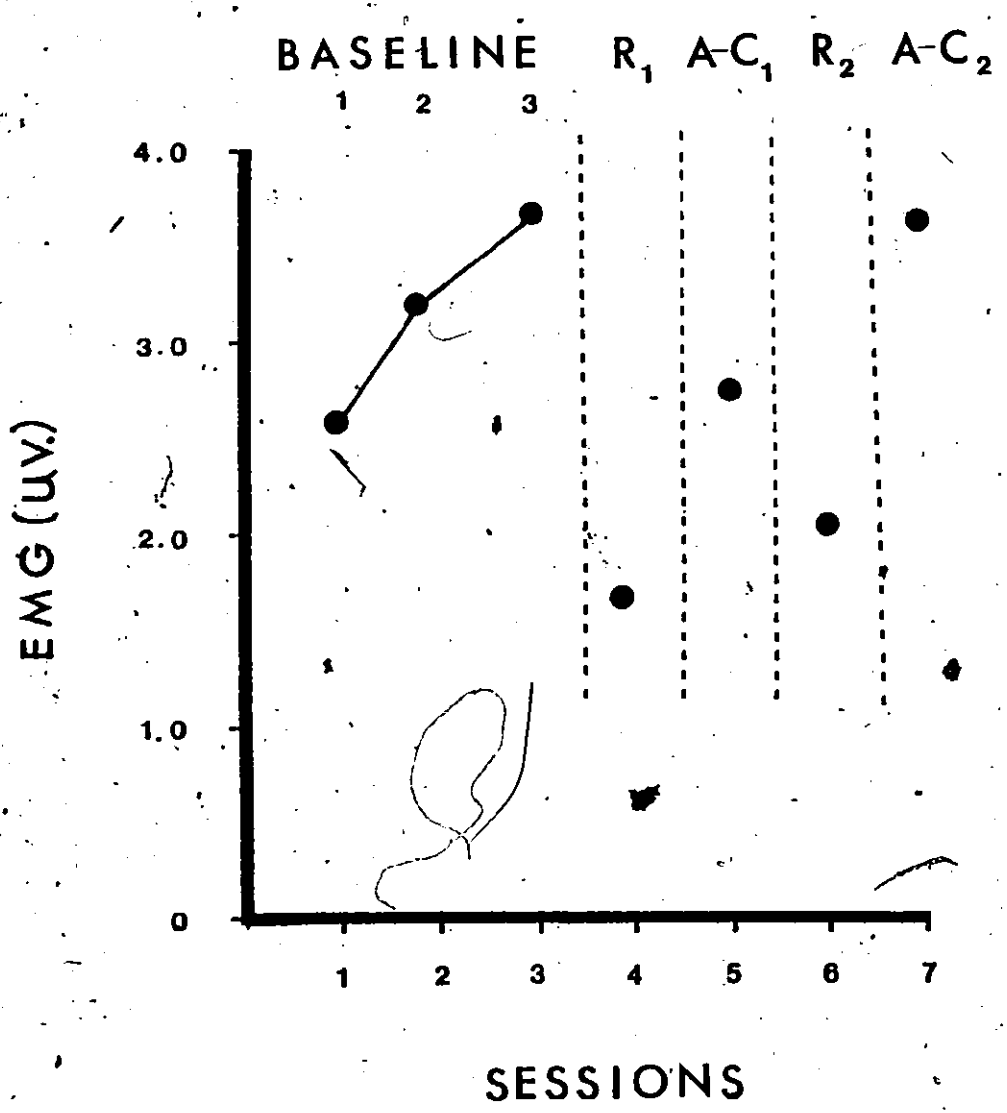
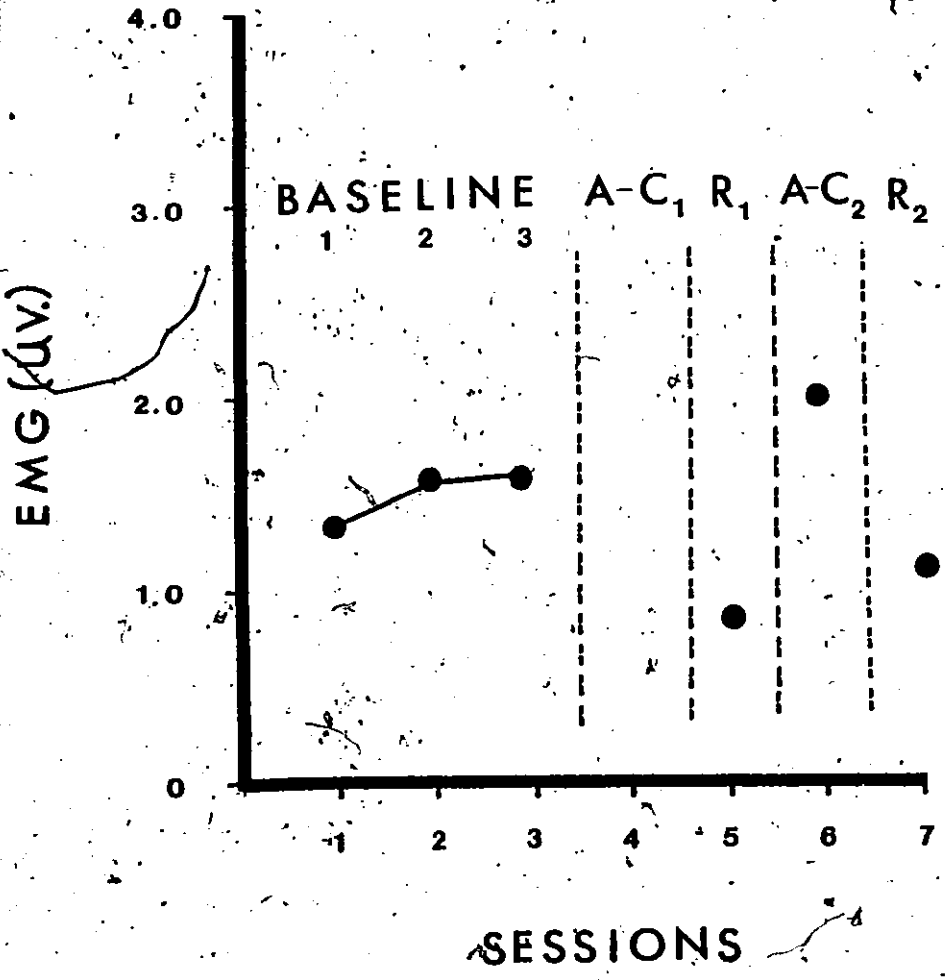

BASELINE
R1
A-C1
R2
A-C2
1
2
3
4.0
3.0
2.0
1.0
0
EMG (μV)
1
2
3
4
5
6
7
SESSIONS

Figure 26

SUBJECT C. EMG TENSION LEVELS ACROSS SESSIONS


4.0
3.0
2.0
1.0
0
EMG (μV.)
BASELINE
A-C1
R1
A-C2
R2
1
2
3
1
2
3
4
5
6
7
SESSIONS

but this was followed by a 44.2% decrease when phase R_2 was introduced. Variances remained low within each phase. Once again the same trend occurred between the relaxation and non-relaxation phases indicating differences in muscle tension levels.

Treatment Credibility

Both the A-C and relaxation treatments were rated as moderately to highly credible by all three subjects (see Table 16). T-tests for correlated samples between phases revealed no significant differences for all three subjects. Thus, observed differences in outcome cannot be attributed to differences in treatment credibility.

Reliability

Because the results of the dependent variables such as blood glucose, urine glucose and EMG were measured by mechanical means reliability checks were not carried out. No reliability measures could be made on the self rated relaxation scale.

Table 16

TREATMENT CREDIBILITY

Subject	Phase A-C	Phase Relaxation	t	
A	6.8	6.8	0.0	N.S.
B	8.2	8.4	1.0	N.S.
C	8.6	8.8	-1.0	N.S.

Compliance with Therapeutic Regimen

Insulin

Because of the highly controlled nature of this study, compliance was high. Insulin levels were the same as the children had been accustomed to prior to their hospitalization and these levels were not changed while they were hospitalized. The type and dosage of insulin used as well as the time of injection for each subject is shown in Table 17. To insure compliance, each injection was made with a nurse present. 100% compliance was reported for all subjects.

Diet

Each child who participated in the study had her daily caloric intake determined by the hospital dietician. Levels were set so that the children would maintain their present weight. Unfortunately an error was made with subject C's diet on the A-C_1 day resulting in incorrect data which could subsequently could not be used. In addition, the results of subject C's blood glucose analyses could not be presented because of a similar error.

Table 17

INSULIN REQUIREMENTS

Subject	Type	Dosage (units)	Injection Time
A	Lente Toronto	44 10	A.M.
B	N.P.H. Toronto	54 12	A.M.
C	N.P.H.	70	A.M.

Relationship Between Dependent Variables

Tables 18, 19, and 20 illustrate the correlation among the dependent variables for subjects A, B and C respectively. All correlations were computed using Spearman's coefficient of rank correlation. Because of the small number of N's associated with each subject, few values of ρ reached statistical significance. In fact, most values for each subject tended to illustrate a random correlation among variables.

This was particularly evident with respect to subject A (see Table 18). The highest correlation of .71 showed the strongest positive relationship between blood glucose (BG) values and fractionated urine glucose (FUG) values. The relationship between blood glucose and electromyograph (EMG) values (ρ=.15) showed at best a random correlation. Other values among the dependent variables ranged from -.25 to -.60 suggesting a trend towards random to inverse relationships.

Subject B's results can be found in Table 19. This correlation matrix indicates that very strong positive relationships were found between blood glucose and fractionated urine glucose values (ρ=.94). A correlation of ρ=.94 was also found between the fractionated urine glucose values and the self rated relaxation scores (SRR). Both correlations reached statistical significance. Overall, it appeared that blood glucose values were more highly

Table 18

SUBJECT A. RANK ORDER CORRELATION AMONG DEPENDENT VARIABLES

	BG	FUG	EMG	SRR
B G				
FUG	.71			
EMG	.15	-.60		
SRR	-.50	-.25	.57	

Table 19

SUBJECT B. RANK ORDER CORRELATION AMONG DEPENDENT VARIABLES

	BG	FUG	EMG	SRR
B G				
FUG	.94*			
EMG	.64	.42		
SRR	.78	.94*	.36	

* $p < .05$

correlated with EMG, FUG and SRR values than among the other dependent variables.

Subject C's results are illustrated in Table 20. Because blood glucose values were not obtained only correlations between FUG, EMG and SRR scores are presented. This matrix illustrates the fact that there seemed to be a random relationship between the dependent variables. The highest correlation (ρ=.77) was found between the FUG scores and SRR scores while the remaining two correlations indicate more random relationships.

Table 20

SUBJECT C. RANK ORDER CORRELATION AMONG DEPENDENT VARIABLES

	FUG	EMG	SRR
FUG			
EMG	.15		
SRR	.77	.42	

CHAPTER VI

DISCUSSION

The purpose of this study was twofold: first to determine if anxiety management training was effective in improving the course and control of juvenile diabetes by improving metabolic regulation of the disease and secondly, to investigate the mechanism through which psychological factors influence diabetic stability.

The results of the first phase of the study suggest that anxiety management training was indeed effective in improving the course and control of juvenile diabetes mellitus by improving metabolic regulation in the subjects who participated in the study. All subjects displayed statistically significant and clinically valuable decreases in their daily mean urine glucose levels between their baseline and AMT phases as well as between their A-C and AMT phases as measured by the Diastix method. Non-significant differences were found between the baseline and A-C phases for all subjects suggesting that the A-C condition could be seen as an extended baseline which had little therapeutic value. Interestingly enough however, slight decreases in daily urine glucose levels were found in four of the five subjects between these phases. It may have been that the subjects, knowing that they were being monitored, made greater efforts to adhere to their therapeutic regimens. However, this alone did not seem to be sufficient to gain

optimal control for further decreases in urine glucose levels occurred only with the use of the anxiety management training.

The results of the weekly 24 hour urine glucose analyses were not as clear although decreases in mean glucose levels between the baseline and AMT phases were found in four of five subjects. Differences in glucose levels between the baseline and A-C phases tended to either rise or fall depending on the subject. Again, the A-C condition may be viewed as an extended baseline which had little therapeutic value whereas the AMT procedure appears to have had more of a positive effect on the reduction of glucose levels. In spite of the variability of test results, it is nevertheless felt that the 24 hour urine collection was a valid measure of assessment. Variability could certainly have stemmed from any number of sources ranging from dietary factors to changes in exercise levels or stress levels of the children. However, repeated testing over time was thought to provide an accurate reflection of routine management which was representative of the child's weekly pattern. Perhaps what is required with this technique is more prolonged testing over several months in order to attain more reliable changes.

The lack of consistency in change as measured by the two urine testing methods in Study I and for the various measures in Study II illustrate an important point which has plagued psychophysiological assessments of anxiety. Recent research has indicated that large discrepencies exist between

concordance correlations of physiological variables for clinical vs. analogue studies (Sallis, Lickstein & McGlynn, 1980). It may very well be that concordance between the measures was not consistent due to individual subject response specificity and the fact that the subjects subjectively experienced relatively low levels of anxiety. This explanation is supported by Hodgson and Rachmans (1974) hypothesis that congruence among measures of anxiety will likely be higher during strong emotional arousal than under conditions of mild arousal.

While the results of the first study demonstrated that AMT had beneficial effects in generally reducing urine glucose levels, no such effect was found on the subjects' cognitive appraisal of their personal anxiety response patterns. It would appear that the AMT treatment was more effective in decreasing the physiological effects of anxiety than the cognitive aspects. However, it may well be that reductions in perceived anxiety are not related at all to reductions in urine glucose levels. In other words, it is possible that another mechanism is at work here. During the interview period with the subjects at the beginning of the study, there was an indication that some subjects tended to repress or deny the existence of physical aspects of anxiety verbally while appearing tense. It could be that the children did not have a well developed sense of their own anxiety response patterns.

Recent research has suggested that awareness of muscle

tension relative to depths of relaxation is not highly correlated (Stilson, Matus & Ball, 1980). The accuracy of passive verbal judgements of anxiety and tension levels is often unrelated to physiological measures of anxiety. Van Egeren (1971) stressed that anxiety is a multidimensional concept which is comprised of experiential, biological and behavioural systems. In support of this hypothesis, Lang (1971) proposed that "emotional behaviours are multiple system responses made up of verbal-cognitive, overt motor and physiological (autonomically innervated organ and tonic muscle activity) events. All systems are modulated by neural centers within the brain, but the correlations between their outputs are surprisingly low" (p. 105).

The lack of concordance between subjective and physiological measures of emotional states is not a new finding. Schachter (1964) posited that emotional states are in part defined by the ongoing physiological state and partly by the individual's cognitive appraisal of this state. It would seem likely that this fact was at least partly responsible for the findings of the present study. Muscle relaxation through instructional control of striate muscles is apt to have caused somatic-autonomic connections to reduce levels of sympathetic activity leading to decreased urine glucose levels.

The fact that self report measures of anxiety and tension did not decrease in the first study may be attributed

to the fact that the subjects in the present study did not have an appropriate cognitive scheme of anxiety. Several authors (eg. Brown, 1974; Budzynski & Stoyva, 1969; and Meichenbaum, 1976) have suggested that awareness of variation in muscle tension is a necessary factor in the ability to diminish tension levels leading to deepened relaxation. In cases where cognitive appraisal is not adequate or accurate, modification of the representation may be necessary to bring about congruency between the cognitive and physiological systems so as to provide stronger evidence of treatment efficacy.

Meichenbaum (1976) suggests that patients develop and reherse sets of cognitive, behavioural and physiological coping skills that increase the awareness of and sense of control over their physiology and behaviour, thereby altering their view of their symptoms. Central to this process is the utilization of patients' cognitive abilities to enhance training. This may be accomplished by allowing patients to alter their behaviour through the emission of self statements and images. Investigators such as Green, Walters, Green and Murphy (1969), and Sargent, Green and Walters (1973) used relaxation inducing self statements to enhance training. Meichenbaum and Turk (1975) have described a number of self statements used to control anxiety. Imagery has also been used to enhance behavioural change by establishing voluntary control over various physiological reactions in order to alter how presenting problems are viewed (Meichenbaum & Turk,

1975; Singer, 1974).

The discordance between cognitive and physiological assessments thought to contribute to diabetic control clearly illustrates a serious problem facing patients and health care workers alike. If patients are unaware of their response patterns then they may be less likely to be concerned about their condition.

It has been found that compliance is better when patients regard the disease as serious and consider themselves personally at risk (Becker, 1976). Many adolescent diabetics however, do not see themselves in this light and deviate from prescribed treatment regimens. Inappropriate behaviour relating to diet, urine testing, insulin injections, and activity levels may all lead to high glucose levels, but not necessarily to states of ketoacidosis. The lack of feedback may be a source of concern for without it, diabetic control is likely to be poor. Interestingly enough, all children in the study seemed to sense when their glucose levels were low. As a result, they would often overcompensate by eating too much or not exchanging their foods proprerly to increase glucose levels. It appeared that none of the children wanted to show a negative urine reading because they would be unaware of how low their sugars were. As a result they tended to maintain their glucose output higher than a negative reading. It would seem then that a deliberate attempt was made to avoid

becoming hypoglycemic resulting in higher glucose levels and poorer control.

Once urine testing began on a regular basis with reliable reporting, decreases in urine glucose levels occurred. It would seem then that this would support the contention that improved compliance to treatment regimens may lead to improved metabolic control. The effects of closer monitoring and supervision of self care has been found to be associated with improved compliance (Haynes & Sackett, 1976). Self monitoring has been found to be a reactive procedure with self regulatory functions (Thorensen & Mahoney, 1974). Thus, accurate charting may cause improved compliance and improved control. Contingency management procedures similar to that used by Lowe and Lutzker (1978) may also prove to be useful. If patients are able to see the beneficial effect of such programming on their levels of control then it may provide the necessary reinforcement to continue with it. An important factor in poor compliance is that often patients do not see the value of treatment (Haynes & Sackett, 1976).

The feedback obtained may have served to regulate the dietary habits of the children. A substantial aspect of treatment compliance in diabetics relates to diet. Adolescent diabetics are notorious for skipping meals or snacks, eating too much, eating sweets or not exchanging foods properly. In looking at Table 10 one can see that subject C who gained the most weight during the study, showed

the poorest response in terms of urine glucose decreases whereas subject D who lost the most weight, consistently showed the best reduction in glucose levels. Subject C also exhibited poor treatment compliance as she ceased urine testing for a 2 week period when the researcher was away and could not check on her.

Compliance may also have been improved through increased accuracy of insulin injection timing. Although the same dosage was given throughout the study, the exact time of injection may have become more consistent. Unfortunately no data was collected to support this contention. Activity levels may have also been monitored more closely but again no data is available to support this hypothesis. Thus, it may be that self monitoring has a positive effect on metabolic regulation. In future studies of this nature, investigators might be well advised to collect data on these variables in order to gain more information on treatment compliance in relation to treatment outcome.

Strict adherance to the treatment regimen appeared to be responsible for subject A's decrease in blood and urine glucose levels in the second phase of the study as well. During the time subject A was hospitalized, she lost 3.1 Kg. of weight on a 1700 cal./day diet. Activity levels were monitored and were kept constant as were insulin injection times. Changes in subject A's blood glucose and urine glucose levels did not reflect the alternation of relaxation

and attention-control conditions. To a lesser extent in Study II, subject C's test results reflected this finding as well, as a reduction in her urine glucose levels seemed to occur as a function of treatment adherence rather than due to the direct effect of the relaxation procedure on psychophysiological mechanisms. As such, it would appear that close adherence to the treatment regimen may have at least been partially responsible for the metabolic improvements noted.

As mentioned earlier however, in the first phase of the study no statistically significant reductions in daily urine glucose levels were found between the baseline and A-C phases in any subject. Differences were highly variable between these phases using the 24 hr. fractionated urinalysis. This finding would seem to suggest that increased compliance alone may not be sufficient to gain optimal diabetic control. Multiple measures of compliance and outcome are needed in future studies nevertheless.

When the anxiety management training treatment was introduced significant decreases in urine glucose levels (Diastix method) were found between the baseline and AMT phases and A-C and AMT phases for all subjects. Decreases were also found using the 24 hr. urinalysis method. It may be hypothesized that glucose levels decline due to the direct influence of the relaxation procedure on psychophysiological mechanisms. A reduction in anxiety seemed to decrease metabolic lability and lower urine glucose levels. Subject

B's performance in the second phase of the study certainly supports this contention as her blood glucose and urine glucose levels dramatically reflected the alternation between the relaxation and A-C phases. Unfortunately however this finding was not supported by the other subjects in Study II. Other studies focussing on stress reduction procedures (eg. reassurance) have reported decreases in blood ketones (Hinkle et al., 1950) and ketonuria (Hinkle & Wolf, 1952). As mentioned earlier in this study, EMG feedback has been used to facilitate relaxation training resulting in decreased insulin requirements (Fowler et al., 1976). A similar approach using seven subjects was reported in an abstract by Guthrie, Moeller, and Guthrie (1976), but unfortunately no outcome data were presented.

As a group, these studies and some of the findings of the present research seem to add support to the alternate hypothesis that stress and anxiety may have direct metabolic effects on levels of diabetic control and that stress reduction may bring about an improvement in control through physiological mechanisms. However, the relationship of stress to the course and control of diabetes based upon available research must be addressed with caution. Most work in this area often failed to distinguish between the direct effects of anxiety and the result of the patient's increased attention to the management of diabetes when helped with the reduction of anxiety. The present study however, attempted to

deal with this methodological problem by instituting the attention-control condition in both phases of the study. Thus, there does seem to be some evidence of a direct physiological effect of anxiety on diabetic control.

A more reasonable explanation, is that indirect and direct effects of stress and anxiety affect diabetic control. The paucity of relevant research prohibits strong statements supporting either hypothesis alone. As a consequence, methods of improving diabetic control must focus on reducing the destabilizing effects of stress and anxiety and fostering improved self care in poorly controlled diabetics.

A particularly relevant issue must now be dealt with. That is, what degree of control do patients need to achieve before the benefits of good control can be gained? The issue of diabetic control is one which has raised considerable controversy. The objective of diabetic control is to restore normal metabolic balance by using carbohydrate metabolism as the index. The control criteria commonly used for 24 hour collections of urine range from 0 gm/24 hrs. indicating excellent control to greater than 100 gm/24 hrs. indicating poor control. An average child in good control spills approximately 20-60 gm of glucose per day. Using this criteria then, only two subjects in the first phase of the study might be considered in good control during the AMT phase, two could be considered in fair control and one could be seen as being in poor control. Of course, baseline levels

must be considered, for children who are in very poor control to begin with and then show large decreases may show experimental improvement but not clinical improvement.

As far as daily urine glucose assessments are concerned, current concensus indicates that 100% of urine specimens free of sugar is considered excellent control. Less than 50% of specimens free of sugar indicates poor control. Using these criteria, none of the children in the study were in good or even fair clinical control. However, statistically significant decrease in urine glucose levels between the baseline and AMT phases for all subjects (Diastix method) indicated a definite improvement in experimental control.

Aside from the short term benefits of improved clinical control (avoidance of hyperglycemia and hypoglycemia) another question is to what extent can good clinical control prevent or delay the onset of the long term degenerative complications such as diabetic retinopathy, nephropathy, neuropathy and peripheral vascular disease. This question cannot be answered because the degree of metabolic control necessary to minimize the risk yet allow the patient leeway has not yet been established (Skyler, 1979). The patient's motivation for pursuing good control is critical. Unless these levels are stated patients may not be convinced of the necessity of striving for good control. In addition, the occurrance of long term complications is not as obvious as the short term complications so immediate feedback which may

play a regulatory function is lacking. On the other hand, chronic complications may still occur even if the patient has given his or her best effort at achieving good control. Poor control may not only be a result of abnormal glucose values, but of other factors as well. While blood and urine glucose values need to be kept as close to normal as possible through adequate management, control can be affected by colds, infections, pregnancy and other factors over which the patient has little or no control. Diet and insulin levels must be adjusted accordingly. Urine testing plays a major role here for as Ludvigsson and Svensson (1979) state,

> "Our main impression is that daily home testing of urine carries with it psychological advantages. The patients or parents get the possibility to manage the treatment, they learn the effects of diet, physical exercise insulin, infection, etc., and can avoid acute complications. Thus the urine tests contribute to increasing knowledge, increasing confidence and independence, a more positive attitude to other parts of treatment and as a consequence, better metabolic control" (p. 890).

An intensive training program was carried out by Peterson, Jones, Dupuis, Bernstein and O'Shea (1978) in an attempt at achieving a high degree of diabetic control. Preliminary results suggested that blood glucose monitoring as well as exercise monitoring was successful in improving control. However all patients are not necessarily going to co-operate with such a rigorous program. Nevertheless, if patients are able to see the results of their efforts to

maintain good control regardless of the method used then this may serve to reinforce future efforts.

The problems encountered in carrying out this study clearly illustrate the fact that behavioural investigation of medical disorder in general and of diabetic control in particular is a highly complicated matter. When objectives such as improved control are specified, it becomes apparent that there are many factors which influence the various dependent measures. The relative importance of different factors varies from patient to patient thus complicating matters and control over these factors is lacking. Nevertheless an effort was made to blend appropriate methodological and measurement techniques to account for these factors and patient variability. The use of a single subject design permitted questions to be answered with only a few patients and permitted important research information to be collected while maintaining a highly individualized approach.

Because of the highly individualized impact of different factors on each subject, it is difficult to make blanket statements regarding treatment effects. The results of the present study have to be attenuated on the basis of several factors. First of all the number of subjects who participated in the study was very small in spite of efforts to recruit a larger number. The subjects who decided to participate may not have been representative of the general population of poorly controlled adolescent diabetics. The

fact that 83% refused to participate could have biased the treatment results and limited the generalizability of the results. This type of selection bias has been shown to seriously affect outcome results and limit the generalization of research with schizophrenic adults (Spohn & Fitzpatrick, 1980).

The fact that only female subjects were used with a male therapist may have also influenced the generalizability of the findings. While there is little research regarding the effect of opposite sex therapist/patient treatment outcomes (Parloff, Waskow & Wolfe, 1978) one study did report a significant therapist sex/patient sex interaction, following systematic desensitization of test anxiety (Geer & Hurst, 1976). It is not inconceivable to assume that some degree of therapist-subject transferance occurred which may have caused non-specific treatment effects. However, the use of the attention-control condition is hoped to have adequately dealt with the effect by controlling for the amount of therapist-subject contact across conditions.

Another limiting factor is the general inconsistency of assessment measures. Problems associated with the validity of assessment measures particularly in the area of behavioural, cognitive and physiological measures of anxiety caused conclusions based on the present data to be seen as tentative. While the single subject design enabled individual responses to treatment to be analyzed, the fact

that individual response specificity is so prevalent prohibits overly general statements about treatment efficacy to be made. However, the treatment of patients with medical disorders such as diabetes requires highly individualized approaches. As such, outcome research should be directed towards answering the question as to "what treatment, by whom is most effective for this individual with what specific problem and under which set of circumstances" (Paul, 1967, p. 111).

Thus, the results of the present study as tenuous as they were, are still felt to have shed some light on the relative merits of the anxiety management training treatment. Because of the variability the AMT had on each subject, the application of a routine treatment program without taking into account each patient's individuality will likely be inefficient, ineffective or both. Since the mechanism through which the AMT worked is still unknown it would be wise to adopt a cautious view. If the aim is to improve metabolic control, it may not be sufficient to attempt to improve compliance alone. Too many other factors such as stress and anxiety can affect the metabolic state. A multi-faceted program is needed to deal with the many factors involved (Watts, 1980).

The extent to which diabetic control is related to psychological adjustment or to anxiety factors cannot be answered at this time as the literature addressing these

issues provide few consistent findings. Although the literature as well as the findings of the present study are inconclusive regarding the mechanism involved, new research endeavors are needed. A replication of the second part of this study is required with more subjects in order to provide more data to support either the direct or indirect hypothesis. Such information is of great importance if the effect of psychological factors on diabetic control is to be specified so decisions can be made as to what psychological intervention techniques may be most effective. Other areas which require investigation are those which deal with the reactivity of various patients to stress. Johnson (1980) poses some of these questions. Are some patients more physiologically reactive to stress than others? Do some cope poorly with normal stress with subsequent physiological effects leading to a less stable form of diabetes? Do individuals have consistant types of physiological stress reactions? Does the reaction depend on the type of stress involved?

Issues involving compliance with diabetic regimens need also be addressed. Research aimed at investigating the effects of self monitoring and supervision of self care are needed. In addition, behavioural programming studies similar to that devised by Lowe and Lutzker (1978) are needed to assess the usefulness of contingency management procedures.

As far as aspects of the first part of the study are

concerned other areas here need further research. Follow up data is needed to determine if subjects who initially improve following treatment by AMT will retain their level of improvement. An area of theoretical research might include AMT studies which are designed to determine which effects of treatment are attirbutable to counterconditioning, experimental extinction, reactive inhibition aspects of instrumental conditioning or other learning principles. It seems likely that AMT is a complex process made up of a number of learning principles being applied at the same time. The process of asking the subject to experience high levels of anxiety and then to switch it off may involve fatiguing the response as well as experimental extinction. The pairing of physiological cues for anxiety with anxiety reduction involves counterconditioning. The use of anxiety control cues in extra therapy sessions may involve instrumental conditioning as well as counterconditiong.

In the end however, further research will be needed to assess those factors which influence an individual's self management and adjustment to diabetes. Health care professionals must become aware of the factors which contribute to compliance and non-compliance in juvenile diabetics and thereby develop treatment regimens which can be incorporated into the patient's lifestyle. More clinical and fundamental investigations are needed to better characterize and quantify how stress and anxiety affect carbohydrate

metabolism in diabetic patients. In doing so, it is hoped that answers may be gained which will facilitate improvements in the course and control of juvenile diabetes mellitus.

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APPENDICES

APPENDIX A

ANXIETY MANAGEMENT TRAINING PROGRAM
INTAKE INTERVIEW RECORD

CONFIDENTIAL

Name: _____

Date: _____

Counselor: _____

Etiology, Chronicity and Pervasiveness of Anxiety

Precipitating Conditions

Conditions which alleviate anxiety
(medications, etc.)

Questions concerning Intake Form, Symptom Check List, etc.
Extent of interference with normal functioning.

Previous psychiatric or psychological contacts

Where? How Long?

When? What For?

APPENDIX B

OUTLINE OF ANXIETY MANAGEMENT TRAINING PROGRAM (AMT)

This is a brief outline for you to keep. It was put together to let you know what to expect from each treatment session in terms of what you will be doing and talking about each treatment session.

I. SESSION I (2 hours)

During this session your therapist will teach you deep muscle relaxation - a technique developed by Jacobson in the 1930's and since used as a way of "unlearning" anxiety by replacing it with feelings of relaxation. The therapist will spend some time talking with you about how the relaxation practice went. The treatment program will be explained in further detail to you and any questions that you have about the program will be answered at this time.

II. SESSION II (2 hours)

This session will begin with a discussion of how the treatment program will proceed and how it works. Deep muscle relaxation will be induced. You will be asked to generate anxiety while in a relaxed state and the therapist will bring the feelings of anxiety under control using relaxation as an

antagonistic response to anxiety. During this session the therapist will help you to control your anxiety and to begin to teach you ways in which you can learn to control feelings of anxiety for yourself. Some time will be spent during the session to talk about how it is going for you.

III. SESSION III (1 hour)

During this session the therapist will again be using relaxation as a means of controlling anxiety. The therapist will once again ask you to generate feelings of anxiety and help you to control them. You will be learning that you can control feelings of anxiety by the method taught during Treatment Sessions I and II. Some time will be spent at the end of the session to discuss how the program is going for you.

IV. SESSION IV (1 hour)

This session is basically the same as Session III.

V. SESSION V (1 hour)

This session will be used primarily as an interaction session between you and the therapist. It will provide an opportunity for you to exchange information with the

therapist concerning how you have been able to utilize the AMT program in your everyday life. The therapist will also be making suggestions to you about how you can best make use of the program in being in control of your own feelings.

Children's Hospital of Eastern Ontario
Hôpital pour enfants de l'est de l'Ontario

APPENDIX C

INFORMED CONSENT

This is to affirm that I have agreed to allow _____ to participate in the investigation of the efficacy of alternate treatment strategies in improving diabetic control, conducted by Mr. M. Rose, Dr. A. Faught, Dr. H. Heick and Dr. P. Firestone at the Children's Hospital of Eastern Ontario.

Further, I have been informed that my child will be given various psychological tests and questionnaires and will be required to perform urine tests at home by him/herself for a period of approximately six months.

(Signed) _____

Relationship _____

Date _____

Witness _____

401 SMYTH ROAD, OTTAWA, ONT. K1H 8L1 TELEPHONE (613) 737-7600

APPENDIX D

TREATMENT RATIONALE

Over the years, various doctors and psychologists have found that the control of blood and urine glucose values can be both directly and indirectly altered by emotional stress and anxiety. We have found that fluctuations in blood and urine glucose levels tend to result in poor diabetic control which may lead to various illnesses.

Anxiety and tension are learned responses to stress which can be modified in a number of ways. It has been shown by many people that simply understanding oneself can help reduce anxiety in people who are under a great deal of stress. Feelings of anxiety, frustration, anger, etc., can be reduced and may be replaced by feelings of relaxation and calmness. In fact, there is little disagreement among doctors that this can play an important role in reducing tension and anxiety. By understanding oneself, relaxation which is a better response than anxiety, can occur and can aid in improving blood and urine glucose values.

In order to assess your personal makeup you will undergo some psychological tests. We will then discuss the results. This will give you a better understanding of yourself and make you less tense and may aid in improving your blood and urine glucose levels.

APPENDIX E

Instructions: Please read each statement and rate each question. Circle a number depending on how strong you feel about the statement. Circle "1" if your answer is negative and circle "10" if your answer is positive. Use 2, 3, 4, 5, 6, 7, 8, 9 for in-between ratings.

1. How good does this type of treatment seem to you?

   1 2 3 4 5 6 7 8 9 10

2. How confident would you be that this treatment would be successful in eliminating tension and anxiety?

   1 2 3 4 5 6 7 8 9 10

3. How confident would you be in recommending this treatment to a friend who was tense and anxious?

   1 2 3 4 5 6 7 8 9 10

4. If you were extremely anxious and tense would you be willing to undergo such treatment?

   1 2 3 4 5 6 7 8 9 10

5. How successful do you feel this treatment would be in decreasing fear; for example, strong fear of taking tests or fear of other things?

   1 2 3 4 5 6 7 8 9 10

Are there any questions

Name: _____

Age _____ Sex _____ Date _____

APPENDIX F

TREATMENT RATIONALE

Over the years various doctors and psychologists have found that the control of juvenile diabetes can be both directly and indirectly altered by emotional stress. We have found that the emotions of stress and anxiety tend to result in poor diabetic control which may lead to various illnesses.

Anxiety and tension are learned responses which can be modified or unlearned by following some known learning principles. One type of treatment which has been used to help people who suffer from tension and anxiety is called Anxiety Management Training (AMT). The purpose of AMT is to provide a new response, relaxation, which is a better response than anxiety and aids in good diabetic control.

Anxiety Management Training consists of three different parts. First you will learn how to relax your whole body by tightening and relaxing different muscles. It will be important for you to find time to practice this relaxation between sessions as like many activities, the more that you can practice it, the easier it will be to become more and more relaxed and to become relaxed more quickly. With more practice, deeper and deeper levels of relaxation can be achieved.

The next part of AMT will help you develop three types of scenes. That is, a pleasant relaxed scene, an anxiety scene and a success scene. Secondly, we will focus on the way you express anxiety physically. We will look at and experience the differences between the opposite responses of relaxation and anxiety. You cannot be anxious and relaxed at the same time. We will also learn a way in which you can get control over feelings of anxiety and tension. Anxiety is a learned response and can be unlearned and calm relaxed feelings can be learned to take the place of the feelings of anxiety. That is, the feelings of anxiety can be stopped and can be replaced with feelings of calmness and relaxation through a learning process. As you become more and more aware of the physical signs of anxiety that you have and more and more aware of the pleasant calm feelings of relaxation you can learn to achieve the feelings of calmness more often and use them to your benefit. You can learn that it is you who have control over these feelings and that the relaxed calm feelings can be used by you in many situations in which you have felt anxious in the past.

APPENDIX G

INSTRUCTIONS: The following are some statements on feelings, daydreams, attitudes, and behaviour. Read each statement and decide how often it applies to you. Circle "1" if the statement never applies to you; "5" is you experience it almost all the time; use "2", "3", and "4" for in-between ratings.

Never = 1

Rarely = 2

Sometimes = 3

Fairly often = 4

Nearly always = 5

Be honest, but do not spend too much time over any one statement. As a rule, first impressions are as accurate as any.

Are there any questions?

Name _____

Age _____ Sex _____ Date _____

Never = 1 Rarely = 2 Sometimes = 3 Fairly Often = 4 Nearly Always = 5

1.	My feelings are easily hurt	1 2 3 4 5
2.	I am troubled with backaches	1 2 3 4 5
3.	I am troubled with discomfort in the pit of my stomach	1 2 3 4 5
4.	The muscles in my neck ache as if they were tied in knots	1 2 3 4 5
5.	I am an easy going person	1 2 3 4 5
6.	I have a tendency to worry	1 2 3 4 5
7.	The top of my head feels tender	1 2 3 4 5
8.	I have pounding headaches in which I can feel a definite beat	1 2 3 4 5
9.	I am bothered by dizziness	1 2 3 4 5
10.	I am a nervous person	1 2 3 4 5
11.	I have a hard time swallowing	1 2 3 4 5
12.	I have trouble with my hand shaking when I write	1 2 3 4 5
13.	I notice my heart pounding	1 2 3 4 5
14.	I am afraid that I am going to blush	1 2 3 4 5
15.	I have frightening dreams	1 2 3 4 5
16.	I do not think I am as happy as others	1 2 3 4 5
17.	I have feelings of panic for no special reason	1 2 3 4 5
18.	I clench my teeth when anxious	1 2 3 4 5
19.	I am troubled by tension interfering with my speech	1 2 3 4 5
20.	I feel chilly at temperatures that are comfortable for others	1 2 3 4 5
21.	I am a relaxed person	1 2 3 4 5
22.	I have trouble with muscles twitching and jumping	1 2 3 4 5
23.	I suddenly feel hot all over, without apparent cause	1 2 3 4 5

Never = 1 Rarely = 2 Sometimes = 3 Fairly Often = 4 Nearly Always = 5

24.	I am easily frightened	1 2 3 4 5
25.	My hand shakes when I try to do something	1 2 3 4 5
26.	My finger tips or other extremities become cold	1 2 3 4 5
27.	I go to sleep without thoughts or ideas bothering me	1 2 3 4 5
28.	My skin becomes painfully sensitive	1 2 3 4 5
29.	In the absence of physical action my heart beats wildly	1 2 3 4 5
30.	I am either too hot to too cold and cannot get comfortable at a constant temperature setting	1 2 3 4 5
31.	I take things hard	1 2 3 4 5
32.	I have pains in the back of the neck	1 2 3 4 5
33.	I am short of breath without knowing why	1 2 3 4 5
34.	My mouth feels dry	1 2 3 4 5
35.	I take things in stride	1 2 3 4 5
36.	Life is a strain for me	1 2 3 4 5
37.	I have sensations of burning, tingling, or crawling in certain parts of my body	1 2 3 4 5
38.	I have continuing headaches that last over several days	1 2 3 4 5
39.	I am bothered by blushing	1 2 3 4 5
40.	I become upset when I have to wait	1 2 3 4 5
41.	My sleep is fitful and disturbed	1 2 3 4 5
42.	My head feels tender to the point that it hurts when I comb my hair or put on a hat	1 2 3 4 5
43.	When embarassed, I break out in a sweat which annoys me greatly	1 2 3 4 5
44.	I have stomach trouble	1 2 3 4 5
45.	I feel that I am about to go to pieces	1 2 3 4 5

Never = 1 Rarely = 2 Sometimes = 3 Fairly Often = 4 Nearly Always = 5

46.	I have trouble getting my breath, for no special reason	1 2 3 4 5
47.	I break out in a sweat, which is not the result of heat or physical exertion	1 2 3 4 5
48.	I worry about little things	1 2 3 4 5
49.	I have periods of such restlessness that I cannot sit still	1 2 3 4 5
50.	I grind my teeth in my sleep	1 2 3 4 5
51.	I am troubled with diarreah	1 2 3 4 5
52.	I become irritable with little things	1 2 3 4 5
53.	I have pressure headaches in which my head feels as if it were caught in a vise or as if there were a tight band around it	1 2 3 4 5

APPENDIX H

DIARY

MONTH _____

DAY	A.M.	P.M.	NIGHT	INSULIN UNITS	REMARKS	CALORIES/ DAY
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
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21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						

APPENDIX I

RELAXATION TECHNIQUES

EXERCISE I:

RELAXATION OF ARMS:

Settle back as comfortably as you can. Let yourself relax to the best of your ability ... Now, as you relax like that, clench your right fist, just clench your fist tighter and tighter, and study the tension as you do so. Keep it clenched and feel the tension in your right fist, hand, forearm ... and now relax. Let the fingers of your right hand become loose and observe the contrast in your feelings ... Now, let yourself go and try to become more relaxed all over ... Once more, clench your right fist really tight ... hold it, and notice the tension again ... Now let go, relax; your fingers straighten out and you notice the difference once more ... Now repeat that with your left fist. Clench your left fist while the rest of your body relaxes; clench that fist tighter and feel the tension ... and now relax. Again enjoy the contrast ... Repeat that once more, clench the left fist, tight and tense. Now do the opposite of tension, relax and feel the difference. Continue relaxing like that for a while ... Clench both fists tighter and tighter, both fists tense, forearms tense, study the sensations ... and relax; straighten out your fingers and feel that relaxation. Continue relaxing your hands and forearms more and more ... Now bend your elbows and tense your biceps, tense them harder and study the tension feelings ... all right, straighten out your arms, let them relax and feel that difference again. Let the relaxation develop ... Once more, tense your biceps; hold the tension and observe it carefully ... Straighten the arms and relax; relax to the best of your ability ... Each time, pay close attention to your feelings when you tense up and when you relax. Now straighten your arms, straighten them so that you feel most tension in the triceps muscles along the back of your arms; stretch your arms and feel that tension ... and now relax. Get your arms back into a comfortable position. Let the relaxation proceed on its own. The arms should feel comfortably heavy as you allow them to relax ... Straighten them. Feel that tension ... and relax. Now let's concentrate on pure relaxation in the arms without any tension. Get your arms comfortable and let them relax further and further. Continue relaxing your arms ever further. Even when your arms seem fully relaxed, try to go that extra bit further; try to achieve deeper and deeper levels of relaxation.

EXERCISE II:

RELAXATION OF FACIAL AREA WITH NECK, SHOULDERS AND UPPER BACK:

Let all your muscles go loose and heavy. Just settle back quietly and comfortably. Wrinkle up your forehead now; wrinkle it tighter ... and now stop wrinkling your forehead, relax and smoothe it out. Picture the entire forehead and scalp becoming smoother as the relaxation increases ... Now frown and crease your brows and study the tension ... Let go of the tension again. Smoooth out the forehead once more ... Now, close your eyes tighter and tighter ... feel the tension. Now relax your eyes. Keep your eyes closed, gently, comfortably and notice the relaxation. Now clench your jaws, bite your teeth together; study the tension throughout the jaws ... Relax your jaws now. Let your lips part slightly ... Appreciate the relaxation ... Now press your tongue hard against the roof of your mouth. Look for the tension ... All right, let your tongue return to a comfortable and relaxed position ... Now purse your lips, press your lips together tighter and tighter ... Relax your lips. Note the contrast between tension and relaxation. Feel the relaxation all over your face, all over the forehead and scalp, eyes, jaws, lips, tongue and throat. The relaxation progresses further and further ... Now attend to your neck muscles. Press your head back as far as it can go and feel the tension in the neck; roll it to the tight and feel the tension shift; now roll it to the left. Straighten your head and bring it forward, press your chin against your chest. Let your head return to a comfortable position and study the relaxation. Let the relaxation develop ... Shrug your shoulders, right up. Hold the tension ... Drop your shoulders and feel the relaxation. Neck and shoulders relaxed ... Shrug your shoulders again and move them around. Bring your shoulders up and forward and back. Feel the tension in your shoulders and in your upper back ... Drop your shoulders once more and relax. Let the relaxation spread deep into the shoulders, right in your back muscles; relax your neck and throat, and your jaws and other facial areas as the pure relaxation takes over and grows deeper ... deeper ... ever deeper.

EXERCISE III:

RELAXATION OF CHEST, STOMACH AND LOWER BACK:

Relax your entire body to the best of your ability. Feel that comfortable heaviness that accompanies relaxation. Breathe easily and freely in and out. Notice how the relaxation increases as you exhale ... as you breathe out just feel that relaxation ... Now breathe right in and fill your lungs; inhale deeply and hold your breath. Study the tension ... Now exhale, let the walls of your chest grow loose and push the air out automatically. Continue relaxing and breathe freely and gently. Feel the relaxation and enjoy it ... With the rest of your body as relaxed as possible, fill your lungs again. Breathe in deeply and hold it again ... That's fine, breathe out and appreciate the relief. Just breathe normally. Continue relaxing your chest and let the relaxation spread to your back, shoulders, neck and arms. Merely let go and enjoy the relaxation. Now let's pay attention to your abdominal muscles, your stomach area: Tighten your stomach muscles, make your abdomen hard. Notice the tension ... and relax. Let the muscles loosen and notice the contrast ... Once more, press and tighten your stomach muscles. Hold the tension and study it ... and relax. Notice the general well-being that comes with relaxing your stomach ... Now draw your stomach in, pull the muscles right in and feel the tension this way ... now relax again. Let your stomach out. Continue breathing normally and easily and feel the gentle massaging action all over your chest and stomach ... Now pull your stomach in again and hold the tension. Now push out and tense like that; hold the tension. Once more pull in and feel the tension ... now relax your stomach fully. Let the tension dissolve as the relaxation grows deeper. Each time you breathe out, notice the rhythmic relaxation both in your lungs and in your stomach. Notice thereby how your chest and your stomach relax more and more ... Try and let go of all contractions anywhere in your body ... Now direct your attention to your lower back. Arch up your back, make your lower back quite hollow and feel the tension along your spine ... and settle down comfortably again relaxing the lower back ... Just arch your back up and feel the tensions as you do so. Try to keep the rest of your body as relaxed as possible. Try to localize the tension throughout your lower back area ... Relax once more, relaxing further and further. Relax your lower back, relax your upper back, spread the relaxation to your stomach, chest, shoulders, arms and facial area. These parts relaxing further and further and further and ever deeper.

EXERCISE IV:

RELAXATION OF HIPS, THIGHS AND CALVES FOLLOWED BY COMPLETE BODY RELAXATION:

Let go of all tensions and relax ... Now flex your buttocks and thighs. Flex your thighs by pressing down your heels as hard as you can ... Relax and note the difference ... Straighten your knees and flex your thigh muscles again. Hold the tension. Relax your hips and thighs. Allow the relaxation to proceed on its own ... Press your feet and toes downwards, away from your face so that your calf muscles become tense. Study that tension ... Relax your feet and calves ... This time, bend your feet towards your face so that you feel tension along your shins. Bring your toes right up ... relax again. Keep relaxing for a while ... Now let yourself relax further all over. Relax your feet, ankles, calves and shins, knees, thighs, buttocks and hips. Feel the heaviness of your lower body as you relax still further ... Now spread the relaxation to your stomach, waist, lower back. Let go more and more. Feel that relaxation all over. Let it proceed to your upper back, chest, shoulders and arms and right to the tips of your fingers. Keep relaxing more and more deeply. Make sure that no tension has crept into your throat; relax your neck and your jaws and all your facial muscles. Keep relaxing your whole body like that for a while. Let yourself relax.

Now you can become twice as relaxed as you are merely by taking in a really deep breath and slowly exhaling. With your eyes closed so that you become less aware of objects and movements around you and thus prevent any surface tensions from developing, breathe in deeply and feel yourself becoming heavier. Take in a long, deep breath and let it out very slowly ... Feel how heavy and relaxed you have become.

In a state of perfect relaxation you should feel unwilling to move a single muscle in your body. Think about the effort that would be required to raise your right arm. As you think about raising your right arm, see if you can notice any tensions that might have crept into your shoulder and your arm ... Now you decide not to lift the arm but to continue relaxing. Observe the relief and the disappearance of the tension ...

Just carry on relaxing like that. When you wish to get up, count backwards from four to one. You should then feel fine and refreshed, wide awake and calm.

APPENDIX J

INTERIM DIRECTIONS

Let the relaxation proceed on its own. The arms should feel comfortably heavy as you allow them to relax ... Now let's concentrate on pure relaxation in the arms without any tension. Get your arms comfortable and let them relax further and further. Continue relaxing your arms ever further. Even when your arms seem fully relaxed, try to go that extra bit further; try to achieve deeper and deeper levels of relaxation.

Let the relaxation spread deep into the shoulders, right into your back muscles, relax your neck and throat, and your jaws and face and forehead as the pure relaxation takes over and grows deeper ... deeper ... ever deeper.

Relax your entire body to the best of your ability. Feel that comfortable heaviness that accompanies relaxation ... Breathe easily and freely in and out. Notice how the relaxation increases as you exhale ... as you breathe out just feel that relaxation ... Now breathe right in and fill your lungs; inhale deeply and hold your breath. Study the tension ... Now exhale, let the walls of your chest grow loose and push the air out automatically. Continue relaxing and breathe freely and gently. Feel the relaxation and enjoy it ... With the rest of your body as relaxed as possible, fill your lungs again. That's fine, breathe out and appreciate the relief. Just breathe normally. Continue relaxing your chest and let the relaxation spread to your head, shoulders, neck and arms. Merely let go ... and enjoy the relaxation.

Now relax again. Continue breathing normally and easily and feel the gentle massaging action all over your chest and stomach ... Now pull your stomach in and hold the tension ... now relax your stomach fully. Let the tension dissolve as the relaxation grows deeper. Each time you breathe out, notice the rhythmic relaxation both in your lungs and in your stomach. Notice and let go of all contraction anywhere in your body.

Relax once more, relaxing further and further. Relax your upper back, relax your lower back, spread the relaxation to your stomach, chest, shoulders, arms and facial area. These parts relaxing further and further and ever deeper.

Relax again. Keep relaxing for a while ... Now let yourself relax further all over. Relax your feet, ankles, knees, thighs, and hips. Feel the heaviness of your lower

body as you relax still further ... Now spread the relaxation to your stomach, waist, lower back. Let go more and more. Feel that relaxation all over. Let it proceed to your upper back, chest, shoulders and arms and right to the tips of your fingers. Keep relaxing more and more deeply. Make sure that no tension has crept into your throat; relax your neck and your jaws and all your facial muscles. Keep relaxing your whole body like that for a while. Let yourself relax.

Now you can become twice as relaxed as you are merely by taking in a really deep breath and slowly exhaling. With your eyes closed so that you become less aware of objects and movements around you and thus prevent any surface tensions from developing, breathe in deeply and feel yourself becoming heavier. Take in a long, deep breath and let it out very slowly ... Feel how heavy and relaxed you have become.

In a state of perfect relaxation you should feel unwilling to move a single muscle in your body.

Now, your whole body becomes progressively heavier, and all your muscles relax. Let go more and more completely. We shall give your muscles individual attention. Relax the muscles of your forehead (pause 5-10 sec.). Relax the muscles of the lower part of your face (pause 5-10 sec.). Relax the muscles of your jaws and those of your tongue (pause 5-10 sec.). The more you relax, the calmer you become (pause). Relax the muscles of your neck (pause). Let all the muscles of your shoulders relax. Just let yourself go (pause). Relax the muscles of your arms (pause). Relax the muscles of your trunk and lower limbs. Let your muscles go more and more. You feel so much at ease and so very comfortable.

APPENDIX K

AMT SCRIPT
ANXIETY MANAGEMENT TRAINING

I. SESSION I (2 hours)

A. Training

B. Orientation to treatment program and interview (10-15 minutes). (Interview time used to see how the relaxation training went for each individual and how clearly scenes were visualized). Three parts to program: relaxation training, visualization training, and therapy. Scenes are to be developed by Ss themselves (relaxation scene and anxiety scene).

"The remaining sessions will continue to make use of deep muscle relaxation. It is important for you to find time to practice the relaxation between sessions as, like many activities, the more that you can practice it the easier it is to become more and more relaxed and to become relaxed more quickly. That is, with continuing practice deeper and deeper levels of relaxation can be achieved. The ideal situation would be to find a quiet place where you live - a place where you will not be bothered by anyone - to practice. Sometimes the only quiet time will be just before going to sleep at night. Any time that is suitable to your schedule is fine; but what IS IMPORTANT is that you can find some time each day to practice the relaxation."

"The remaining sessions will consist of two basic parts. First we will be focusing on developing three types of scenes clearly, that is, a pleasant relaxed scene, an anxiety scene, and a success scene and secondly, we will be focusing on the ways in which you express anxiety physically. We will look at and experience the differences between the opposite responses of relaxation and anxiety. They are antagonistic responses - that is, you cannot be relaxed and anxious at the same time. We will also learn a way in which you can achieve control over feelings of anxiety. Anxiety is a learned response and hence can be unlearned and calm, relaxed feelings can be learned to take the place of the feelings of anxiety. That is, the feelings of anxiety can be stopped and replaced with feelings of calmness and relaxation through a learning process. As you become more and more aware of the physical signs of anxiety that you have and more and more aware of the pleasant, calm feelings of relaxation you CAN learn to achieve the feelings of calmness more often and use them to your benefit. You CAN learn that it is you who HAVE

CONTROL over these feelings and that the relaxed calm feelings can be used by you in many situations in which you have felt anxious in the past."

C. Hand out treatment program outline prepared for the clients.

II. SESSION II (2 hours)

A. Orientation to the treatment procedure

"During this session we will be using the deep muscle relaxation technique that you have learned to look at the differences between feelings of anxiety and feelings of relaxation. You will also be developing a pleasant scene, an anxiety scene, and a success scene of your own choosing to help you become more aware of the great differences between those opposite feelings. We will also be stopping from time to time to talk about how it is going for you. Also during this session we will begin to learn how to achieve control over anxiety by switching from feelings of tension and the anxious scene to relaxed feelings and the pleasant scene. At first I will be helping you control the anxiety so do not be afraid to allow yourself to experience the anxiety associated with that scene fully and appreciate the differences between anxiety and the feelings of calmness and relaxation that come with the pleasant scene. I will be here to help you control the anxiety at first, but as you learn that anxiety can be controlled, you will be more and more in control of the situation and eventually will no longer need help from me in controlling the anxiety. You will notice that as you become more and more in control of your own feelings and more able to feel relaxed and calm a new set of feelings will begin to develop. You will begin to have some real positive feelings of competence and mastery over the anxiety as well as the pleasant, relaxed state that replaced the feelings of anxiety."

B. Relaxation with muscle tension

C. Break and interview (see how it went for each subject and emphasize a focus on the feelings of relaxation)

D. Relaxation with interim directions - for visualization training

"Now focus, without doing anything, on the feeling of bodily and mental relaxation you have achieved ... Notice exactly how it feels to be so relaxed and calm ... you can achieve this relaxed state more often than you think, and it can be very useful to you ... You will be able to recapture

part or all of this relaced state when you get anxious or afraid ... this may help you to feel better and function better or more comfortably in a variety of situations ... just notice what it feels like for a moment ... focus on the feeling, the state, and enjoy it ..."

E. Pleasant scene

"Let yourself relax all over and let all distractions fade away ... let your mind become a blank screen, relaxed and calm ... let your awareness of anything outside yourself fade away ... now I want you to visualize yourself in a relaxed, pleasant scene ... it can be any scene, indoors or out, with or without people ... just let a pleasant, comfortable, relaxed, happy scene appear ... visualize many of the details of the scene as clearly as you can ... try to see yourself in the scene, be in it, put yourself in the relaxing, pleasant scene and as the scene becomes more and more clear actually experience the calmness, harmony, the relaxation ... if it helps you get into the scene, pay attention to any sounds, smells, tastes, or bodily sensations associated with this scene and the relaxation ... use any senses if they help you get into the scene and experience the pleasurable relaxation. Focus on the feelings ... the state of relaxation you are experiencing right now ... study the way it feels, physically and mentally relaxed and calm. This is the feeling of calmness that you can learn to achieve more often and use to your benefit ... just enjoy the feeling for a moment more ... now let the pleasant scene dissolve away ... let your mind go blank and continue relaxing for a moment ..." (awaken instructions and interview ... emphasize focus on clarity of imagery and feeling state.)

F. Relaxation with interim directions

G. Anxiety Induction

"Alright, let the relaxation go now and pick out a real life situation from your past that involves a great deal of anxiety, fear, uncertainty, dread and awfulness. The scene must be useful to you in calling up and reliving feelings of anxiety and fearfulness ... Just decice on any scene that helps you create a very anxious state. Begin to visualize the anxiety scene now. Use any image, sound or bodily sensation that helps you recreate that anxious or fearful feelings. Try to visualize it clearly ... be in it and let the sensations become more intense ... feel your heart starting to pound and your breathing becoming very shallow and irregular ... palms beginning to sweat and your stomach becoming jittery ... As the scene becomes clearer and clearer notice the various bodily sensations you use to express your anxiety ... the muscles becoming tight and tense ... your

stomach feels like it has a knot in it ... your mouth feels dry ... just notice all the bodily changes that occur as the anxiety increases and spreads throughout your entire body. Don't stop yourself from feeling more and more fear and anxiety ... just let yourself experience the feelings that are associated with the anxiety scene. Experience the scene vividly and be in it ... Feel the discomfort of your body ... how rapidly you are breathing and how hard your heart is pounding ... feel any changes of body temperature, heat or chills ... the tight muscles ... the panicky helpless feelings ... let the feelings of anxiety reach a high peak as you visualize the scene ... let the anxiety reach such an intense point that you feel you have no control over it ..."

H. Anxiety control cue and relaxation

"Now take in a deep breath, hold it for a moment ... slowly exhale ... and relax ... good. Switch back to relaxing now ... first let the anxiety scene fade away ... just sweep the scene away and focus only on reachieving the comfortable feelings of relaxation ... focus on the refreshing feelings of relaxation that spread throughout your entire body ... the forehead and scalp, smooth out ... the arms, comfortably heavy ... spread the relaxation to all the facial muscles, the muscles of the back ... and allow the relaxation to flow into the muscles of the stomach, waist ... trunk, legs, thighs, and right down to your feet. Attend to your own breathing now ... notice how the rhythmic patterns of your own breathing serves to increase the feelings of tranquility and well being ... as you attend to your own breathing notice how comfortable the chest area becomes as feelings of relaxation spread across the chest and down into the stomach area ... the upper portion of your body becomes comfortably heavy and very relaxed ... Just let the same good feelings spread down into the legs ... the thighs, calves, ankles, and feet, so that the entire body is bathed in feelings of relaxation and inner tranquility ..."

"As you enjoy this state of inner calm note that you achieved this yourself ... with comfort and relaxation ... enjoy these feelings for a few moments ... You can become twice as relaxed as you are by merely taking in a deep breath and slowly exhaling."

I. Break and interview (see how it went for each subject)

"Notice how the relaxation can be achieved again after you have become anxious ... and think about how enjoyable and pleasant those feelings of relaxation are ... Now we will be relaxing again and visualizing a scene we'll call the 'success scene' ... a situation in which you felt anxiety but

were not overwhelmed and were able to go on and succeed at what you were trying to accomplish."

J. Relaxation with interim directions

K. Success scene

"Now recall a scene or situation from your past life in which you experienced real feelings of success ... it should involve such things as facing a difficult challenge and meeting it successfully ... it might be small to someone else, but it was important to you ... it may involve some feelings of anxiety or apprehension but they didn't overwhelm you ... rather you mastered them ... you should pick one situation that will help you develop and maintain certain feelings of success ... of mastery of the situation .... self-confidence ... competence the ability to face a difficult situation and handle it very well. Let the scene develop ... begin to put yourself into the scene ... really live it ... and focus in on the feelings of success, satisfaction, competence ... just experience these feelings for a moment and enjoy them ... now let the scene fade away your mind becomes blank ..."

L. Break and interview (see how it went)

M. Relaxation with interim directions - scene switching training

N. Anxiety induction

"Okay, now let the relaxation go and switch to the anxiety scene ... let it develop and become clear ... see yourself in it. Visualize the anxiety scene as clearly as possible and as you do so focus on the various ways you express your anxiety physically. See yourself in the scene and concentrate on the feelings of anxiety and fearfulness ... just let them develop. Let the feelings of anxiety spread throughout the entire body ... feel the muscles becoming tight and tense ... the palms beginning to sweat ... feel your heart pounding and your breathing becoming very shallow and irregular ... just let the anxiety develop more and more ... visualize the scenes clearly and experience the ways you express your anxiety fully ... let the anxiety completely take over ... feel the discomfort ... you may have trouble holding still ... just let the anxiety develop more and more ... feel it in as many parts of your body as you can ... experience it fully."

O. Anxiety control cue and pleasant scene

"Take in a deep breath - breathe out slowly ... and

relax ... Good, now switch to the pleasant scene. Let it develop ... see yourself in it. Let yourself relax fully from head to toe ... let all anxious thoughts and feelings pass completely away ... let all your muscles go loose and heavy, and let the feelings of calmness and relaxation develop fully ... let the muscles of your hands and arms relax ... smooth out your forehead and scalp ... let all the muscles of your face relax .... just let the relaxation develop on its own and spread throughout your entire body ... relax the muscles of the shoulders and back ... relax the neck muscles ... relax your chest and lungs ... let the relaxation spread to your lower body ... relax the legs ... let your calves relax ... and feet relax. As you develop the pleasant scene more and more just relax yourself all over ... let the relaxation become deeper ... and deeper. Notice the pleasant, calm feelings ... you can recapture some of these relaxed feelings when you get anxious or afraid ... they will help you to feel more calm and do things more comfortably when you want to ... just go on relaxing like that for awhile."

P. Success scene

"Now switch to the success scene. Picture it clearly and vividly ... and let the feelings of success, satisfaction, and competence develop also ... see yourself in the scene and experience it fully ... play the scene in all its details and don't stop yourself from feeling proud, or satisfied ... just let these feelings take over, and enjoy them ... let yourself feel successful ... you may be able to recapture or develop these feelings in difficult situations ... they may help you handle difficult feelings or situations more successfully ... focus on these feelings and enjoy them fully for a moment longer ..."

Q. Anxiety scene

"Now switch to the anxious scene ... let the anxious scene develop now ... picture the scene clearly and vividly ... actually be in the scene, and let the feelings of anxiety and fearfulness develop ... you may find the anxiety getting stronger now ... let it develop ... use any sound or smell or sensation that helps arouse the anxious and fearful feelings ... keep them up ... experience the anxiety fully ... feel the fright and anxiety in as many parts of your body as you can ... let the feelings fill your thoughts and mind as well ... don't stop yourself from feeling more and more fear ... you may want to let other feelings of uncertainty, dread or awfulness develop ... feel these fully ... let your imagination go, keep the anxiety and fear at a high pitch ... keep them up ... Now let the anxiety scenes fade away and let your mind become blank."

R. Anxiety control cue and pleasant scene

"Now take in a deep breath, hold your breath a moment, breathe out slowly ... and relax ... good! Let the pleasant sccene develop ... let all anxious thoughts and feelings pass completely away ... just put yourself in the pleasant scene and let all your muscles relax. Again return yourself to a state of inner calm and comfort ... permit your body to be immersed in the feelings of relaxation and well being ... See yourself in the pleasant scene vividly and focus on the relaxation ... just let those feelings of relaxation and inner calm develop more and more ... let them spread throughout your entire body .... good!"

S. Success scene

"As you continue relaxing like that switch to the success scene. Let the success scene develop now, picture it clearly and vividly, and let the feelings of success, satisfaction, and competence develop also ... play your part in the scene, several times over if you wish; and enjoy it ... play the scene in all its details ... don't stop yourself from feeling proud, or satisfied, or courageous ... let yourself feel and enjoy these fully ... notice how rewarding these feelings of success and satisfaction are ... enjoy them ... let them take over, and enjoy them .... you may have been successful in spite of anxiety, obstacles or uncertainty ... be aware of this as you play the scene, or parts of the scene again ... let yourself feel successful, on top of the situation, and contented in as many ways as you can ... notice how rewarding and pleasurable these feelings you have developed are ... you may be able to recapture or develop these feelings in difficult situations ... they may help you handle difficult feelings or situations more successfully ... focus on these feelings and enjoy them fully for a moment longer ..."

"As you attend to these feelings, focus on the ease with which you have been able to achieve relaxation and calmness within yourself ... you have been able to dispel all feelings of tension in your body ... and replace them with feelings of inner calm and relaxation associated with the pleasant scene and the success scene ... you have mastered your own inner tension ... enjoy the feelings of accomplishment ... let these feelings develop fully ... a sense of mastery over your own personal feelings ... focus on these feelings and enjoy them for a moment longer."

T. Break and interview

"In a moment I'll count backward slowly from 4 to 1. When I get to 1 you'll be able to get up and feel alert, but

you'll be relaxed, awake and quite calm and relaxed."

4 - 3 - 2 - 1

III. SESSION III (1 hour)

A. Relaxation with interim directions

"As you are relaxing like that focus on the feelings of bodily and mental relaxation you have achieved ... Notice exactly how it feels to be so relaxed and calm ... you will be able to achieve this relaxed state more often than you think, and it can be very useful to you ... you will be able to recapture part or all of the relaxed state when you get anxious or afraid ... just continue relaxing like that for a few moments ..."

B. Anxiety induction and anxiety scene

"Alright, let the relaxation go now and switch to your anxiety scene. Try to visualize it clearly ... just be in the scene and become aware of the various sensations that you use to express your anxiety ... let the feelings of anxiety and fearfulness develop ... use any sound or smell or sensation that helps you arouse the anxious and fearful feelings ... keep them up ... experience the anxiety fully ... feel them in as many parts of your body as you can ... let it fill your thoughts and mind as well ... feel your heart starting to pound and your breathing becoming shallow and irregular ... notice your palms beginning to sweat and your stomach becoming jittery ... let the scene develop and allow yourself to visualize it with as many details as possible ... let the anxiety develop more and more ... your mouth feels dry ... muscles becoming tight and tense ... as your scene becomes quite clear notice the various sensations and feelings of dread and helplessness ... just let the scene change in any way that helps you experience the anxiety and fear ... don't stop yourself from feeling more and more fear and anxiety ... don't stop yourself from feeling more and more fear and anxiety ... let it take over ... let it become more and more intense ... notice how rapidly you are breathing and how hard your heart is pounding ... feel the discomfort of your body ... it may be difficult for you to hold still ... feel the chills and the heat ... the tight muscles ... the panicky helpless feeling ... feel the anxiety beginning to reach a peak as you see yourself in the scene ... as you live it in all its details ... just let the anxiety reach such an intense point that you feel you have no control over it ..."

C. Anxiety control cue and pleasant scene

"Now let the anxious scene dissolve away ... Take in a deep breath, hold it for a moment, let it out slowly ... and relax ... good! Try to recapture the pleasant, calm feelings of relaxation and as you do so switch to the pleasant scene. Just let the pleasant scene develop ... be in it ... live it, and let it develop and change in any way that helps you experience feelings of relaxation and inner calm ... Dissolve away any tensions that are still present anywhere in your body ... and focus on the feelings of relaxation that spread throughout your entire body ... the arms ... comfortably heavy, the forehead and scalp ... smooth ... The feelings of relaxation spread into the muscles of the neck ... the back ... and flow downward into the trunk, legs, and feet ... Notice your breathing ... relaxed and calm ... and how the rhythmic pattern of your own breathing increases the relaxation of the chest and stomach area ... the comfortable, heavy feelings of relaxation develop more and more ... so that the entire body is bathed in these feelings of relaxation and inner calm."

"Just let the scene develop in all its relaxing, pleasant details and as you do so note that you achieved this yourself ... you have been able to sweep away the tensions and provide yourself with considerable relief and comfort ... enjoy the feelings of inner calm as well as a feeling of accomplishment for having attained it ... you can become twice as relaxed as you are merely by taking in a deep breath and slowly exhaling ..."

D. Success scene

"Now, just let the pleasant scene dissolve away ... let your mind become blank ... and switch to the success scene. Now switch to the success scene ... let the success scene develop now, picture it clearly and vividly, and let the feelings of success, satisfaction, and competence develop also ... play your part in the scene, several times over if you wish, and enjoy it ... play the scene in all its details ... don't stop yourself from feeling proud, or satisfied or courageous ... let yourself feel and enjoy these fully ... notice how rewarding these feelings of success and satisfaction are ... enjoy them ... let them take over, and enjoy them ... you may have been successful in spite of anxiety, obstacles or uncertainty ... be aware of this as you play the scene, or parts of the scene again ... let yourself feel successful; on top of the situation, and contented in as many ways as you can ... notice how rewarding and pleasurable these feelings you have developed are ... you may be able to recapture or develop these feelings in difficult situations ... they may help you handle difficult feelings or situations

more successfully ... focus on these feelings and enjoy them fully for a moment longer ..."

E. Anxiety induction and anxiety scene

"Now switch to the anxious scene ... let the anxious scene develop now ... picture the scene clearly and vividly ... actually be in the scene, and let the feelings of anxiety and fearfulness develop ... you may find the anxiety getting stronger now ... let it develop ... use any sound or smell or sensation that helps arouse the anxious and fearful feelings ... keep them up ... experience the anxiety fully ... feel the fright and anxiety in as many parts of your body as you can ... let the feelings fill your thoughts and mind as well ... don't stop yourself from feeling more and more fear ... you may want to let other feelings of uncertainty, dread, or awfulness develop ... feel these fully ... let your imagination go, keep the anxiety and fear at a high pitch ... keep them up ..."

F. Anxiety control cue and pleasant scene

"Now let the anxiety scene dissolve away ... let your mind go blank, and as you do so take in a deep breath ... hold it for a moment ... slowly exhale ... and relax ... good! Now switch to the pleasant scene and as it develops try to recapture the pleasant feelings of pure relaxation and inner calm ... Let the pleasant scene build up ... live in it, and experience it in as many ways as possible to help you recapture the feelings of pure relaxation ... the arms becoming comfortably relaxed and heavy ... the facial area ... calm and smooth as the same refreshing feelings sweep across the forehead and scalp and down the sides of the face ... Just visualize the pleasant scene and dissolve away any tensions that remain anywhere in your body ... Let the feelings of relaxation spread into the muscles of the shoulders and back ... focus on your breathing - relaxed and calm ... and notice how your own rhythmic pattern of breathing serves to increase the relaxation ... feel how comfortable and relaxed the chest and stomach area becomes ... Each time you exhale notice the relaxation increases as the heavy, comfortable feelings spread throughout the entire body ... Let the same good feelings sweep down into the legs ... the thighs, calves, ankles, and feet ... and let the whole body enjoy the pleasant, calming feelings of relaxation."

"As you enjoy this state of inner calm it is important for you to note that you achieved this yourself ... you have been able to dissolve the tension and provide yourself with considerable relief ... just enjoy these feelings for a few minutes ... good!"

G. Success scene

"Now let the pleasant scene fade away ... just let your mind go blank for a moment ... now switch to the success scene ... let the success scene develop now, picture it clearly and vividly, and let the feelings of success, satisfaction, and competence develop also ... play your part in the scene, several times over if you wish, and enjoy it ... play the scene in all its details ... don't stop yourself from feeling proud, or satisfied, or courageous ... let yourself feel and enjoy these fully ... notice how rewarding these feelings of success and satisfaction are ... enjoy them ... let them take over, and enjoy them ... you may have been successful in spite of anxiety, obstacles or uncertainty ... be aware of this as you play the scene, or parts of the scene again ... let yourself feel successful, on top of the situation, and contented in as many ways as you can ... notice how rewarding and pleasurable these feelings you have developed are ... you may be able to recapture or develop these feelings in difficult situations ... they may be able to recapture or develop these feelings in difficult situations ... they may help you handle difficult feelings or situations more successfully ... focus on these feelings and enjoy them fully for a moment ..."

H. Anxiety induction and anxiety scene

"Let the success scene fade away ... and once again switch to the anxiety scene ... let the relaxation go and concentrate on letting yourself become anxious ... as the scene becomes more clear, just let the feelings of anxiety and fearfulness develop ... live in the scene, and experience the anxiety in as many parts of your body as possible ... experience the anxiety fully ... let it fill your thoughts and mind as well ... don't stop yourself from feeling more and more fear ... let some feelings such as uncertainty, dread, or awfulness also develop as you experience the anxiety scene in as many ways as you can ... let yourself go and keep the anxiety and fear at a high pitch ... keep them up ... feel it throughout your entire body ... let the anxiety and fear completely take over ..."

I. Anxiety control cue and pleasant scene

"Now let the anxiety scene go ... Just take in a deep breath ... hold it for a moment ... and slowly exhale ... and relax. Switch to the pleasant scene ... develop it fully and be in it ... permit those heavy comfortable feelings to come into awareness as you visualize the pleasant scene ... let the feelings of relaxation develop on their own and enjoy them ... good!"

J. Success scene

"As you enjoy the feelings of relaxation and inner calm, let the pleasant scene dissolve away and switch to the success scene ... Just visualize the success scene ... see the scene in all its details ... and don't stop yourself from feeling proud, or satisfied ... let yourself enjoy these feelings fully ... how you've been successful in spite of anxiety ... you will be able to recapture or develop these feelings in a variety of difficult situations ... they may help you handle difficult feelings or situations ... you can provide yourself with considerable relief from tensions whenever you want to ... focus on these feelings a moment longer ... and enjoy them ... Now let the success scene fade away and continue relaxing for a moment longer."

"As you're relaxing like that I'll count backward slowly from 4 to 1. When I get to 1 you'll open your eyes and you'll be alert, relaxed, and wide awake."

4 - 3 - 2 - 1

K. Break and interview (see how it went)

IV. SESSION IV (1 hour)

A. Relaxation with interim directions

B. Anxiety induction and anxiety scene

"Now switch to the anxious scene ... let the anxious scene develop now ... picture the scene clearly and vividly ... actually be in the scene, and let the feelings of anxiety and fearfulness develop ... you may find the anxiety getting stronger now ... let it develop ... use any sound or smell or sensation that helps arouse the anxious and fearful feelings ... keep them up ... experience the anxiety fully ... feel the fright and anxiety in as many parts of your body as you can ... let the feelings fill your thoughts and mind as well ... don't stop yourself from feeling more and more fear ... you may want to let other feelings of uncertainty, dread or awfulness develop ... feel these fully ... let your imagination go, keep the anxiety and fear at a high pitch ... keep them up ..."

C. Anxiety control cue and pleasant scene

"Now let the anxiety scene fade ... let your mind go blank, and as you do so take in a deep breath, hold it a moment, exhale slowly ... and relax ... fine! Switch to the pleasant scene ... and let it develop with all its details ... As the pleasant scene develops clearly, try to recapture

the comfortable, heavy feelings of relaxation ... just let yourself go ... spread the relaxation throughout your entire body ... you can reeapture some of these relaxed feelings often ... you will be able to develop these relaxed feelings when you get anxious or afraid ... they will help you to feel more calm or do things more comfortably, when you want to ... continue relaxing, more and more deeply ... let yourself enjoy the relaxation ... keep on relaxing for a moment more ... let yourself relax fully and dissolve away any tensions you feel anywhere in your body ..."

D. Success scene

Now switch to the success scene ... let the success scene develop now, picture it clearly and vividly, and let the feelings of success, satisfaction, and competence develop also ... play your part in the scene, several times over if you wish, and enjoy it ... play the scene in all its details ... don't stop yourself from feeling proud, or satisfied, or courageous ... let yourself feel and enjoy these fully ... notice how rewarding these feelings of success and satisfaction are ... enjoy them ... let them take over, and enjoy them ... you may have been successful in spite of anxiety, obstacles or uncertainty ... be aware of this as you play the scene, or parts of the scene again ... let yourself feel successful, on top of the situation, and contented in as many ways as you can ... notice how rewarding and pleasurable these feelings you have developed are ... you may be able to capture or develop these feelings in difficult situations ... they may help you handle difficult feelings or situations more successfully ... focus on these feelings and enjoy them fully for a moment longer ..."

E. Anxiety induction and anxious scene

"Now switch to the anxious scene ... let the anxious scene develop now ... picture the scene clearly and vividly ... actually be in the scene, and let the feelings of anxiety and fearfulness develop ... you may find the anxiety getting stronger now ... let it develop ... use any sound or smell or sensation that helps arouse the anxious and fearful feelings ... keep them up ... experience the anxiety fully ... feel the fright and anxiety in as many parts of your body as you can ... let the feelings fill your thoughts and mind as well ... don't stop yourself from feeling more and more fear ... you may want to let other feelings of uncertainty, dread or awfulness develop ... feel these fully ... let your imagination go, keep the anxiety and fear at a high pitch ... keep them up ..."

F. Anxiety control cue and pleasant scene

"Now take a deep breath, and relax ... good! Again return yourself to a state of inner calm and comfort ... permit your body to become relaxed all over and switch to the pleasant scene ... Visualize the pleasant scene vividly and recapture the pleasant feelings of relaxation ... As you experience the pleasant scene fully focus in on the ease with which you have been able to achieve the feelings of relaxation ... how you have provided yourself with inner calm ... completely relaxed ... you have mastered your own inner tension ... let these feelings develop and enjoy them for a few moments ..."

G. Success scene

"Now switch to the success scene ... let the success scene develop now, picture it clearly and vividly, and let the feelings of success, satisfaction, and competence develop also ... play your part in the scene, several times over if you wish, and enjoy it ... play the scene in all its details ... don't stop yourself from feeling proud, or satisfied, or courageous ... let yourself feel and enjoy these fully ... notice how rewarding these feelings of success and satisfaction are ... enjoy them ... let them take over, and enjoy them ... you may have been successful in spite of anxiety, obstacles or uncertainty ... be aware of this as you play the scene, or parts of the scene again ... let yourself feel successful, on top of the situation, and contented in as many ways as you can ... notice how rewarding and pleasurable these feelings you have developed are ... you may be able to recapture or develop these feelings in difficult situations ... they may help you handle difficult feelings or situations more successfully ... focus on these feelings and enjoy them fully for a moment longer ..."

H. Anxiety induction and anxiety scene

"Now let the success scene fade away and switch back to the anxiety scene. Now switch to the anxious scene ... let the anxious scene develop now ... picture the scene clearly and vividly ... actually be in the scene, and let the feelings of anxiety and fearfulness develop ... you may find the anxiety getting stronger now ... let it develop ... use any sound or smell or sensation that helps arouse the anxious and fearful feelings ... keep them up ... experience the anxiety fully ... feel the fright and anxiety in as many parts of your body as you can ... let the feelings fill your thoughts and mind as well ... don't stop yourself from feeling more and more fear ... you may want to let other feelings of uncertainty, dread, or awfulness develop ... feel these fully ... let your imagination go, keep the anxiety and

fear at a high pitch ... keep them up ..."

I. Anxiety control cue and pleasant scene

"Take in a deep breath and relax yourself ... just let the anxiety scene fade away and once more switch to the pleasant scene. Picture the pleasant scene in all its details ... permit the heavy, comfortable feelings of relaxation to come into awareness ... let them develop on their own and enjoy them ... good! Once again, as you become more and more relaxed, attend to your own feelings of personal strength ... and the ease with which you were able to mobilize it ... how you were able to master the inner tensions and provide yourself with considerable relief and relaxation ... just go on relaxing."

J. Success scene

"Now switch to the success scene ... let the success scene develop now, picture it clearly and vividly, and let the feelings of success, satisfaction, and competence develop also ... play your part in the scene, several times over if you wish, and enjoy it ... play the scene in all its details ... don't stop yourself from feeling proud, or satisfied, or courageous ... let yourself feel and enjoy these fully ... notice how rewarding these feelings of success and satisfaction are ... enjoy them ... let them take over, and enjoy them ... you may have been successful in spite of anxiety, obstacles or uncertainty ... be aware of this as you play the scene, or parts of the scene again ... let yourself feel successful, on top of the situation, and contended in as many ways as you can ... notice how rewarding and pleasurable these feelings you have developed are ... you may be able to recapture or develop these feelings in difficult situations ... They may help you handle difficult feelings or situations more successfully ... focus on these feelings and enjoy them fully for a moment longer ..."

"... In a moment I'll count backward slowly from 4 to 1. When I get to 1 you'll open your eyes and be alert, but you'll feel relaxed and calm."

4 - 3 - 2 - 1

K. Break and interview

V. TERMINATION SESSION (1 hour)

A. Interaction period with feedback regarding progress in using the technique to control anxiety

Children's Hospital of Eastern Ontario
Hôpital pour enfants de l'est de l'Ontario

APPENDIX L

Informed Consent

This is to affirm that I have agreed to allow _____
to participate in the investigation of alternate treatment strategies in improving diabetic control, conducted by M Rose, MA; A Faught, MD; H Heick, MD, PhD; and P Firestone, PhD, at the Children's Hospital of Eastern Ontario.

Further, I have been informed ~~that my child will~~ be admitted, as an in-patient, to the Children's Hospital for a period of ten days. During such time, my child will be given various psychological tests and questionnaires, will undergo blood and urine testing, and will undergo progressive deep muscle relaxation training.

Signed _____

Relationship _____

Date _____

Witness _____

Child's Signature _____

APPENDIX M

TREATMENT RATIONALE

Over the years, various doctors and psychologists have found that the control of blood and urine glucose values can be both directly and indirectly altered by emotional stress and anxiety. We have found that fluctuations in blood and urine glucose values tend to result in poor diabetic control which may lead to various illnesses.

Anxiety and tension are learned responses to stress which can be modified in a number of ways. It has been shown by many people that by simply becoming aware of one's interests, one can reduce tension and anxiety associated with decision making regarding future employment. Feelings of anger, frustration, fear, anxiety, etc. can be reduced and may be replaced by feelings of relaxation and calmness. In fact, there is little disagreement among doctors that this knowledge can play an important role in reducing tension and anxiety and can therefore aid in improving blood and urine glucose values.

In order to assess your interests you will undergo some tests. We will then discuss the results. This will give you a better understanding of yourself and may improve your diabetic control.

APPENDIX N

TREATMENT RATIONALE

Over the years, various doctors and psychologists have found that the control of blood and urine glucose values can be both directly and indirectly altered by emotional stress. We have found that fluctuations in blood and urine glucose levels tend to result in poor diabetic control which may lead to various illnesses.

Anxiety and tension are learned responses to stress. However, these responses can be modified or unlearned following some known learning principles. One type of treatment which has been used to help people who suffer from tension and anxiety is called progressive deep muscle relaxation. Muscle relaxation provides a new response which is incompatible with tension and may therefore improve blood and urine glucose levels. As such, good diabetic control will follow.

Now you will learn to relax your whole body by tightening and relaxing different muscles. Through the use of this procedure, tension can be stopped and can be replaced with feelings of relaxation.

APPENDIX O

RELAXATION RATING SCALE